

LTC1562/LTC1562-2

Quad 2nd Order Active RC Filter IC

DESCRIPTION

Demonstration circuit DC266B-A is for the evaluation of 8th order filter circuits using an LTC1562 (*no dash*) and DC266B-B for an LTC1562-2. LTC1562 and LTC1562-2 are quad 2nd order active-RC filter building blocks. The LTC1562 or LTC1562-2 2nd order sections can be configured with external resistors to implement lowpass and narrow or wide band bandpass filters. The frequency range for a *lowpass* filter is 10kHz to 150kHz and 20kHz to 300kHz for the LTC1562 and LTC1562-2 respectively. The frequency range for a *bandpass* filter is 20kHz to 120kHz and 40kHz to 250kHz for the LTC1562 and LTC1562-2 respectively (the LTC1562A is higher precision version of the LTC1562).

For testing and evaluation, the DC266B-A is configured as an 8th order, 50kHz bandpass filter and the DC266B-B is configured as an 8th order, 200kHz bandpass filter.

For other possible LTC1562 or LTC1562-2 configurations, the DC226B-A and DC226B-B have unused pads for 0805 surface mount resistors and capacitors preconfigured with PCB traces to allow for the following filter circuits:

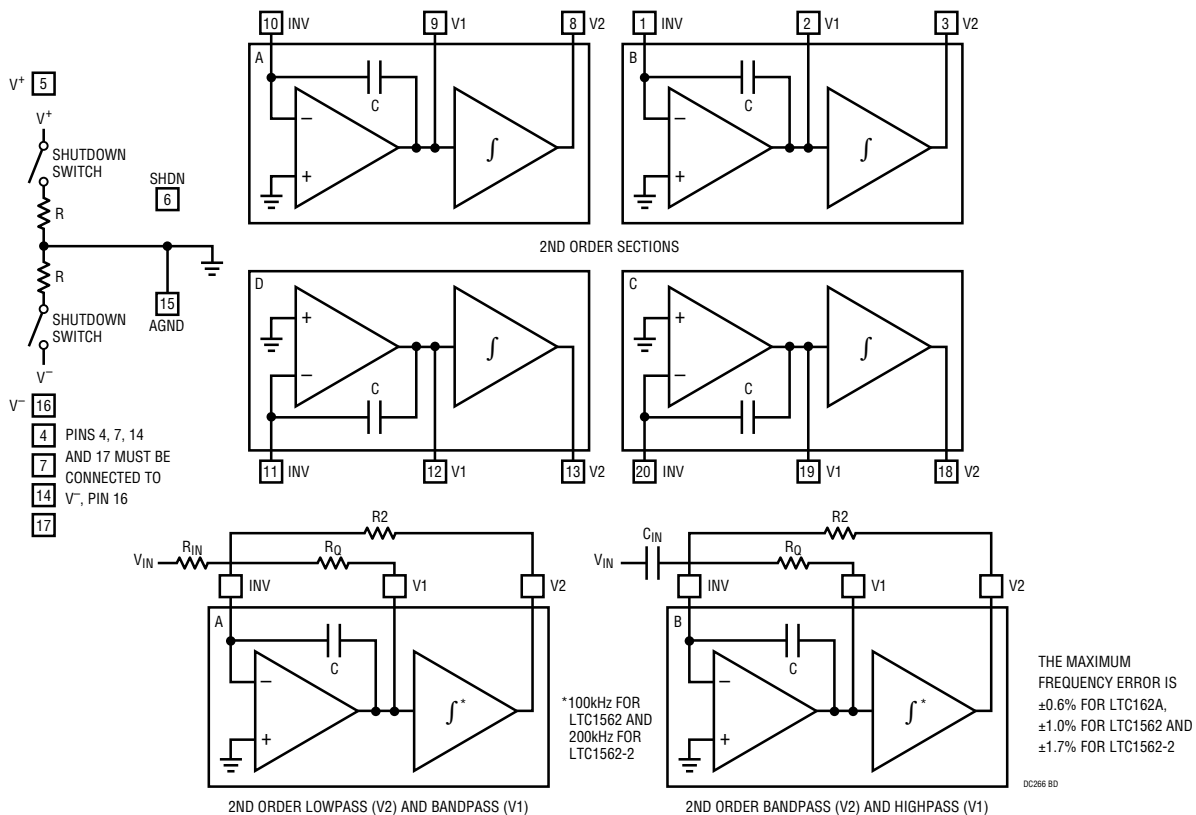
1. 8th order lowpass filter
2. Dual 4th or 5th order lowpass filter
3. 8th order narrow band bandpass
4. 8th order wide band bandpass.

Refer to the LTC1562 or LTC1562-2 data sheet for comprehensive filter design information.

Design files for this circuit board are available at <http://www.linear.com/demo/DC266B>

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

LTC1562 AND LTC1562-2 BLOCK DIAGRAM



QUICK START PROCEDURE

See Figure 1 for proper measurement equipment setup and follow the procedure below.

1. Set SW1 to DUAL.
2. With power off, connect a dual 5V power supply to +V and -V.
3. Connect a function generator to IN.
4. For a DC266B-A, set the function generator to a $2V_{P-P}$, 50kHz, sine wave.
5. For a DC266B-B, set the function generator to a $2V_{P-P}$, 200kHz, sine wave.

6. Connect an oscilloscope channel to OUT.
7. For a DC266B-A, set the scaling of an oscilloscope to $1V/20\mu s$ per division.
- For a DC266B-B, set the scaling of an oscilloscope to $1V/5\mu s$ per division.
8. Power up the system and the oscilloscope should show $2V_{P-P}$ sine wave.
9. To test stopband attenuation of DC266B-A, set the input frequency to 25kHz or 75kHz.
10. To test stopband attenuation of DC266B-B, set the input frequency to 150kHz or 250kHz.

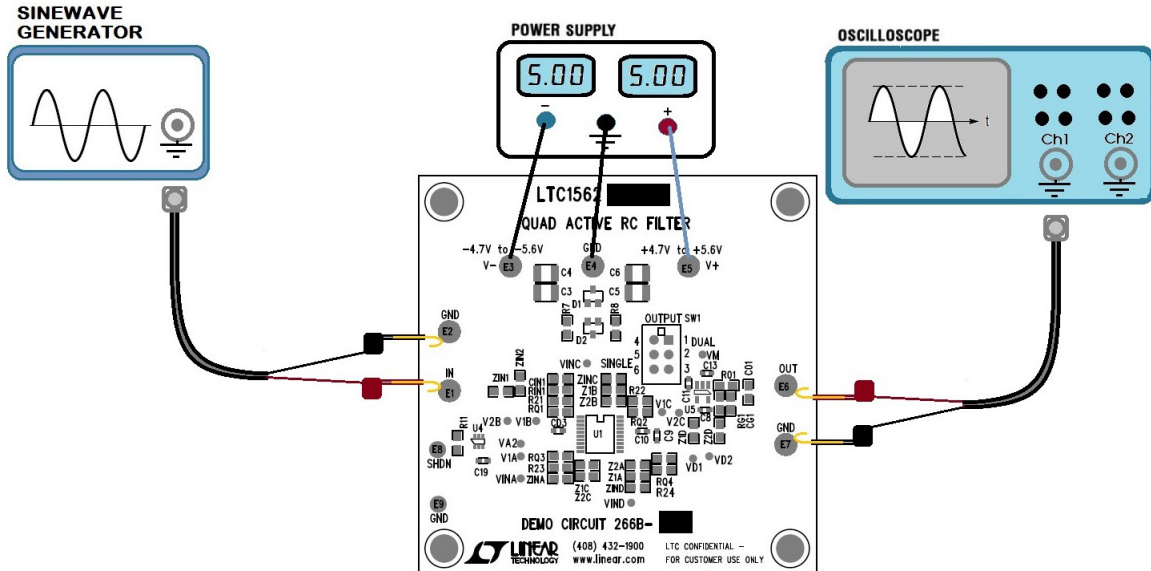


Figure 1. Quick Start Test Equipment Setup

DC266B FILTER CIRCUITS

For testing and evaluation, the DC266B-A is configured as an 8th order, 50kHz bandpass filter (Figure 2) and the DC266B-B is configured as an 8th order, 200kHz bandpass filter (Figure 3). The external resistors for the 50kHz and 200kHz bandpass filter are $\pm 0.1\%$ precision to highlight the frequency accuracy of the LTC1562A or LTC1562-2 ($\pm 0.6\%$ and $\pm 1.7\%$ 2nd order frequency error for the LTC1562A and LTC1562-2 respectively).

NOTE 1: The precision of external resistors and capacitors depend on the filter type. A lowpass and wideband bandpass filter can be implemented with $\pm 1\%$ resistors and $\pm 5\%$ capacitors. A narrowband bandpass filter requires $\pm 0.1\%$ resistors and 1% capacitors to implement a 100% reliable manufacturing lot.

NOTE 2: In a dual supply operation, the DC266B connects two Schottky diodes in series with the V^- supply. The diodes provide 100% protection for possible 2nd order oscillations when a V1 or V2 output approaches the supply rails.

The V1 diodes can be shorted out on the board if testing the filter circuit with an input that saturates the output nodes does not produce any oscillations.

Re-Configuring the DC266B

Removing the default passive components (RIN1, RQ1, R21, Z1B, RQ2, R22, Z1C, RQ3, R23, Z1A, RQ4, R24) a variety of bandpass and lowpass LTC1562/LTC1562-2 filter circuits can be implemented.

The LTC1562 and LTC1562-2 data sheets provide filter design guides and a variety of pre-designed filter circuits.

The typical f_c and gain error can be evaluated by LTspice®. * A guideline is to consider an f_c error greater than 3% or a passband gain peak greater than 2dB as an indication the circuit is operating beyond a reliable f_c frequency (an f_c error less than 3% or gain error less than 2dB can be adjusted using the external resistors).

*LTspice is a high performance simulator, schematic capture and waveform viewer available for free download at www.linear.com/LTspice.

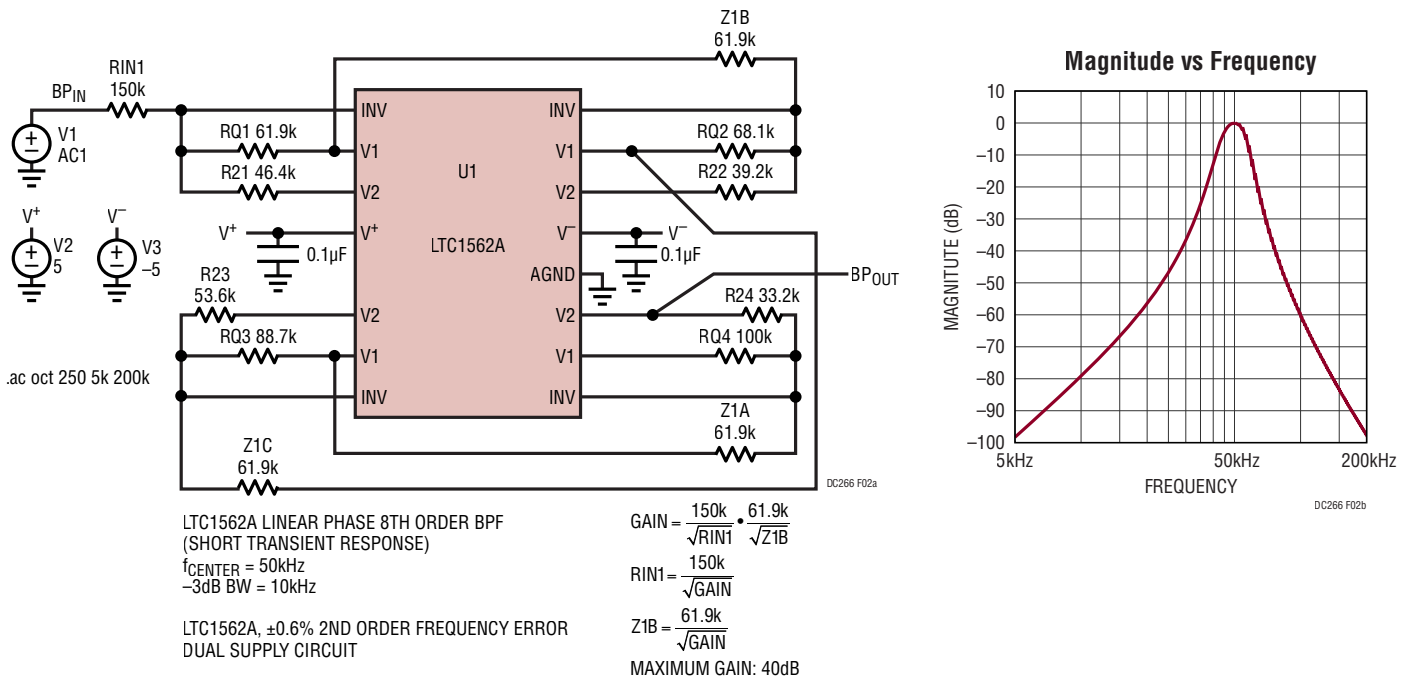


Figure 2. The Default DC266B-A Circuit

DEMO MANUAL DC266B

DC266B FILTER CIRCUITS

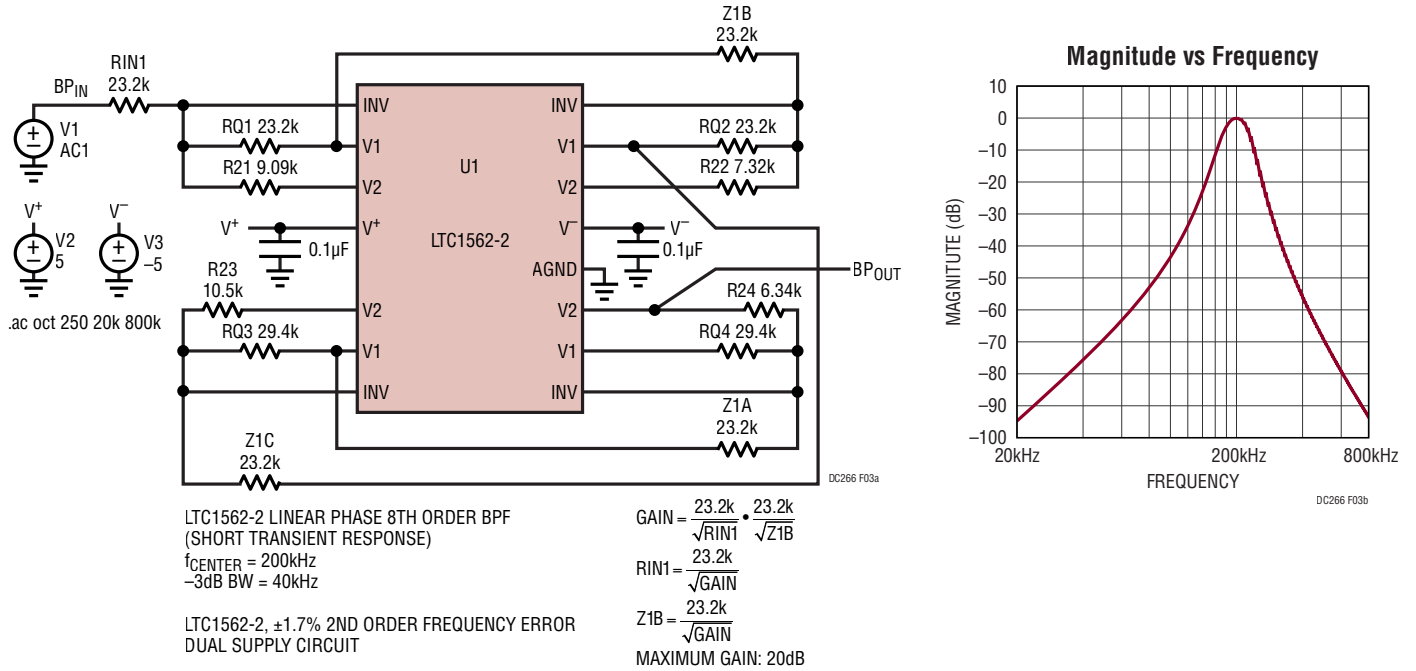


Figure 3. The Default DC266B-B Circuit

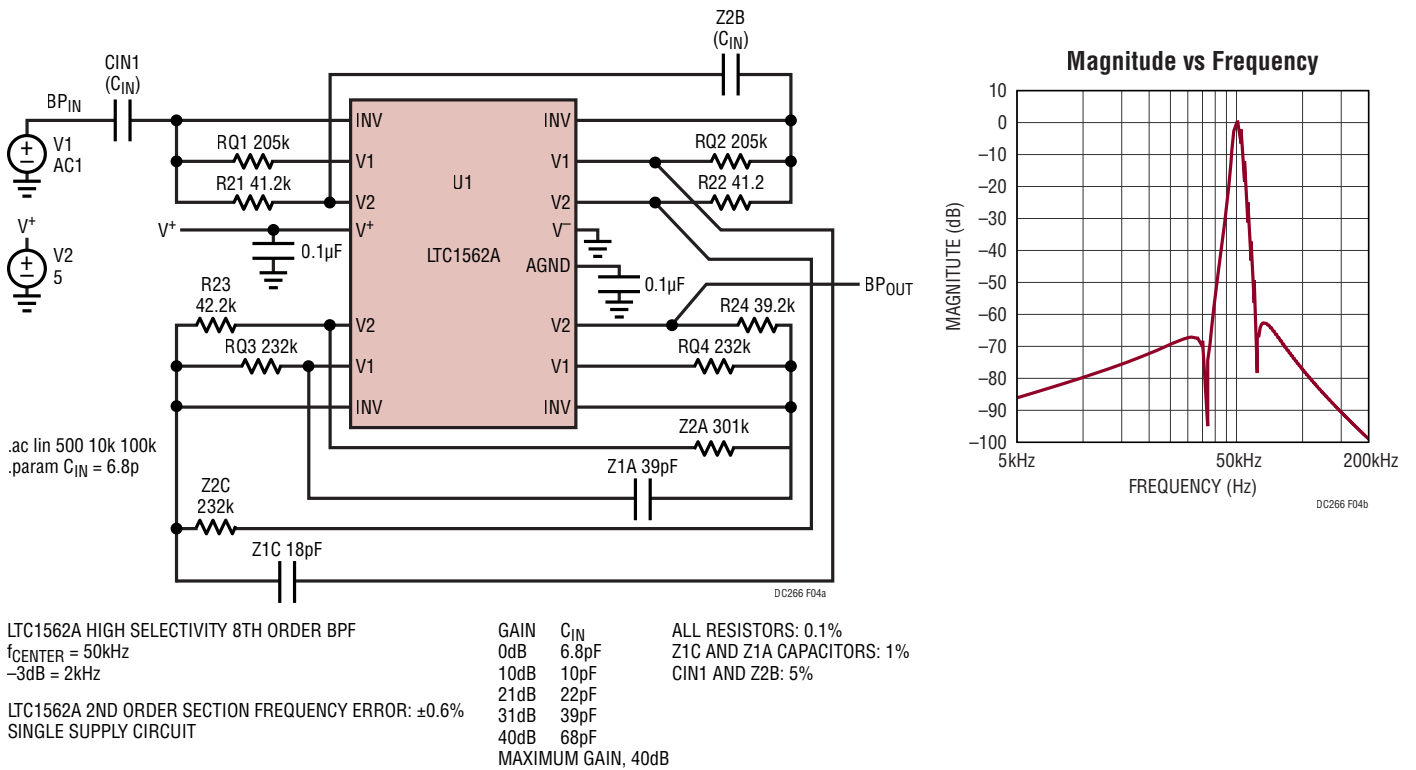
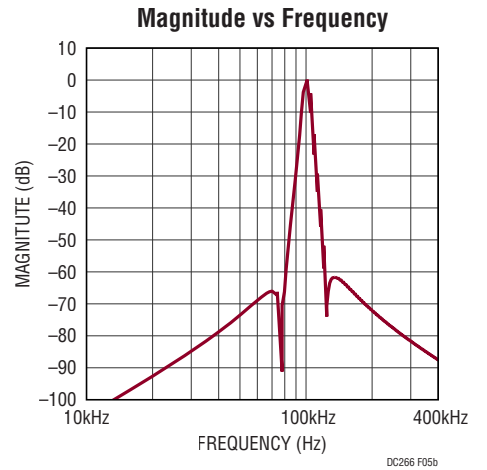
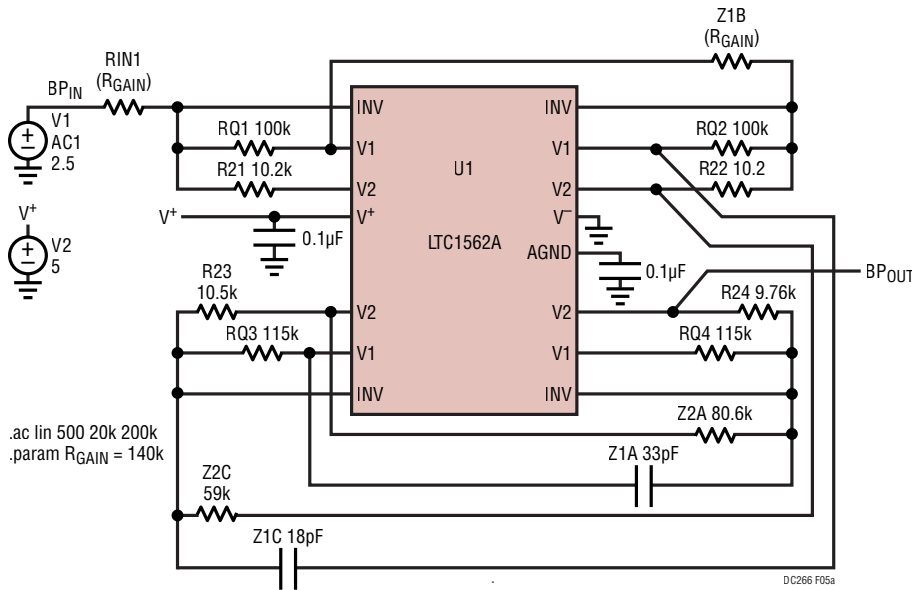


Figure 4. Reconfigured for LTC1562A 8th Order, 50kHz High Selectivity, Bandpass Filter

DC266B FILTER CIRCUITS



LTC1562A HIGH SELECTIVITY 8TH ORDER BPF
 $f_{CENTER} = 100kHz$
 $-3dB = 4kHz$

LTC1562A 2ND ORDER SECTION FREQUENCY ERROR: $\pm 0.6\%$
 SINGLE SUPPLY CIRCUIT

$$GAIN = \left(\frac{140k}{R_{GAIN}} \right)^2$$

$$R_{GAIN} = \frac{140k}{\sqrt{GAIN}}$$

MAXIMUM GAIN: 26dB

RESISTORS: 0.1%
 (RIN1 AND Z1B: 1%)
 Z1C AND Z1A CAPACITORS: 1%

Figure 5. Reconfigured for LTC1562A 8th Order, 100kHz High Selectivity, Bandpass Filter

DEMO MANUAL DC266B

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