Low-cost switcher converts 5 to 24V

PAUL C FLORIAN, PLANO, TX

The low-cost, three-transistor boost switching regulator in **Figure 1a** is a modified astable multivibrator comprising Q_1, Q_2, and L_1, which substitutes as a load for Q_2. At the full output power of 200 mW, the oscillation frequency is approximately 60 kHz. The efficiency is 65% with V_{OUT} equal to 24V and sourcing 8 mA.

When the base of Q_2 is high, energy stores in L_1's magnetic field. When the circuit drives the base of Q_2 low, the induced voltage from L_1's magnetic field collapses to add with the supply voltage. This voltage spike charges C_1 through D_1. When the accumulated charge in C_1 results in a voltage equal to the zener voltage of D_2 plus 0.6V, Q_3 pulls Q_2's base to ground, decreasing the amount of time Q_2 is on in subsequent oscillations and thereby decreasing the energy transferred to C_1. This feedback through D_2 regulates the output voltage to 24.6V±the tolerance of D_2. To change the output voltage of the circuit, simply change the zener voltage of D_2.

Many VCOs require tuning voltages as high as 20V, and you can use this switching regulator to generate a 0 to 20V tuning voltage from a 0 to 5V control voltage (**Figure 1b**). The circuit configures one-half an LM358N as a noninverting amplifier with a gain of 4. C_1 eliminates gain for the noise generated by the 24V supply. You can manually adjust the tuning voltage using R_1 or control the voltage using feedback from a PLL. (DI #2159) e

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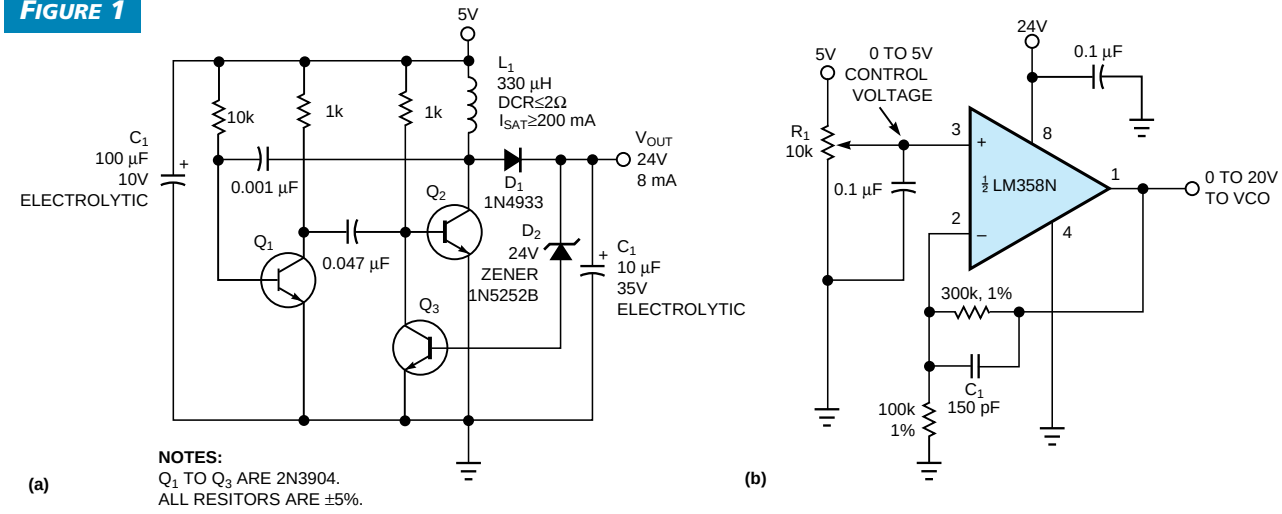
FIGURE 1



A simple three-transistor switching regulator (a) supplies 24V and 8 mA. The circuit can help provide a 0 to 20V VCO tuning voltage from a 0 to 5V control voltage (b).