Resettable High-Speed Fuse Uses FET As A Sense Resistor

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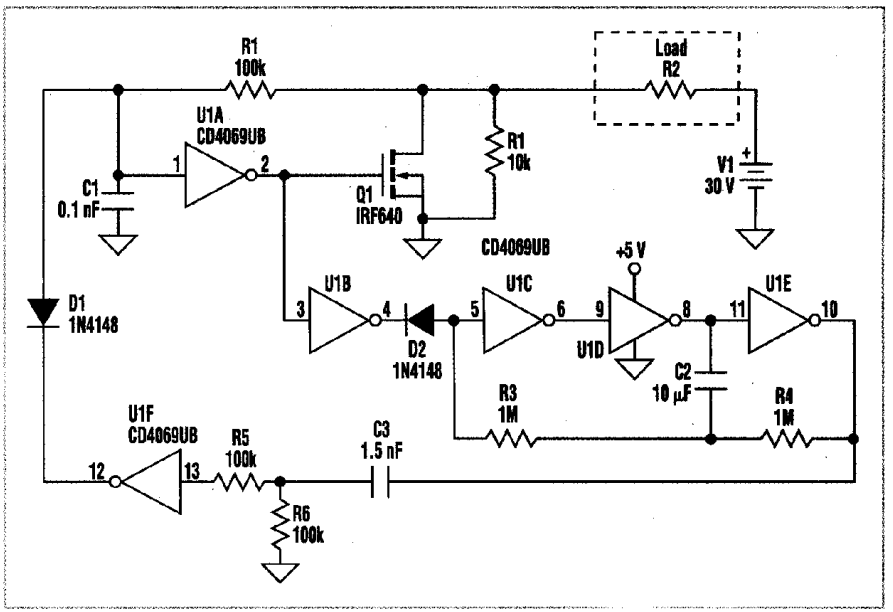
This design idea describes a resettable high-speed fuse that uses only a few off-the-shelf parts, resets itself after blowing, and doesn't require a special current-sense resistor. While the circuit has been designed to switch on a negative current from ground, it can easily be modified for use in a floating arrangement.

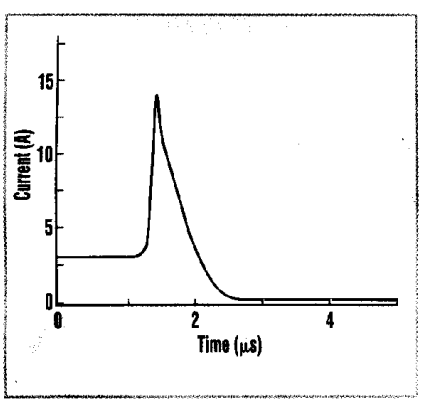
The circuit shown in Fig. 1 uses a power FET as a switch and, when saturated, as a sense resistor. When an excessive current flows through the FET, the source-drain voltage increases and is sensed by inverter U1A. This decreases the gate potential, causing the drain voltage to go even higher and the circuit to drop out in a stable state. In this state, almost no current flows through the load.

The speed of the fuse can be tuned by modifying capacitor C1, which low-pass filters the signal from Q1's drain. The fuse's firing current can be made adjustable by inserting a resistive voltage divider between the inverter output and the transistor gate. Since the fuse speed will decrease due to the FET's gate capacitance, it should be compensated with a capacitor. With the values shown in the schematic, the fuse blows in roughly 1 µs when changing load resistor R2 from 10 to 1 Ω *(Fig. 2)*.

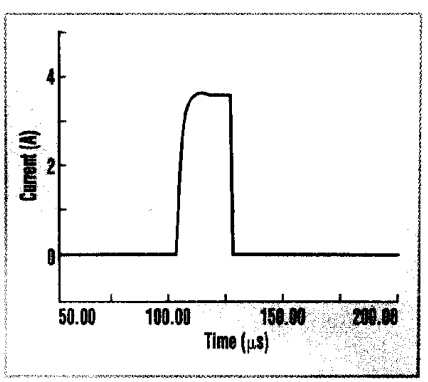
Prior to the activation of the fuse, the three-gate oscillator (U1C-E) is disabled



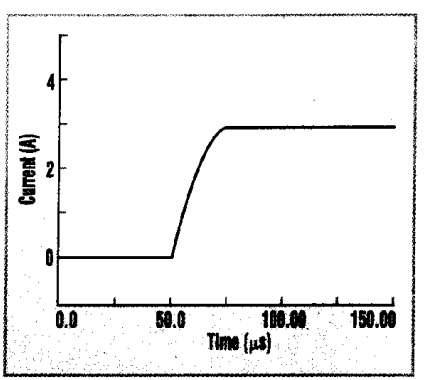
1. This resettable fuse uses the on-resistance of FET Q1 as the current-sense element.



2. When the load is stepped from 10 to 1 Ω, the electronic fuse trips in roughly 1 µs.



3. If the overload condition is still present when the fuse attempts to reset itself, the load current rises to the trip point in 25 µs.



4. During a successful fuse reset, the current rises to its normal operating level in 25 µs.

by gate U1B and diode D1. When the fuse "blows," the oscillator begins oscillating. This periodically (every few tenths of a second) sends a pulse to the inverter U1A input, attempting to reset the fuse. If the short persists, the fuse blows again; this process takes 25 µs *(Fig. 3)*. If the short does not persist, the current rises in 25 µs *(Fig. 4)*.