

LT8610A

42V, 3.5A Micropower Synchronous Step-Down Regulator

DESCRIPTION

Demonstration circuit 2139A is a 42V, 3.5A micropower synchronous step-down regulator featuring the LT[®]8610A. The LT8610A is a compact, high efficiency, high speed synchronous monolithic step-down switching regulator that consumes only 2.5 μ A of quiescent current when output is regulated at 5V and is unloaded. The 2139A uses two input ceramic capacitors in series to improve reliability in case of an input capacitor short failure. Top and bottom power switches, compensation components and other necessary circuits are inside of the LT8610A to minimize external components and simplify design.

The SYNC pin on the demo board is grounded by default for low ripple burst mode operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC turret. Once JP1 is on SYNC position, a DC voltage of higher than 2V or INTV_{CC} can be applied to the SYNC turret for pulse-skipping operation. Figure 1 shows the efficiency of the circuit at 12V input.

Figure 2 shows the thermal performance of the circuit. When running at input voltage greater than 30V, 3.5A

output current and 2MHz switching frequency, the temperature rise will be significant. Either reducing the input voltage, the output current or the switching frequency will bring the temperature down to acceptable level without external cooling.

The demo board has an EMI filter installed. The board and the IC are designed to minimize conducted and radiated EMI. The radiated EMI performances of the board are shown in Figure 3 to Figure 5. The limits on those figures are CISPR25, Class 5 peak limits. The circuit passes the test with a wide margin.

The LT8610A data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for demo circuit 2139A.

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

LT, LT, LTC, LTM, Linear Technology and the Linear Logo 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°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V _{IN} *	Input Supply Range		5.5		42	V
V _{OUT}	Output Voltage		4.8	5	5.2	V
I _{OUT}	Maximum Output Current		3.5			A
F _{SW}	Switching Frequency		1.85	2	2.15	MHz
EFE	Efficiency at DC	I _{OUT} = 1A		92		%

*Refer to Figure 2 to determine the maximum input voltage. If IC temperature exceeds target, reduce input voltage, output current or switching frequency.

QUICK START PROCEDURE

Demonstration circuit 2139A is easy to set up to evaluate the performance of the LT8610A. Refer to Figure 6 and Figure 7 for proper measurement equipment setup and follow the procedure below:

1. With power off, connect the input power supply to V_{IN} and GND. When evaluating EMI performance, input power supply should be connected between VEMI and GND.

2. With power off, connect the load V_{OUT} and GND.

3. Check JP1 setting

4. Turn on the power at the input.

5. Carefully evaluate other design parameters as needed.

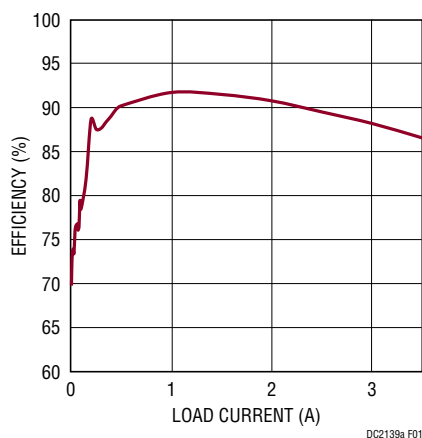


Figure 1. LT8610A 12V_{IN} to 5V_{OUT} Efficiency at 2MHz Switching Frequency

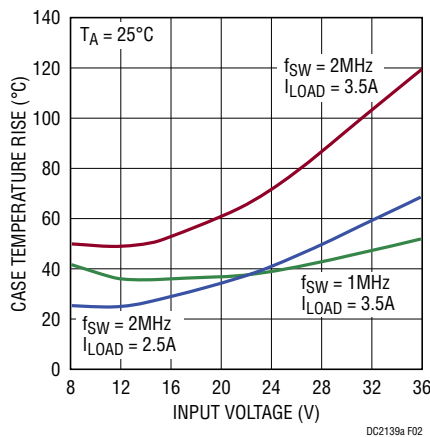


Figure 2. LT8610A Case Temperature Rise, $V_{OUT} = 5V$, $T_A = 25^\circ C$

QUICK START PROCEDURE

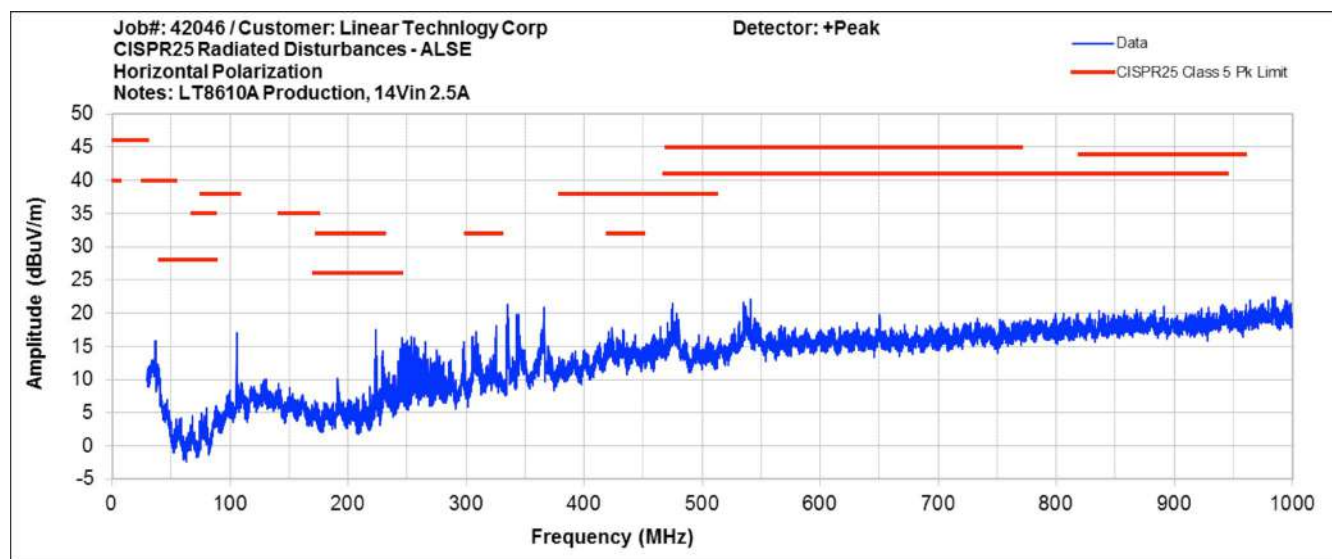


Figure 3. 30MHz to 1GHz Radiated EMI Performance. $V_{IN} = 12V$, $V_{OUT} = 5V$, $I_{OUT} = 2.5A$
 Antenna Polarization: Horizontal; Switching Frequency: 2MHz.

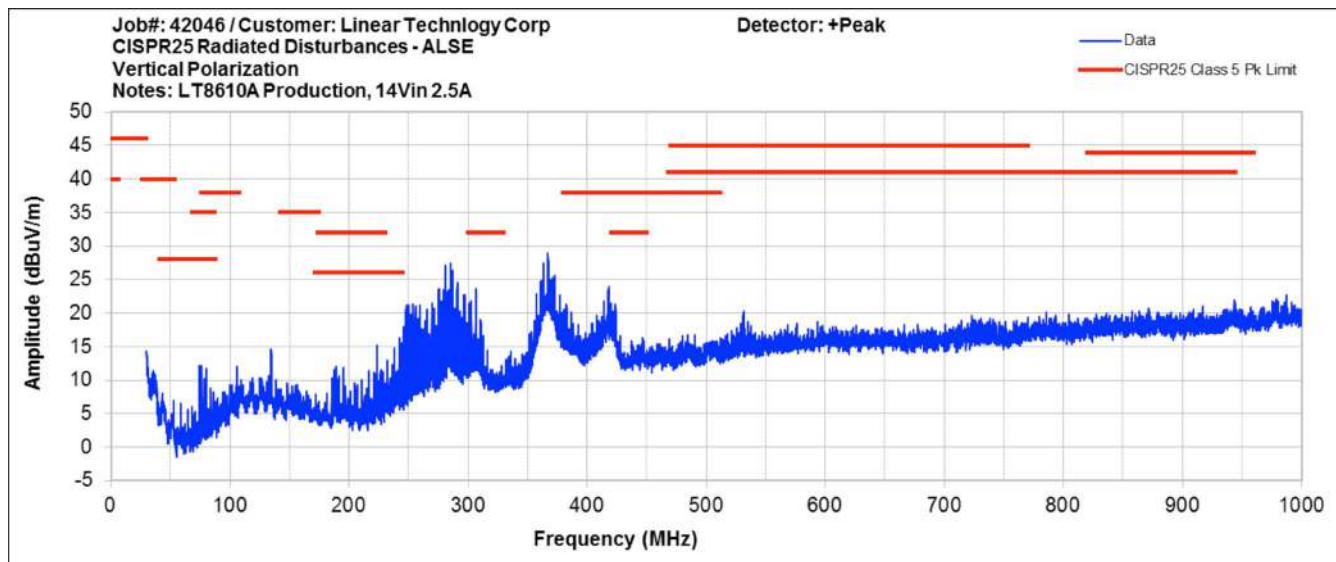
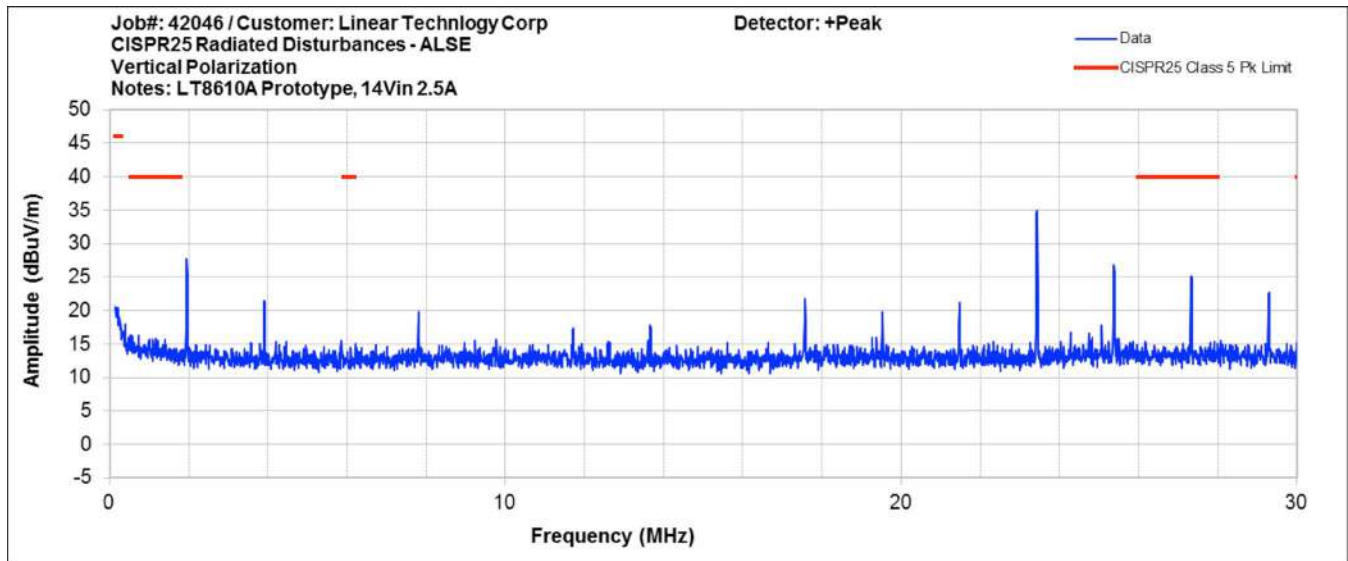


Figure 4. 30MHz to 1GHz Radiated EMI Performance. $V_{IN} = 12V$, $V_{OUT} = 5V$, $I_{OUT} = 2.5A$
 Antenna Polarization: Vertical; Switching Frequency: 2MHz.

QUICK START PROCEDURE



**Figure 5. 150kHz to 30MHz Radiated EMI Performance. $V_{IN} = 12V$, $V_{OUT} = 5V$, $I_{OUT} = 2.5A$
Antenna Polarization: Vertical; Switching Frequency: 2MHz.
(In the frequency range between 150kHz and 30MHz, only vertical polarization is required)**

QUICK START PROCEDURE

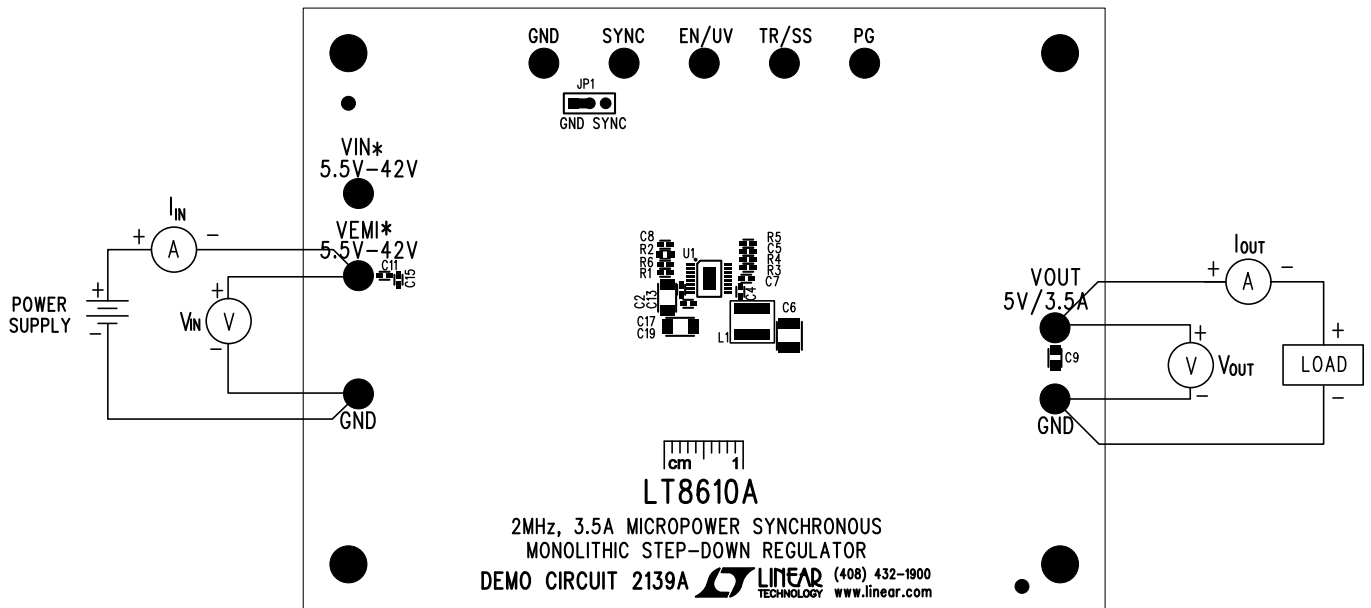


Figure 6. Proper Measurement Equipment Setup

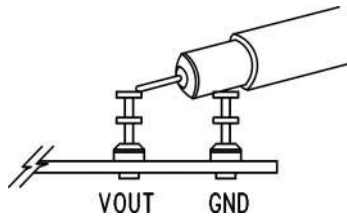


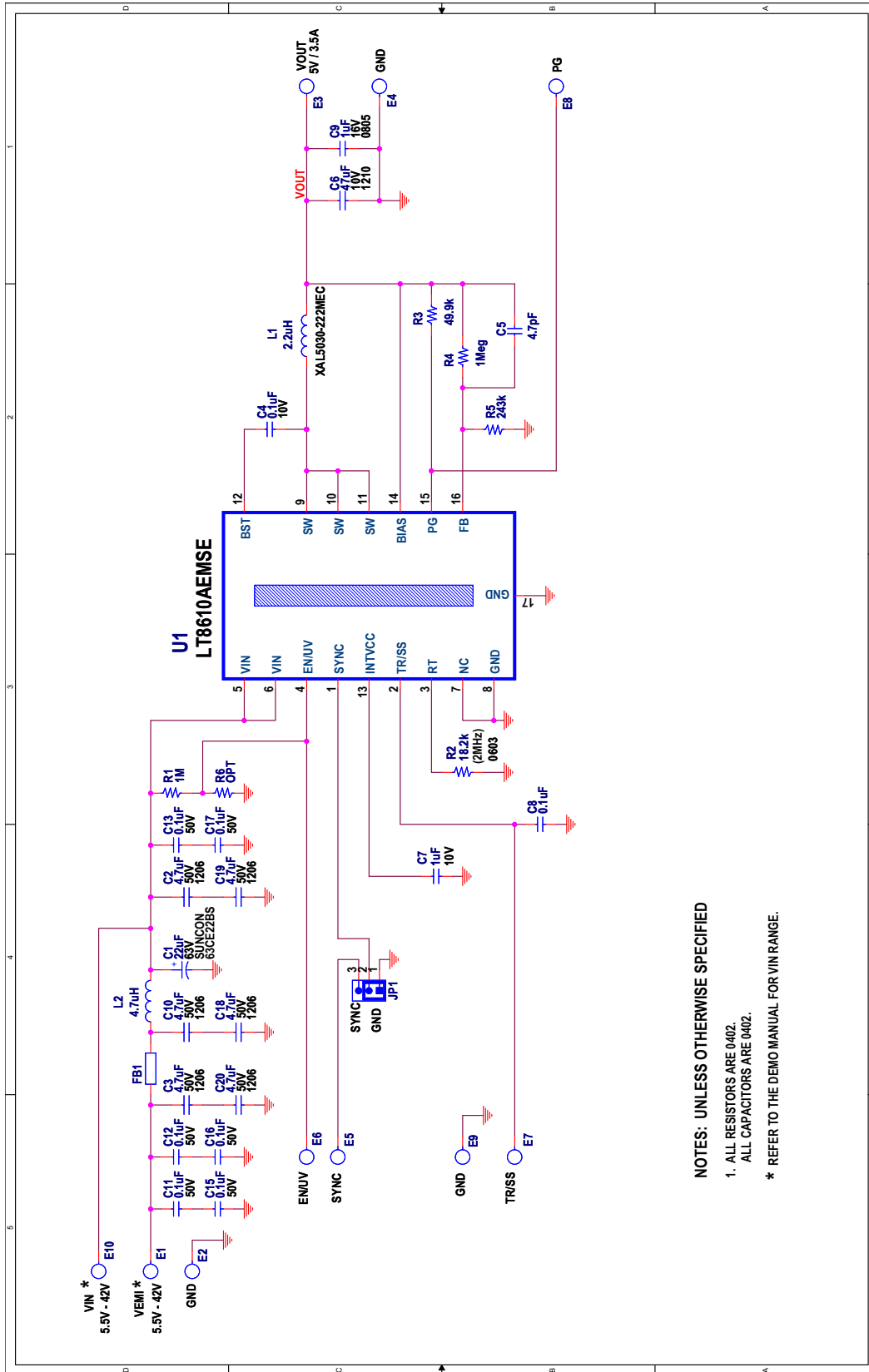
Figure 7. Measure Output Ripple

DEMO MANUAL DC2139A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C2, C19	CAP, X7R, 4.7 μ F, 50V, 10%, 1206	MURATA, GRM31CR71H475KA12L
2	2	C4, C8	CAP, X7R, 0.1 μ F, 16V, 10%, 0402	MURATA, GRM155R71C104KA88D
3	1	C5	CAP, C0G, 4.7pF, 25V, \pm 0.1pF, 0402	MURATA, GRM1555C1E4R7BZ01D
4	1	C6	CAP, X7R, 47 μ F, 10V, 10%, 1210	MURATA, GRM32ER71A476KE15L
5	1	C7	CAP, X5R, 1 μ F, 10V, 10%, 0402	MURATA, GRM155R61A105K
6	1	L1	IND, 2.2UH	COILCRAFT, XAL5030-222MEC
7	2	R1, R4	RES, CHIP, 1M, 1/16W, 1% 0402	NIC, NRC04F1004TRF
8	1	R2	RES, CHIP, 18.2k, 1/10W, 1% 0603	VISHAY, CRCW060318K2FKED
9	1	R3	RES, CHIP, 49.9k, 1/16W, 1% 0402	VISHAY, CRCW040249K9FKED
10	1	R5	RES, CHIP, 243k, 1/16W, 1% 0402	VISHAY, CRCW0402243KFKED
11	1	U1	IC, LT8610AEMSE MSE16	LINEAR TECHNOLOGY CORPORATION, LT8610AEMSE#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP, ALUM, 22 μ F, 63V	SUN ELECT, 63CE22BS
2	4	C3, C10, C18, C20	CAP, X7R, 4.7 μ F, 50V, 10%, 1206	MURATA, GRM31CR71H475KA12L
3	1	C9	CAP, X7R, 1 μ F, 16V, 10%, 0805	AVX, 0805YC105KAT2A
4	6	C11, C12, C13, C15, C16, C17	CAP, X7R, 0.1 μ F, 50V, 10%, 0402	TDK, C1005X7R1H104K
5	1	FB1	FERRITE BEAD 0805	TDK, MPZ2012S101AT
6	1	L2	IND 4.7UH	VISHAY, IHLP2020BZ-ER4R7M01
7	0	R6	RES, OPT, 0402	OPT
Hardware: For Demo Board Only				
1	10	E1 TO E10	TESTPOINT, TURRET, 0.094" pbf	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	3 PIN 0.079 SINGLE ROW HEADER	SAMTEC, TMM103-02-L-S
3	1	XJP1	SHUNT, 0.079" CENTER	SAMTEC, 2SN-BK-G
4	4	MH1 TO MH4	STAND-OFF, NYLON 0.50" TALL	KEYSTONE, 8833(SNAP ON)

SCHEMATIC DIAGRAM



NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL RESISTORS ARE 0402.
 ALL CAPACITORS ARE 0402.
 * REFER TO THE DEMO MANUAL FOR VIN RANGE.

DEMO MANUAL DC2139A

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