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APPLICATION BULLETIN
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SIMPLE OUTPUT FILTER ELIMINATES ISO AMP OUTPUT RIPPLE AND KEEPS FULL BANDWIDTH

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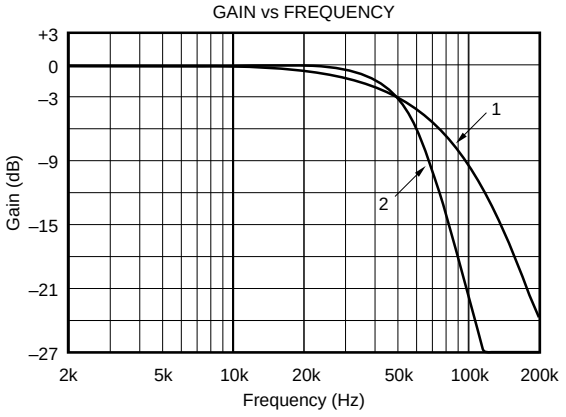
The ISO120/121/122 isolation amplifiers (ISO amps) have a small (10-20mVp-p typ) residual demodulator ripple at the output. A simple filter can be added to eliminate the output ripple without decreasing the 50kHz signal bandwidth of the ISO amp.

The ISO120/121/122 is designed to have a 50kHz single-pole (Butterworth) signal response. By cascading the ISO amp with a simple 50kHz, Q = 1, two-pole, low-pass filter, the overall signal response becomes three-pole Butterworth. The result is a maximally flat 50kHz magnitude response and the output ripple reduced below the noise level.

Figure 1 shows the complete circuit. The two-pole filter is a unity-gain Sallen-Key type consisting of A_1, R_1, R_2, C_1, and C_2. The values shown give Q = 1 and f_{-3dB} bandwidth = 50kHz. Since the op amp is connected as a unity-gain follower, gain and gain accuracy of the ISO amp are unaffected. Using a precision op amp such as the OPA602 also preserves the DC accuracy of the ISO amp.

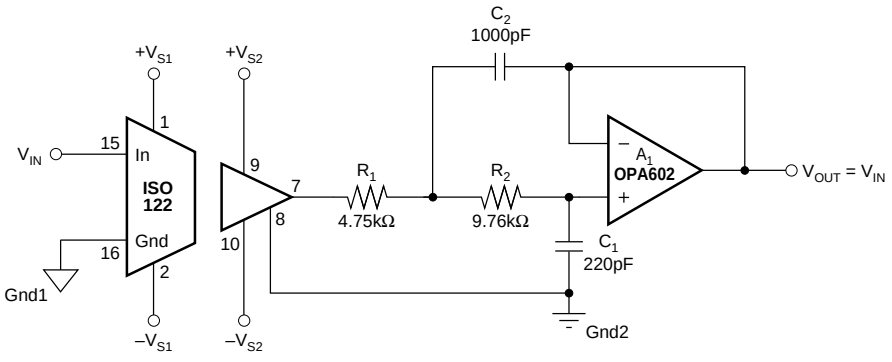
Figure 2 compares the magnitude response of the standard and filtered ISO amp. Figures 3 and 4 show the output ripple improvement. Figures 5 and 6 show the good step response of both the standard and filtered ISO amp.



1) Standard ISO122 has 50kHz single-pole (Butterworth) response.

2) ISO122 with cascaded 50kHz, Q = 1, two-pole, low-pass filter has three-pole Butterworth response.

FIGURE 2. Gain vs Frequency Plot.



NOTE: Cascading the 50kHz single-pole response ISO122 with a 50kHz, Q = 1, two-pole, low-pass filter produces an overall three-pole Butterworth response and eliminates output ripple.

FIGURE 1. ISO122 with Output Filter for Improved Ripple.

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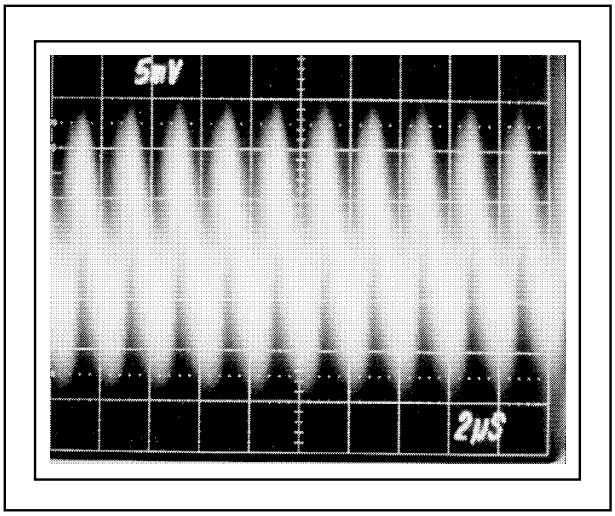


FIGURE 3. Standard ISO122 (approximately 20mVp-p output ripple).

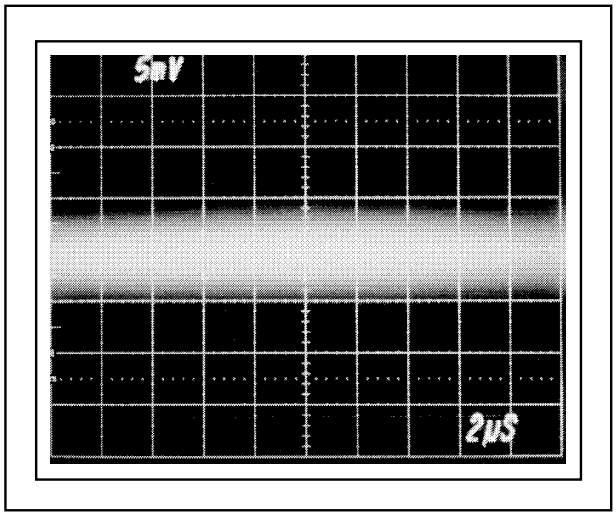


FIGURE 4. Filtered ISO122 (no visible output ripple).

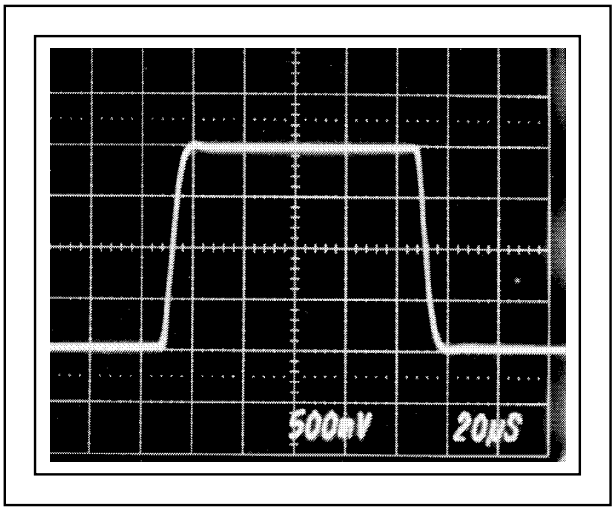


FIGURE 5. Step Response of Standard ISO122.

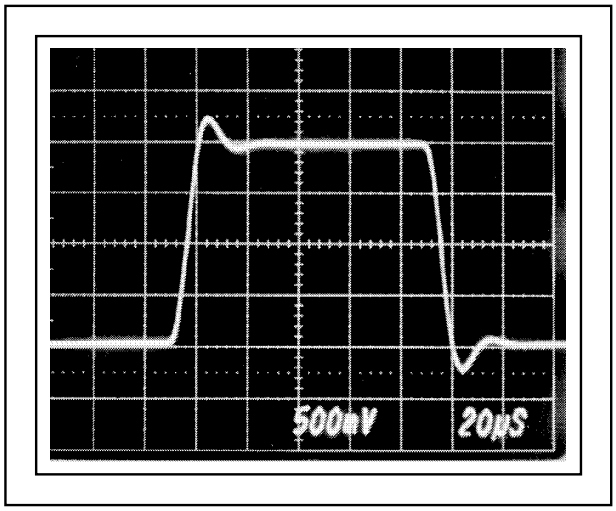
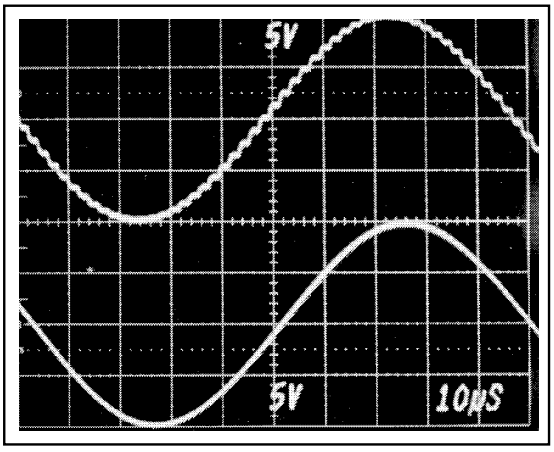


FIGURE 6. Step Response of ISO122 with Added Two-pole Output Filter.



NOTE: Ripple is eliminated from the output waveform by the filter.

FIGURE 7. Large-signal, 10kHz Sine-wave Response of ISO122 with and without Output Filter.

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