Ramp generator has separate slope and frequency controls

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Isolating with four analog switches the frequency-determining portion of the circuit from that controlling the charging and discharging of its RC integrator, this ramp generator achieves independent selection of slope ratio and repetition rate. Such a unit is useful in a music synthesizer, where timbre must be changed without affecting a note's fundamental frequency.

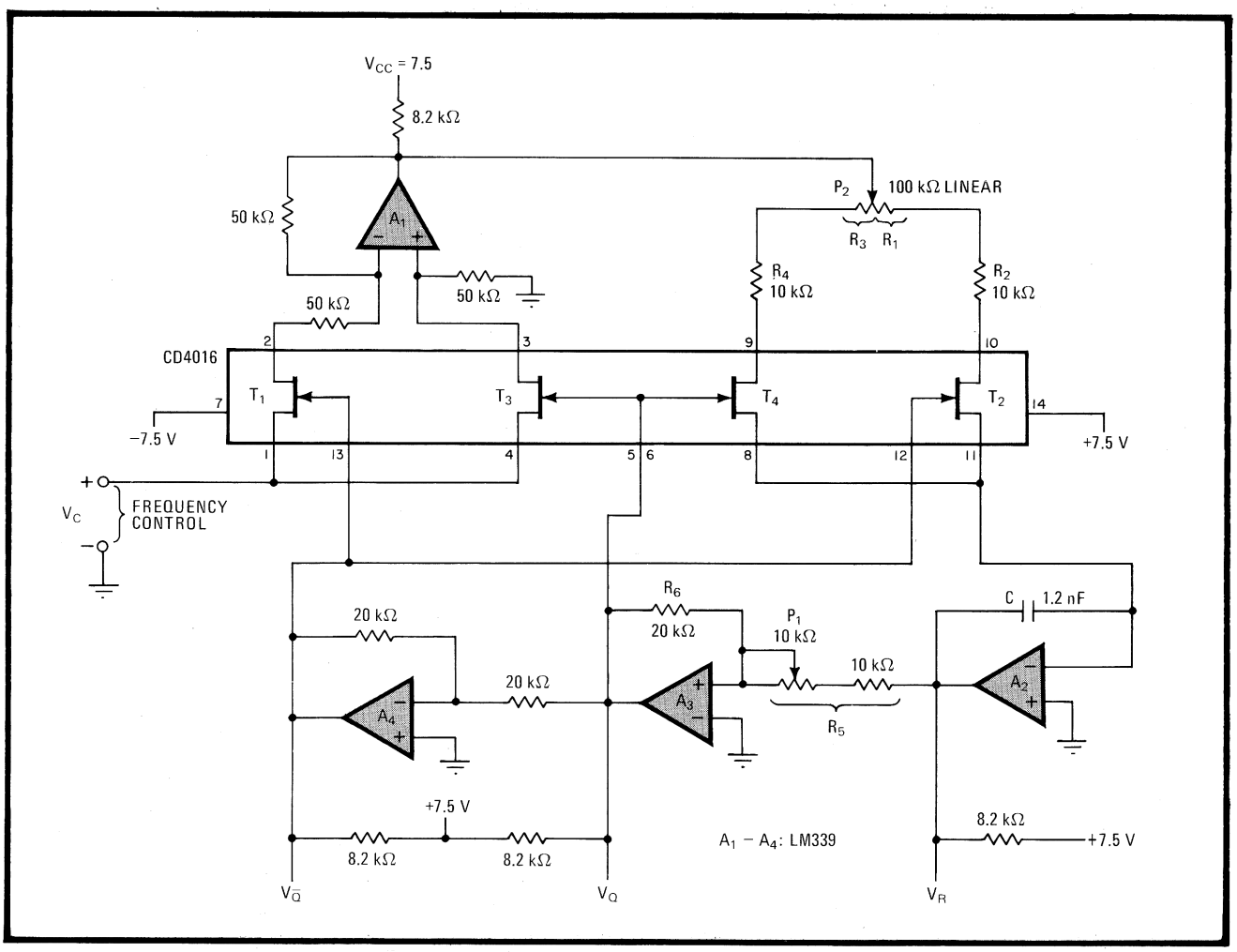
Analog gates T_1 and T_2 are initially switched on, and therefore V_c is applied via operational amplifier A_1 to the integrator built around A_2 (see figure). Thus, $-V_c$ appears at the inverting input of A_2, and its positive-going output reaches voltage V_H in $T_1 = 2V_HC(R_1+R_2)/V_c$ seconds, where $V_H = V_{cc}R_5/R_6$.

At this time, A_3 switches on and A_4 goes off. T_1 and T_2 are thus disabled, and T_3 and T_4 are brought high so that $+V_c$ is applied to the integrator. The output at A_2 thus falls linearly toward $-V_H$, where time $T_2 = 2V_HC(R_3+R_4)/V_c$.

The frequency of the ramp is given by:

$$f = 1/(T_1+T_2)$$
$$= R_6V_c/[2CR_5V_{cc}(R_1+R_2+R_3+R_4)] = kV_c$$

where k is a constant (in the approximate range of 1 kHz/V) that can be adjusted with potentiometer P_1. Because R_1+R_3 is a constant, it is seen that an adjustment in potentiometer P_2 will affect the slope ratio, but not the frequency. With the values shown, the slope ratio can be selected from 1/11 to 11. The slope ratio is given by $T_1/T_2 = (R_1+R_2)/(R_3+R_4)$. □



Separation. Transmission gates T_1–T_4 separate the portion of the ramp generator that determines the frequency from the circuitry that sets the charge and discharge times of its integrator, so that the up/down slope ratio and frequency can be independently selected. The inexpensive circuit, which costs less than $10 and works in the audio range, is a useful timbre control in music synthesizers.