APPLICATION NOTE 1751

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

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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.](image)

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 < 10mVp-p. Figure 2 illustrates the variation of output voltage with...
output current.

![Output Voltage vs. Output Current](image)

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.

**Related Parts**

| MAX5025 | 500kHz, 36V Output, SOT23, PWM Step-Up DC-DC Converters | Free Samples |

**More Information**

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