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LTC3536
1A, Low Noise, Wide V_{IN} Buck-Boost DC/DC Converter

DESCRIPTION

Demonstration circuit 1852A is a combined step-up and step-down DC/DC converter, using the LTC3536 monolithic synchronous buck-boost regulator. The DC1852A 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 DC1852A can be set as low as 1.8V and can go as high as 5.5V. DC1852A supports two operation 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 DC1852A consumes less than 28µA of quiescent current during Burst Mode operation, and during shutdown, it consumes less than 1µA. The DC1852A 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 DC1852A, small, low profile surface mount components are used in the circuit. These features, plus the LTC3536's small 12-lead MSOP package, make the DC1852A a perfect match for battery-powered, handheld applications.

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

PERFORMANCE SUMMARY (T_A = 25°C)

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 ±2%
Maximum Continuous Output Current	Fixed Frequency Mode	1A
Preset Operating Frequency	R6 = 100kΩ	1MHz
External Clock Sync. Frequency Range		300kHz to 2MHz
Efficiency	V_{IN} = 5V, V_{OUT} = 3.3V, I_{OUT} = 1A	95%
Typical Output Ripple V_{OUT}	V_{IN} = 5V, I_{OUT} = 1A (20MHz BW)	<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 1852A 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 FREQ and JP2 OFF positions, which connects the RUN pin to ground (GND), and thus, shut down 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 DC1852 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 3µA, 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 3.3V ±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} 5V.
4. Vary the input voltage from 1.8V to 5.5V, the **available output current depends on the input voltage**, see 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 3.3V ±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 should no exceed 0.15A at V_{IN} 5V and 0.1A at 2.5V, see LTC3536 data sheet for details.

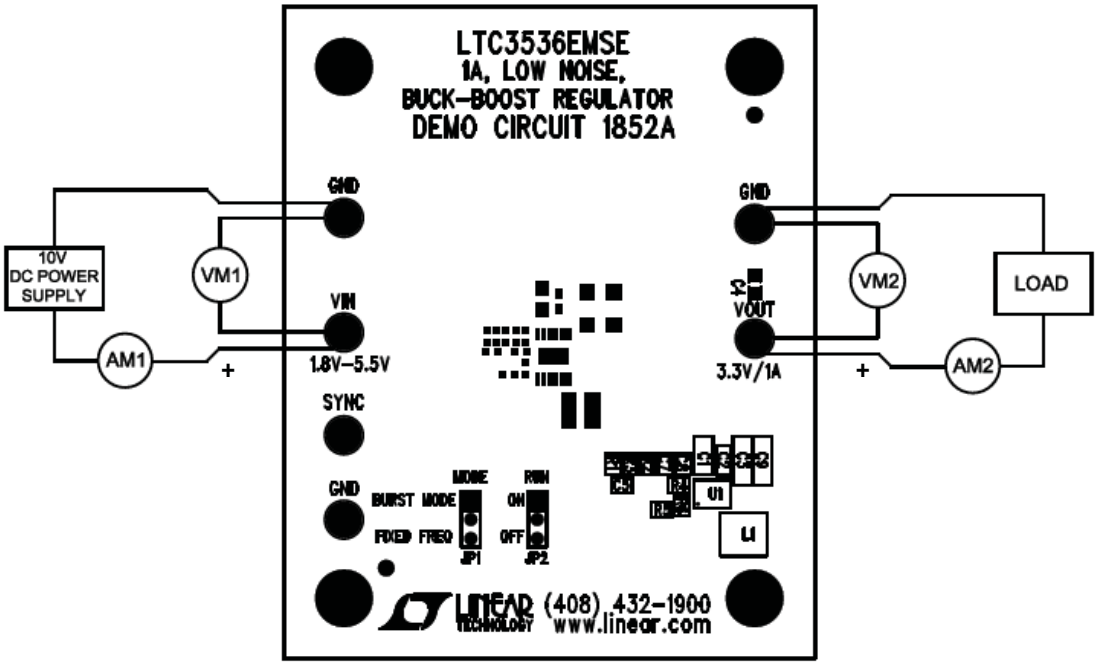


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

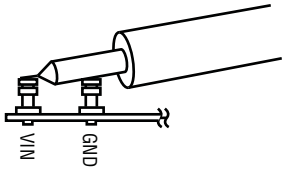


Figure 2. Measuring Input or output Ripple

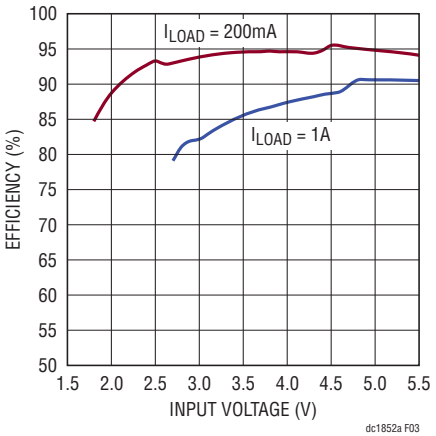


Figure 3. Efficiency vs Input Voltage

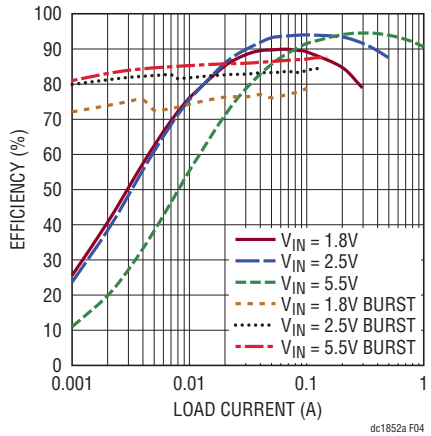


Figure 4. Efficiency vs Input Voltage for Fixed Frequency and Burst Mode Operation

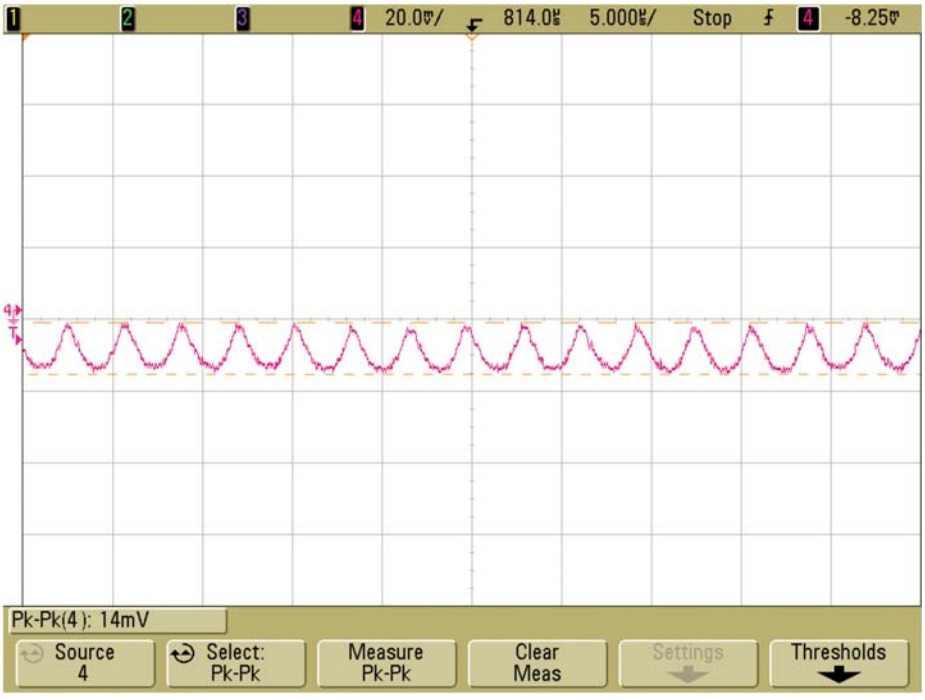
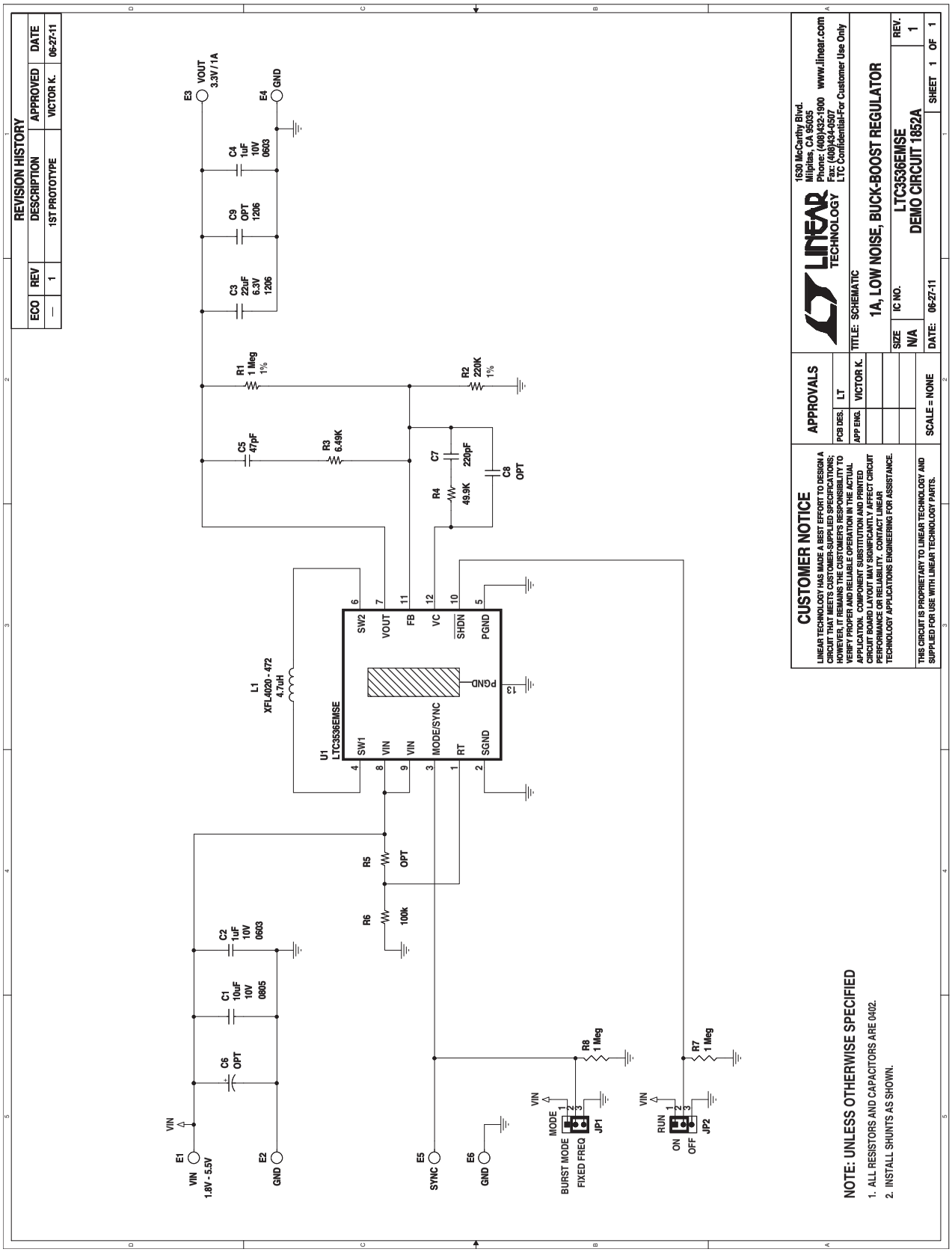


Figure 5. Output Noise, V_{IN} 4.5V, I_O 1A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP CER 10µF 10V X5R 10% 0805	MURATA, GRM21BR61A106KE19L
2	2	C2, C4	CAP CER 1µF 10V X7R 20% 0603	AVX, 06036C105MAT2A
3	1	C3	CAP CER 22µF 6.3V X5R 10% 1206	AVX, 12066D226KAT2A
4	1	C5	CAP CER 47pF 50V C0G 5% 0402	TDK, C1005C0G1H470J
5	1	C7	CAP CER 220pF 50V C0G 5% 0402	MURATA, GRM1555C1H221JA01D
6	1	L1	INDUCTOR, 4.7µH	COILCRAFT XFL4020-472MEC
7	3	R1, R7, R8	RES 1mΩ 1/16W 1% 0402 SMD	VISHAY, CRCW04021M00FK
8	1	R2	RES 220k 1/16W 1% 0402 SMD	VISHAY, CRCW0402220KFKED
9	1	R3	RES 6.49k 1/16W 1% 0402 SMD	VISHAY, CRCW04026K49FKED
10	1	R4	RES 49.9k 1/16W 1% 0402 SMD	VISHAY, CRCW040249K9FKED
11	1	R6	RES 100k 1/16W 1% 0402 SMD	VISHAY, CRCW0402100KFKED
12	1	U1	BUCK-BOOST CONVERTER	LINEAR TECHNOLOGY, LTC3536EMSE
Additional Demo Board Circuit Components				
1	0	C6	CAP POSCAP 47µF 10V	SANYO, 10TPB47MC, OPT
2	0	C8	CAP C0G 0402	OPT
3	0	R5	RES 0402	OPT
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 DIA	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



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