LTC3130EUDC-1
25V, 600mA Buck-Boost DC/DC Converter with 1.6µA Quiescent Current

DESCRIPTION

Demonstration circuit 2397A features the LTC®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_{OUT} 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® 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_{OUT}. This output asserts low when V_{OUT} is below regulation.

The LTC3130-1 allows the internal V_{CC} rail to be fed externally from the $EXTV_{CC}$ pin. In some applications the efficiency of the converter can be improved by allowing V_{CC} to be back-fed from a supply, such as V_{OUT}. Setting the $EXTV_{CC}$ jumper (JP6) on the demo board to "EXT" back-feeds V_{CC} through $EXTV_{CC}$ from V_{OUT}. Setting this jumper to internal ("INT") powers V_{CC} off the V_{IN} 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.

PERFORMANCE SUMMARY

Input Voltage Range	2.4V to 25V
V_{OUT}	1.8V, 3.3V, 5V, 12V
I_{OUT} (see Note 1)	600mA
Efficiency	See Figure 1

Note 1: The demo board output current is a function of V_{IN}. 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:

PS1:	OFF
JP1: MODE	FIXED FREQ
JP2: VS1	V_{CC}
JP3: VS2	V_{CC}
JP4: MPPC	OFF
JP5: RUN	ON
JP6: $EXTV_{CC}$	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.

3. Connect a 50mA load (240Ω) 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 ~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).

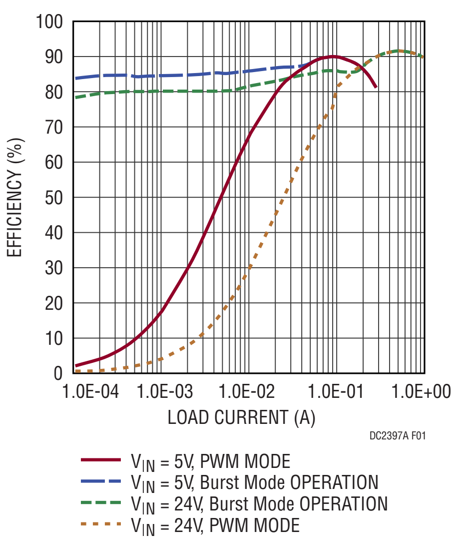


Figure 1. DC2397A Typical Efficiency vs Load. V_{OUT} = 12V.

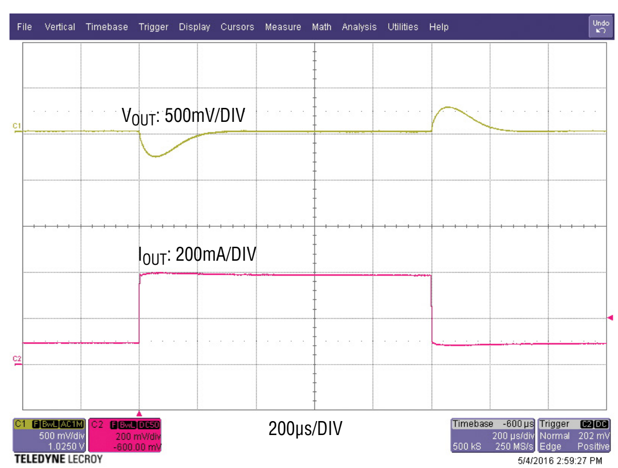


Figure 2. DC2397A Step Load Response. V_{IN} = 12V, V_{OUT} = 12V, Load Step is from 100mA to 400mA.

QUICK START PROCEDURE

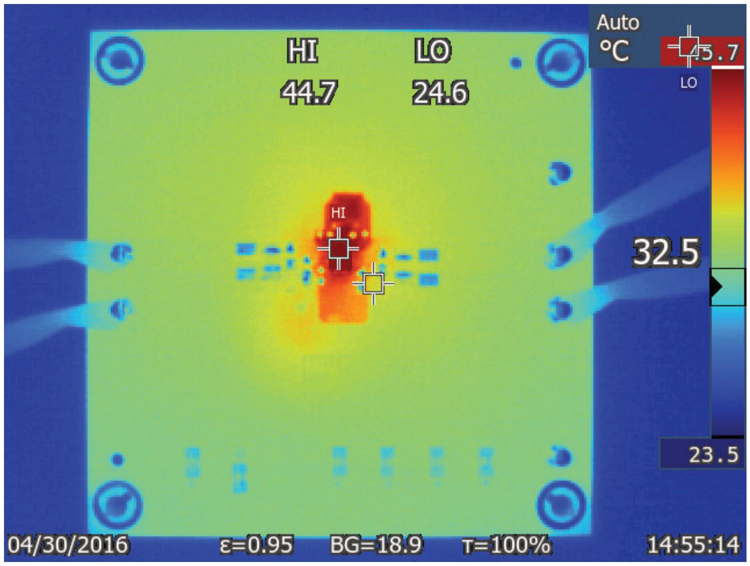


Figure 3. DC2397A Thermal Performance. V_{IN} = 12V, V_{OUT} = 12V, Load = 600mA.

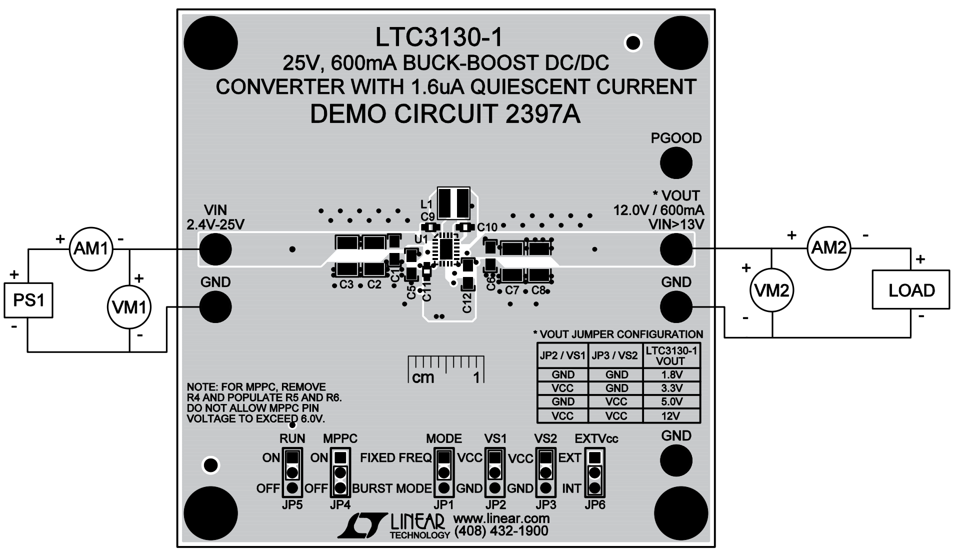


Figure 4. Proper Measurement Equipment Setup

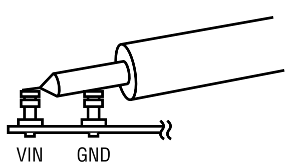
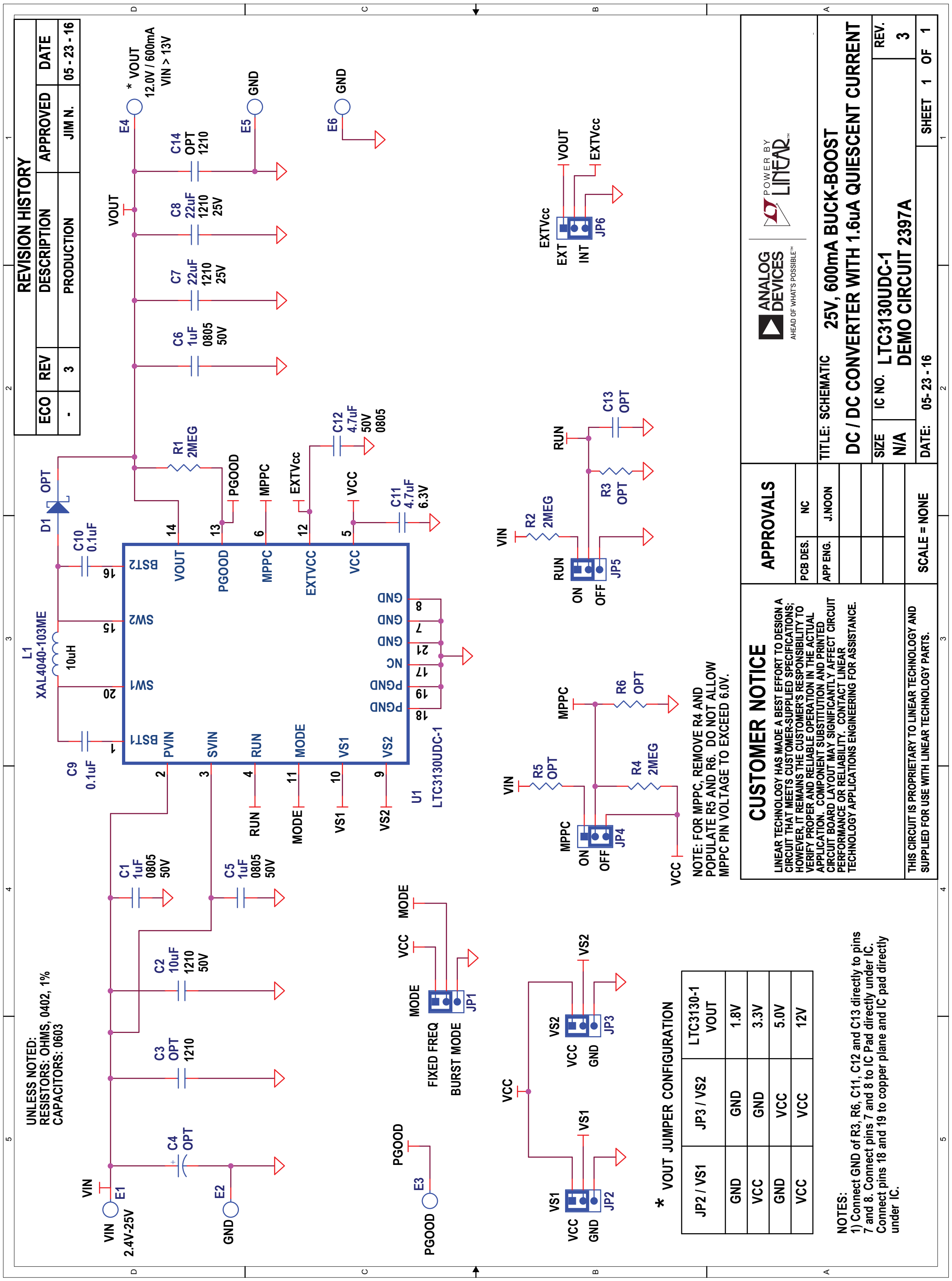


Figure 5. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	3	C1, C5, C6	CAP CER 1μF 50V 10% X7R 0805	MURATA, GRM21BR71H105KA12L
2	1	C2	CAP CER 10μF 50V X7R 1210	MURATA, GRM32ER71H106KA12L
3	2	C7, C8	CAP CER 22μF 25V X7R 1210	MURATA, GRM32ER71E226KE15L
4	2	C9, C10	CAP CER 0.1μF 50V X7R 0603	MURATA, GRM188R71H104KA93D
5	1	C11	CAP CER 4.7μF 6.3V 10% X5R 0603	MURATA, GRM188R60J475KE19D
6	1	C12	CAP CER 4.7μF 50V 10% X5R 0805	MURATA, GRM21BR61H475KE51L
7	3	R1, R2, R4	RES 2MΩ 1/16W 1% 0402 SMD	VISHAY, CRCW04022M00FKED
8	1	L1	INDUCTOR, 10μH, ±20%	COILCRAFT, XAL4040-103ME
9	1	U1	25V, 600mA BUCK-BOOST DC/DC CONVERTER	ANALOG DEVICES, LTC3130UDC-1 #PBF
Additional Demo Board Circuit Components				
10	0	C3, C14	CAP, 1210 (OPT)	
11	0	C4	CAP ALUM 220μF 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



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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