

## DESCRIPTION

Demonstration Circuit 625 is a constant-frequency synchronous Buck-Boost converter using the LTC3441. The input range is from 2.4V to 5.5V, making it ideal for single-cell lithium-ion or three-cell NiCd/NiMH battery applications. This converter provides up to 95% efficiency, much higher than traditional Buck-Boost converters. For 2.5V minimum input voltage, this converter can provide up to 1A load current.

The output voltage is set at 3.3V. A different output voltage in the range of 2.4V to 5.25V can be obtained by changing one of the feedback resistors. The switching frequency is set at 1MHz, which is a good trade-off between efficiency and size. Applying twice the desired

frequency at the MODE/SYNC pin can also synchronize the switching frequency between 1.15MHz to 1.7MHz. In shutdown, the IC draws less than 1 $\mu$ A.

When using long wire connections to the input sources (such as wall adaptors), there can be input over voltage transients during initial plug-in. C8 is installed on DC625 to damp the possible voltage transients. C8 is not needed for any application when input source is close to the regulator. Please refer to Application Note 88 for details.

**Design files for this circuit board are available. Call the LTC factory.**

**Table 1. Performance Summary (T<sub>A</sub> = 25°C unless otherwise noted)**

PARAMETER	CONDITION	VALUE
Minimum Input Voltage	-40°C to 85°C	2.4V (2.5V minimum input for 1A load)
Maximum Input Voltage	-40°C to 85°C	5.5V
Output Voltage V <sub>OUT</sub>	V <sub>IN</sub> = 2.5V to 5.25V, I <sub>OUT</sub> = 0A to 1A	3.3V $\pm$ 3%
Maximum Output Current	V <sub>IN</sub> = 2.5V to 5.25V	1A
Typical Output Ripple V <sub>OUT</sub>	V <sub>IN</sub> = 3.0V, I <sub>OUT</sub> = 1A (20MHz BW)	40mV <sub>P-P</sub>
Typical Switching Frequency		1MHz
Efficiency	V <sub>IN</sub> = 4.2V, I <sub>OUT</sub> = 0.2A	94% Typical
	V <sub>IN</sub> = 4.2V, I <sub>OUT</sub> = 1A	89% Typical
On/Off Control	Logic Low Voltage-Off, -40°C to 85°C	0.4V MAX
	Logic High Voltage-On	2.4V MIN

## QUICK START PROCEDURE

Demonstration circuit 625 is easy to set up to evaluate the performance of the LTC3441. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

**NOTE:** 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 Vin

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 625

## 1MHZ, 1A SYNCHRONOUS BUCK-BOOST CONVERTER

or Vout and GND terminals. See Figure 2 for proper scope probe technique.

1. Place jumpers in the following positions:

- JP1** RUN
- JP2** FIXED FREQ.

2. With power off, connect the input power supply to Vin and GND.

3. Turn on the power at the input.

**NOTE:** Make sure that the input voltage does not exceed 5.5V.

4. Check for the proper output voltage. Vout = 3.2V to 3.4V.

**NOTE:** If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

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

Linear Tech. Corp.  
Demo Circuit 625 RevA

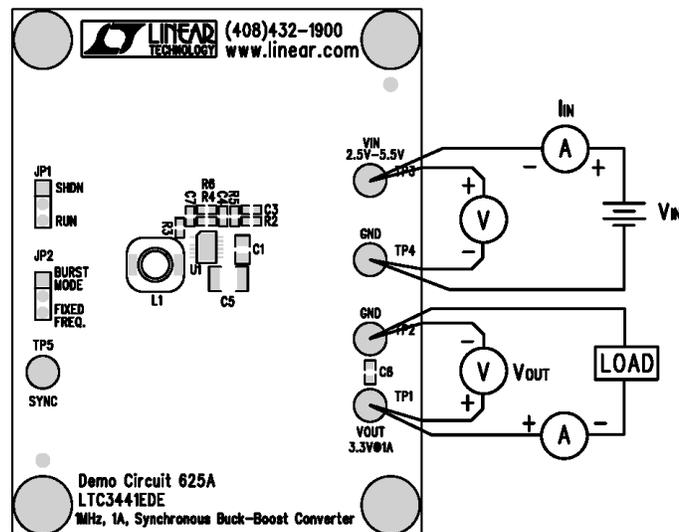


Figure 1. Proper Measurement Equipment Setup

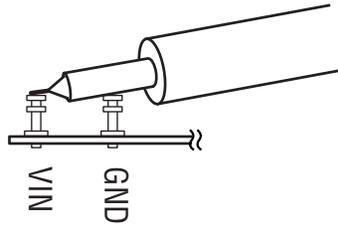


Figure 2. Measuring Input or Output Ripple

## GRAPHICS

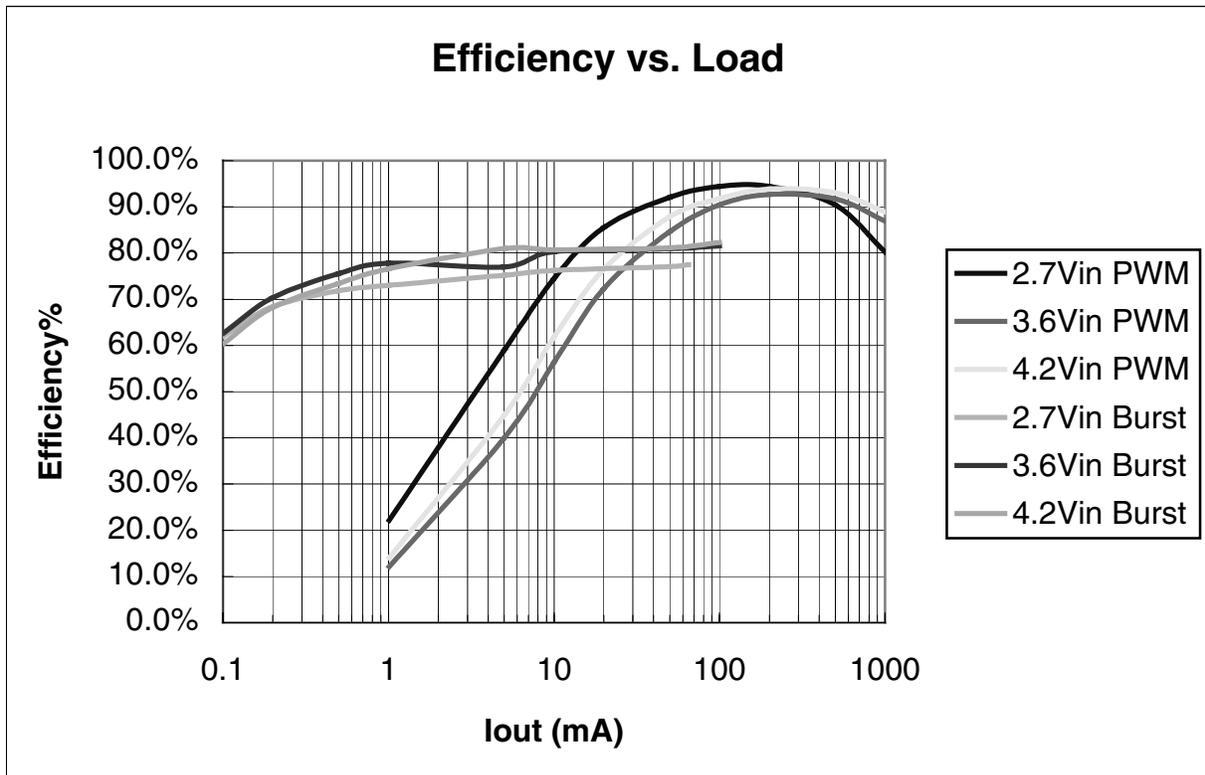


Figure 3. Efficiency of DC625

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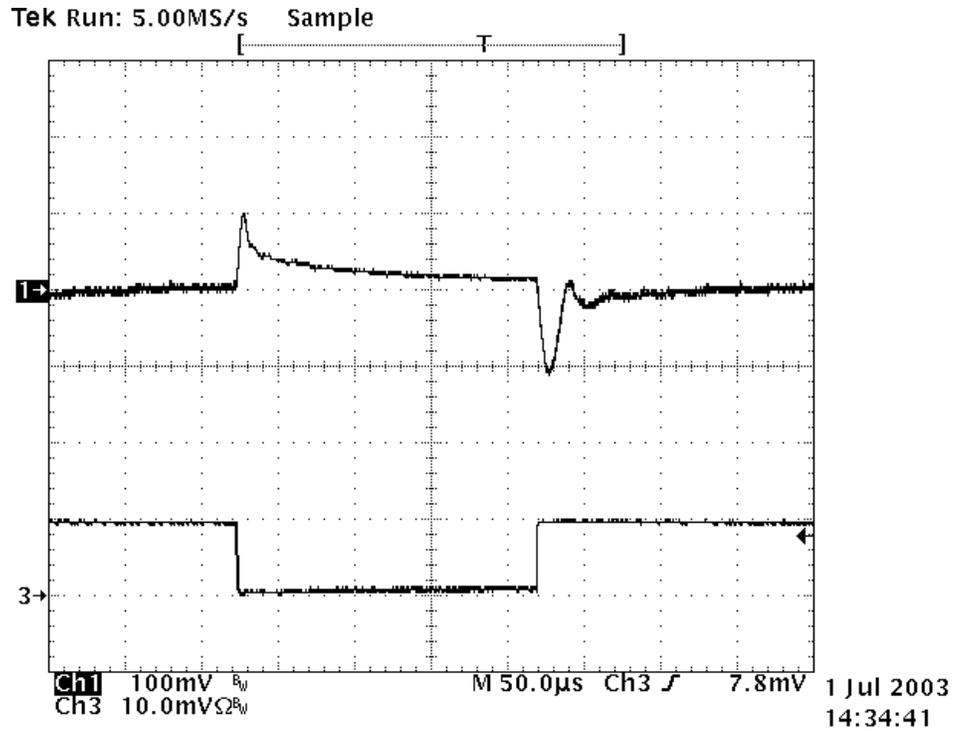
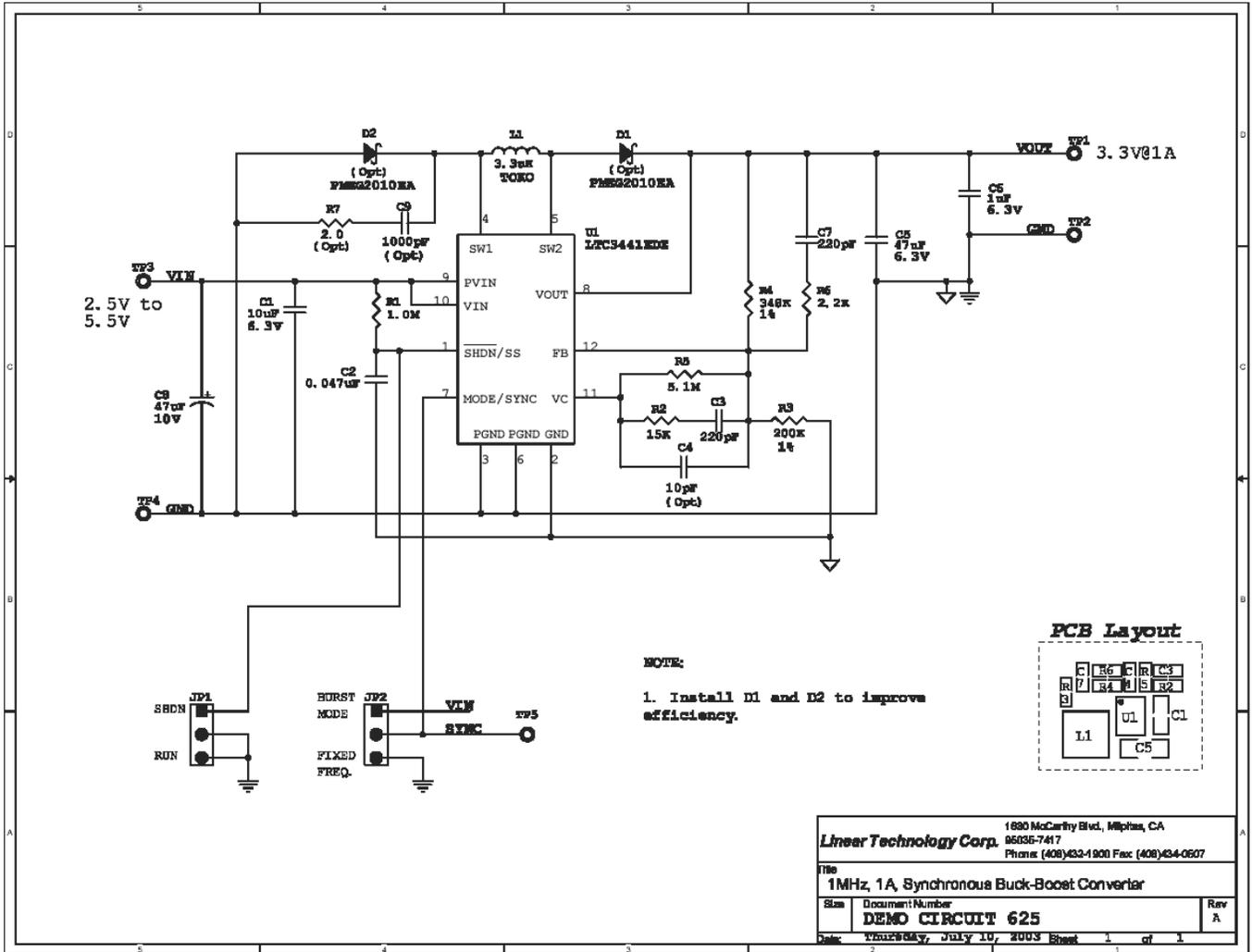


Figure 4. Load Transient Response ( $V_{in}=3V$ ; Channel 1:  $V_{out}$ ; Channel 2:  $I_{out}$ : load step from 100mA to 1A)

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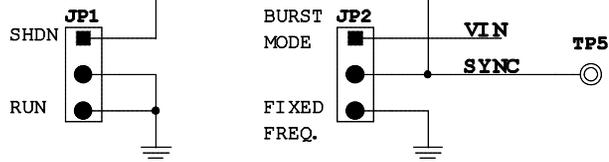
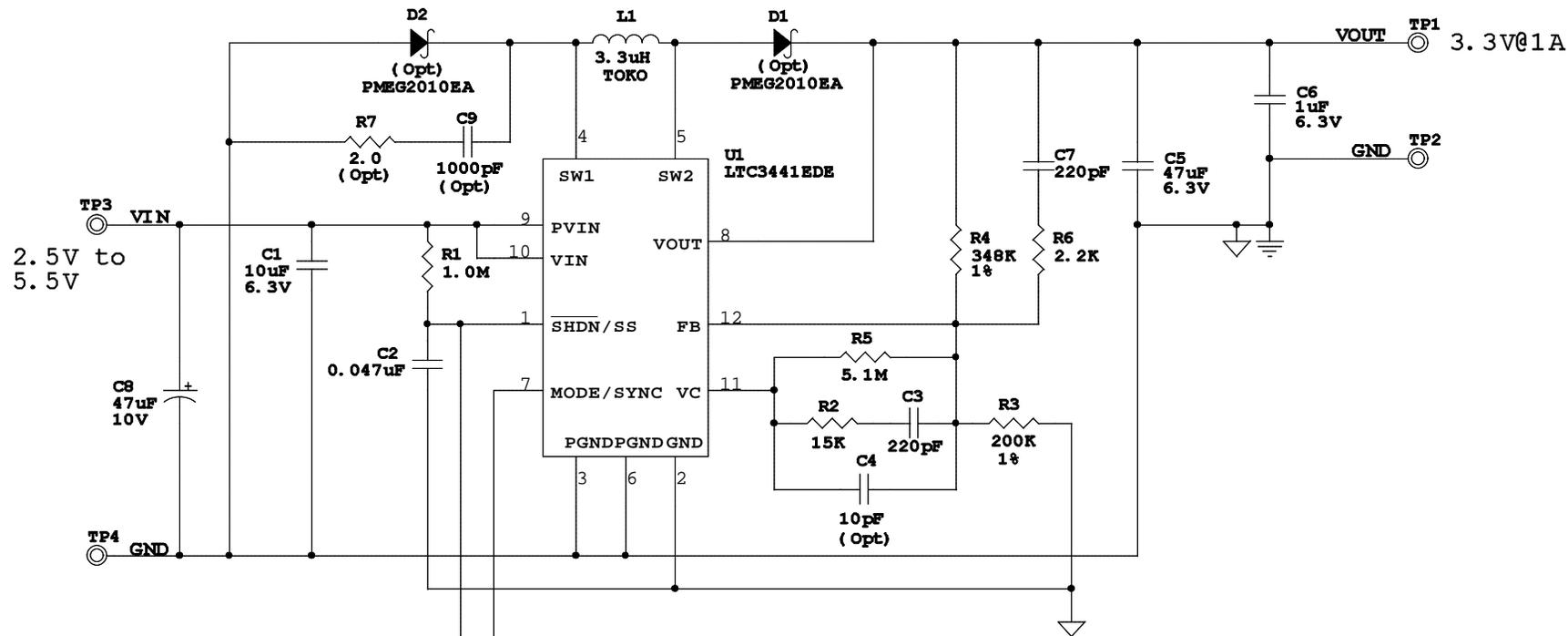
## 1MHZ, 1A SYNCHRONOUS BUCK-BOOST CONVERTER



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## 1MHZ, 1A SYNCHRONOUS BUCK-BOOST CONVERTER

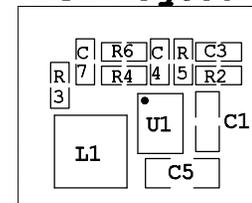
<i>Item</i>	<i>Qty</i>	<i>Reference</i>	<i>Part Description</i>	<i>Manufacture / Part #</i>
1	1	C1	Cap., X5R 10uF 6.3V 20%	Taiyo Yuden JMK212BJ106MG-T
2	1	C2	Cap., X5R 0.047uF 16V 5%	AVX 0402YD473JAT
3	2	C3,C7	Cap., NPO 220pF 25V 10%	AVX 04023A221KAT2A
4	0	C4 (Opt)	Cap., NPO 10pF 25V 10%	AVX 04023A100KAT2A
5	1	C5	Cap., X5R 47uF 6.3V 20%	Taiyo Yuden JMK325BJ476MM-T
6	1	C6	Cap., X5R 1uF 6.3V 10%	Taiyo Yuden JMK107BJ105KA-T
7	1	C8	Cap., Tant. 47uF 10V 20%	AVX TAJB476M010
8	0	C9 (Opt)	Cap., X7R 1000pF 25V 20%	AVX 04023C102MAT2A
9	2	D2,D1	Schottky Diode, 1A / 20V	PHILIPS PMEG2010EA
10	2	JP1,JP2	Headers, 3 Pins 2mm Ctrs.	CommConn Con Inc. 2802S-03G2
11	2	XJP1,XJP2	Shunt, 2 Pins 2mm Ctrs.	CommConn Con Inc. CCIJ2MM-138G
12	1	L1	Inductor, 3.3uH	TOKO A916CY-3R3M
13	1	R1	Res., Chip 1.0M 1/16W 5%	AAC CR05-105JM
14	1	R2	Res., Chip 15K 1/16W 5%	AAC CR05-153JM
15	1	R3	Res., Chip 200K 0.06W 1%	AAC CR05-2003FM
16	1	R4	Res., Chip 348K 1/16W 1%	AAC CR05-3483FM
17	1	R5	Res., Chip 5.1M 1/16W 5%	AAC CR05-515JM
18	1	R6	Res., Chip 2.2K 0.06W 5%	AAC CR05-222JM
19	0	R7 (Opt)	Res., Chip 2.0 0.06W 1%	AAC CR05-2R00FM
20	5	TP1,TP2,TP3,TP4,TP5	Turret, Testpoint	Mill Max 2501-2
21	1	U1	I.C., Buck Converter	Linear Tech. Corp. LTC3441EDE
22	4		SCREW, #4-40, 1/4"	ANY
23	4		STANDOFF, #4-40 1/4"	MICRO PLASTICS 14HTSP101
24	1		PRINTED CIRCUIT BOARD	FAB., DEMO CIRCUIT 625A
25	2		TOP STENCIL	STENCIL DC625A



**NOTE:**

1. Install D1 and D2 to improve efficiency.

**PCB Layout**



Monday, August 25, 2003

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<b>Linear Technology Corp.</b>		
Title <b>1MHz, 1A, Synchronous Buck-Boost Converter</b>		
Size	Document Number <b>DEMO CIRCUIT 625</b>	Rev A
Date:	Sheet 1 of 1	

6/17/2005

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