Remove DC Offset from Lowpass Filters

Adding one more RC network to a lowpass filter (**Figure 1**) restores perfect dc accuracy at the output (otherwise, the output in this case exhibits an offset of about 50mV). You choose R and C for a pole frequency three decades below the filter's cutoff frequency f_C: $1/2\pi RC = f_C/1000$. If desired, the RC output may be buffered with a low-offset op amp as shown. The MAX427, for example, guarantees an offset voltage of 5µV typical (15µV max).

At dc and low frequencies, the dc-accurate output tracks the unfiltered input because R provides a signal path that bypasses the filter. At higher frequencies C begins to conduct, allowing the dc-accurate output to track the filter's lowpass (LPO) output.

Provided the lowpass filter has unity gain and low ripple, the RC network has virtually no effect on filter gain or phase response; the input signal and LPO output swing together throughout most of the passband. Attenuation in the RC filter is sufficient that the active-lowpass filter shape is maintained for frequencies between f_C and the stopband. At higher frequencies, the RC network sets the filter's rolloff rate at 20dB/decade (**Figure 2**).

The RC network slows the process of nulling offsets to zero, but it has no effect on the circuit's response to a step change in the dc input level.

(Circle 3)

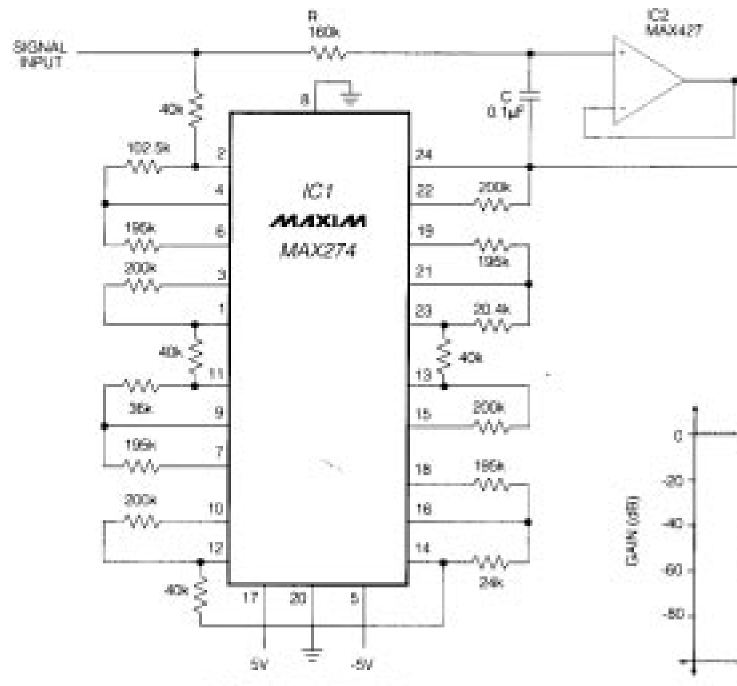

Figure 1. The external R and C remove dc-offset errors that might otherwise be contributed by the lowpass filter.

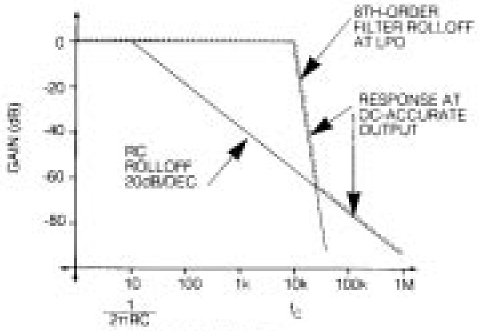

Figure 2. *This Bode plot for the Figure 1 filter shows that the RC network affects frequency response only in the filter's stopband.*