

LTC3536

1A, Low Noise, Wide V_{IN} Buck-Boost DC/DC Converter

DESCRIPTION

Demonstration circuit 1797A is a combined step-up and step-down DC/DC converter using the LTC[®]3536 monolithic synchronous buck-boost regulator. The DC1797A has wide input voltage range of 1.8V to 5.5V, and is capable of delivering up to 1A of output current. The output voltage of the DC1797A can be set as low as 1.8V and can go as high as 5.5V. The DC1797A supports two operational modes: fixed-frequency pulse-width modulation (PWM) and Burst Mode[®] operation. Fixed-frequency mode of operation maximizes the output current, reduces output voltage ripple, and yields a low noise switching spectrum. Burst Mode operation employs a variable frequency switching algorithm that minimizes the no-load input quiescent current and improves efficiency at light loads.

The DC1797A consumes less than 28 μ A of quiescent current during Burst Mode operation, and during shutdown, it consumes less than 1 μ A. The DC1797A has a standard operating frequency of 1MHz, but can be adjusted to frequencies as high as 2MHz. If Pin 1 (RT) is tied to V_{IN} , the default switching frequency is 1.2MHz. Because of the high switching frequency of the DC1797A, small, low profile surface mount components are used in the circuit. These features, plus the LTC3536 availability in a small 10-lead DFN package, make the DC1797A a perfect match for battery-powered, hand-held applications.

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

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PERFORMANCE SUMMARY

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		1.8V
Maximum Input Voltage		5.5V
Output Voltage V_{OUT} Regulation	$V_{IN} = 1.8V$ to 5.5V	3.3V \pm 2%
Maximum Continuous Output Current	Fixed Frequency Mode	1A
Preset Operating Frequency	$R6 = 100k\Omega$	1MHz
External Clock Sync. Frequency Range		300kHz to 2MHz
Efficiency	$V_{IN} = 5V, V_{OUT} = 3.3V, I_{OUT} = 0.2A$	95%
Typical Output Ripple V_{OUT}	$V_{IN} = 5V, I_{OUT} = 1A$ (20MHz Bandwidth)	< 15mV _{p-p}
Burst Mode Operation	$V_{IN} = 5V, V_{OUT} = 3.3V$ $V_{IN} = 2.5V, V_{OUT} = 3.3V$	< 0.15A < 0.1A

QUICK START PROCEDURE

Demonstration circuit 1797A is easy to set up to evaluate the performance of the LTC3536. For proper measurement equipment configuration, set up the circuit according to the diagram in Figure 1. Before proceeding to test, insert shunts into JP1 fixed frequency and JP2 off positions, which connects the RUN pin to ground (GND), and thus, shutdown the circuit.

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 V_{IN} or V_{OUT} and GND terminals. See Figure 2 for proper scope probe technique.

1. With the DC1797 set up according to the proper measurement and equipment in Figure 1, apply 5V at V_{IN} . Measure V_{OUT} ; it should read 0V. If desired, one can measure the shutdown supply current at this point. The supply current will be approximately $3\mu\text{A}$, or less, in shutdown.

2. Turn on the circuit by inserting the shunt in header JP2 into the ON position. The output voltage should be regulating. Measure V_{OUT} —it should measure $3.3\text{V} \pm 1\%$ (Do not apply more than the rated maximum voltage of 5.5V to the board or the part may be damaged).
3. Vary the converter load, which should not exceed 1A at V_{IN} 5.0V.
4. Vary the input voltage from 1.8V to 5.5V, the available output current depends on the input voltage, see the LTC3536 data sheet for details.
5. Set output current to zero and move jumper JP2 into Burst Mode position and measure V_{OUT} —it should register $3.3\text{V} \pm 1\%$.
6. Vary the input voltage from 1.8V to 5.5V, the available output current depends on the input voltage. Load in Burst Mode operation should no exceed 0.15A at V_{IN} 5.0V and 0.1A at 2.5V, see the LTC3536 data sheet for details.

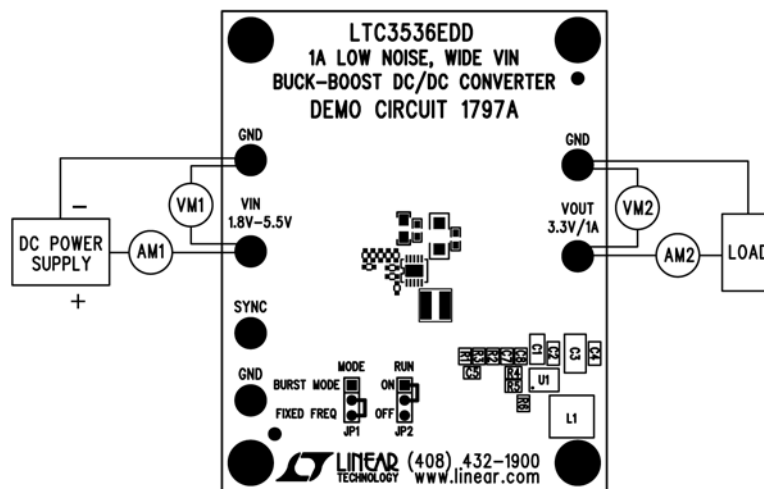


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

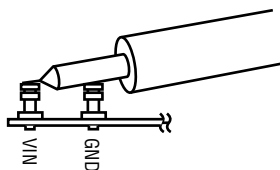


Figure 2. Measuring Input or Output Ripple

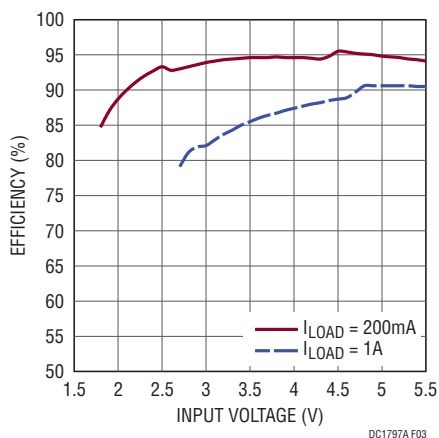


Figure 3. Efficiency vs Input Voltage

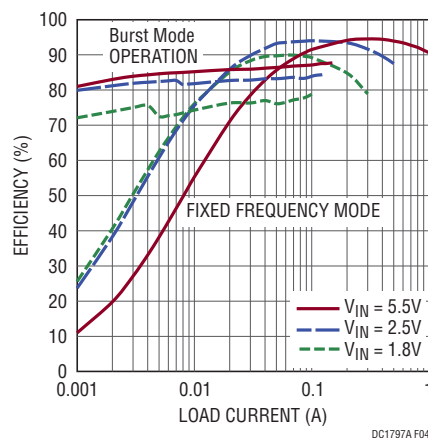


Figure 4. Efficiency vs Input Voltage for Fixed Frequency and Burst Mode Operation

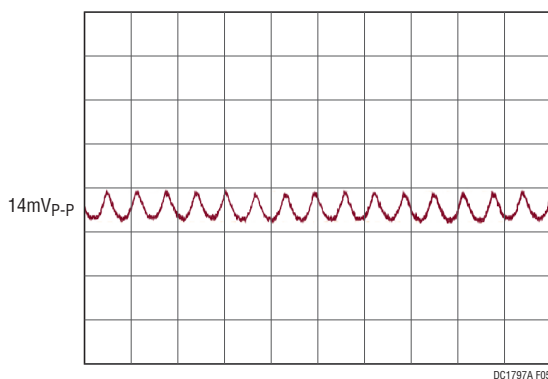


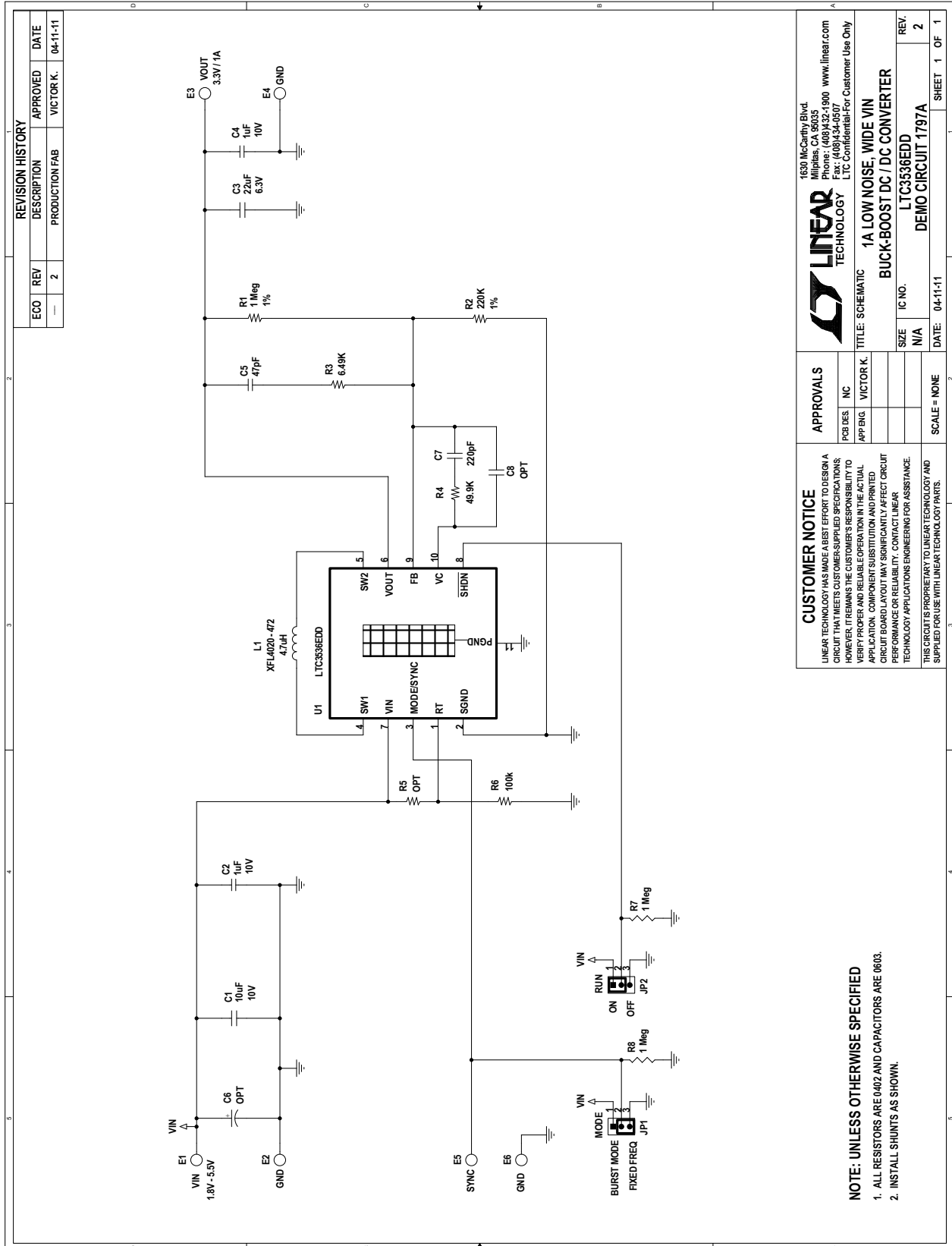
Figure 5. Output Noise, $V_{IN} = 4.5V$, $I_{OUT} = 1A$

DEMO MANUAL DC1797A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER, PART NUMBER
Required Circuit Components				
1	1	C1	Capacitor Ceramic 10 μ F 10V X5R 10% 0805	Murata, GRM21BR61A106KE19L
2	2	C2, C4	Capacitor Ceramic 1.0 μ F 10V X7R 20% 0603	AVX, 06036C105MAT2A
3	1	C3	Capacitor Ceramic 22 μ F 6.3V X5R 10% 1206	AVX, 12066D226KAT2A
4	1	C5	Capacitor Ceramic 47PF 50V C0G 5% 0402	TDK, C1005C0G1H470J
5	1	C7	Capacitor Ceramic 220PF 50V C0G 5% 0402	Murata, GRM1555C1H221JA01D
6	1	L1	Inductor, 4.7 μ H	Coilcraft XFL4020-472MEC
7	3	R1, R7, R8	Resistor 1.00M Ω 1/16W 1% 0402 SMD	Vishay, CRCW04021M00FK
8	1	R2	Resistor 220k Ω 1/16W 1% 0402 SMD	Vishay, CRCW0402220KFKED
9	1	R3	Resistor 6.49k Ω 1/16W 1% 0402 SMD	Vishay, CRCW04026K49FKED
10	1	R4	Resistor 49.9k Ω 1/16W 1% 0402 SMD	Vishay, CRCW040249K9FKED
11	1	R6	Resistor 100k Ω 1/16W 1% 0402 SMD	Vishay, CRCW0402100KFKED
12	1	U1	Buck-Boost Converter	Linear Technology, LTC3536EDD
Additional Demo Board Circuit Components				
1	0	C6	Capacitor, POSCAP 47 μ F 10V	Sanyo, 10TPB47MC, Optional
2	0	C8	Capacitor C0G 0402	Optional
3	0	R5	Resistor, 0402	Optional
Hardware				
1	4	MH1-MH4	Stand-Off, Nylon (Snap On), 0.375" Tall	Keystone, 8832
2	6	E1, E2, E3, E4, E5, E6	Turret, 0.09 Diameter	Mill-Max, 2501-2-00-80-00-00-07-0
3	2	JP2, JP1	Headers, 3 Pins, 2mm CTRs	Samtec, TMM-103-02-L-S
4	2	XJP1, XJP2	Shunt, 2mm CTRs	Samtec, 2SN-BK-G
5	1	FAB, Printed Circuit Board	Demo Circuit 1797A-2	

SCHEMATIC DIAGRAM



DEMO MANUAL DC1797A

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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.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

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Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

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