Feedback Gives Peak Detector More Precision

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The standard method for measuring the peak of a signal involves the use of a diode. If the diode is used alone, the input voltage has to be significantly larger than the turn-on voltage to obtain acceptable accuracy. The turn-on voltage ranges from 200mV in germanium diodes to 700mV in silicon diodes. To achieve 10% error, the simple detector requires an input voltage of 2V to 7V, respectively.

High-frequency op amps can utilize feedback to compensate for the diode turn-on voltage. The circuit in Figure 1 shows such a configuration. The diode labeled D6 is providing the rectification, just like it would in a simple peak detector. Similarly, R_{23} and C_1 provide the low-pass filtering to average the peak signal. One of the dual op amps buffers this averaged output while the other provides a high-impedance input and feedback node for the circuit.

The resistor network surrounding Q_1 provides a clamping circuit. When the input to the circuit is higher than the average, the output of the forward op amp is also higher than average. The diode (D_6) conducts as in the simple case, and Q_1 is held off. However, when the input drops below the average level, the diode does not conduct and Q_1 allows a feedback path to be created around the forward op amp. This switched feedback action forces the negative input of the forward op amp to track the output voltage. This tracking behavior is critical for recovery, especially at high speeds. If this network was removed, the op amp could saturate and would suffer in recovery time.

The quality of this peak detector implementation is demonstrated in Figures 2 and 3. Figure 2 plots the error versus input voltage swing for various frequencies. The large bandwidth of the dual op amp package allows for errors within a few percentage points for signals up to 1MHz. The "sweet spot" of operation extends from 700mV to about 4V with a 5V supply.

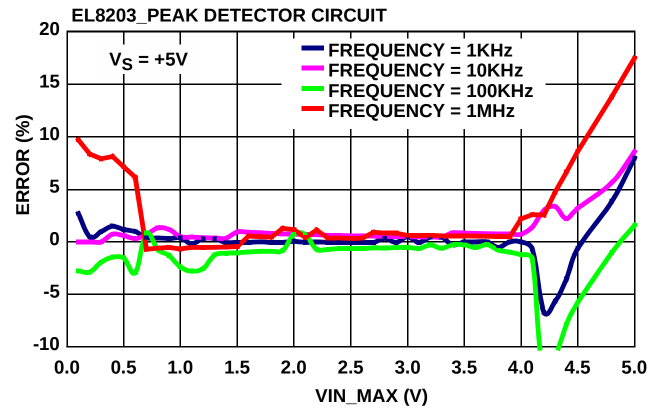

FIGURE 2. PEAK ERROR vs AMPLITUDE

Figure 3 plots the error versus frequency for a $1V_{P-P}$ input signal. Again, errors are small for frequencies below 1MHz. This plot also shows that errors are within 5% up to 3MHz and 10% up to about 15MHz. Recall that a $1V_{P-P}$ signal into a simple peak detector would exhibit 70% error.

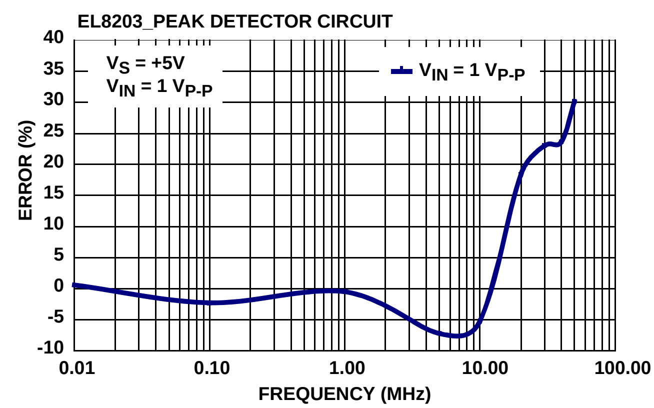

FIGURE 3. PEAK ERROR vs FREQUENCY (USING ISL8116 GENERATOR WITH TRIANGLE SIGNALS)

In summary, a high-speed dual op amp and a few components can add resolution and accuracy to a simple peak detector. The given circuit provides 2% error for signals up to 1MHz, making it suitable for audio applications and localized transmission, like infrared.

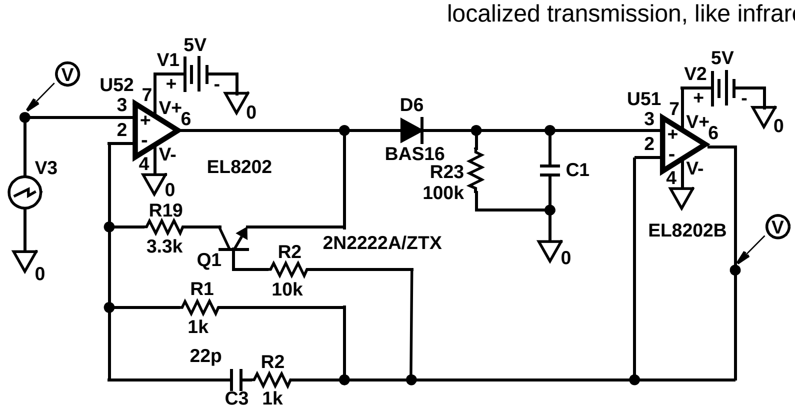

FIGURE 1. EL8202 PEAK DETECTOR