

# LTC3130EUD-1

## 25V, 600mA Buck-Boost DC/DC Converter with 1.6 $\mu$ A Quiescent Current

### DESCRIPTION

Demonstration circuit 2397A features the **LTC<sup>®</sup>3130-1**, a wide input voltage, wide output voltage operating range, high efficiency, low noise monolithic DC/DC buck-boost converter.

The LTC3130-1 has 4-pin selectable output voltages and operates from input voltages of 2.4V to 25V. The LTC3130-1 incorporates a proprietary low noise switching algorithm which optimizes efficiency with input voltages above, below, or equal to the output voltage and ensures seamless transitions between operating modes.

The LTC3130-1's user selectable output voltages are 1.8V, 3.3V, 5.0V and 12V. To set the desired output voltage on the DC2397A, use the "V<sub>OUT</sub> JUMPER CONFIGURATION" table on the front of the board to determine the jumper settings for JP2 and JP3.

The DC2397A demo board has two user selectable operating modes: Burst Mode<sup>®</sup> operation and fixed frequency PWM (JP1). In PWM Mode, the LTC3130-1 operates at 1.2MHz to allow high efficiency while minimizing the solution footprint.

Internal compensation reduces footprint size by reducing the number of external components. This also simplifies the design process and reduces external component cost.

An accurate RUN threshold can be set to enable the converter at a desired input voltage. The DC2397A demo board is set up to use R2 in conjunction with R3 to set this threshold. See the data sheet for details.

Maximum power point control (MPPC) allows for simple optimization of power transfer between the converter and a non-ideal supply such as a photovoltaic panel or another high impedance source. The DC2397A demo board can be set to operate in MPPC mode by setting jumper JP4 to "ON", removing R4 and populating R5 and R6. In most applications this function can be realized, often with better efficiency, by using the accurate RUN comparator functionality. See the data sheet for details.

A PGOOD open-drain output is provided and is pulled up to V<sub>OUT</sub>. This output asserts low when V<sub>OUT</sub> is below regulation.

The LTC3130-1 allows the internal V<sub>CC</sub> rail to be fed externally from the EXTV<sub>CC</sub> pin. In some applications the efficiency of the converter can be improved by allowing V<sub>CC</sub> to be back-fed from a supply, such as V<sub>OUT</sub>. Setting the EXTV<sub>CC</sub> jumper (JP6) on the demo board to "EXT" back-feeds V<sub>CC</sub> through EXTV<sub>CC</sub> from V<sub>OUT</sub>. Setting this jumper to internal ("INT") powers V<sub>CC</sub> off the V<sub>IN</sub> input. See the data sheet for additional details.

The LTC3130/LTC3130-1 data sheet has detailed information about the operation, specifications, and applications of the device. The data sheet should be read in conjunction with this quick start guide.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2397A>**

LT, LT, LTC, LTM, Linear Technology, the Linear logo and Burst Mode are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

### PERFORMANCE SUMMARY

Input Voltage Range	2.4V to 25V
V <sub>OUT</sub>	1.8V, 3.3V, 5V, 12V
I <sub>OUT</sub> (see Note 1)	600mA
Efficiency	See Figure 1

**Note 1:** The demo board output current is a function of V<sub>IN</sub>. Please refer to the data sheet for more information.

## QUICK START PROCEDURE

Using short twisted pair leads for any power connections and with all loads and power supplies off, refer to Figure 4 for the proper measurement and equipment setup. The power supply (PS1) should not be connected to the circuit until told to do so in the procedure below.

When measuring the input or output voltage ripple, 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  $V_{IN}$  or  $V_{OUT}$  and GND terminals (see Figure 5), or by using an oscilloscope probe tip jack.

1. Jumper and PS1 settings to start:

<b>PS1:</b>	OFF
<b>JP1: MODE</b>	FIXED FREQ
<b>JP2: VS1</b>	$V_{CC}$
<b>JP3: VS2</b>	$V_{CC}$
<b>JP4: MPPC</b>	OFF
<b>JP5: RUN</b>	ON
<b>JP6: EXT<math>V_{CC}</math></b>	INT

2. With power OFF connect the power supply (PS1) as shown in Figure 4. If accurate current measurements are desired (for efficiency calculation for example) then connect ammeters in series with supplies as shown. The ammeters are not required however.

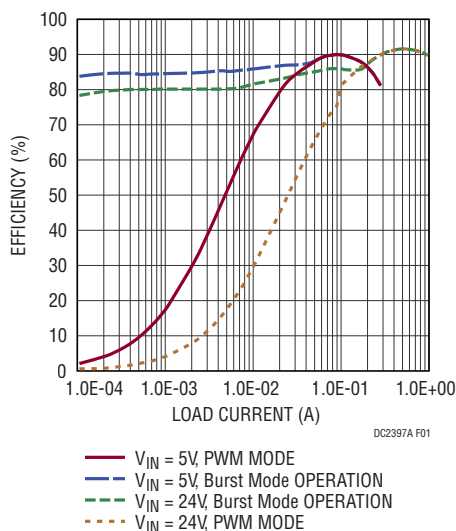


Figure 1: DC2397A Typical Efficiency vs Load.  $V_{OUT} = 12V$ .

3. Connect a 50mA load ( $240\Omega$ ) to  $V_{OUT}$  as shown in Figure 4.
4. Turn on PS1 and slowly increase the voltage until the voltage at  $V_{IN}$  is 3V.
5. Verify  $V_{OUT}$  is  $\sim 12V$ .
6.  $V_{IN}$  can now be varied between 2.4V and 25V. The load may need to be reduced for  $V_{IN} < 3V$  for  $V_{OUT}$  to remain in regulation.
7. The load can be varied. The maximum load is a function of  $V_{IN}$  and the device current limit. Consult the data sheet for more information on output current vs  $V_{IN}$ .
8.  $V_{OUT}$  can be varied by setting jumpers JP2 and JP3 in accordance with the “ $V_{OUT}$  JUMPER CONFIGURATION” table on the front of the DC2397A demo board.
9. For operation in Burst Mode, move jumper JP1 to “Burst Mode” position. See the data sheet for more information on Burst Mode operation.
10. For operation with  $V_{CC}$  powered from  $V_{OUT}$ , move JP6 to “EXT”.

**NOTE:** If  $V_{OUT}$  drops out of regulation, check to be sure the maximum load has not been exceeded, and that  $V_{IN}$  is not below the minimum value for regulation (see data sheet).

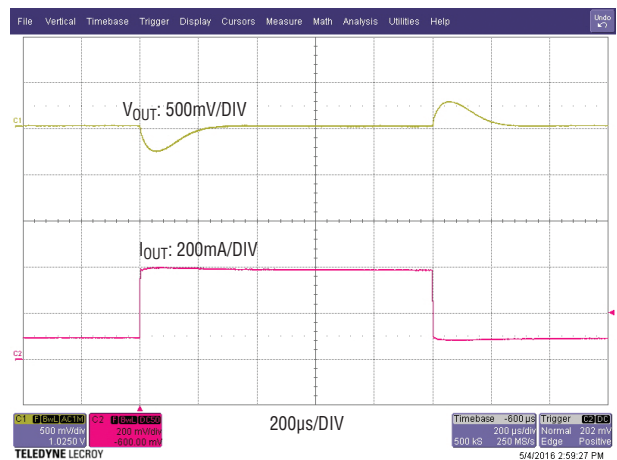


Figure 2. DC2397A Step Load Response.  $V_{IN} = 12V$ ,  $V_{OUT} = 12V$ , Load Step is from 100mA to 400mA.

QUICK START PROCEDURE

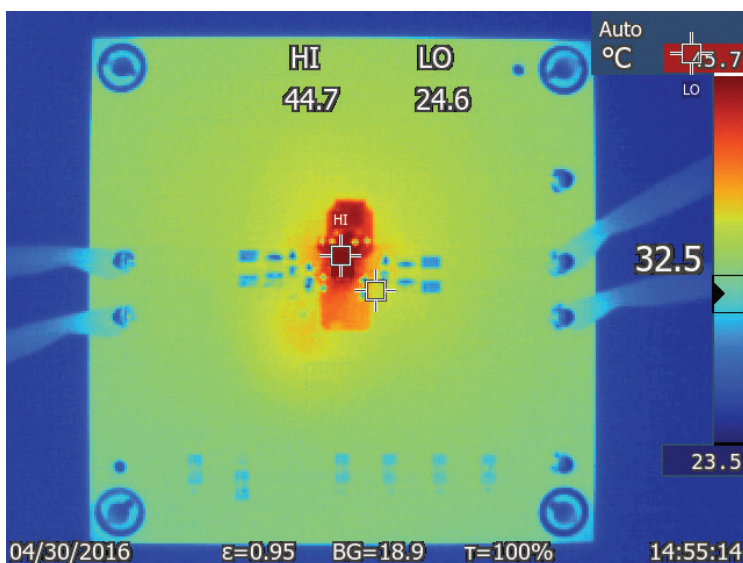


Figure 3. DC2397A Thermal Performance.  $V_{IN} = 12V$ ,  $V_{OUT} = 12V$ , Load = 600mA.

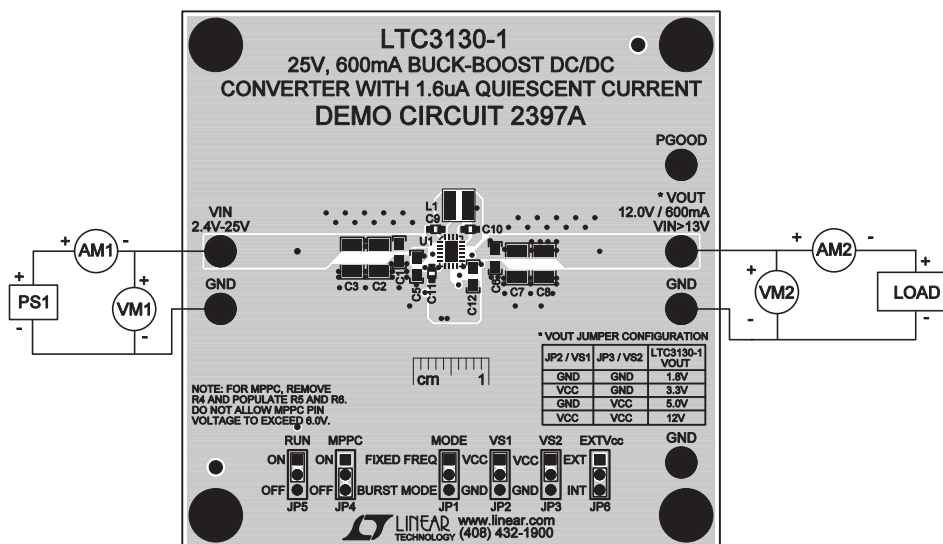


Figure 4. Proper Measurement Equipment Setup

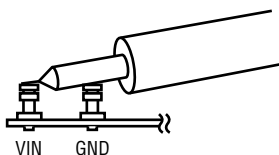


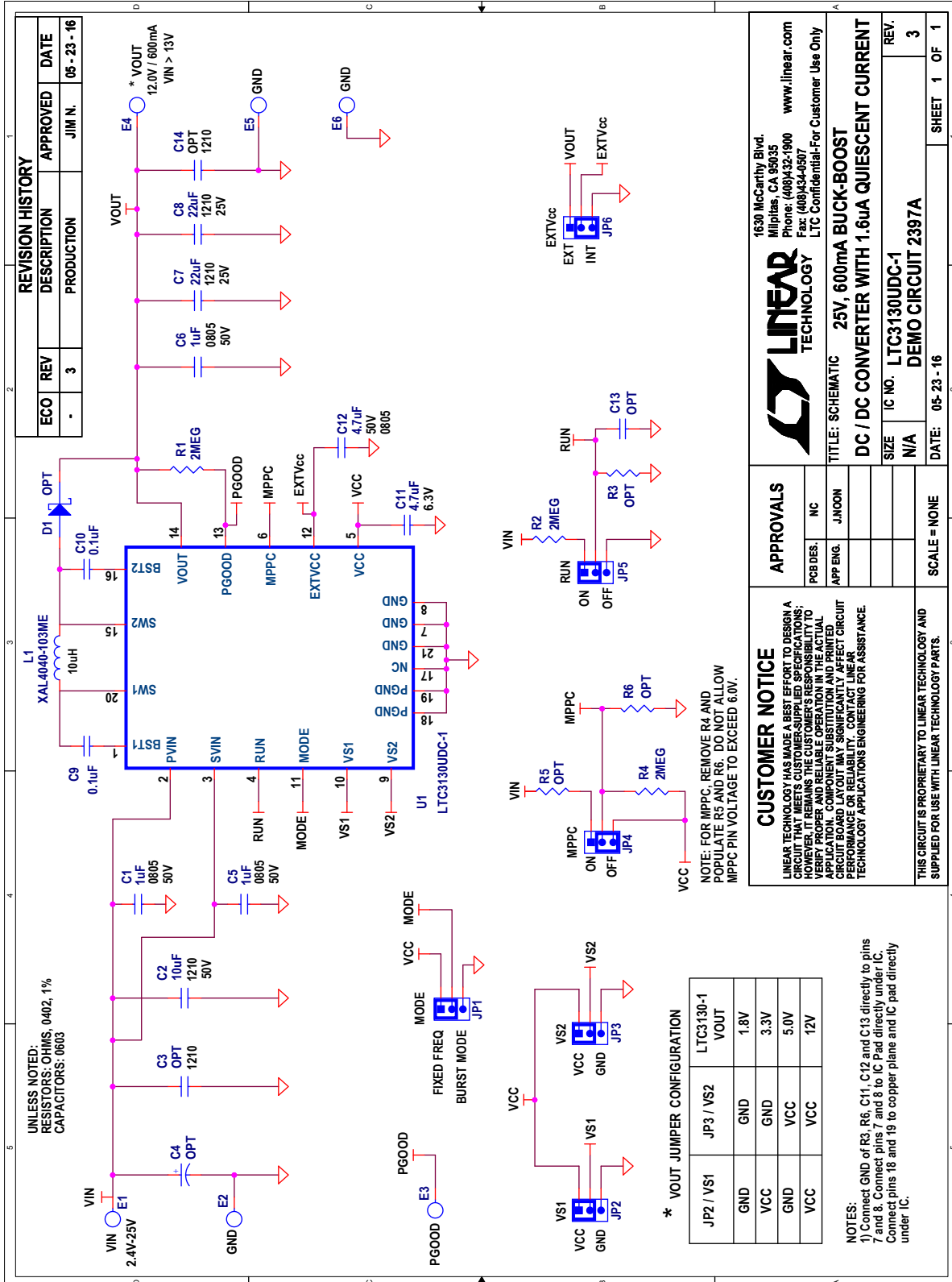
Figure 5. Measuring Input or Output Ripple

# DEMO MANUAL DC2397A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	3	C1, C5, C6	CAP CER 1 $\mu$ F 50V 10% X7R 0805	MURATA, GRM21BR71H105KA12L
2	1	C2	CAP CER 10 $\mu$ F 50V X7R 1210	MURATA, GRM32ER71H106KA12L
3	2	C7, C8	CAP CER 22 $\mu$ F 25V X7R 1210	MURATA, GRM32ER71E226KE15L
4	2	C9, C10	CAP CER 0.1 $\mu$ F 50V X7R 0603	MURATA, GRM188R71H104KA93D
5	1	C11	CAP CER 4.7 $\mu$ F 6.3V 10% X5R 0603	MURATA, GRM188R60J475KE19D
6	1	C12	CAP CER 4.7 $\mu$ F 50V 10% X5R 0805	MURATA, GRM21BR61H475KE51L
7	3	R1, R2, R4	RES 2M $\Omega$ 1/16W 1% 0402 SMD	VISHAY, CRCW04022M00FKED
8	1	L1	INDUCTOR, 10 $\mu$ H, $\pm$ 20%	COILCRAFT, XAL4040-103ME
9	1	U1	25V, 600mA BUCK-BOOST DC/DC CONVERTER	LINEAR TECHNOLOGY, LTC3130UDC-1 #PBF
<b>Additional Demo Board Circuit Components</b>				
10	0	C3, C14	CAP, 1210 (OPT)	
11	0	C4	CAP ALUM 220 $\mu$ F 35V 20% SMD (OPT)	PANASONIC, EEE-FP1V221AP
12	0	C13	CAP, 0603 (OPT)	
13	0	R3, R5, R6	RES, 0402 (OPT)	
14	0	D1	DIODE SCHOTTKY 40V 2A SOD123 (OPT)	ROHM, RB068M-40TR
15	6	E1 – E6	TP, TURRET, 0.094", PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
16	6	JP1 – JP6	JMP, 3-PIN 1 ROW 0.079" CC	SULLINS, NRPN031PAEN-RC
17	6	XJP1 – XJP6	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
18	4		SPACER STACKING #4 SCREW NYLON 0.500"	KEYSTONE, 8833

**SCHEMATIC DIAGRAM**



# DEMO MANUAL DC2397A

---

## DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

**Please read the DEMO BOARD manual prior to handling the product.** Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation