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.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage		10	12	30	V
Output Voltage	$I_{OUT(MIN)}$ = 5mA	11.4	12	12.6	V
Maximum Output Current	V_{IN} = 10V	0.6			A
	V_{IN} = 12V	0.7			A
	V_{IN} = 24V	1.0			A
	V_{IN} = 30V	1.1			A
Output Voltage Ripple (Peak to Peak)	V_{IN} = 24V, I_{OUT} = 1A		70		mV
Efficiency	V_{IN} = 10V, I_{OUT} = 0.6A		89.45		%
	V_{IN} = 12V, I_{OUT} = 0.7A		89.81		%
	V_{IN} = 24V, I_{OUT} = 1A		90.76		%
	V_{IN} = 30V, I_{OUT} = 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 (±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.

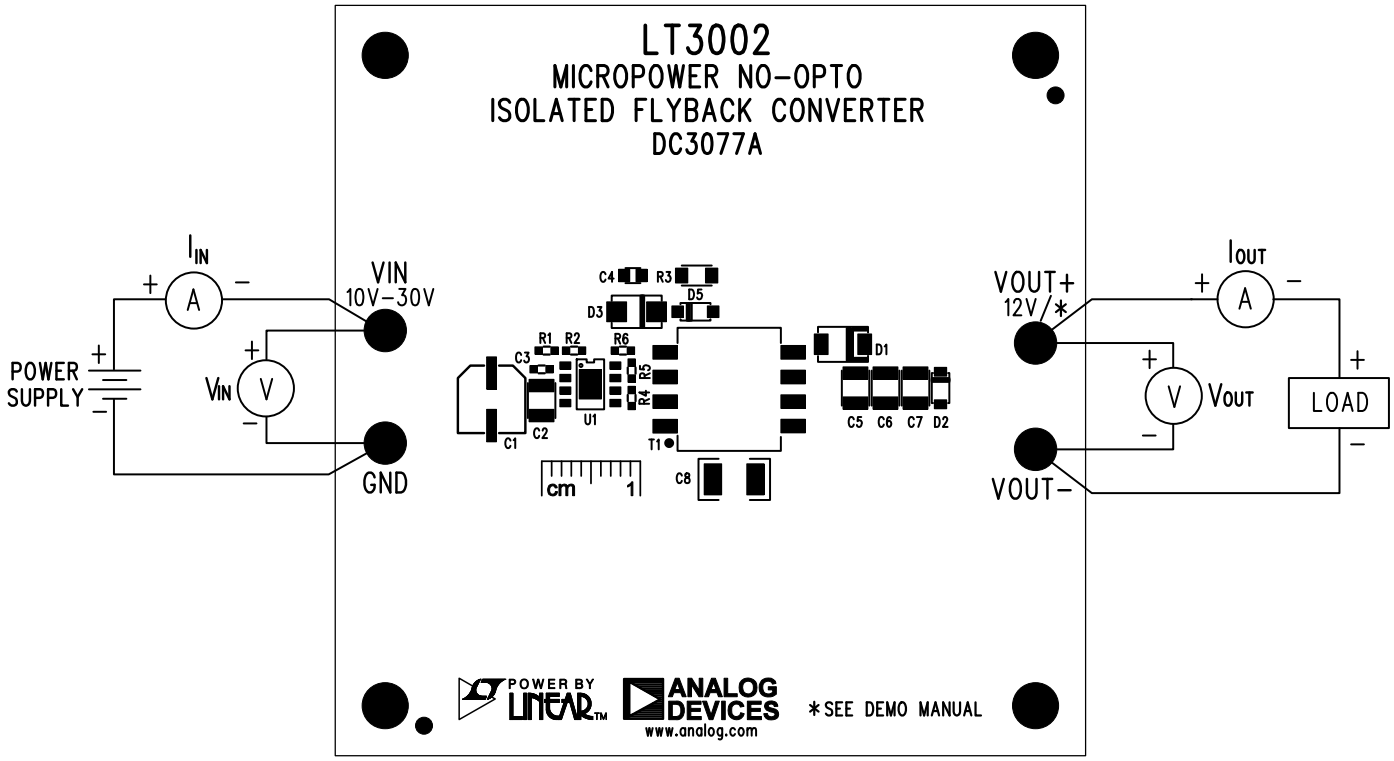


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

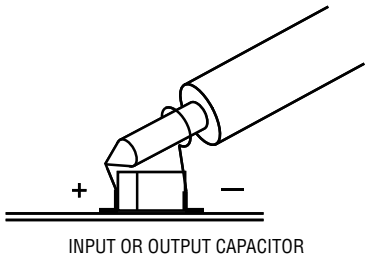


Figure 2. Proper Scope Probe Placement for Measuring Input or Output Ripple

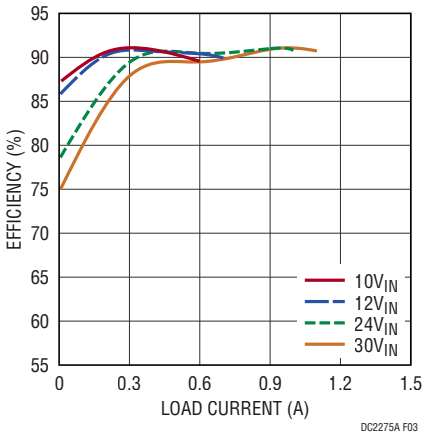


Figure 3. Typical Efficiency Curves

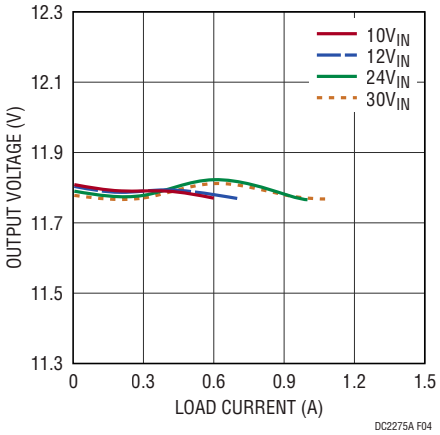
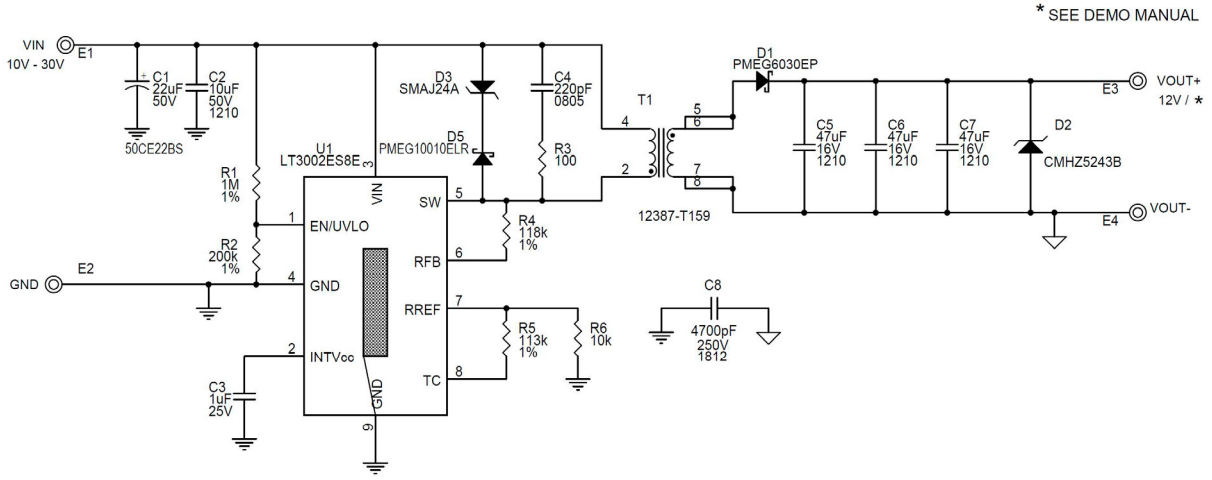


Figure 4. Regulation Curves

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP., 22µF, ALUM, 50V, 20%, SMD 6.3mm × 6.0mm	SUN ELECTRONIC, 50CE22BS
2	1	C2	CAP., 10µF, X7R, 50V, 10%, 1210	AVX, 0603YD225MAT2A
3	1	C3	CAP., 1µF, 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., 47µF, 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, PMEG6030EP,115
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., 1MΩ, 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW06031M00FKEA
12	1	R2	RES., 200k, 1%, 1/10W, 0603	VISHAY, CRCW0603200KFKEA
13	1	R3	RES., 100Ω,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
Hardware				
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



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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS ($100.00). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.