Three-input supply powers 3.3V portables

The single-ended primary-inductance converter (SEPIC) of **Figure 1** accepts input voltages ranging from 3V to over 6V, and produces a regulated 3.3V, 200mA output. It accepts an input voltage from three sources: a 5V dc wall cube, a 3-cell AA battery, and a lithium backup battery.

Unlike conventional boost regulators, whose battery current continues to flow during shutdown (unless you add a cutoff switch), this circuit's output turns fully "off" in response to a shutdown command. And, unlike flyback-transformer regulators and combination step-up/linear regulators, the Figure 1 circuit requires no transformer. Coils L1 and L2 should be the same type and have the same value, but coupling between them is not required. They can be wound on the same core for convenience, but the circuit works equally well if they are completely separate.

Capacitor C3 couples energy to the output and requires low ESR to handle the high ripple currents. Conversion efficiency with a low-ESR Sanyo OS-CON capacitor is 85%, which is 3% higher than that available with less-expensive 1µF ceramic capacitors. Tantalum capacitors are not recommended because high ripple currents cause them to self-heat.

During normal operation, the ac adapter's 5V output powers the circuit and turns off Q1. Disconnecting the adapter removes 5V, turns on Q1, and allows the three AA cells to provide power. If the 3.3V output drops below 3.0V, a low-battery comparator in IC1 alerts the system by driving LBO low. And for backup, a diode-OR connection allows an optional lithium battery (coin cell B2) to provide load current at the 3.3V output.

As an added twist, diode D2 provides a supply voltage for IC1 (pin 8) by capturing the switching pulses at LX (pin 7). This voltage (approximately the sum of V_{IN} and V_{OUT}) improves start-up capability under full load, and improves low-V_{IN} efficiency by boosting gate drive to the internal switching MOSFET. Maximum V_{IN} is limited to about 12V, which easily accommodates the 3-cell battery.

A related idea appeared in the 4/13/95 issue of EDN.

(Circle 2)

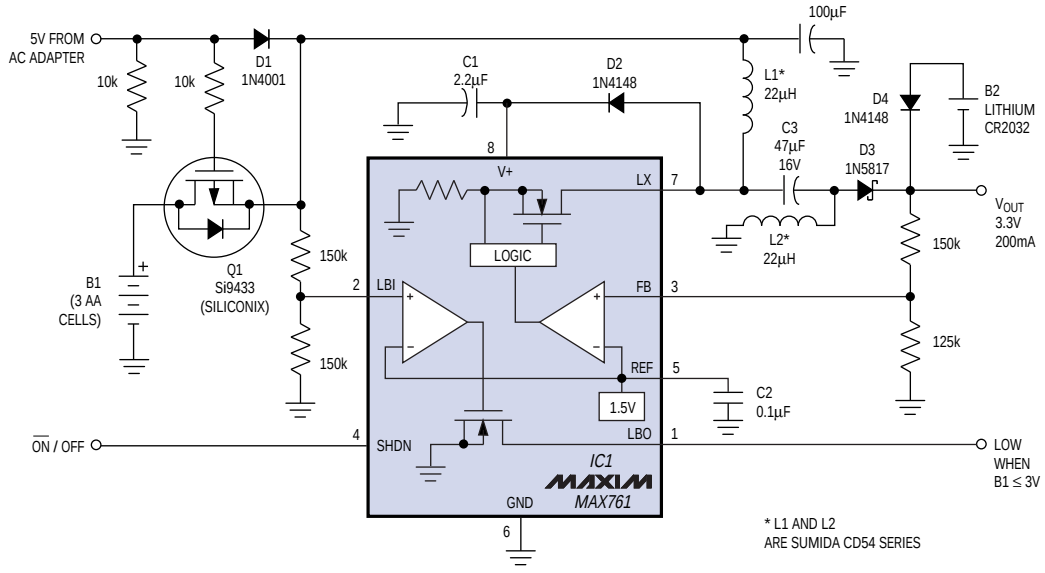

Figure 1. When the wall cube is disconnected, this SEPIC regulator draws power from a 3-cell battery. A lithium battery (optional) backs up the 3.3V output.