Use a switching-regulator controller to generate fast pulses

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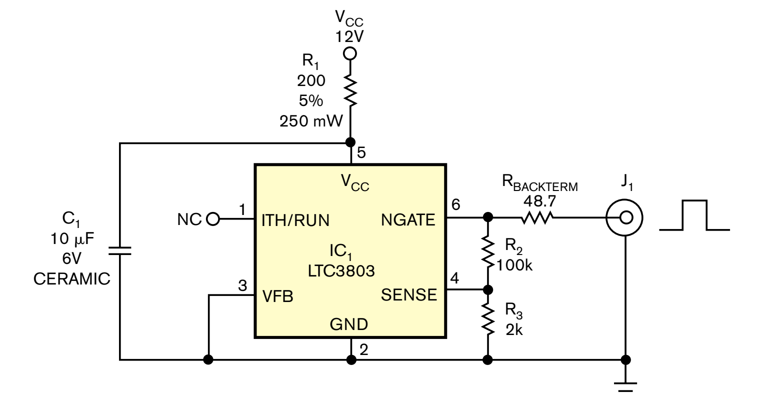

Figure 1 Switching-regulator-controller IC_1 delivers pulses with 1.5-nsec rise and fall times into a 50Ω load.

A source of pulses with fast-rising edges that approximate the step function can help you perform many useful laboratory measurements, including characterization of coaxial cables' rise times and location of cable faults using time-domain-reflectometry methods. For example, evaluating the rise time of a 10- to 20-ft-long RG-58/U cable requires edge-transition times of 1 to 2 nsec. Agilent's (www.agilent.com) HP8012B, a workhorse pulse generator that finds use in many electronics labs, can deliver pulses with rise times of 5 nsec that are adequate for many applications but not for cable characterization.

As an alternative, switching-regulator-controller ICs can deliver gate-drive pulses with rise and fall times of less than 2 nsec, making them ideal candidates for laboratory pulse-generation service. A simple implementation uses Linear Technology's (www.linear.com) LTC3803 constant-frequency flyback controller, IC_1 (**Figure 1**). The controller self-clocks at 200 kHz, and applying a sample of its output to its Sense pin causes the controller to operate at its minimum duty cycle and produce a 300-nsec-wide output pulse.

The LTC3803's output can deliver more than 180 mA into a 50Ω load, so use a low-series-inductance bypass capacitor that connects as directly as possible between IC_1's power and ground (pins 5 and 2). The decoupling components, C_1, a 10-µF ceramic capacitor, and R_1, a 200Ω resistor, minimize pulse-top aberrations without introducing amplitude droop. The circuit's output directly drives a 50Ω termination at amplitudes as high as 9V. For applications that require maximum pulse fidelity, use a back-termination resistor, $R_{BACKTERM}$, to suppress triple-transit echos and absorb reflections from the cable and any mismatch in the cable's far-end termination impedance. Back-termination also helps when driving passive filters, which expect to see a specific generator impedance. The LTC-3803's output impedance is approximately 1.5Ω, which affects the value of the back-termination resistor. The back-termination technique

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works well with load impedances of at least 2 kΩ. At impedances higher than that value, parasitic impedances associated with the terminating resistor and IC_1 degrade bandwidth and pulse fidelity.

In a back-terminated, 50Ω system, the circuit delivers a 4.5V output pulse with symmetric rise and fall times of 1.5 nsec, pulse-top-amplitude aberrations of less than 10%, and amplitude droop of less than 5%. Directly driving a 50Ω load doesn't degrade the output's rise and fall times. For best pulse fidelity, use stripline techniques to route IC_1's output directly to the termination resistor and output connector J_1. Using a 100-mil-wide trace on a 1/16-in., double-sided, glass-epoxy pc board approximates a 50Ω surge impedance. EDN