

APPLICATION NOTE 1751

# High-V DC-DC Converter Is Ideal for MEMS (Warning: High-Voltage Circuit)

Microelectromechanical system (MEMS) devices often require high DC-bias voltages (40V to 100V) at low current (< 1mA), but the available supply voltage may be < 12V. A DC-DC converter that combines inductive and capacitive step-up circuitry (**Figure 1**) achieves the high voltage without need for a costly transformer.

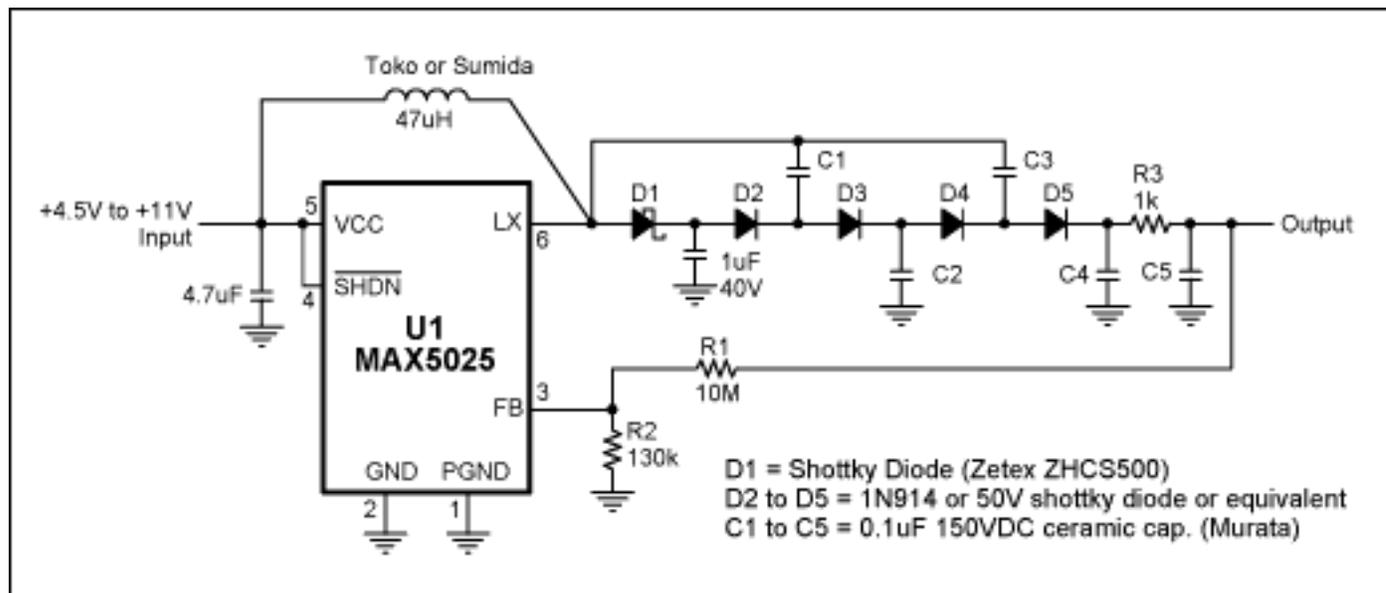


Figure 1. A high-voltage DC-DC converter (U1) converts a typical 5V input to 36V, and a 2-stage charge pump boosts that voltage to more than 100V.

U1 is a step-up DC-DC converter capable of output voltages to +36V, and a 2-stage charge-pump converter (D2-D5 and C1-C4) nearly triples the U1 output. The R1/R2 divider provides feedback for regulating the circuit's output voltage. Use these equations to calculate the resistor values:

$$V_{OUT} = \frac{1.25V (R1 + R2)}{R2}$$

$$R1 = R2 \left( \frac{V_{OUT}}{1.25V} - 1 \right)$$

For lower output voltages (< 70V), remove D4, D5, C3, and C4 to produce a single-stage charge pump. Similarly, you can add another stage to produce voltages higher than 100V. An optional post filter (R3 and C5) reduces the output ripple to < 10mV<sub>p-p</sub>. **Figure 2** illustrates the variation of output voltage with output current.

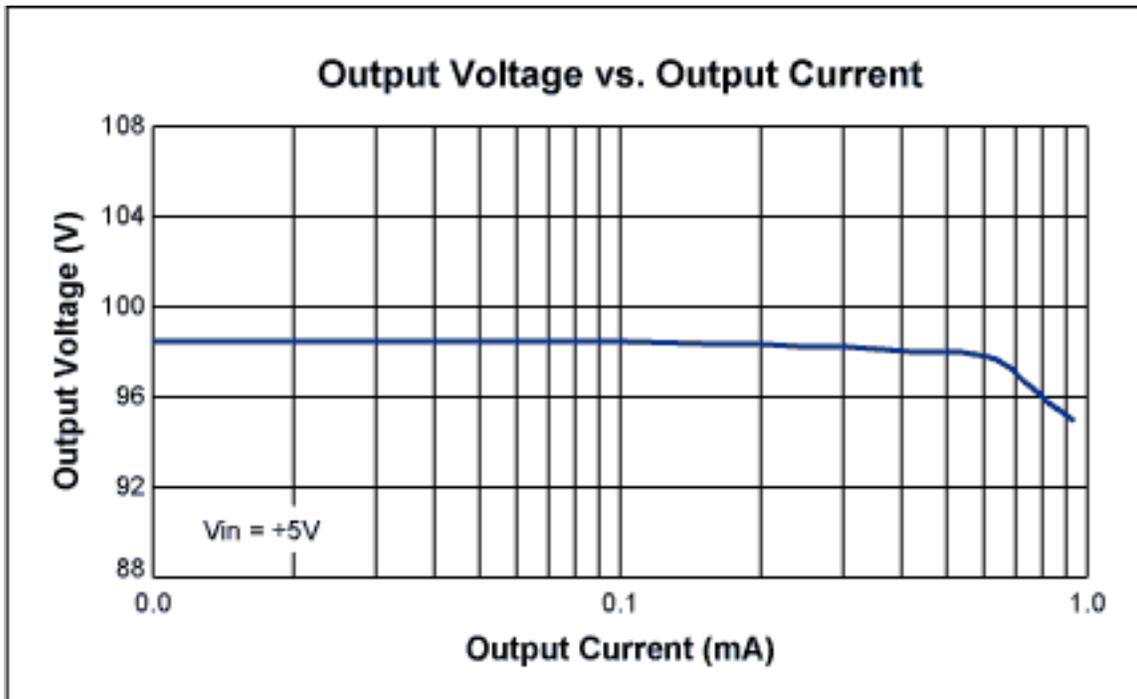


Figure 2. The output voltage in Figure 1 is well regulated for load currents up to 0.7mA.

A similar version of this article appeared in the August 18, 2002 issue of *EET* magazine.

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Application Note 1751: <http://www.maxim-ic.com/an1751>

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