AN-585 APPLICATION NOTE

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AD5232–Programmable Oscillator Using Digital Potentiometers

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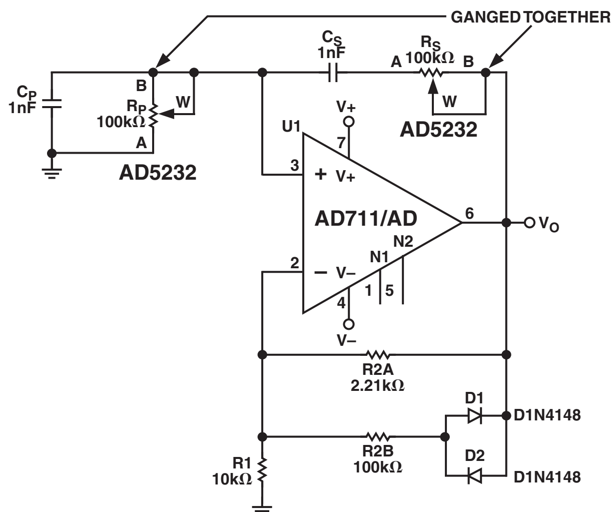

Figure 1. Programmable Wien-Bridge Oscillator with Amplitude Stabilization

This digital potentiometer is so versatile that it can be used in various filter and waveform generation applications. In such applications, users should be aware that its bandwidth is a function of programmable resistance at a given setting. As a result, the bandwidth performance of the digital potentiometer is usually published in the data sheets. If the application does not violate the bandwidth limitation, the digital potentiometer can be applied in a programmable oscillator where the programmable resistance can be used to set the programmable frequency. Figure 1 shows one implementation where a popular Wien-Bridge oscillator with amplitude stabilization is furnished by D1 and D2. If we set $C_P = C_S = C$, $R_P = R_S = R$, and $R2 = R2_A \parallel (R2_B + R_{DIODE})$, it can be shown that the loop gain equation simplifies to

$$L(s) = \frac{1 + R2/R1}{3 + sCR + 1/sCR} \qquad (1)$$

$$L(j\omega) = \frac{1 + R2/R1}{3 + j(\omega CR + 1/\omega CR)} \qquad (2)$$

$$\omega_o = \frac{1}{CR} \qquad (3)$$

$$R = \frac{256 - D}{256} R_{AB} \qquad (4)$$

where D is the decimal equivalent of the digital code of the AD5232 dual 256-step digital potentiometer and R_{AB} is the end-to-end resistance.

To sustain oscillation, we set the loop gain to unity such that

$$\frac{R2}{R1} = 2 \qquad (5)$$

By using 1 nF for C, 100 kΩ for R (end-to-end resistance of the digital potentiometer), and with D set to 0, 128 , and 196, oscillations occur, respectively, at 1.59 kHz, 3.18 kHz, and 6.36 kHz with amplitude of ±1 V (See Figure 2).

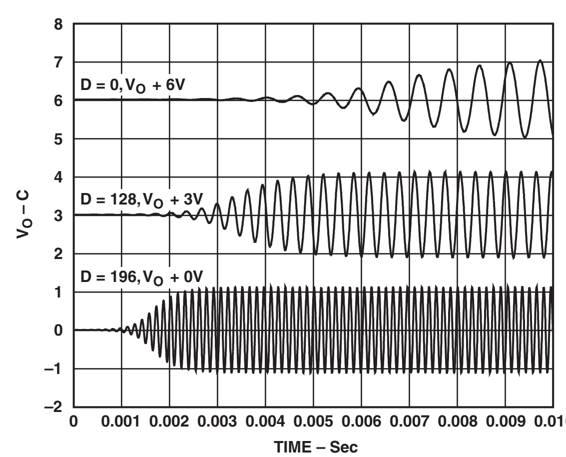

Figure 2. For D = 0, 128, and 196, Oscillations Occur at 1.59 kHz, 3.18 kHz, and 6.36 kHz, Respectively