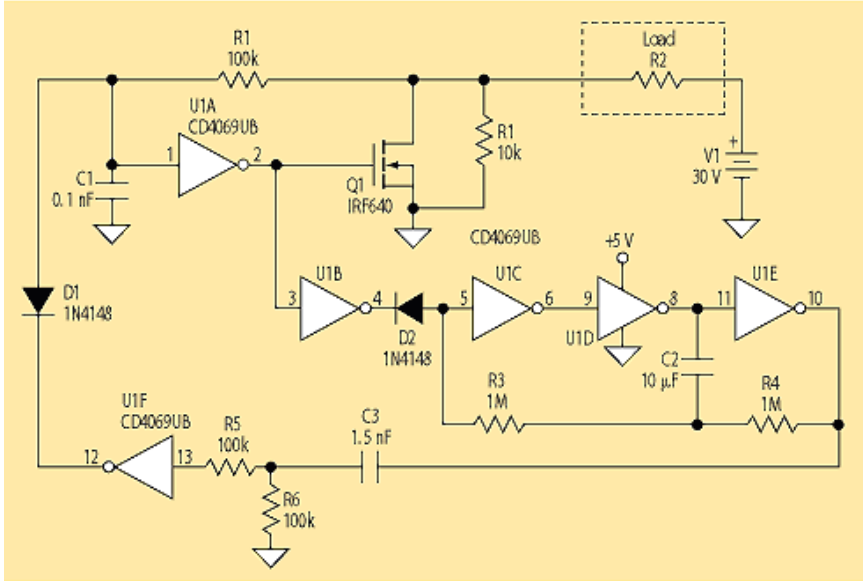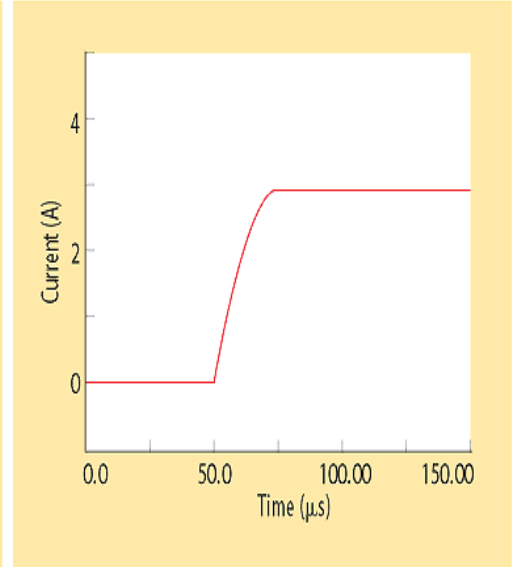# Resettable High-Speed Fuse Uses FET As A Sense Resistor

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


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

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 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).
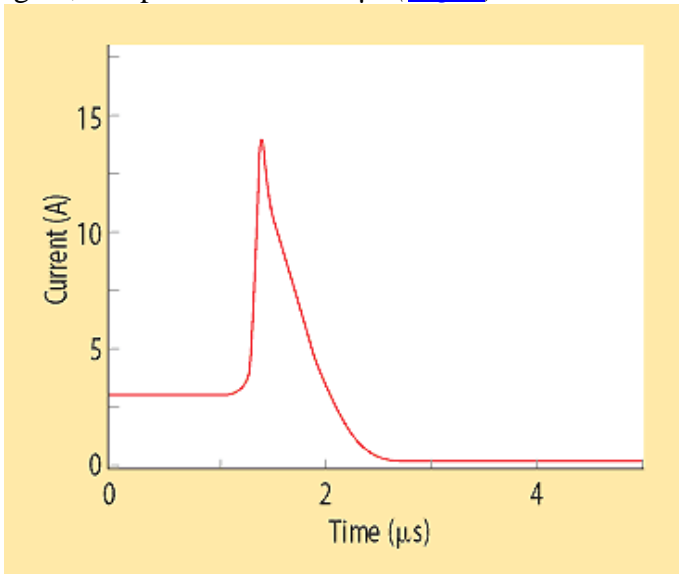
2. When the load is stepped from 10 to 1 Ω the electronic fuse trips in roughly 1 µs.
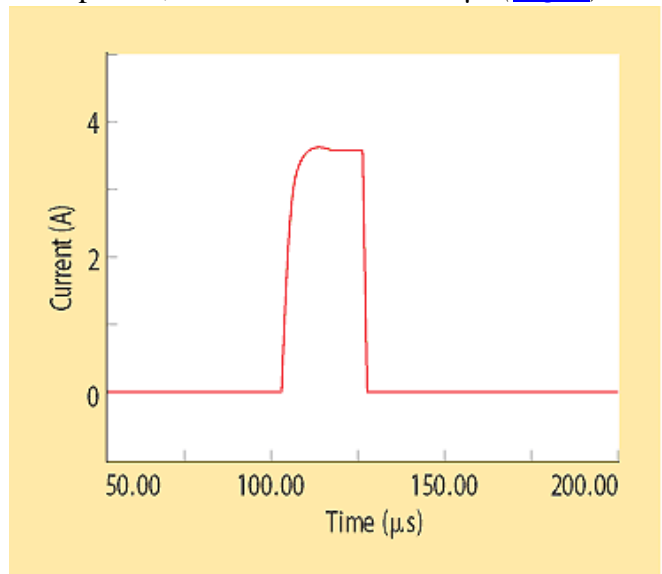
3. If the overload condition is still present when the fuse attempts to reset itself, the load current rises to the trip point in 25 µs.