

# LTC3638EMSE

## High Efficiency, High $V_{IN}$ , 250mA Step-Down Converter

### DESCRIPTION

Demonstration circuit 2057A is a high input voltage, 250mA output DC/DC power supply featuring the [LTC®3638](#). The IC operates with high efficiency Burst Mode® operation and includes an internal high side power MOSFET. The board will accept an input voltage between 4V and 140V, and provide jumper selected output voltages of 1.8V, 3.3V, 5V with an option for additional voltages. The IC includes internal soft-start and a provision for increasing soft-start time.

Included on the board is an ON/OFF jumper that can also be configured as a precision undervoltage lockout. Additional PC pads are included for programming current limit to optimize efficiency and for reducing output voltage ripple and reducing component size. A terminal (FBO) is included to allow multiple boards to be paralleled for higher output current.

Output voltages between 800mV and  $V_{IN}$  can be programmed using optional resistors (higher voltage rating output capacitors may be required).

The LTC3638 data sheet gives a complete description of the IC operation and application information. The data sheet must be read in conjunction with this quick start guide.

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

LT, LT, LTC, LTM, Linear Technology, the Linear logo and Burst Mode are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

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

PARAMETER	CONDITION	VALUE
Input Voltage Range		4V to 140V
1.8V Output Voltage	$V_{IN} = 12\text{V}$ , $I_{OUT} = 0\text{A}$ to 250mA	1.8V $\pm 2\%$
3.3V Output Voltage	$V_{IN} = 12\text{V}$ , $I_{OUT} = 0\text{A}$ to 250mA	3.3V $\pm 2\%$
5V Output Voltage	$V_{IN} = 12\text{V}$ , $I_{OUT} = 0\text{A}$ to 250mA	5V $\pm 2\%$
Maximum Output Current, $I_{OUT}$	$V_{IN} = 4\text{V}$ to 140V, $V_{OUT} = 1.8\text{V}$ , 3.3V or 5V	250mA
Typical Efficiency	$V_{IN} = 12\text{V}$ , $V_{OUT} = 5\text{V}$ , $I_{OUT} = 250\text{mA}$	83.7%
Typical Output Ripple	$V_{IN} = 140\text{V}$ , $V_{OUT} = 5\text{V}$ , $I_{OUT} = 100\text{mA}$ (20MHz BW)	81mV <sub>P-P</sub>

## QUICK START PROCEDURE

Demonstration circuit 2057A is easy to set up to evaluate the performance of the LTC3638. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply (set for 0V) to VIN and GND (input return).
2. Select 5V output using jumper JP1 (B position) and JP2 (A position). Select ON position for JP3.
3. Connect the 5V output load between VOUT and GND (Initial load: no load).
4. Connect the DVMs to the input and outputs.
5. Turn on the input power supply and slowly increase to 12V. Check for the proper output voltages. (5V output should be within  $5V \pm 2\%$ .)
6. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage and other parameters.

7. With power off, move jumpers JP1 and JP2 to the other fixed voltage settings (1.8V or 3.3V). Repeat steps 5 and 6. Check for the proper output voltage and other parameters.

Note: When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (–) terminals of an output capacitor. The probe's ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.

Additional Notes:

1. **CAUTION: Be careful when testing with high voltage. High voltage can result in an electric shock if care is not taken.**
2. For 5V output,  $V_{IN}$  input voltage should be at least 5V or higher.

**QUICK START PROCEDURE**

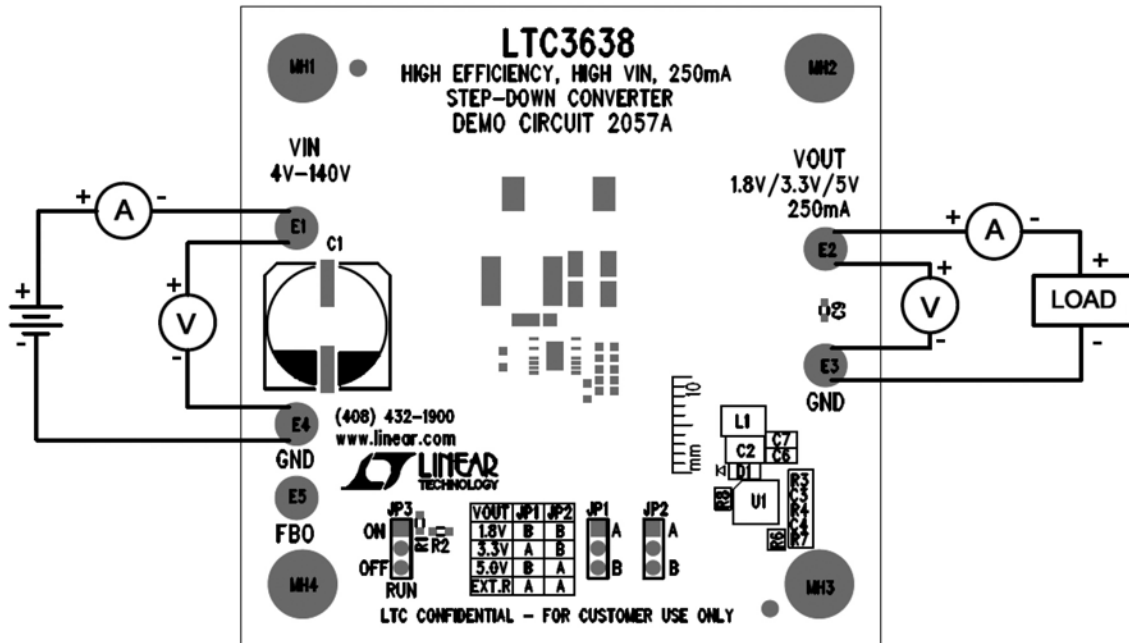


Figure 1. Proper Measurement Equipment Setup

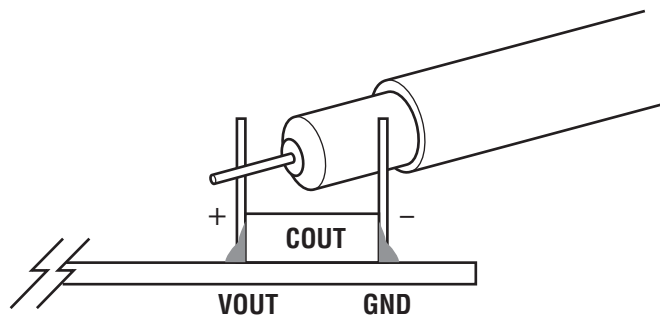
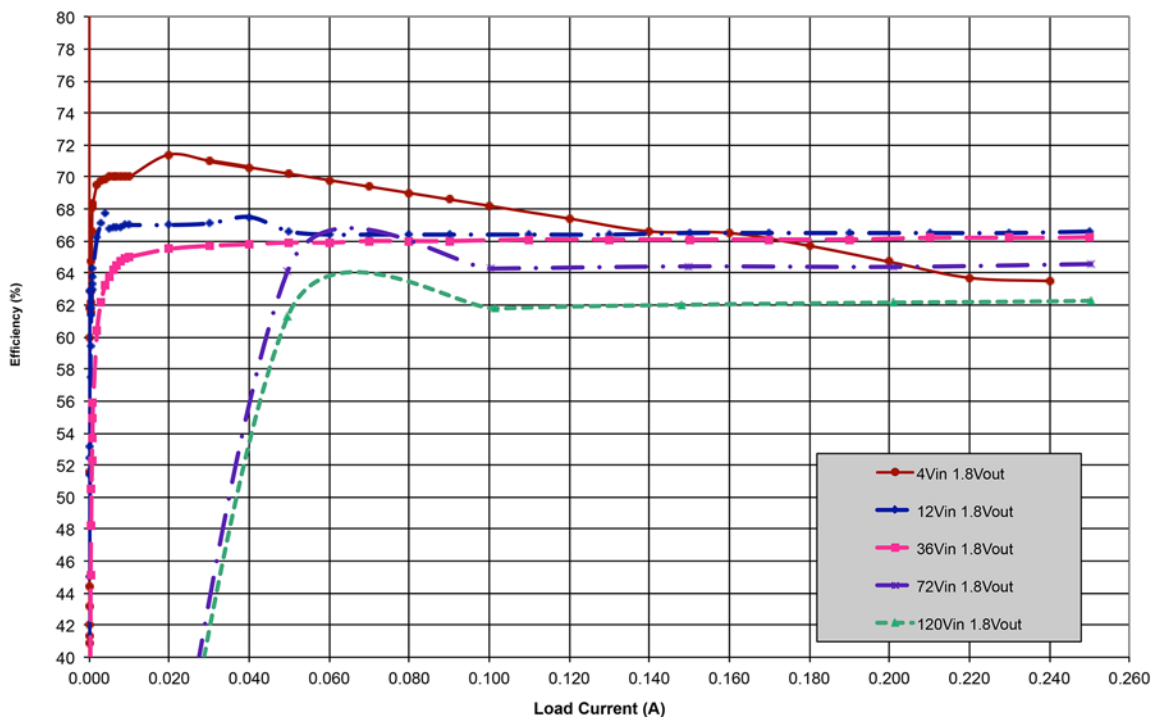


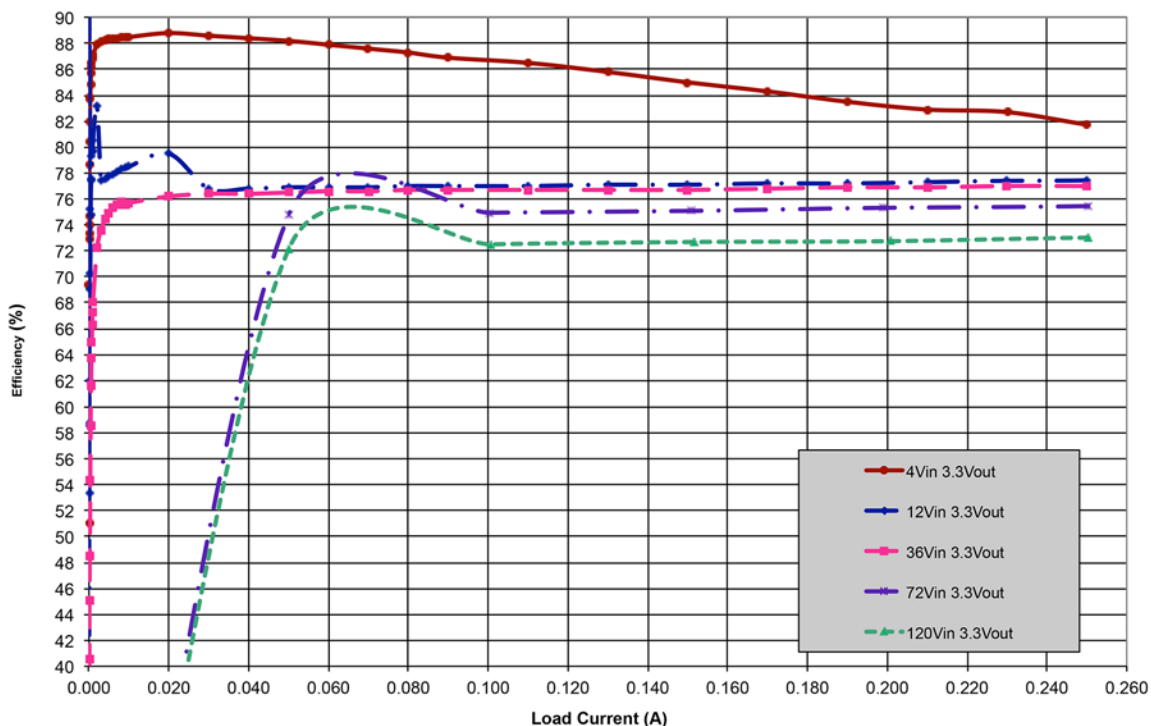
Figure 2. Measuring Output Voltage Ripple

## QUICK START PROCEDURE

### LTC3638 1.8V<sub>OUT</sub> Efficiency vs Load Current

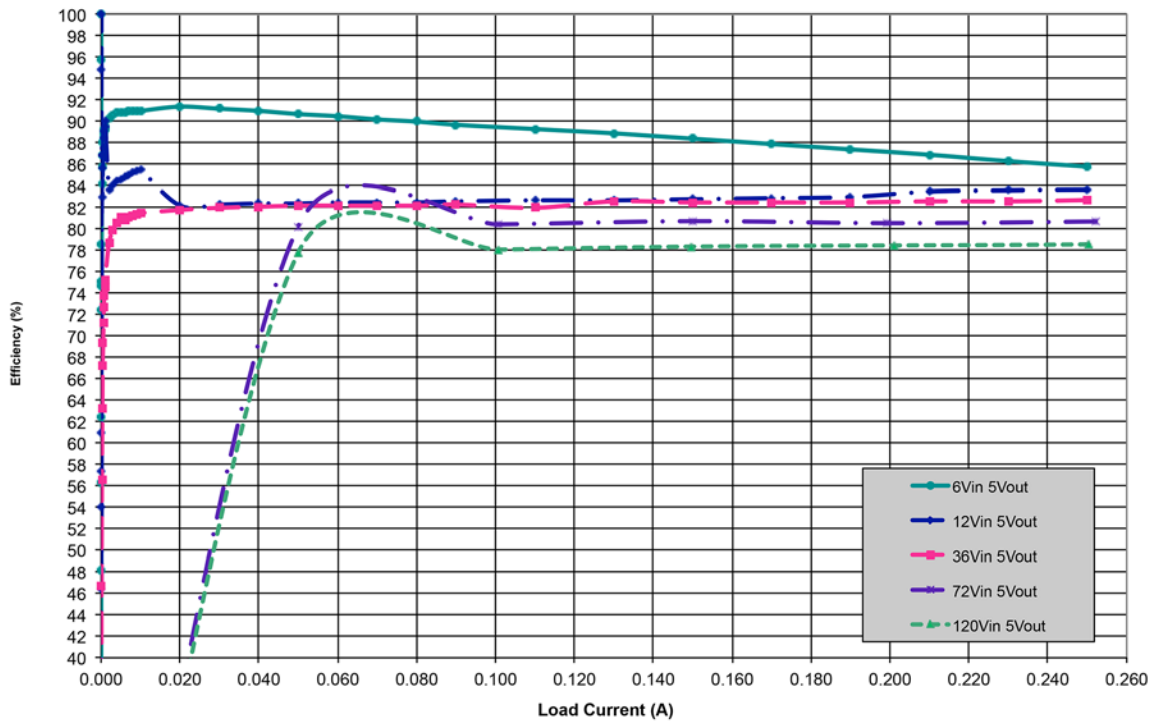


### LTC3638 3.3V<sub>OUT</sub> Efficiency vs Load Current



**QUICK START PROCEDURE**

LTC3638 5V<sub>OUT</sub> Efficiency vs Load Current



# DEMO MANUAL DC2057A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	C1	CAP.SMD ALUM. ELECT., 22 $\mu$ F, 200V KE0-MVA	NIPPON CHEMI-CON, EMVE201ARA220MKG5S
2	1	C2	CAP., X7R, 1 $\mu$ F, 200V, 10% 2220	KEMET, C2220X105K2RACTU
3	1	C4	CAP., X7R, 47nF, 25V, 10% 0603	AVX, 06033C473KAT2A
4	2	C6, C7	CAP., X7R, 100 $\mu$ F, 10V, 20% 1210	TAIYO YUDEN, LMK325ABJ107MMH-T
5	1	C9	CAP., X7R, 0.1 $\mu$ F, 25V, 10% 0603	AVX, 06033C104KAT2A
6	1	D1	DIODE, SBR1U200P1	DIODES, SBR1U200P1-7
7	1	L1	INDUCTOR, 150 $\mu$ H	SUMIDA, CDRH105R-151
8	1	R1	RES., CHIP, 2M, 1/16W, 5% 0603	VISHAY, CRCW06032M00JNEA
9	1	U1	IC., LTC3638EMSE MSE16(12), 4X3MM	LINEAR TECH., LTC3638EMSE

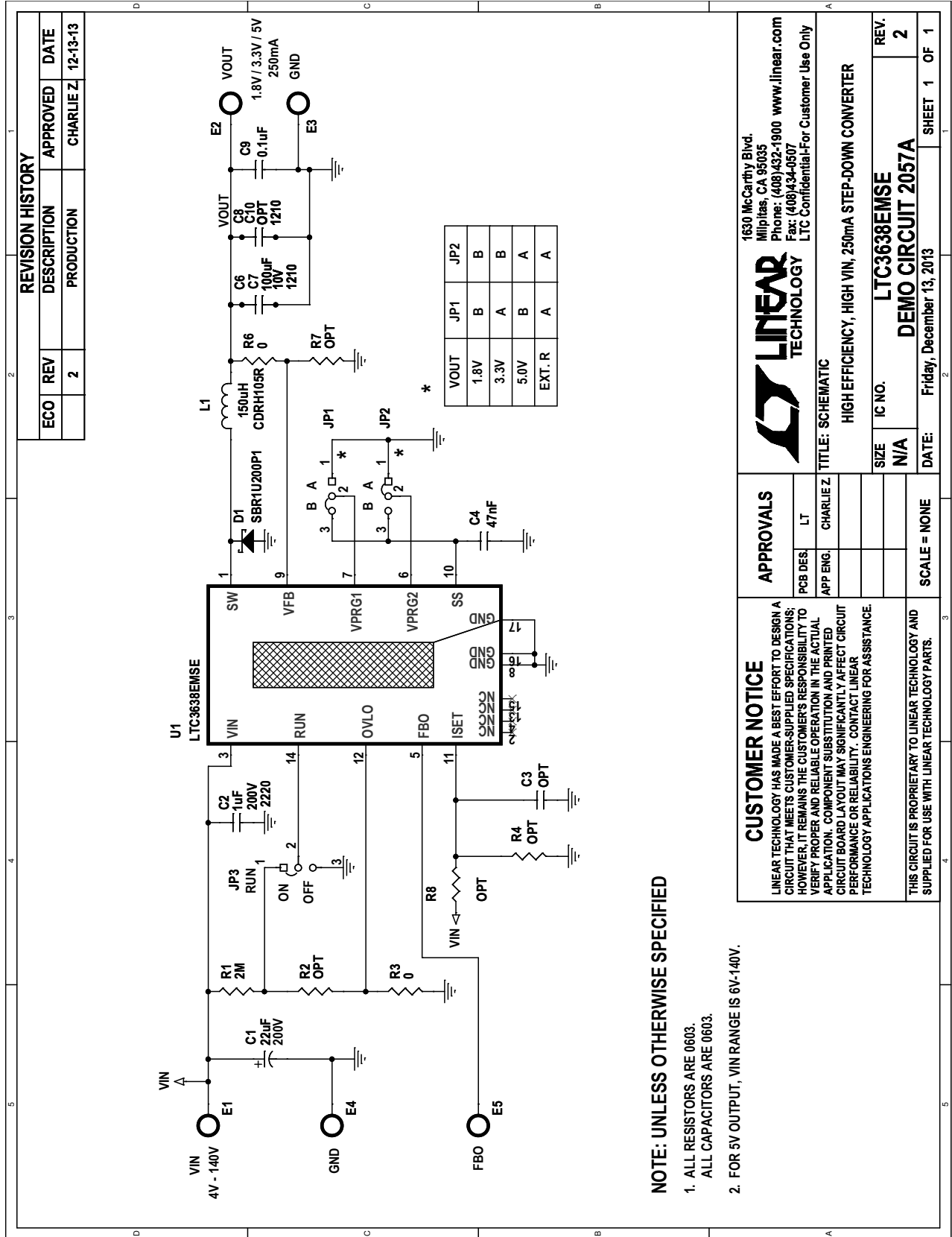
### Additional Demo Board Circuit Components

10	0	C3 (OPT)	CAP., 0603	OPT
11	0	C8, C10 (OPT)	CAP., 1210	OPT
12	0	R2, R4, R7, R8 (OPT)	RES., 0603	OPT
13	2	R3, R6	RES., CHIP, 0 $\Omega$ , 1/16W, 0603	VISHAY, CRCW06030000Z0EA

### Hardware

14	5	E1, E2, E3, E4, E5	TESTPOINT, TURRET 0.094"	MILLMAX 2501-2-00-80-00-00-07-0
15	3	JP1, JP2, JP3	JMP, 0.079 SINGLE ROW HEADER, 3-PIN	SULLINS, NRPN031PAEN-RC
16	3	XJP1, XJP2, XJP3	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
17	4	STAND-OFFS	STAND-OFF, NYLON 0.5"	KEystone, 8833 (SNAP ON)

**SCHEMATIC DIAGRAM**



REVISION HISTORY				
ECO	REV	DESCRIPTION	APPROVED	DATE
	2	PRODUCTION	CHARLIE Z	12-13-13

**NOTE: UNLESS OTHERWISE SPECIFIED**

1. ALL RESISTORS ARE 0603.  
ALL CAPACITORS ARE 0603.
2. FOR 5V OUTPUT, VIN RANGE IS 6V-140V.

**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.

**APPROVALS**

PCB DES.	LT
APP ENG.	CHARLIE Z

SCALE = NONE

**LINEAR TECHNOLOGY**  
1630 McCarthy Blvd.  
Milpitas, CA 95035  
Phone: (408)432-1900 www.linear.com  
Fax: (408)434-0507  
LTC Confidential-For Customer Use Only

**TITLE: SCHEMATIC**  
HIGH EFFICIENCY, HIGH VIN, 250mA STEP-DOWN CONVERTER

SIZE	IC NO.	REV.
N/A	LTC3638EMSE	2
DATE:	Friday, December 13, 2013	SHEET 1 OF 1



Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

# DEMO MANUAL DC2057A

---

## 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.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

**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

Copyright © 2004, Linear Technology Corporation