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

PERFORMANCE SUMMARY Specifications are at T$_A$ = 25°C

PARAMETER	CONDITION	VALUE
Input Voltage Range		4V to 140V
1.8V Output Voltage	V$_{IN}$ = 12V, I$_{OUT}$ = 0A to 250mA	1.8V ±2%
3.3V Output Voltage	V$_{IN}$ = 12V, I$_{OUT}$ = 0A to 250mA	3.3V ±2%
5V Output Voltage	V$_{IN}$ = 12V, I$_{OUT}$ = 0A to 250mA	5V ±2%
Maximum Output Current, I$_{OUT}$	V$_{IN}$ = 4V to 140V, V$_{OUT}$ = 1.8V, 3.3V or 5V	250mA
Typical Efficiency	V$_{IN}$ = 12V, V$_{OUT}$ = 5V, I$_{OUT}$ = 250mA	83.7%
Typical Output Ripple	V$_{IN}$ = 140V, V$_{OUT}$ = 5V, I$_{OUT}$ = 100mA (20MHz BW)	81mV$_{P-P}$

dc2057af

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 ±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.

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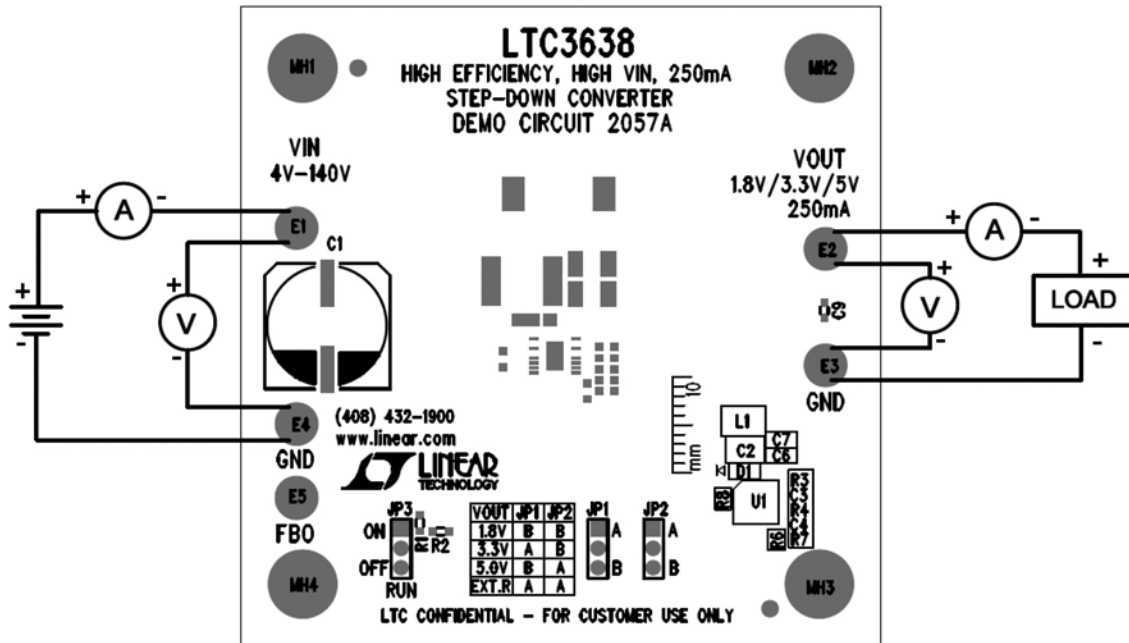LINEAR
TECHNOLOGY

QUICK START PROCEDURE

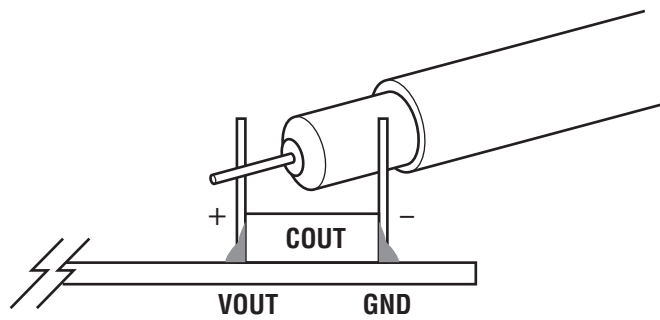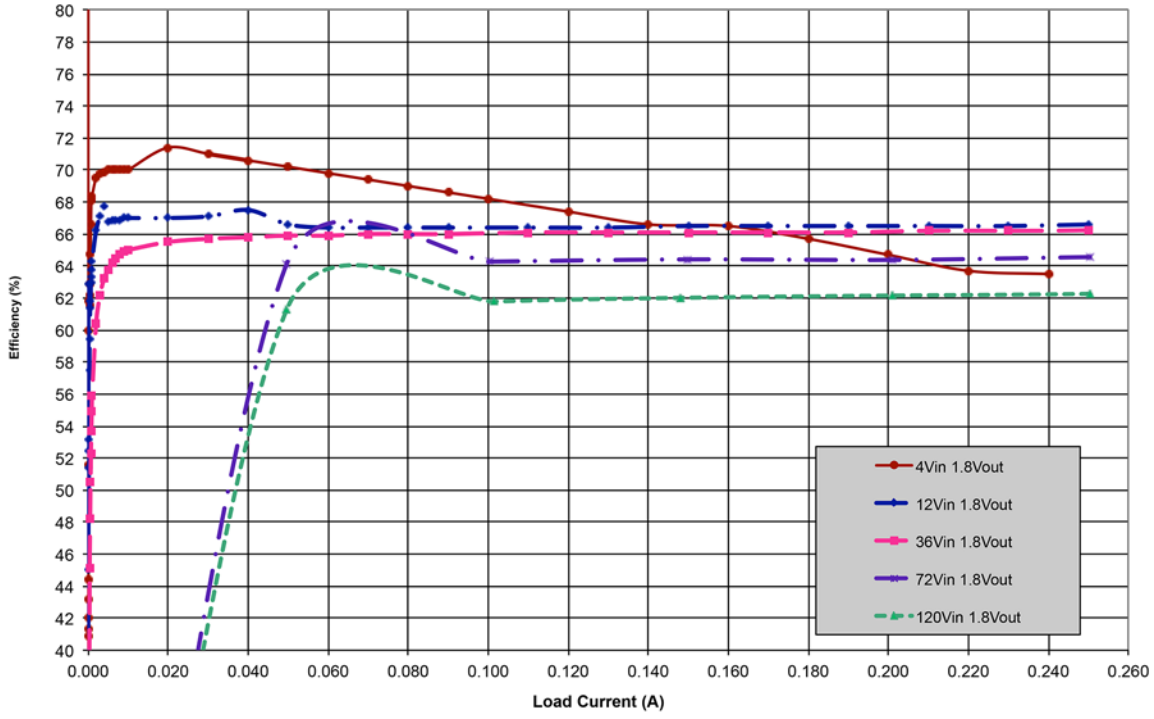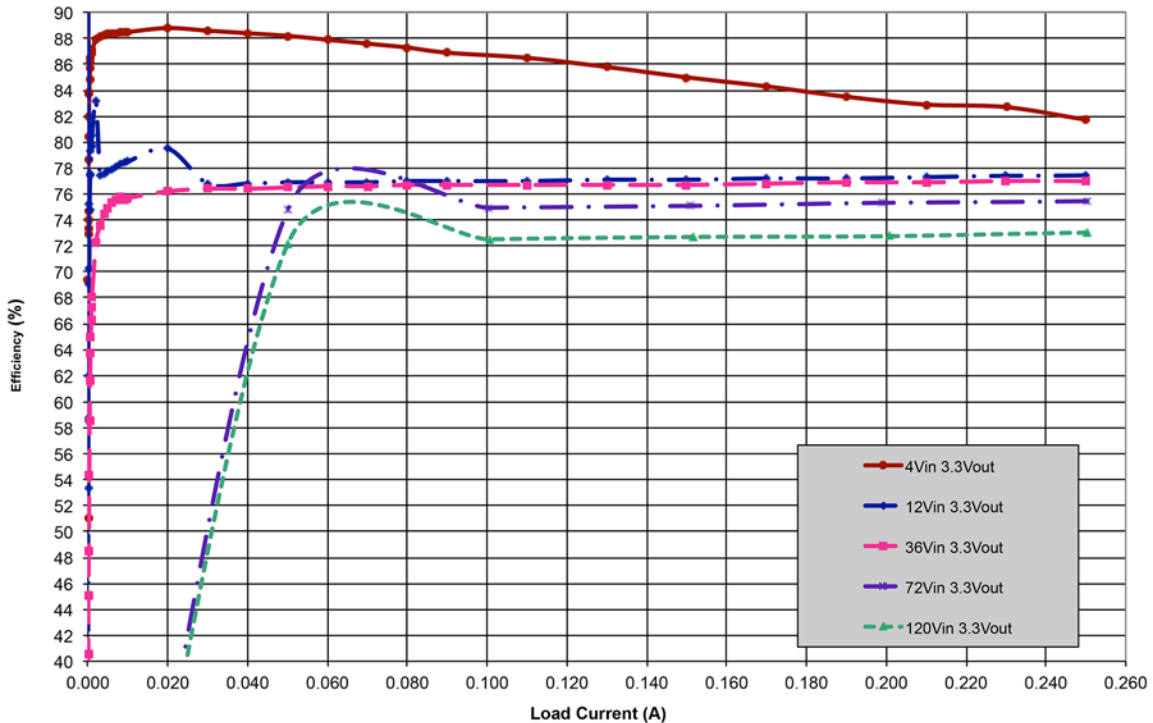Figure 1. Proper Measurement Equipment Setup

Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

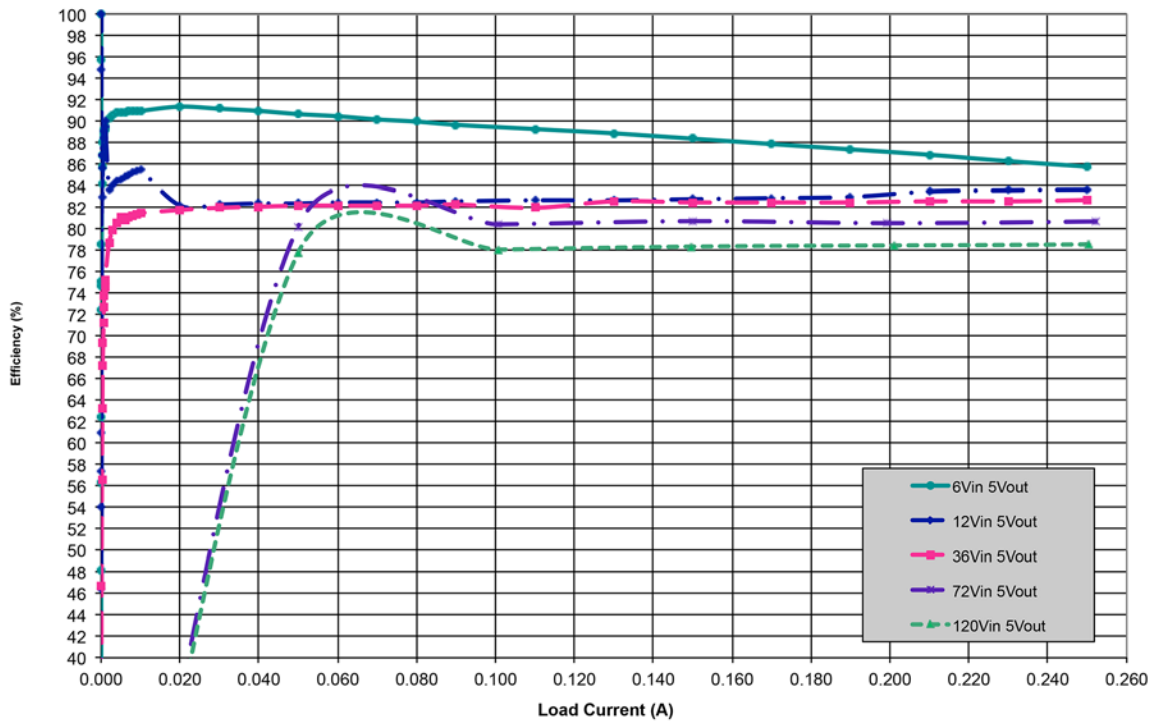**LTC3638 1.8V$_{OUT}$ Efficiency vs Load Current**

LTC3638 3.3V$_{OUT}$ Efficiency vs Load Current

QUICK START PROCEDURE

LTC3638 5V$_{OUT}$ Efficiency vs Load Current

PARTS LIST

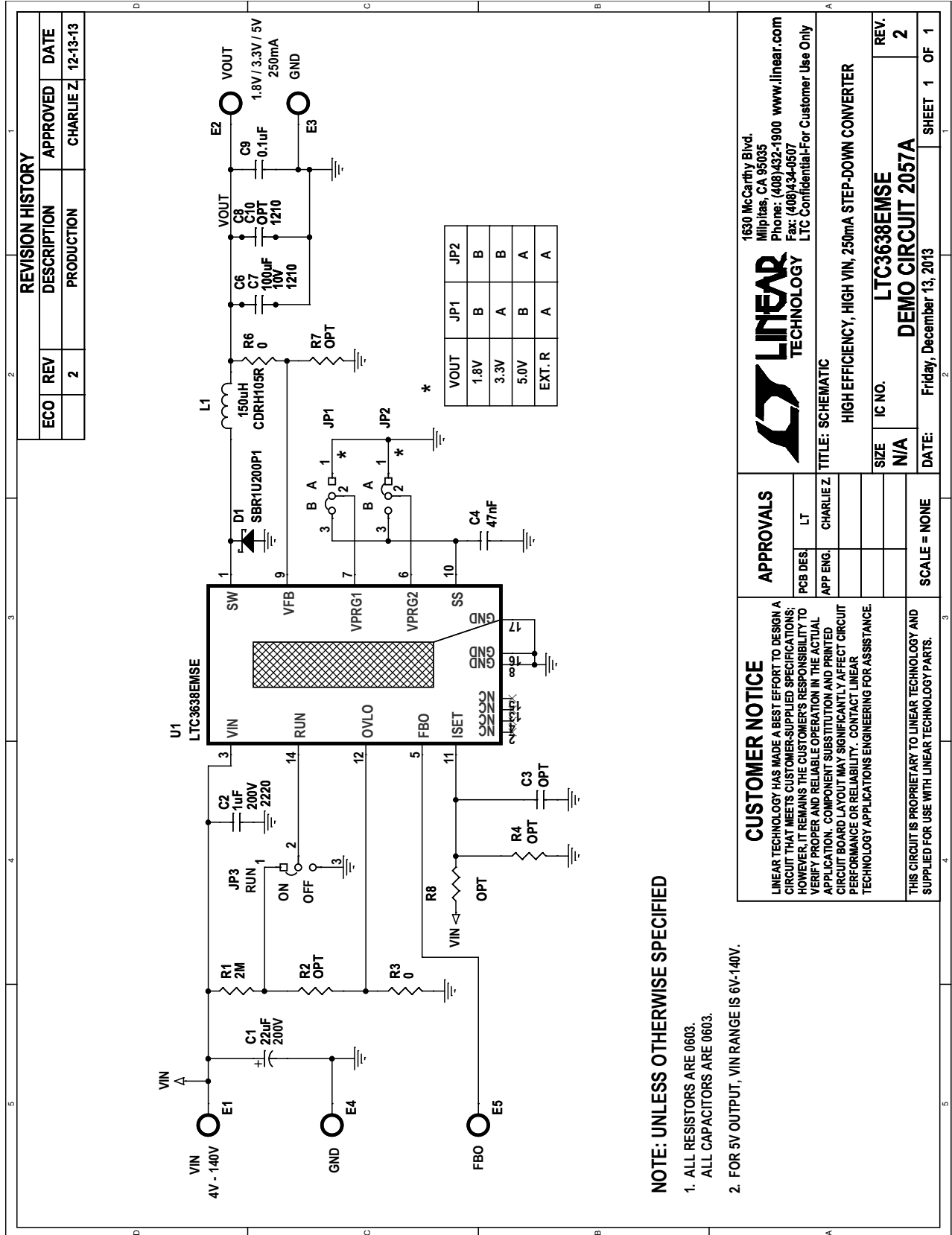| ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
1	1	C1	CAP.SMD ALUM. ELECT., 22µF, 200V KE0-MVA	NIPPON CHEMI-CON, EMVE201ARA220MKG5S
2	1	C2	CAP., X7R, 1µF, 200V, 10% 2220	KEMET, C2220X105K2RACTU
3	1	C4	CAP., X7R, 47nF, 25V, 10% 0603	AVX, 06033C473KAT2A
4	2	C6, C7	CAP., X7R, 100µF, 10V, 20% 1210	TAIYO YUDEN, LMK325ABJ107MMH-T
5	1	C9	CAP., X7R, 0.1µF, 25V, 10% 0603	AVX, 06033C104KAT2A
6	1	D1	DIODE, SBR1U200P1	DIODES, SBR1U200P1-7
7	1	L1	INDUCTOR, 150µH	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, 0Ω, 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

E2 VOUT
1.8V / 3.3V / 5V
250mA
E3 GND

C9 0.1uF

VOUT
C8 C10 OPT 1210

C6 C7 100uF 10V 1210

R6 0
R7 OPT

L1 150uH CDRH105R

VOUT	JP1	JP2
1.8V	B	B
3.3V	A	B
5.0V	B	A
EXT. R	A	A

*

JP1 JP2
B A   B A
*   *

C4 47nF

D1 SBR1U200P1

U1 LTC3638EMSE

SW 1		
VFB 9		
VPRG1 7		
VPRG2 6		
SS 10		
GND 17		
GND 16		
GND 8		
NC		
NC		
NC		

VIN 3
RUN 14
OVLO 12
FBO 5
ISET 11

C2 1uF 200V 2220

JP3 RUN
ON OFF
2 1 3

VIN
C3 OPT
R4 OPT

R8 OPT

R1 2M
R2 OPT
R3 0

C1 22uF 200V

VIN
4V - 140V
E1

GND
E4

FBO
E5

NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 0603.
   ALL CAPACITORS ARE 0603.

2. FOR 5V OUTPUT, VIN RANGE IS 6V-140V.

APPROVALS

PCB DES.		LT
APP ENG.		CHARLIE Z

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1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900 www.linear.com
Fax: (408)434-0507
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TITLE: SCHEMATIC

HIGH EFFICIENCY, HIGH VIN, 250mA STEP-DOWN CONVERTER

IC NO. LTC3638EMSE REV. 2
DEMO CIRCUIT 2057A

SIZE N/A		SHEET 1 OF 1

DATE: Friday, December 13, 2013

SCALE = NONE

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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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