

Figure 2. Recorded Peak-to-Peak Noise of the Composite Op Amp, Figure 1, During a 10 Sec. Window

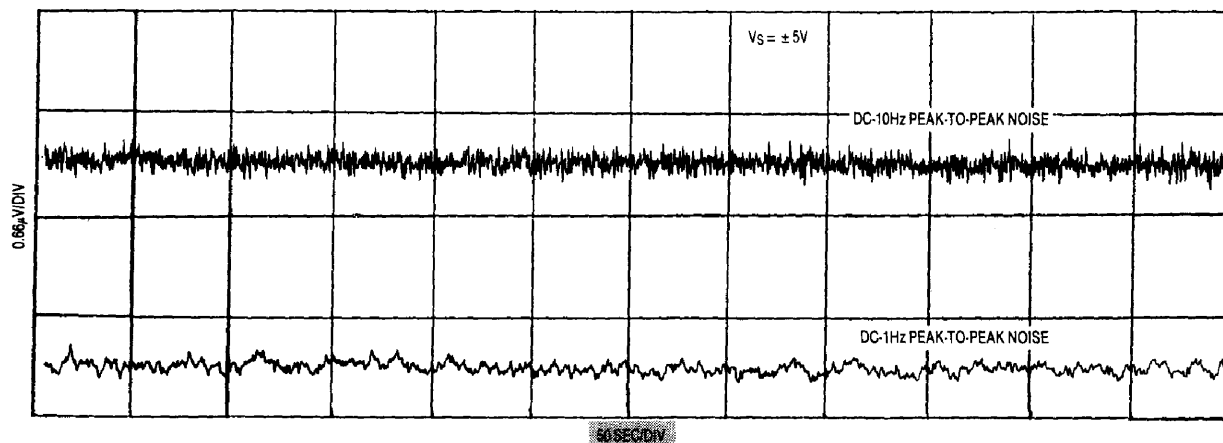


Figure 3. Recorded Peak-to-Peak Noise of the Composite Op Amp, Figure 1, During a 10 Minute Window

Noise Measurements

Bipolar op amp datasheets commonly specify 0.1Hz-10Hz peak-to-peak noise measured during a period of 10 sec. (or "10 sec. window"). The peak-to-peak noise is the difference of the highest positive noise spike to the lowest negative noise spike occurring during the 10 sec. interval. When working with chopper op amps, it is very tempting to apply this 10 sec. window test for noise measured from DC to 10Hz. In fact, the LTC1051 zeros its V_{OS} at a 2.5kHz rate, so it is reasonable to assume its noise spectral density continues to be "flat" below 0.1Hz. Experiments prove this assumption to be quite valid since the 0.1Hz to 10Hz peak-to-peak noise dominates the DC to 0.1Hz noise. For the composite op amp of Figure 1, however, the assumption may not be correct. The 0.1Hz to 10Hz noise of the LT1007 is at least an order of magnitude lower than the LTC1051 noise. Assuming that only a minute portion of the LTC1051 noise is injected into the LT1007 offset pin, then most 10 sec. windows should show outstanding noise results. Figure 2 shows this is so. Notice that for both

DC-1Hz, and DC-10Hz bandwidths the peak-to-peak noise was 100nV!! Any additional noise, therefore, should be contributed by the ultra low frequency "hunting" of the V_{OS} adjusting circuit's, integrator loop. Figure 3 shows the noise recorded in a 10 minute period. Again, results are quite impressive. The DC to 10Hz peak-to-peak noise is about the same as the DC to 1Hz peak-to-peak noise. The 0.2µVp-p recorded represents a 7 to 9 times improvement over the LTC1051 DC to 10Hz noise measured under the same conditions, and a 2.5 times improvement of the equivalent DC to 1Hz noise. The turn-on settling time of the circuit is 16 sec. Once the integrator captures the V_{OS} , the circuit's response time is undistinguishable from a normal amplifier. The circuit of Figure 1 should be used with source resistances less than 1kΩ to maintain noise performance.

For literature on our Ultra Low Noise Op Amps, call (800) 637-5545. For applications help, call (408) 432-1900, Ext. 456.