APPLICATIONS INFORMATION

NOTCH FILTER

A notch filter rejects a specific interfering frequency and can be implemented using a single op amp. Figure 59 shows a 60 Hz notch filter that uses the twin-T network with the ADA4062-x configured as a voltage follower. The ADA4062-x works as a buffer that provides high input resistance and low output impedance. The low bias current (2 pA typical) and high input resistance (10 TΩ typical) of the ADA4062-x enable large resistors and small capacitors to be used.

Alternatively, different combinations of resistor and capacitor values can be used to achieve the desired notch frequency. However, the major drawback to this circuit topology is the need to ensure that all the resistors and capacitors be closely matched. If they are not closely matched, the notch frequency offset and drift cause the circuit to attenuate at a frequency other than the ideal notch frequency.

Therefore, to achieve the desired performance, 1% or better component tolerances are usually required. In addition, a notch filter requires an op amp with a bandwidth of at least 100× to 200× the center frequency. Hence, using the ADA4062-x with a bandwidth of 1.4 MHz is excellent for a 60 Hz notch filter. Figure 60 shows the frequency response of the notch filter. At 60 Hz, the notch filter has about 50 dB attenuation of signal.

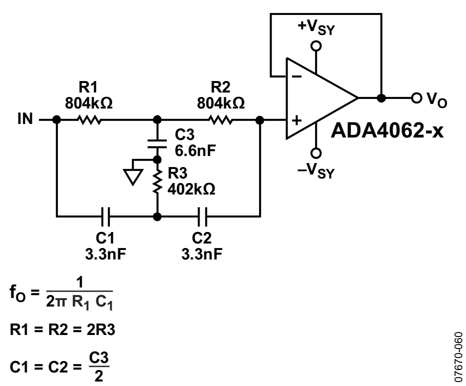

Figure 59. Notch Filter Circuit

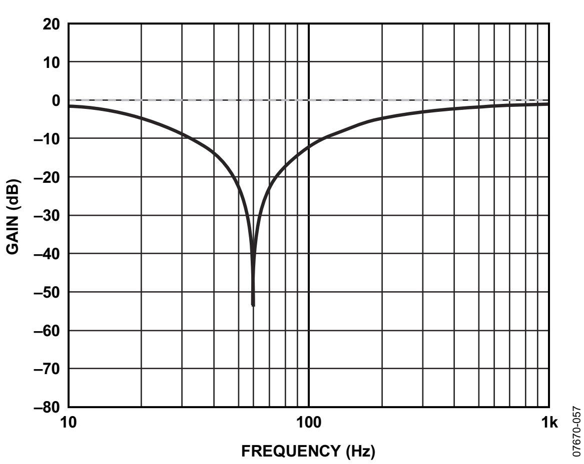

Figure 60. Frequency Response of the Notch Filter

HIGH-SIDE SIGNAL CONDITIONING

Many applications require the sensing of signals near the positive rail. The ADA4062-x can be used in high-side current sensing applications. Figure 61 shows a high-side signal conditioning circuit using the ADA4062-x. The ADA4062-x has an input common-mode range that includes the positive supply (−11.5 V ≤ V_{CM} ≤ +15 V). In the circuit, the voltage drop across a low value resistor, such as the 0.1 Ω shown in Figure 61, is amplified by a factor of 5 using the ADA4062-x.

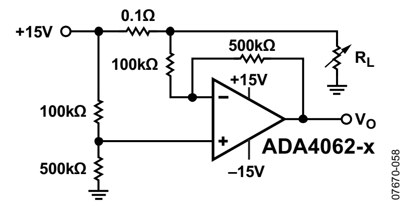

Figure 61. High-Side Signal Conditioning

MICROPOWER INSTRUMENTATION AMPLIFIER

The ADA4062-2 is a dual amplifier and is perfectly suited for applications that require lower supply currents. For supply voltages of ±15 V, the supply current per amplifier is 165 µA typical. The ADA4062-2 also offers a typical low offset voltage drift of 5 µV/°C and a very low bias current of 2 pA, which make it well suited for instrumentation amplifiers.

Figure 62 shows the classic 2-op-amp instrumentation amplifier with four resistors using the ADA4062-2. The key to high CMRR for this instrumentation amplifier are resistors that are well matched to both the resistive ratio and relative drift. For true difference amplification, matching of the resistor ratio is very important, where R3/R4 = R1/R2. Assuming perfectly matched resistors, the gain of the circuit is 1 + R2/R1, which is approximately 100. Tighter matching of two op amps in one package, as is the case with the ADA4062-2, offers a significant boost in performance over the classical 3-op-amp configuration. Overall, the circuit only requires about 330 µA of supply current.

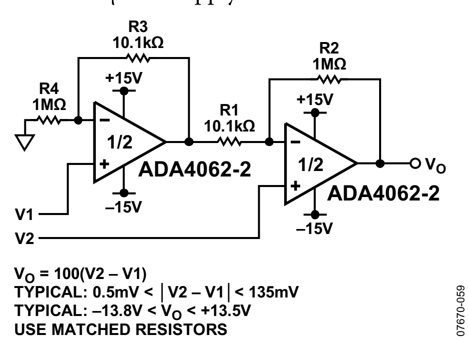

Figure 62. Micropower Instrumentation Amplifier

PHASE REVERSAL

Phase reversal occurs in some amplifiers when the input common-mode voltage range is exceeded. When the voltage driving the input to these amplifiers exceeds the maximum input common-mode voltage range, the output of the amplifiers changes polarity. Most JFET input amplifiers have phase reversal if either input exceeds the input common-mode range.

For the ADA4062-x, the output does not phase reverse if one or both of the inputs exceeds the input voltage range but remains within the positive supply rail and 0.5 V above the negative supply rail. In other words, for an application with a supply voltage of ±15 V, the input voltage can be as high as +15 V without any output phase reversal. However, when the voltage of the inputs is driven beyond −14.5 V, phase reversal occurs due to saturation of the input stage leading to forward biasing of the gate-drain diode. Phase reversal in ADA4062-x can be prevented by using a Schottky diode to clamp the input terminals to each other. In the simple buffer circuit in Figure 63, D1 protects the op amp against phase reversal, and R limits the input current that flows into the op amp.

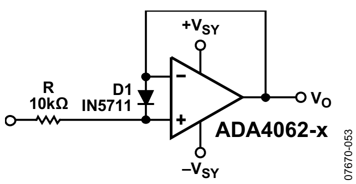

Figure 63. Phase Reversal Solution Circuit

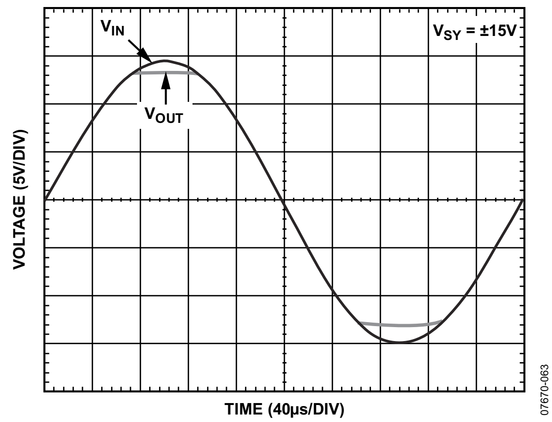

Figure 64. No Phase Reversal