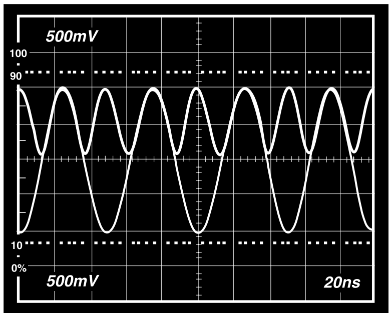

Figure 14. Full-Wave Rectifier Scope

Thus for either positive or negative input signals, the output is unity times the absolute value of the input signal. The circuit can be easily configured to produce the negative absolute value of the input by applying the input to V_H instead of V_L.

The circuit can get to within about 40 mV of ground during the time when the input crosses zero. This voltage is fixed over a wide frequency range and is a result of the switching between the conventional op amp input and the clamp input. But because there are no diodes to rapidly switch from forward to reverse bias, the performance far exceeds that of diode based full wave rectifiers.

The 40 mV offset mentioned can be removed by adding an offset to the circuit. A 27.4 kΩ input resistor to the inverting input will have a gain of 0.01, while changing the gain of the circuit by only 1%. A plus or minus 4 V dc level (depending on the polarity of the rectifier) into this resistor will compensate for the offset.

Full wave rectifiers are useful in many applications including AM signal detection, high frequency ac voltmeters and various arithmetic operations.

Amplitude Modulator

In addition to being able to be configured as an amplitude demodulator (AM detector), the AD8037 can also be configured as an amplitude modulator as shown in Figure 15.

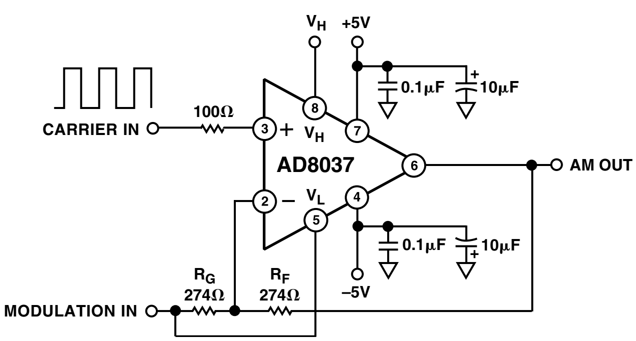

Figure 15. Amplitude Modulator

The positive input of the AD8037 is driven with a square wave of sufficient amplitude to produce clamping action at both the high and low levels. This is the higher frequency carrier signal.

The modulation signal is applied to both the input of a unity gain inverting amplifier and to V_L, the lower clamping input. V_H is biased at 0.5 V dc.

To understand the circuit operation, it is helpful to first consider a simpler circuit. If both V_L and V_H were dc biased at –0.5 V and the carrier and modulation inputs driven as above, the output would be a 2 V p-p square wave at the carrier frequency riding on a waveform at the modulating frequency. The inverting input (modulation signal) is creating a varying offset to the 2 V p-p square wave at the output. Both the high and low levels clamp at twice the input levels on the clamps because the noise gain of the circuit is two.

When V_L is driven by the modulation signal instead of being held at a dc level, a more complicated situation results. The resulting waveform is composed of an upper envelope and a lower envelope with the carrier square wave in between. The upper and lower envelope waveforms are 180° out of phase as in a typical AM waveform.

The upper envelope is produced by the upper clamp level being offset by the waveform applied to the inverting input. This offset is the opposite polarity of the input waveform because of the inverting configuration.

The lower envelope is produced by the sum of two effects. First, it is offset by the waveform applied to the inverting input as in the case of the simplified circuit above. The polarity of this offset is in the same direction as the upper envelope. Second, the output is driven in the opposite direction of the offset at twice the offset voltage by the modulation signal being applied to V_L. This results from the noise gain being equal to two, and since there is no inversion in this connection, it is opposite polarity from the offset.

The result at the output for the lower envelope is the sum of these two effects, which produces the lower envelope of an amplitude modulated waveform. See Figure 16.

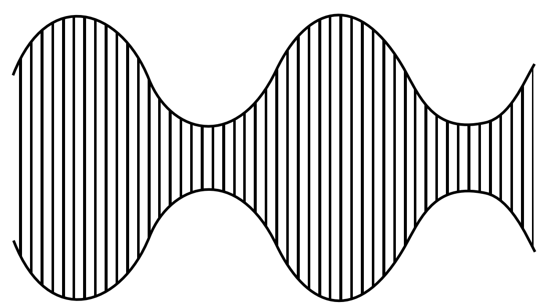

Figure 16. AM Waveform

The depth of modulation can be modified in this circuit by changing the amplitude of the modulation signal. This changes the amplitude of the upper and lower envelope waveforms.

The modulation depth can also be changed by changing the dc bias applied to V_H. In this case the amplitudes of the upper and lower envelope waveforms stay constant, but the spacing between them changes. This alters the ratio of the envelope amplitude to the amplitude of the overall waveform.