end of each period, a positive-going edge appears at F. Each positive edge at F makes counter IC_2 count down by one.

When the circuit has produced N periods at S, the voltage at C goes high, which indicates end of count. The voltage at D goes high and disables the counter. IC_{3C} and IC_{3D} invert the voltage at D, and the resulting 0V drive turns on Q_1. A 5V level is present at E, and IC_4 switches are on. The internal oscillator of IC_1 stops, and the output signal at F returns to zero. Before returning to the original state, the signal at B should return to zero, which happens after the end of the delay that one-shot IC_{5A} produces.

All is now ready for another train of pulses. Using S_1, you can program the circuit for one to 15 pulses. The circuit can produce other signal shapes, depending on how you connect A_0 and A_1 of IC_1 (**Table 1**). You can also replace S_1 with a µC to produce any pattern of pulses.

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High-voltage current-feedback amplifier is speedy

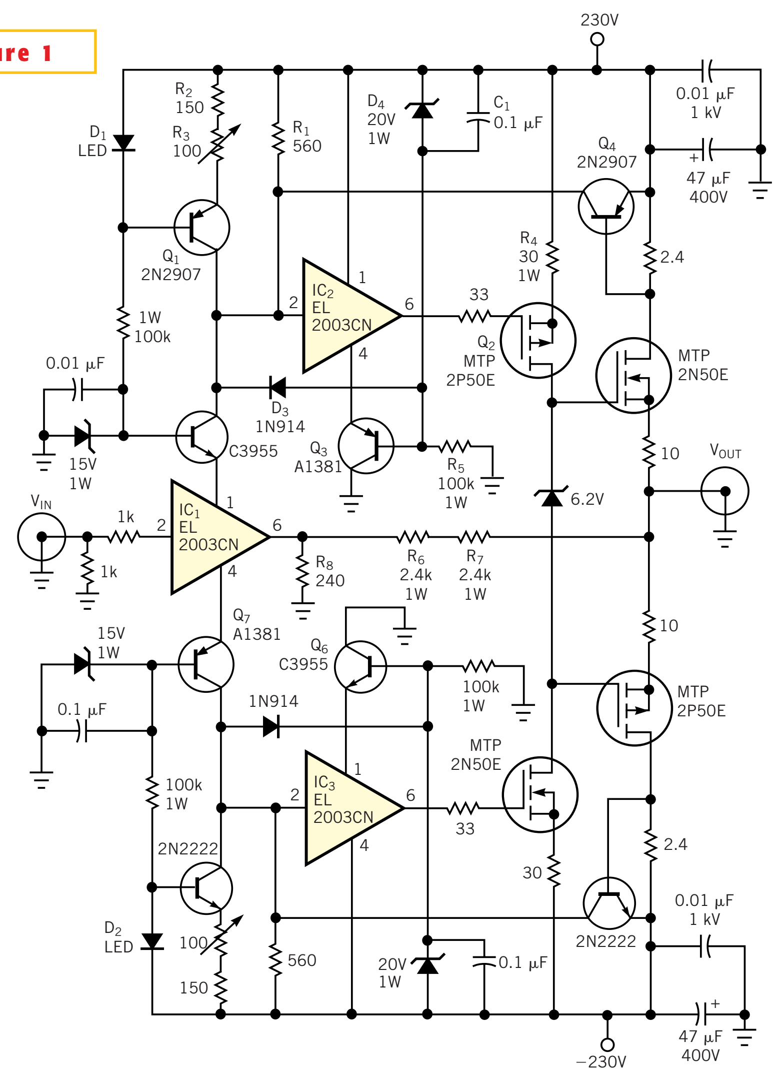
Joseph Ting, Institute of Atomic and Molecular Sciences of the Academia Sinica, Taipei, Taiwan

The circuit in **Figure 1** powers a microparticle and nanoparticle ion trap through a 1-to-5-turns-ratio, high-voltage transformer. It also works successfully as a driver for a piezo-tube scanner and in a near-field scanning optical microscope. The circuit is robust and works with supplies ranging from ±50 to ±230V. The measured parameters at ±230V supply voltage are gain of 26-dB from dc to −3-dB point at 7 MHz; output swing of ±200V, rise and fall times of 70 nsec for an output step of 350V, slew rate of 4100V/µsec, and supply current of 56 mA.

The red LEDs, D_1 and D_2, in **Figure 1** provide a 1.8V drop; the LEDs are more rugged than precision IC voltage references. The current supply for IC_1 comes from R_1 and the source comprising D_1, R_2, R_3, and Q_1. R_3's trimmed value is such that Q_2's quiescent current is approximately 15 mA. You can determine this current by measuring the voltage drop across R_4. The same adjustment also controls the output-voltage offset. IC_2 is a unity-gain, high-current driver for Q_2. D_3 prevents IC_2's input from going more negative than its negative supply. Q_3, D_4, C_1, and R_5 provide the negative bias for IC_2. Q_4 is an output-current limiting switch. Q_4 starts to turn on at I_{OUT}=290 mA. You can replace the bipolar transistors C3955 (npn, Q_2 and Q_6) and A138 (pnp, Q_3 and Q_7) by equivalents as long as they have the following minimum specs: V_{CEO}≥250V; I_C≥100 mA, and f_T≥100 MHz.

You should mount all the power tran-

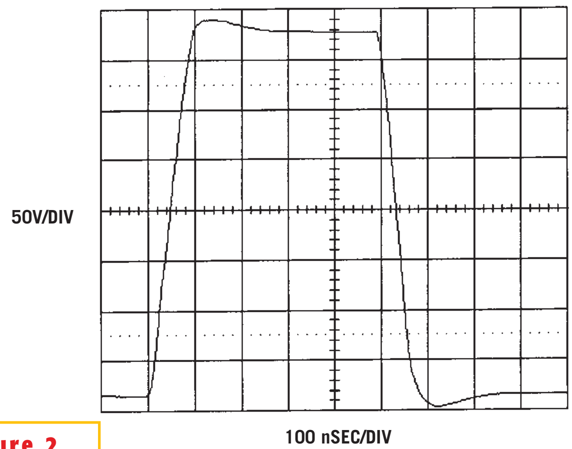
Figure 1



This high-voltage, current-feedback amplifier slews at 4100V/µsec.

sistors in individual finned heat sinks with an overhead 3-in. fan for cooling. The pc-board layout is not critical and needs no ground plane. However, you must use single-point grounding to minimize ringing. For the component values shown, the circuit is very stable and needs no compensation capacitors. **Figure 2** shows a large-signal response for a ±9V, 1-MHz square-wave input. This circuit has a fixed gain of 20. For higher gains, you can increase the values of R_6 and R_7. For lower values, it is better to insert an attenuator at the input, because smaller values of R_6 and R_7 may result in excessive dissipation. Do not change the value of R_8, because it is optimized for speed. Be cautious when measuring and using this circuit, because it harbors lethal voltages. The National Science Council of Taiwan sponsored this project.

Figure 2



The circuit has a clean square-wave response with minimal overshoot and no ringing.

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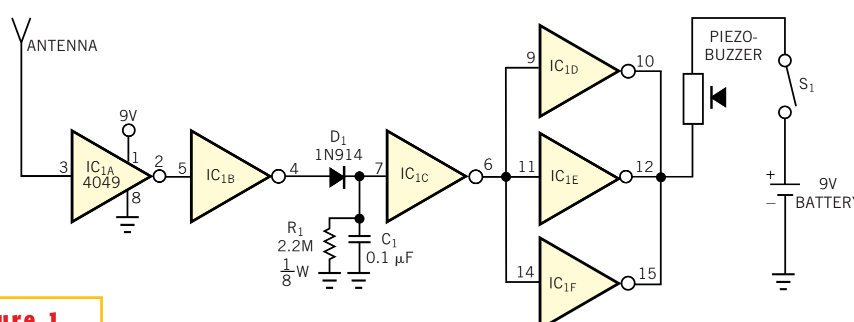
AC-power monitor uses remote sensing

Sanjay R Chendvankar, Tata Institute of Fundamental Research, Colaba, Mumbai, India

THE DETECTION CIRCUIT in the Design Idea "Circuit monitors ac-power loss" (*EDN*, Nov 24, 1999, pg 172) requires a physical connection with the mains to sense the power loss. The circuit in **Figure 1** senses the power loss through the radiated power-line signal. The battery-operated circuit has a quiescent-current drain of approximately 2 μA. The antenna, which is either a telescopic antenna or simply an approximately 2-ft-long wire, intercepts the radiated power-line signal. The CMOS inverters, IC_{1A} and IC_{1B}, amplify this weak signal and convert it into a digital signal. D_1 and C_1 generate a steady dc voltage at the input of IC_{1C}. D_1 prevents discharge of C_1 through the output of IC_{1B} when the square wave at this output periodically goes to a low level. Inverters IC_{1D}, IC_{1E}, and IC_{1F} connected in parallel enhance the current-sink capacity for sinking the piezo-buzzer current. When the ac mains is present, the output of IC_{1C} is low; hence, the levels of IC_{1D}, IC_{1E}, and IC_{1F} are high, and the buzzer is off. When the ac power fails, the output of IC_{1B} goes low; C_1 discharges through R_1; and IC_{1D}, IC_{1E}, and IC_{1F} go low. This level activates the piezo-buzzer and warns of ac-line failure. Switching off the battery power deactivates the buzzer. You can turn S_1 on after ac power resumes.

Figure 1



A low level at the outputs of IC_{1D}, IC_{1E}, and IC_{1F} activates the piezo-buzzer and warns of ac-line failure.

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