

Keywords: charge pump, inverting charge pump, microprocessor supervisor, uP, low-voltage circuit

## APPLICATION NOTE 2080

# Simple Circuit Disconnects Load from Low-Voltage Supply

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*Abstract: Design note shows how a simple circuit disconnects the load from a low-voltage supply. The circuit uses an inverting charge pump to generate a negative voltage ~ equal to the input supply and a microprocessor supervisor to monitor the voltage difference. Schematic is shown.*

A similar version of this article appeared in the April 14, 2003 issue of *EDN* magazine.

Power supplies often include a circuit that disconnects the load when the supply voltage drops too low (when a battery is nearly discharged, for example). A p-channel MOSFET connected between supply and load is the typical approach. However, a 1.5V single-cell battery or other low-voltage supply is not sufficient to fully turn on the MOSFET. For such low-voltage systems, consider the circuit of **Figure 1**.

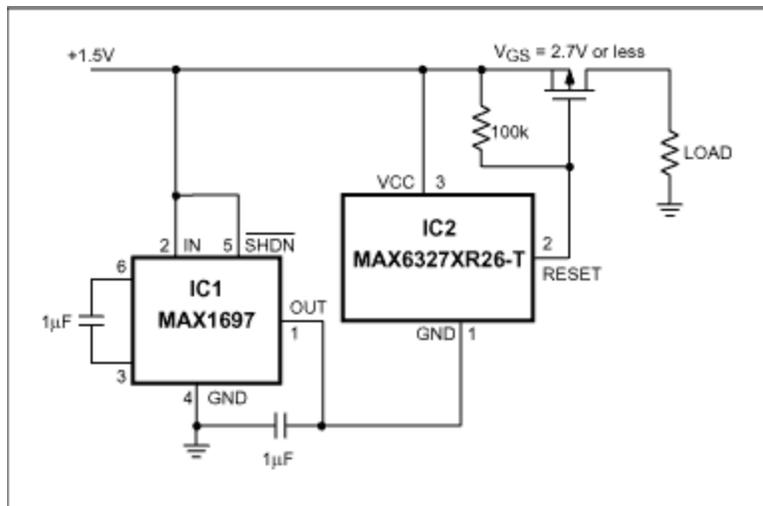


Figure 1. This low-voltage circuit disconnects the load when the supply voltage drops below a predetermined threshold (1.3V in this case).

A small inverting charge pump (IC1) generates a negative voltage approximately equal to the input supply ( $V_{CC}$ ). That voltage connects to the ground terminal of a microprocessor supervisor (IC2), which monitors the voltage difference between its own  $V_{CC}$  and GND pins. As long as this difference is greater than the supervisor's internal trip-voltage threshold, the RESET output voltage is driven to the charge-pump output (approximately  $-2V_{CC}$ ), which provides a gate-source voltage adequate to keep the MOSFET on. When the monitored voltage drops below the threshold of the supervisor, its RESET output

goes up to  $V_{CC}$  and turns the MOSFET off.

The supervisor shown has a threshold of 2.6V. Because the voltage it detects is twice the supply voltage, this circuit disconnects the load when the supply voltage drops below 1.3V, making it suitable for use with a typical 1.5V battery. Other internal threshold voltages are available.

#### Related Parts

<a href="#">MAX1697</a>	60mA, SOT23 Inverting Charge Pump with Shutdown	<a href="#">Free Samples</a>
<a href="#">MAX6327</a>	3-Pin, Ultra-Low-Power SC70/SOT $\mu$ P Reset Circuits	<a href="#">Free Samples</a>

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