

# 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:

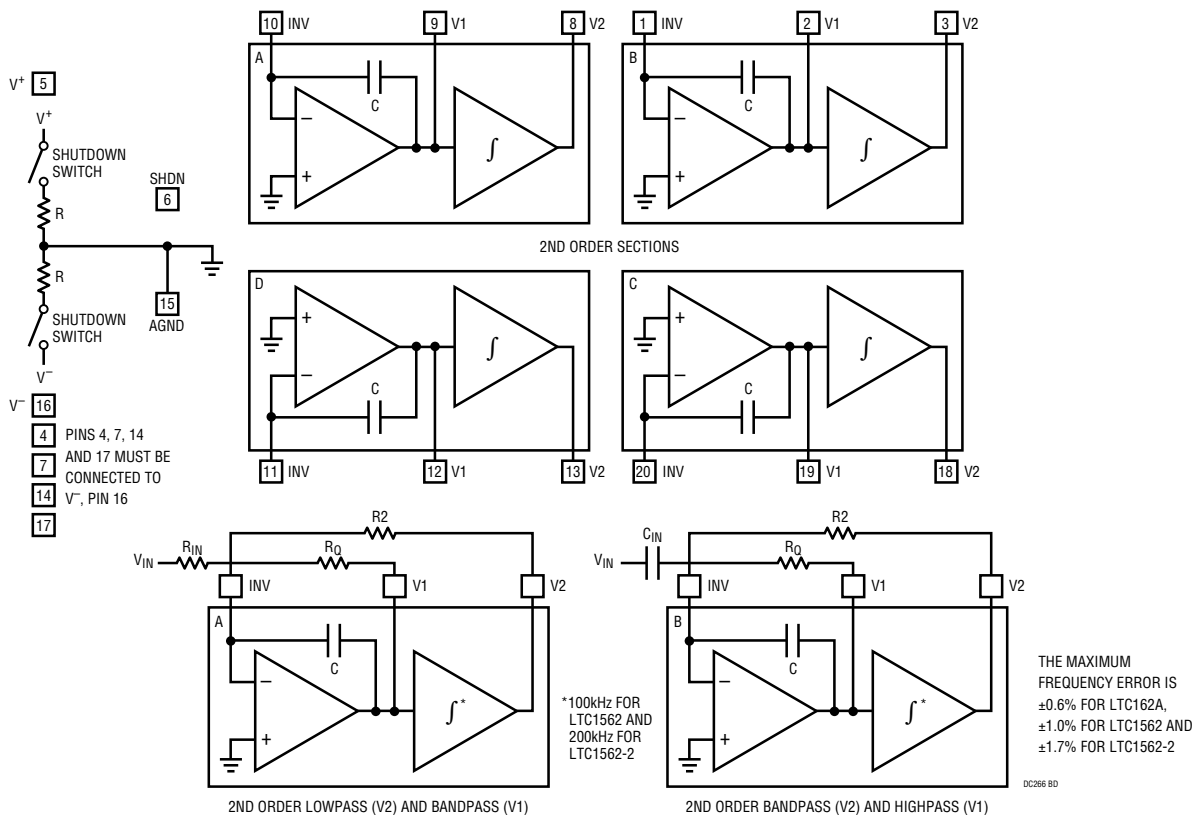
1. 8th order lowpass filter
2. Dual 4th or 5th order lowpass filter
3. 8th order narrow band bandpass
4. 8th order wide band bandpass.

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>**

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### 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.

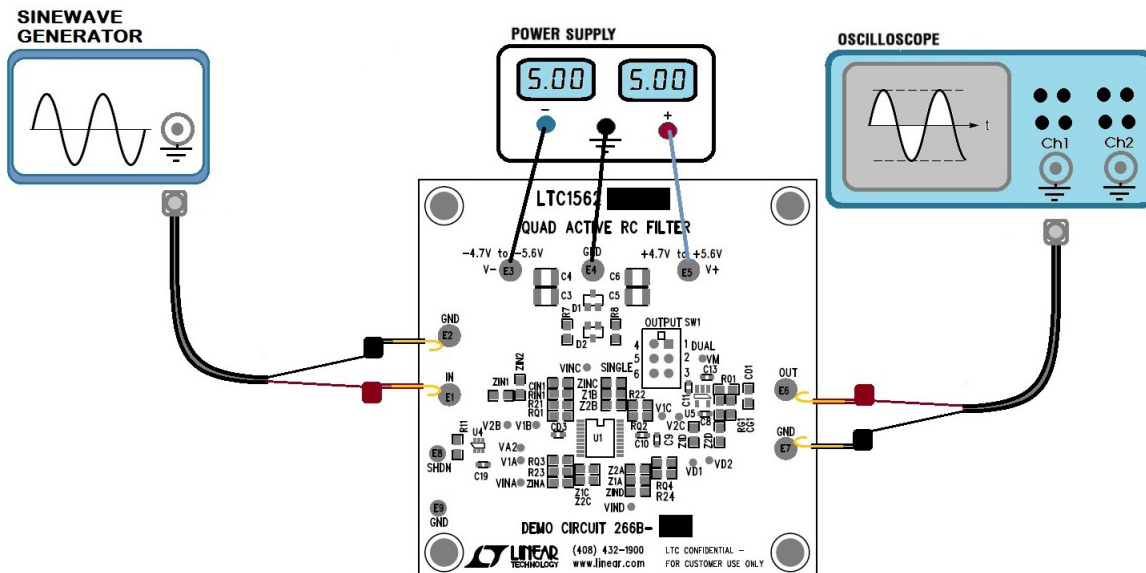


Figure 1. Quick Start Test Equipment Setup

## 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](http://www.linear.com/LTspice).

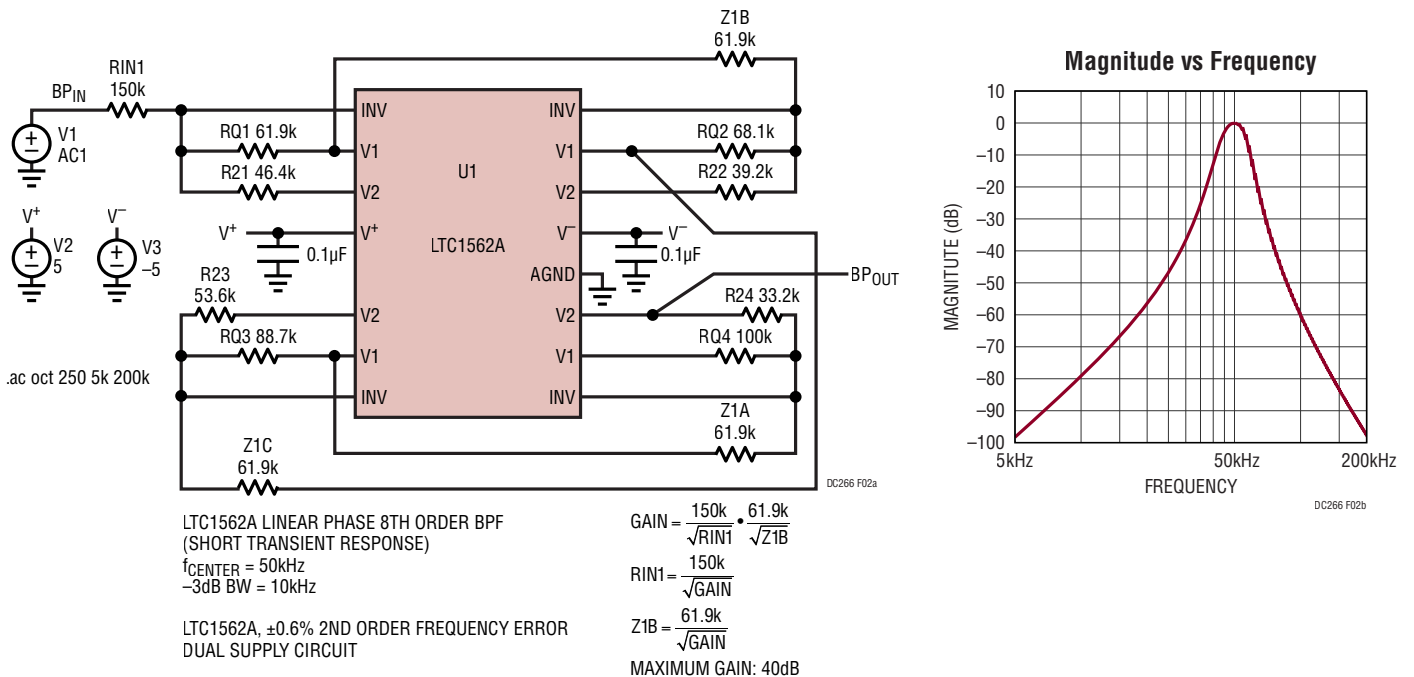


Figure 2. The Default DC266B-A Circuit

# DEMO MANUAL DC266B

## DC266B FILTER CIRCUITS

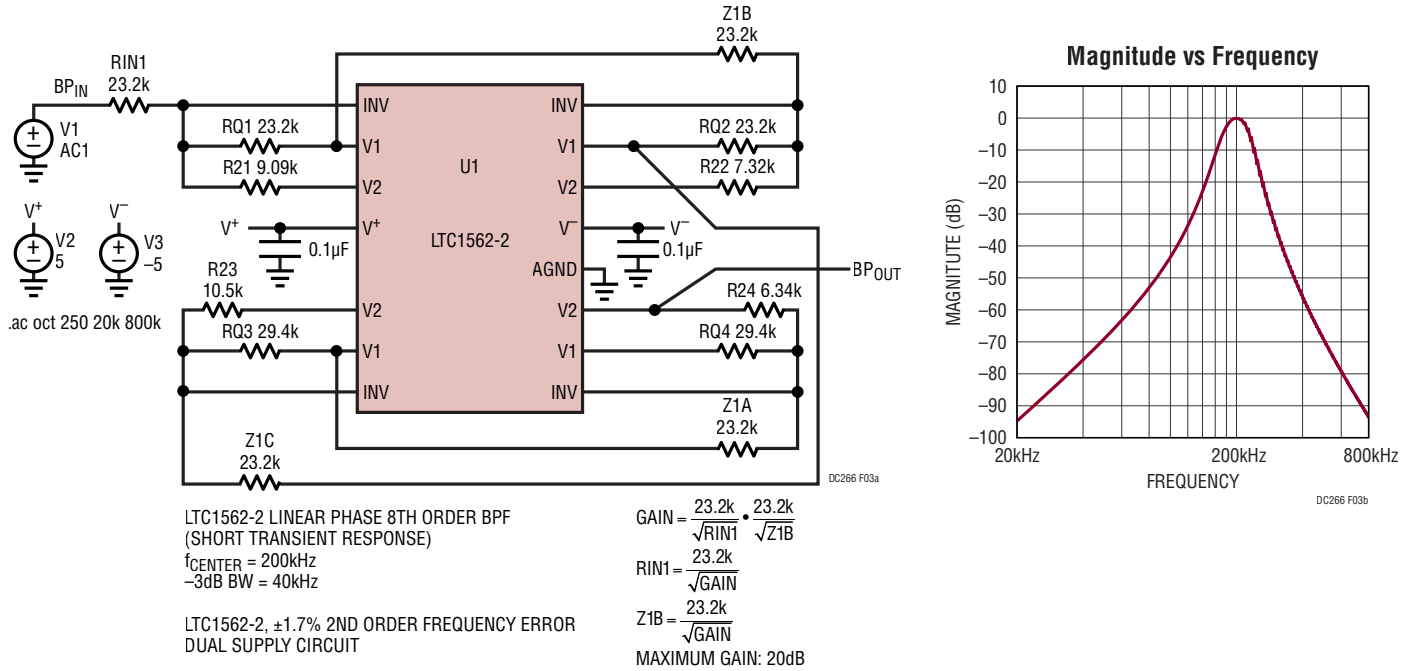


Figure 3. The Default DC266B-B Circuit

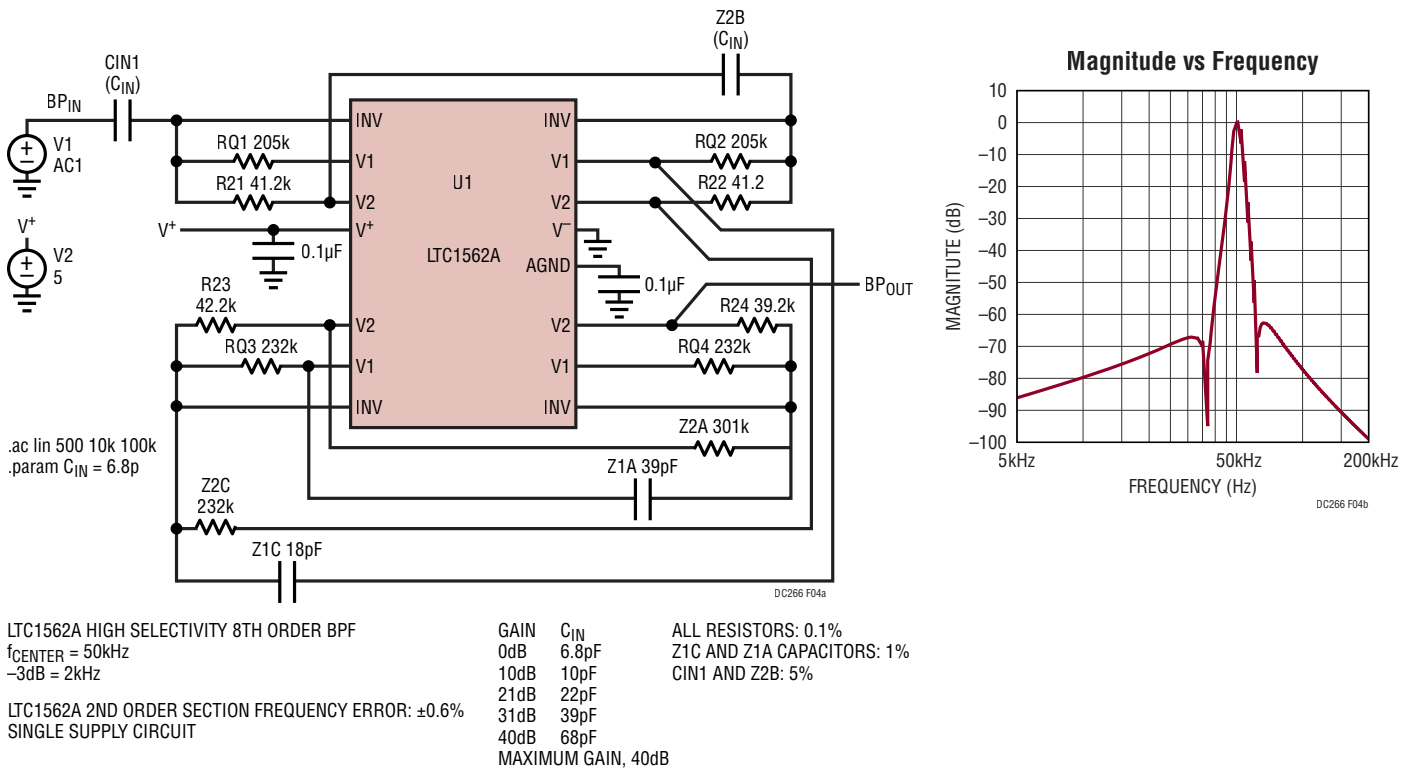
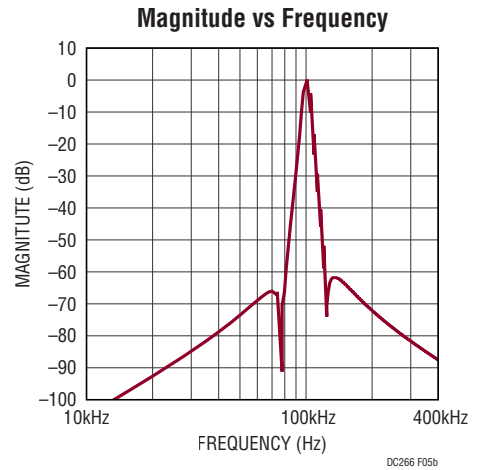
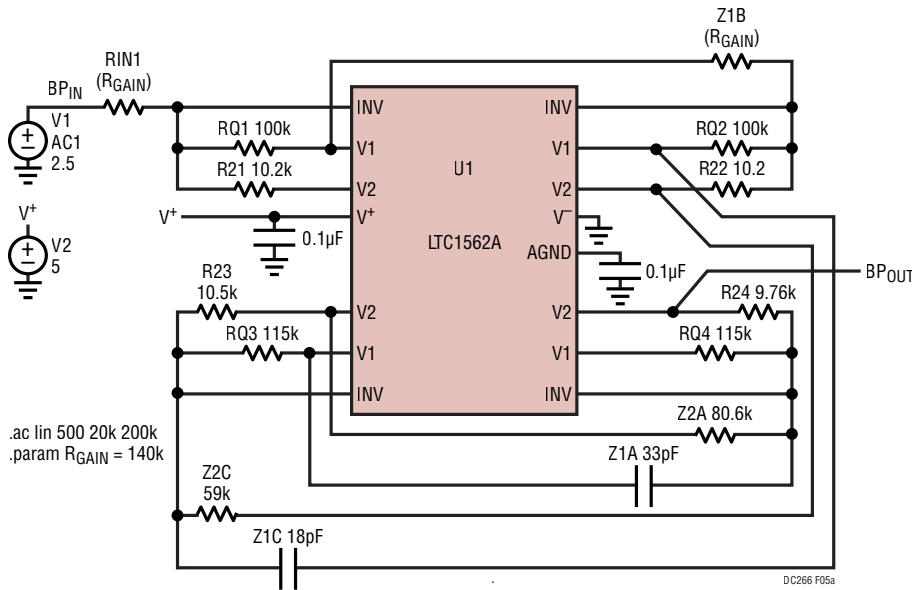


Figure 4. Reconfigured for LTC1562A 8th Order, 50kHz High Selectivity, Bandpass Filter

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

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