SCRs make serviceable relaxation oscillators

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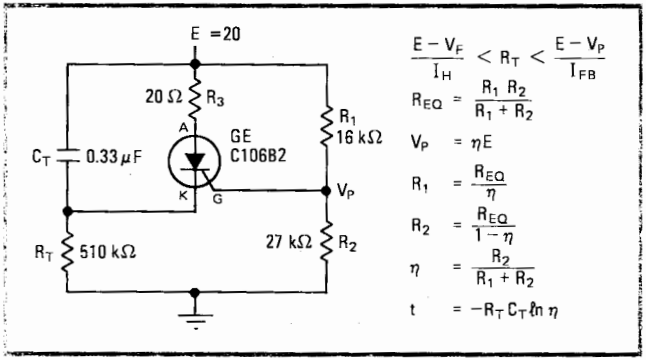
Few designers realize that a silicon controlled rectifier can be used as a relaxation oscillator, just like its sister thyristor, the programmable unijunction transistor. The circuit arrangement is much akin to the PUT oscillator, as shown in the figure.

When power is applied, capacitor C_T charges, and the voltage across resistor R_T decreases exponentially. When the voltage across R_T, which is the cathode voltage of the SCR, drops to 0.6 volt less than the gate voltage, the SCR turns on. This turn-on produces current flow through C_T and a voltage spike across R_3.

Since the large value of R_T prohibits there being sufficient current to maintain conduction, the SCR immediately turns off, and C_T begins its charge cycle again. The period of oscillation is approximately given by $t = -R_T C_T (\ln \eta)$, where η is the fraction of the supply voltage that is applied to the gate, or $R_2/(R_1 + R_2)$. The high-impedance (500-kilohm) sawtooth-waveform output is available at the SCR's cathode, and a pulse waveform appears at its anode. The output impedance at this point is less than 20 ohms. If a high-current pulse is desired, a pulse transformer might replace R_3.

Design equations in the figure outline the criteria for oscillation. Values for SCR on-voltage, holding and forward blocking currents may be obtained from the data sheets. □



Programmability. An SCR oscillator retains the features of a unijunction-transistor circuit, including programmability of the firing point. Values shown yield an oscillation frequency of about 15 Hz. Gate-to-cathode voltage drop is neglected in the equations.

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