LTC3863
Low I_Q Inverting DC/DC Converter

DESCRIPTION

Demonstration circuit 1737A is a current-mode inverting DC/DC converter featuring the LTC®3863.

The board operates from an input range of 4.5V to 16V, and provides a –5.2V, 1.7A output or a –12V, 1A output (jumper selectable). It operates at 400kHz and may be synchronized to an external clock. A soft-start feature controls output voltage slew rate at start-up, reducing current surge and voltage overshoot. Burst Mode® operation that improves efficiency at light loads can be enabled with a jumper. A power good output signal is provided. The demonstration board has options for larger MOSFET and diode packages on the back of the board for higher output current requirements.

This board is suitable for a wide range of automotive, telecom, industrial, and other applications. The LTC3863 is available in small 12-pin thermally enhanced MSOP and DFN Packages. For other output requirements, see the LTC3863 data sheet or contact the LTC factory.

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°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		4.5		16	V
V_{OUT}	Output Voltage			–5.2V/–12V		V
I_{OUT}	Output Current Range, Continuous	Free Air	0		–1.7/1.0	A
f_{SW}	Switching (Clock) Frequency			400		kHz
$V_{OUT\ P-P}$	Output Ripple	V_{IN} = 12V, V_{OUT} = –12V, I_{OUT} = 1A (20MHz BW)		30		mV_{P-P}
V_{REG}	Output Regulation	Line and Load (4.5V_{IN} to 16V_{IN}, –12V_{OUT}, 0A to 1A Out)		±0.1		%
P_{OUT}/P_{IN}	Efficiency (See Figure 3)	V_{IN} = 12V, V_{OUT} = –12V, I_{OUT} = 1A		89.3		%
	Approximate Size	Component Area × Top Component Height		0.9 × 0.8 × 0.18		Inches

QUICK START PROCEDURE

Demonstration circuit 1737 is easy to set up to evaluate the performance of the LTC3863. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

Note: When measuring the output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip and ground ring directly across the last output capacitor as shown in Figure 1.

1. Set an input power supply that is capable of 4.5V to 16V to 5V. Then turn off the supply.
2. With power off, connect the supply to the input terminals +VIN and –VIN.
   a. Input voltages lower than 4.5V can keep the converter from turning on due to the undervoltage lockout feature of the LTC3863.
   b. If efficiency measurements are desired, an ammeter capable of measuring 2A DC or a resistor shunt can be put in series with the input supply in order to measure the DC1737A's input current.
   c. A voltmeter with a capability of measuring at least 16V can be placed across the input terminals in order to get an accurate input voltage measurement.
3. Turn on the power at the input.

Note: Make sure that the input voltage never exceeds 16V.

4. Check for the proper output voltage of –5.2V. Turn off the power at the input.

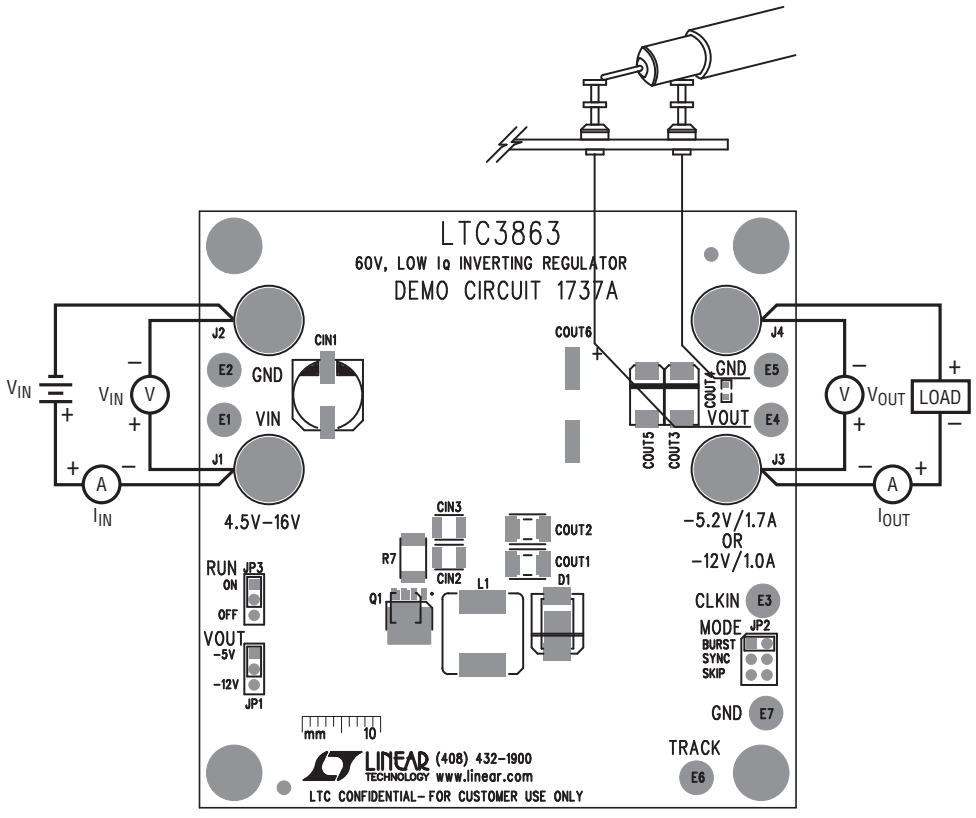


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

5. Once the proper output voltage is established, connect a variable load capable of sinking 1.7A at 5.2V to the output terminals +VOUT and –VOUT. Set the current for 0A.
   a. If efficiency measurements are desired, an ammeter or a resistor shunt that is capable of handling 1.7A DC can be put in series with the output load in order to measure the DC1737A's output current.
   b. A voltmeter with a capability of measuring at least 12V can be placed across the output terminals in order to get an accurate output voltage measurement.
6. Turn on the power at the input.

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

7. Once the proper output voltage is again established, adjust the load and/or input within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.
8. Remove the VOUT jumper to observe operation at $-12V_{OUT}$ up to 1A.

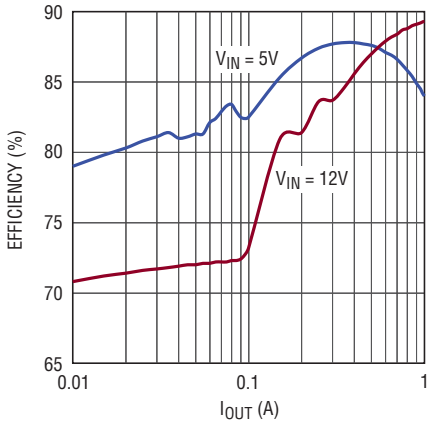


Figure 2. $-12V_{OUT}$ Efficiency with Burst Mode Operation at Light Loads

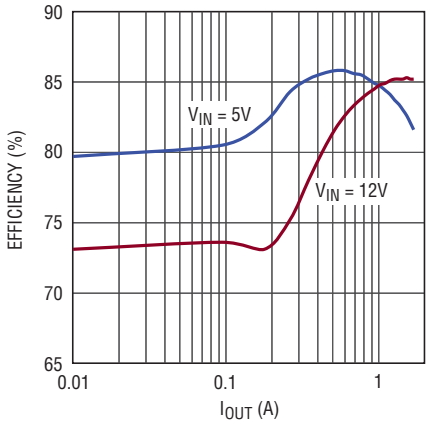


Figure 3. $-5.2V_{OUT}$ Efficiency with Burst Mode Operation at Light Loads

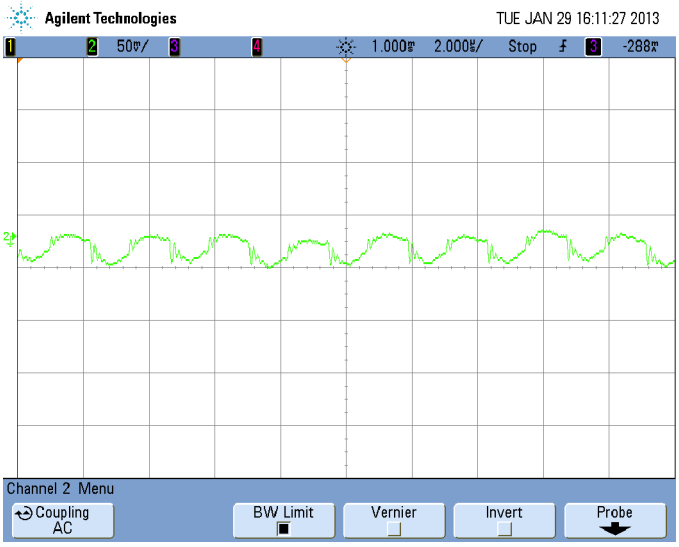


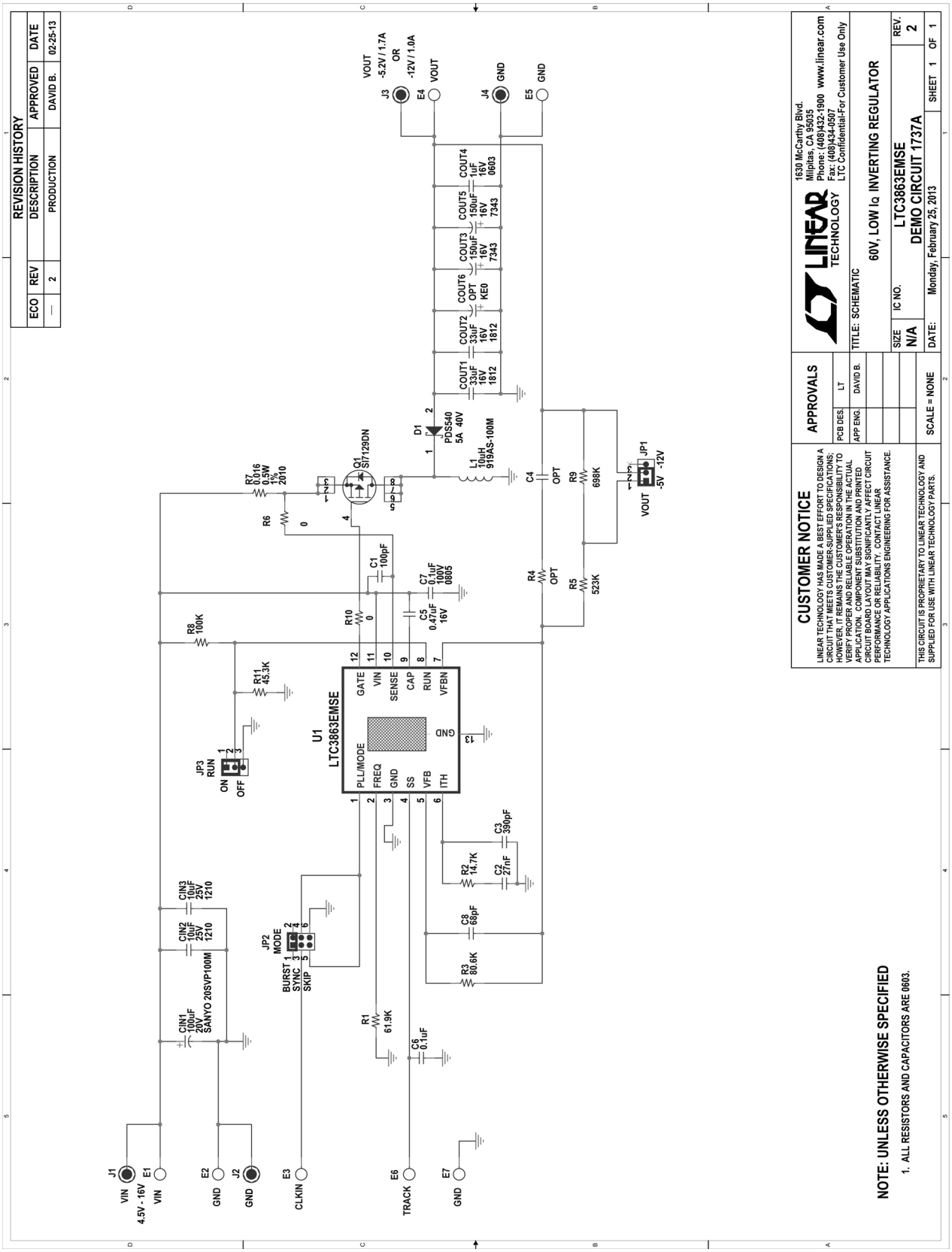
Figure 4. Output Ripple at $12V_{IN}$, $-12V_{OUT}$ and 1A Out (50mV, 2µs/Div, 20MHz)

Figure 5. Transient Response Waveform at $12V_{IN}$, $-12V_{OUT}$ and 0.5A to 1A to 0.5A Out (0.5A, 100mV, 10µs/Div)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	Cap., SMT, 100µF, 20V, SVP OSCON	SANYO, 20SVP100M
2	2	CIN2, CIN3	CAP.,X7R, 10µF, 25V, 20%, 1210	TDK, C3225X7R1E106M
3	2	COUT1, COUT2	CAP.,X7R, 33µF, 16V, 20%, 1812	TDK, C4532X7R1C336M
4	2	COUT3, COUT5	CAP.,POSCAP, 150µF, 16V 7343	PANASONIC, 16TQC150MYF
5	1	COUT4	CAP.,X7R, 1µF, 16V, 10%, 0603	AVX, 0603YC105KAT2A
6	1	C1	Cap., NPO, 100pF, 50V, 10%, 0603	AVX, 06035A101kAT1A
7	1	C2	Cap., X7R, 27nF 25V, 10%, 0603	AVX, 06033C273KAT
8	1	C3	Cap., NPO, 390pF, 25V, 1%, 0603	AVX, 06033A391FAT2A
9	1	C5	Cap., X7R, 0.47µF, 16V, 20%, 0603	AVX, 0603YC474MAT2A
10	1	C6	Cap., X7R, 0.1µF, 16V, 20%, 0603	AVX, 0603YC104MAT2A
11	1	C7	Cap., X7R, 0.1µF, 100V, 20%, 0805	TDK, C2012X7R2A104M
12	1	C8	CAP., NPO, 68pF, 50V, 5%, 0603	AVX, 06035A680JAT2A
13	1	D1	DIODE, PDS540, POWERDI5-2PIN	DIODES INC, PDS540-13
14	1	L1	IND, 10uH, 20%, D104C	TOKO, 919AS-100M=P3
15	1	Q1	TRANSISTOR, SI7129DN, PWRPAK1212-8	VISHAY, Si7129DN-T1-GE3
16	1	R1	RES., CHIP, 61.9k, 1/16W, 1% , 0603	VISHAY, CRCW060361K9FKED
17	1	R2	RES., CHIP, 14.7k, 1/16W, 1% , 0603	VISHAY, CRCW060314K7FKED
18	1	R3	RES., CHIP, 80.6k, 1/16W, 1% , 0603	VISHAY, CRCW060380K6FKED
19	1	R5	RES., CHIP, 523k, 1/16W, 1% , 0603	VISHAY, CRCW0603523KFKED
20	1	R7	RES., 0.016 1/2W 1% 2010	VISHAY, WSL2010R0160FEA
21	1	R8	RES., CHIP, 100k, 1/16W, 1% , 0603	VISHAY, CRCW0603100KFKED
22	1	R9	RES., CHIP, 698k, 1/10W, 1% , 0603	VISHAY, CRCW0603698KFKED
23	1	R11	RES., CHIP, 45.3k, 1/16W, 1% , 0603	VISHAY, CRCW060345K3FKED
24	1	U1	IC, LTC3863EMSE, MSE12	LINEAR TECH.CORP. LTC3863EMSE
Additional Demo Board Circuit Components				
25	0	COUT6	CAP., OPT KE0	OPT
26	0	C4	CAP., OPT 0603	OPT
27	1	R4	RES., OPT 0603	OPT
28	2	R6, R10	RES., CHIP, 0Ω, 1/16W, 0603	VISHAY, CRCW06030000Z0ED
Hardware For Demo Board Only				
29	7	E1, E2, E3, E4, E5, E6, E7	TESTPOINT, TURRET, .090” pbf	MILL-MAX, 2501-2-00-80-00-00-07-0
30	2	JP1, JP3	JMP, 0.079 SINGLE ROW HEADER, 3-PIN	SULLINS, NRPN031PAEN-RC
31	1	JP2	JMP, 0.079 DOUBLE ROW HEADER, 6-PIN	SULLINS, NRPN062PAEN-RC
32	4	J1, J2, J3, J4	CONN, BANANA JACK	KEYSTONE 575-4
33	3	XJP1, XJP2, XJP3	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
34	4	MTGS AT 4 CORNERS	STAND-OFF, SNAP ON NYLON 0.50" tall	KEYSTONE, 8833(SNAP ON)

SCHEMATIC DIAGRAM



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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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