

LTC3111EDHD

15V, 1.5A Synchronous Buck-Boost DC/DC Converter

DESCRIPTION

Demonstration circuit 1999A is a fixed frequency synchronous buck-boost converter with an extended input and output range. The unique 4-switch, single inductor architecture provides low noise and seamless operation from input voltages above, below, or equal to the output voltage.

The LTC[®]3111 features selectable PWM or Burst Mode[®] operation, and an easily synchronizable oscillator. Jumper JP1 is provided to enable the converter. The demo board is configured for 800kHz. A jumper, JP2, is provided to select PWM, or Burst Mode operation. A clock signal can also be applied to JP2 if synchronization is desired.

The LTC3111 operates with a 2.5V to 15V input voltage range and a V_{OUT} range from 2.5V to 15V. The demonstration board has been designed to operate with V_{IN} from 2.5V to 15V and an output current up to 1.5A. For $V_{IN} < 5V$, I_{OUT} capability is reduced. V_{OUT} is set to 5.0V.

Typical demo board efficiency is shown in Figure 2 for several loads. The demo board has the provision to set an accurate run threshold. Consult the LTC3111 data sheet for more information. The transient response of the converter to a 100mA to 600mA transient at input voltages of 3.5V and 12V are presented in Figures 3 and 4.

The LTC3111 data sheet has detailed information about the operation, specifications, and applications of the part. 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>

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PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ\text{C}$

INPUT VOLTAGE RANGE	2.5V to 15V
V_{OUT}	5V
I_{OUT}	1.5A for $V_{IN} > 5V$

QUICK START PROCEDURE

Using short twisted-pair leads for any power connections and with all loads and power supplies off, refer to Figure 1 for the proper measurement and equipment setup. The power supply 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.

1. JP1, JP2 and Load Settings to start:

- JP1 (RUN) = OFF
- JP2 (PWM) = 800kHz (Fixed Frequency)
- LOAD = 0.1A/50Ω 10W Resistor

2. With power OFF connect the power supply as shown in Figure 1. If accurate current measurements are desired (for efficiency calculations for example) then connect an ammeter in series with the supply as shown. The ammeter is not required however.

3. Connect the load to VOUT as shown in Figure 1. Again, connect an ammeter if accurate current measurement or monitoring is desired.
4. Turn on the power supply and slowly increase voltage until the voltage at VIN is 2.5V. Move Jumper JP1 to ON.
5. Verify VOUT is ~5.0V.
6. VIN can now be varied between 2.5V and 15.0V. VOUT should remain in regulation.
7. IOUT can also be varied from 0A to 1.5A. For VIN < 5.0V, maximum IOUT is reduced. This reduction is due to IIN increasing as VIN decreases. Once the input current limit is reached, VOUT will fall out of regulation.

Note: If VOUT drops out of regulation, check to be sure the maximum load has not been exceeded, or that VIN is not below the minimum value (2.5V).

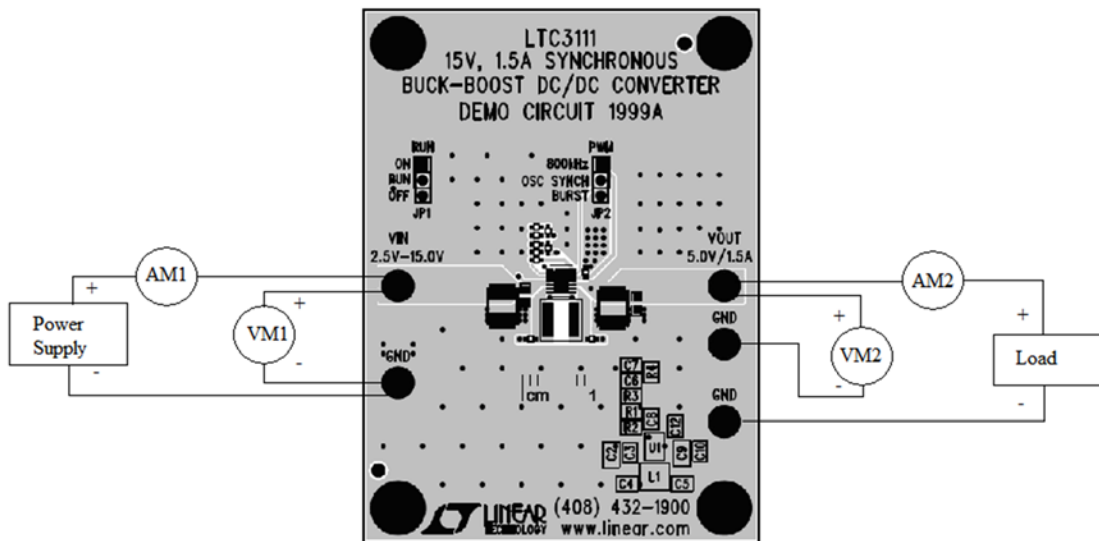


Figure 1. Measurement Setup

QUICK START PROCEDURE

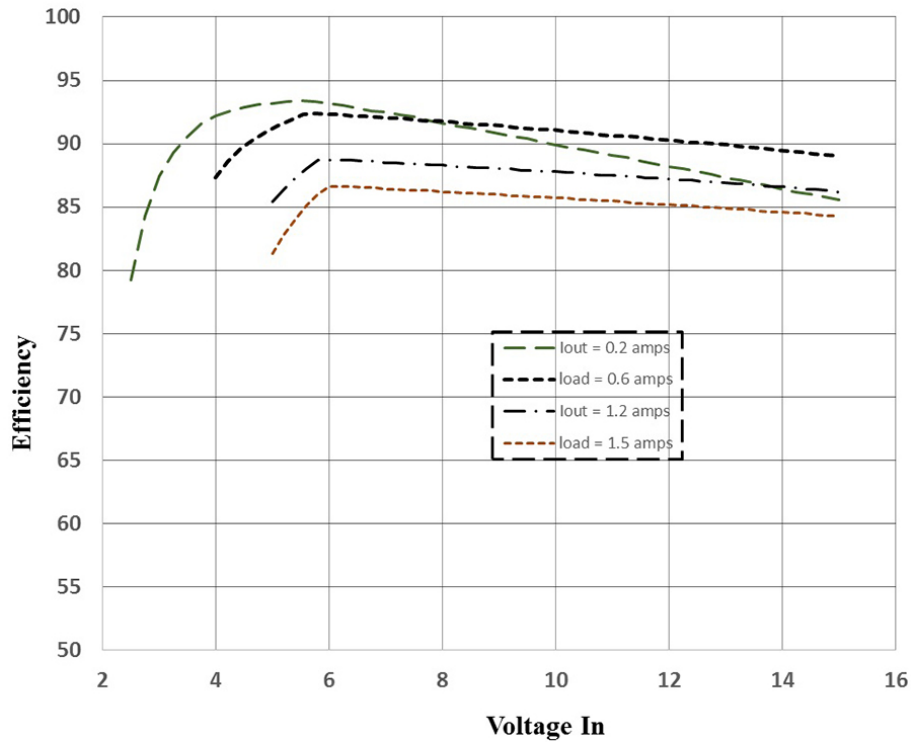


Figure 2. Typical Efficiency as a Function of Input Voltage and Load Current

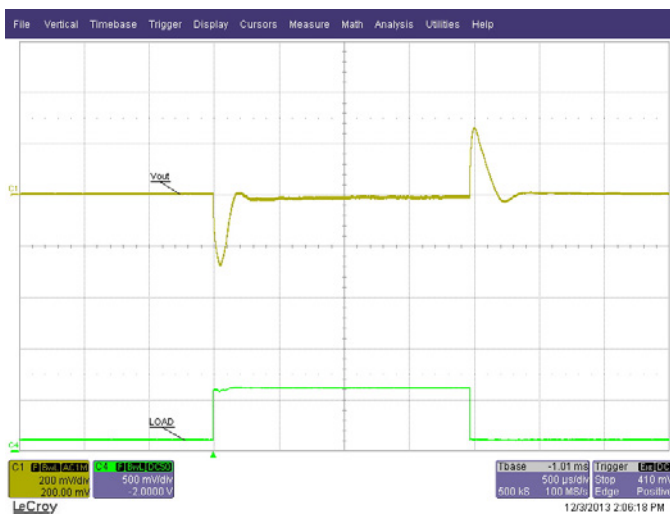


Figure 3. Typical Transient Load Response for a 100mA to 600mA Transient Load $V_{IN} = 3.5V$

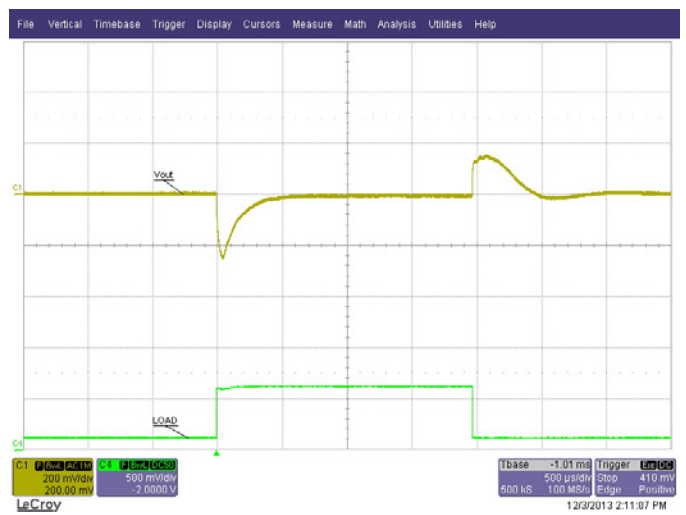


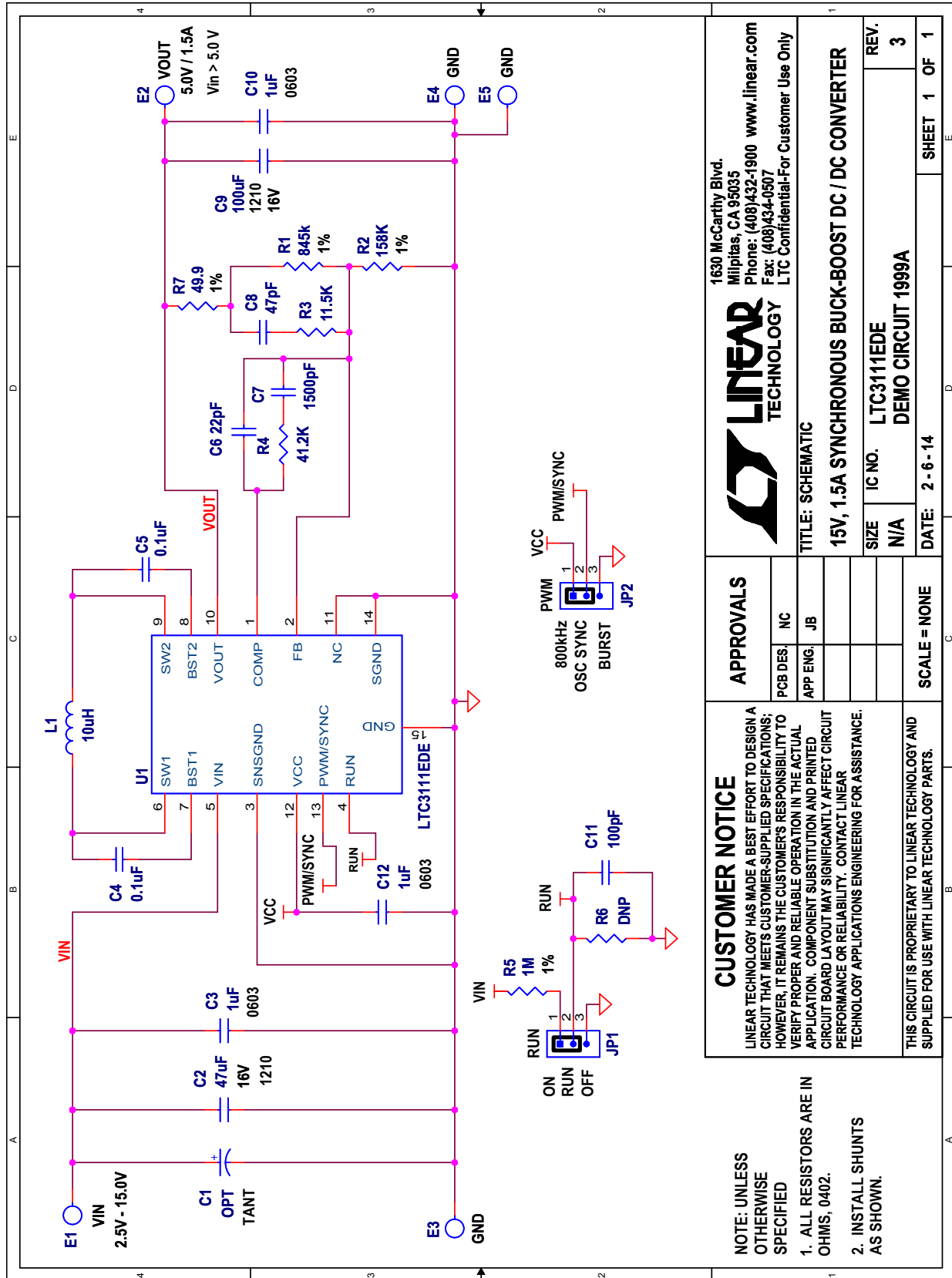
Figure 4. Typical Transient Load Response for a 100mA to 600mA Transient Load $V_{IN} = 12V$

DEMO MANUAL DC1999A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C2	CAP CER 47 μ F 16V 20% X5R 1210	MURATA, GRM32ER61C476ME15L
2	3	C3, C10, C12	CAP CER 1 μ F 16V 10% X5R 0603	MURATA, GRM188R61C105KA93D
3	2	C4, C5	CAP CER 0.1 μ F 16V 10% X7R 0402	MURATA, GRM155R71C104KA88D
4	1	C6	CAP CER 22pF 50V 1% NPO 0402	MURATA, GJM1555C1H220FB01D
5	1	C7	CAP CER 1500pF 16V 10% 0402	AVX, 0402YC152KAT2A
6	1	C8	CAP CER 47pF 50V 5% NPO 0402	MURATA, GRM1555C1H470JZ01D
7	1	C9	CAP CER 100 μ F 16V 20% X5R 1210	TAIYO YUDEN, EMK325ABJ107MM-T
8	1	C11	CAP CER 100pF 50V 5% NPO 0402	MURATA, GRM1555C1H101JA01D
9	1	L1	INDUCTOR, 10 μ H	COILCRAFT, XAL5050-103M
10	1	R1	RES 845k 1/16W 1% 0402 SMD	PANASONIC, ERJ-2RKF8453X
11	1	R2	RES 158k 1/16W 1% 0402 SMD	PANASONIC, ERJ-2RKF1583X
12	1	R3	RES 11.5k 1/16W 1% 0402 SMD	PANASONIC, ERJ-2RKF1152X
13	1	R4	RES 41.2k 1/16W 1% 0402 SMD	PANASONIC, ERJ-2RKF4122X
14	1	R5	RES 1.00M 1/16W 1% 0402 SMD	PANASONIC, ERJ-2RKF1004X
15	1	R6	RES 0402 SMD (DNP)	
16	1	R7	RES 49.9 Ω 1/16W 1% 0402 SMD	PANASONIC, ERJ-2RKF49R9X
17	1	U1	15V, 1.5A SYNCHRONOUS BUCK-BOOST DC/DC CONVERTER	LINEAR TECH., LTC3111EDE #PBF
Additional Demo Board Circuit Components				
1	0	C1 (OPT)	CAP, TANT LOW ESR 47 μ F 35V 20% SMD	AVX, TPSE476M035R0200
Hardware-For Demo Board Only				
1	5	E1-E5	TURRET, 0.09 DIA	MILL-MAX, 2501-2-00-80-00-00-07-0
3	2	JP1, JP2	JMP, 3-PIN 1 ROW 0.079CC	SAMTEC, TMM-103-02-L-S
4	2	XJP1, XJP2	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
5	4	STAND OFF	STAND-OFF, NYLON 0.375" TALL	KEYSTONE, 8832 (SNAP ON)

SCHEMATIC DIAGRAM



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TITLE: SCHEMATIC
15V, 1.5A SYNCHRONOUS BUCK-BOOST DC / DC CONVERTER

CUSTOMER NOTICE
 LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE IN OHMS, 0402.
2. INSTALL SHUNTS AS SHOWN.

DEMO MANUAL DC1999A

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.

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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.

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