

DESCRIPTION

Demonstration circuit DC338B-A is for the evaluation of filter circuits using an [LTC®1563-2](#) and DC338B-B for an [LTC1563-3](#). LTC1563-2 and LTC1563-3 are dual 2nd order active RC filter building blocks with precision $\pm 1.5\%$ capacitors. The LTC1563-2 uses six equal value resistors to implement a 4th order Butterworth lowpass filter, and the LTC1563-3 uses six equal value resistors to implement a 4th order Bessel lowpass filter. The lowpass cutoff frequency (f_c) range of an LTC1563-X filter is 256Hz to 256kHz.

For testing and evaluation, the DC338B-A is configured as a single 4th order, 25.6kHz Butterworth lowpass filter; and the DC338B-B is configured as a single 4th order, 25.6kHz Bessel lowpass filter.

For other LTC1563-X configurations, the DC338B has unused pads for 0805 surface mount resistors and capacitors preconfigured with PCB traces to allow for the following LTC1563-X filter circuits:

1. 4th order lowpass filter
2. 5th order lowpass filter
3. 4th order narrow bandpass filter
4. 4th order wide bandpass filter

Refer to the LTC1563-X data sheet for additional information about filter circuit configurations.

Design files for this circuit board are available at <http://www.linear.com/demo/DC338B>

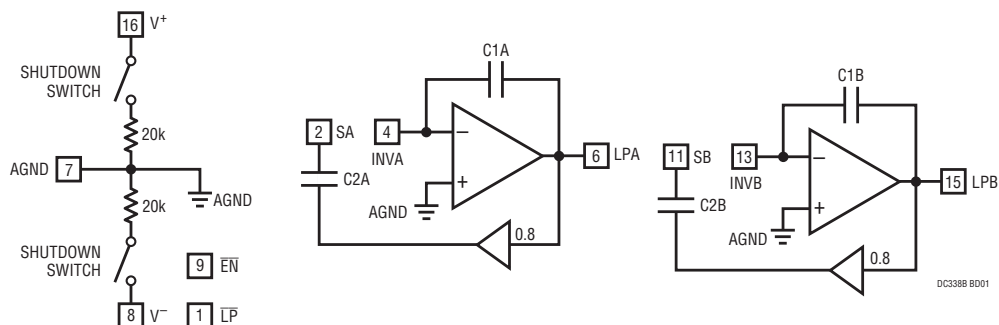
LT, LT, LTC, LTM, Linear Technology, the Linear logo and LTSpice are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Total Supply Voltage		●	2.7		11	V
Supply Current	$V_S = 2.7\text{V}$, LP MODE	●		1	1.8	mA
	$V_S = \pm 5\text{V}$, HS MODE	●		15	23	mA
Lowpass Cutoff Frequency Range	LP MODE		0.256		25.6	kHz
Lowpass Cutoff Frequency Range	HS MODE		0.256		256	kHz
Bandpass Center Frequency Range	LP MODE		0.4		10	kHz
Bandpass Center Frequency Range	HS MODE		0.4		50	kHz
Output Voltage High, LPA and LPB	$R_L = 10\text{k}$			$V^+ - 50\text{mV}$		V
Output Voltage Low, LPA and LPB	$R_L = 10\text{k}$			$V^- + 50\text{mV}$		V
DC Voltage Offset	$V_S = 2.7\text{V}$, LP MODE	●			$6\pm$	mV
	$V_S = \pm 5\text{V}$, HS MODE	●			$3\pm$	mV
LTC1563-X OP AMP GBW	$V_S = 2.7\text{V}$, LP MODE			1.5		MHz
	$V_S = 4.75\text{V}$, LP MODE			1.8		MHz
	$V_S = 2.7\text{V}$, HS MODE			8		MHz
	$V_S = 4.75\text{V}$, HS MODE			9		MHz
	$V_S = \pm 5\text{V}$, HS MODE			11		MHz

LTC1563-X BLOCK DIAGRAM



Capacitor Values:

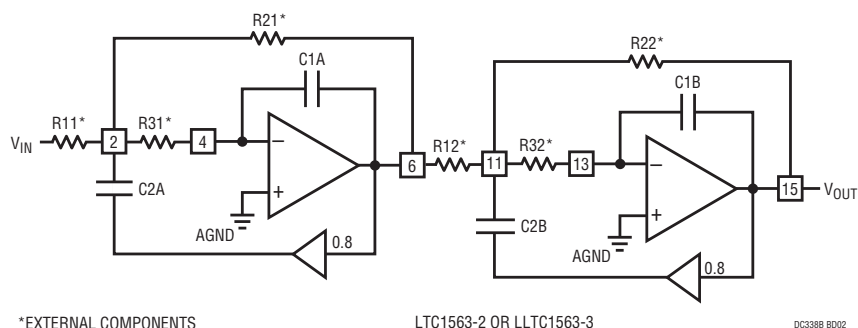
LTC1563-2, SIDE A C1A = 53.8pF, C2A = 64.2pF. SIDE B C1B = 39.1pF, C2B = 87.9pF.

LTC1563-3, SIDE A C1A = 34.9pF, C2A = 38.8pF. SIDE B C1B = 26.8pF, C2B = 40.3pF.

Typical Capacitor Specifications:

Side A to Side B capacitor mismatch $\pm 1.5\%$, part to part capacitor variation $\pm 2\%$. Note: There is a stray 5pF capacitor from SA and SB node to ground.

LTC1563-X 4TH ORDER LOWPASS FILTER

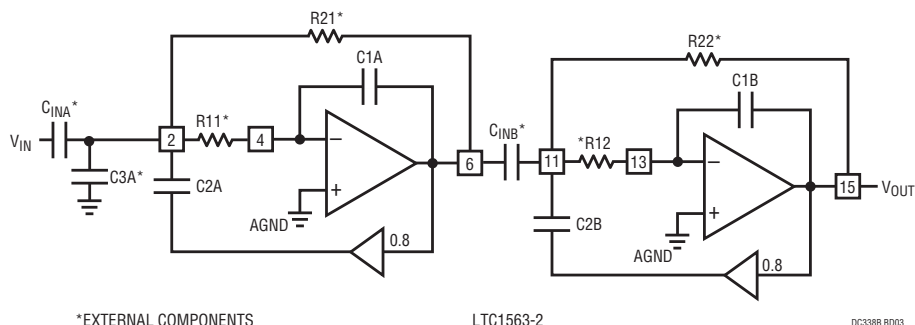


*EXTERNAL COMPONENTS

LTC1563-2 OR LLTC1563-3

DC338B 8D02

LTC1563-X 4TH ORDER BANDPASS FILTER (NARROW PASSBAND)



*EXTERNAL COMPONENTS

LTC1563-2

DC338B 8D03

QUICK START PROCEDURE

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

1. Place jumpers in the following positions: JP4 to DUAL SUPPLY, JP3 to ACTIVE, JP5 to HIGH SPEED.
2. With power off, connect a dual 5V power supply to +V and -V.
3. Connect a 10kHz, 1V_{P-P}, sine wave generator to V_{IN} and GND turrets.
4. Set the scaling of an oscilloscope to 1V/100μs per division.
5. Connect an oscilloscope probe from V_{OUT} and GND to oscilloscope channel 1.
6. Power up the system and the oscilloscope should show a 10kHz 1V_{P-P} sine wave.
7. To test stopband attenuation, set the input frequency to 100kHz and the output voltage drops to less than 5mV_{P-P} and 25mV for the DC338B-A and DC338B-B, respectively.

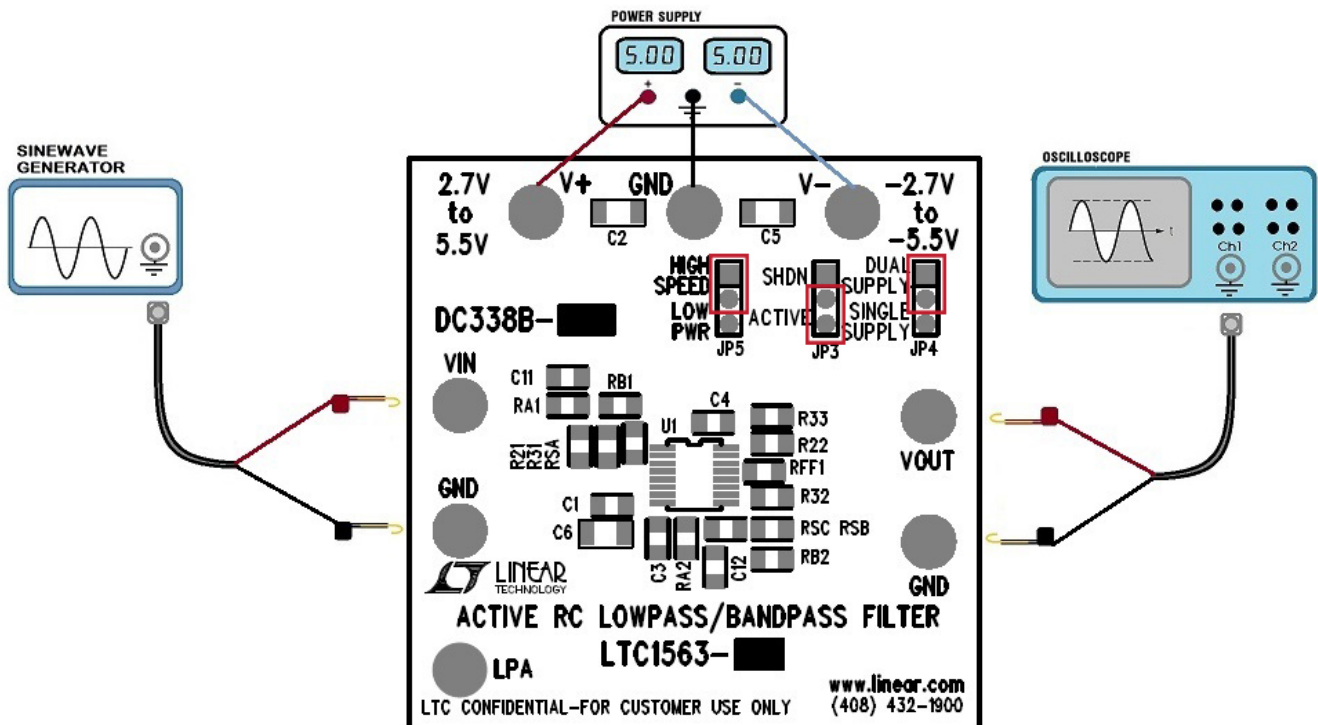


Figure 1. Quick Start Test Equipment Setup

QUICK START PROCEDURE

DC338B Default Configuration

For testing and evaluation, the DC338B-A is configured as a single 4th order, 25.6kHz Butterworth lowpass filter (the Figure 2 circuit) and the DC338B-B is configured as a single 4th order, 25.6kHz Bessel lowpass filter (the Figure 3 circuit).

Reconfiguring the DC338B

Removing the default passive components (RA1, RB1, RSA, R31, R21, RA2, RB2, RSB, R32 and R22), the DC338B can be configured for variety of lowpass or bandpass filter circuits. Figures 2 thru 6 highlight easy to design and simulate with LTspice^{®1} LTC1563 filter circuits.

Note: The LTC1563-X LTspice models only, the high speed mode (HP) with op amps at the maximum GBW (listed under Electrical Characteristics). The GBW limit must be considered when simulating LTspice circuits. For example, if an LTC1563 circuit operates in low power mode then the maximum lowpass cutoff frequency is 25.6kHz and an LTspice simulation showing a typical frequency response at cutoff frequencies greater than 25.6kHz is overly optimistic.

¹LTspice is a high performance simulator, schematic capture and waveform viewer available for free download at www.linear.com/LTspice.

QUICK START PROCEDURE

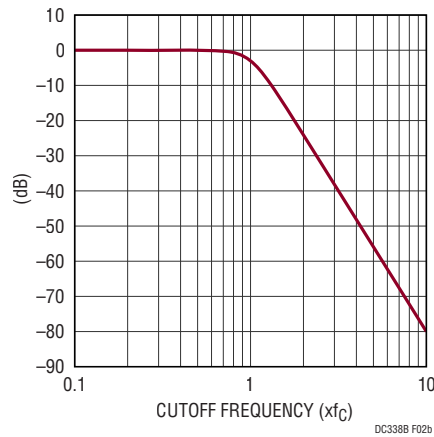
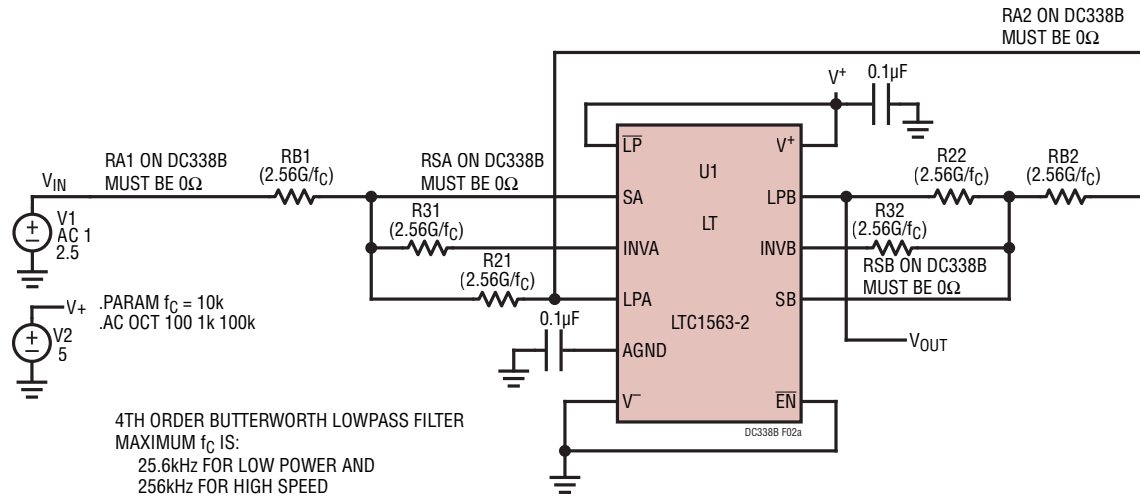


Figure 2. 4th Order Butterworth Lowpass Filter (DC338A-A Default Configuration)

The LTspice file for this circuit is available at www.linear.com/demo/DC338B.

QUICK START PROCEDURE

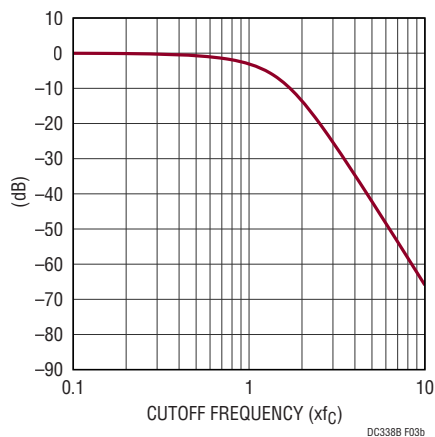
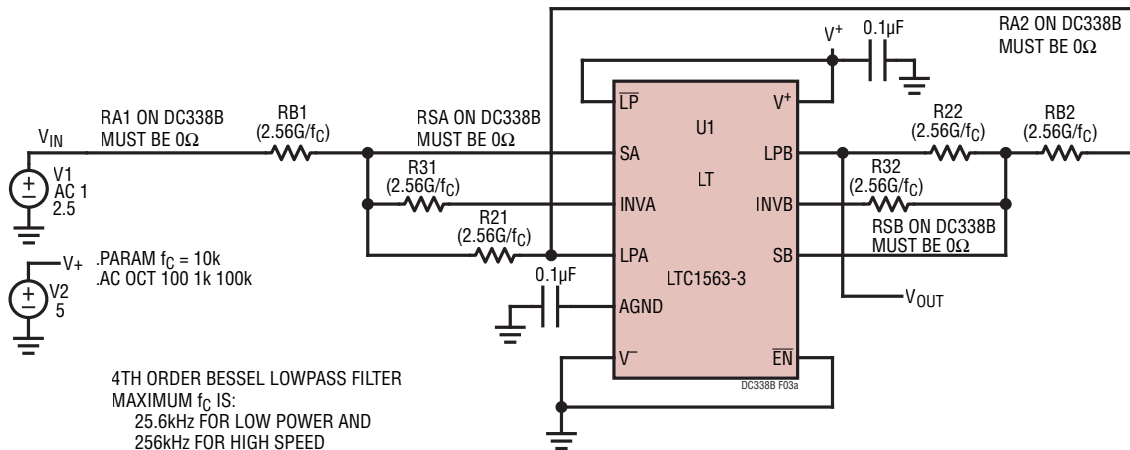


Figure 3. 4th Order Bessel Lowpass Filter (DC338A-B Default Configuration)

The LTspice file for this circuit is available at www.linear.com/demo/DC338B.

QUICK START PROCEDURE

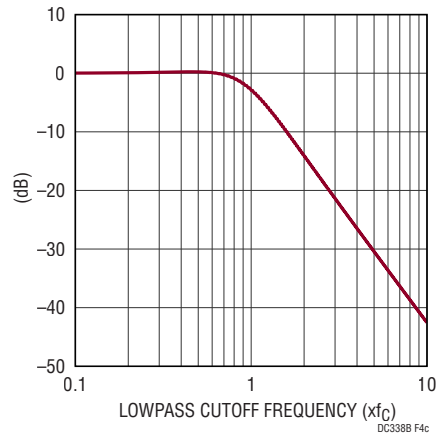
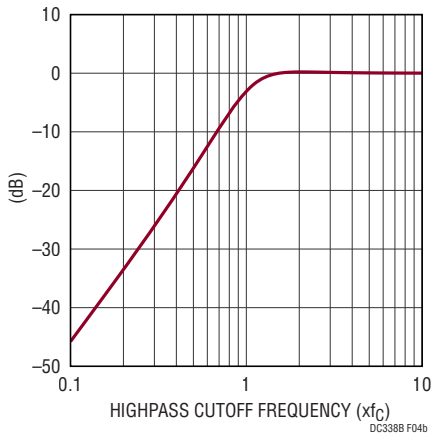
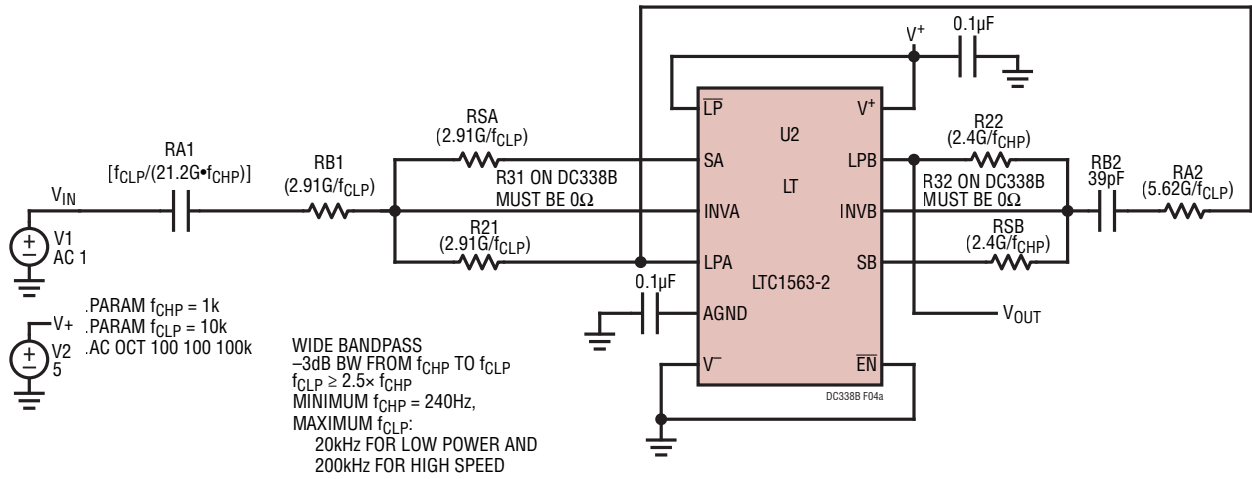


Figure 4. 4th Order Wide Bandpass Filter

The LTspice file for this circuit is available at www.linear.com/demo/DC338B.

QUICK START PROCEDURE

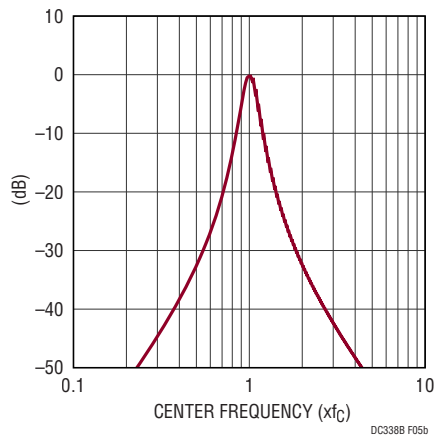
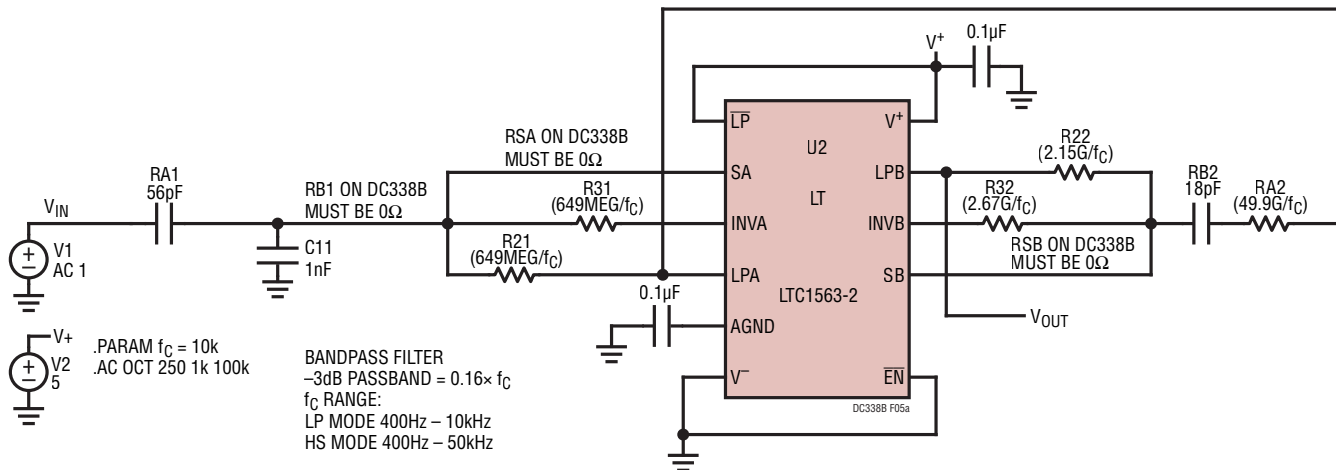


Figure 5. 4th Order Narrow Bandpass Filter

The LTspice file for this circuit is available at www.linear.com/demo/DC338B.

QUICK START PROCEDURE

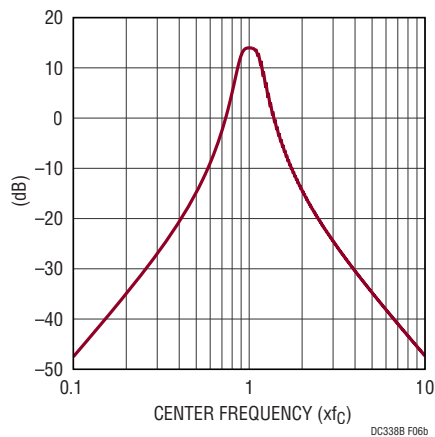
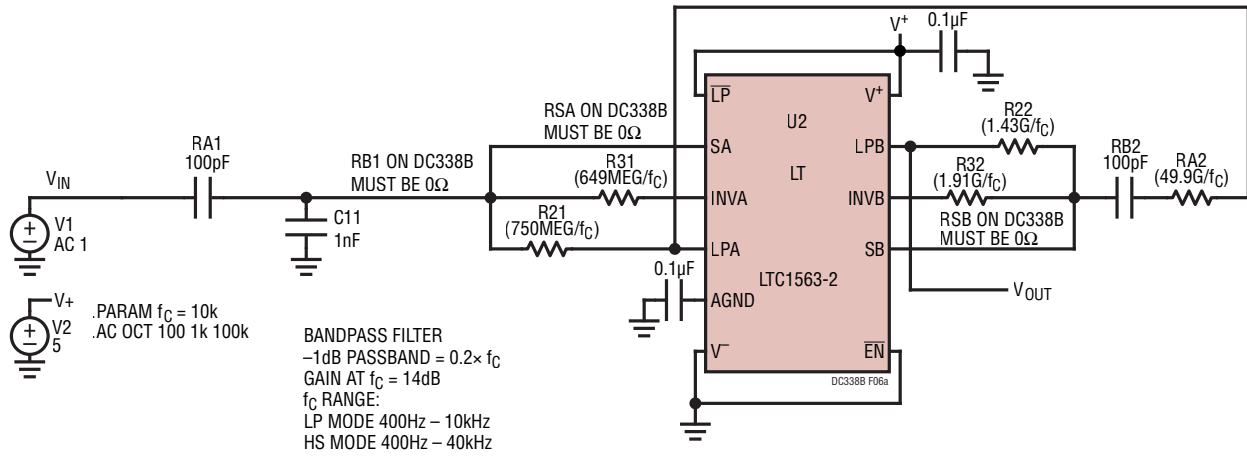


Figure 6. 4th Order Narrow Bandpass Filter with 14dB Gain

The LTspice file for this circuit is available at www.linear.com/demo/DC338B.

DEMO MANUAL DC338B

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