

Keywords: charge pumps, switched-capacitor voltage converters, voltage inverters

APPLICATION NOTE 3659

Simple Circuit Converts +5V to -10V

Dec 14, 2005

Abstract: This simple charge-pump voltage inverter produces more than -10V at no load, and more than 200mA while the output voltage remains greater than the input.

The versatile switched-capacitor charge pump is easy to use and requires no inductor. It can double a positive voltage or convert a positive voltage to negative.

For some applications in which only a positive supply is available, the system must generate a negative voltage of larger magnitude than the positive rail. For that purpose, the circuit of **Figure 1** inverts the input voltage and doubles the resulting negative output at the same time. The voltage inverter shown (IC1) converts a positive input to a negative output voltage, normally with an absolute magnitude lower than that of the input. But in this circuit, the two Schottky diodes and the two capacitors at the output produce a higher output voltage.

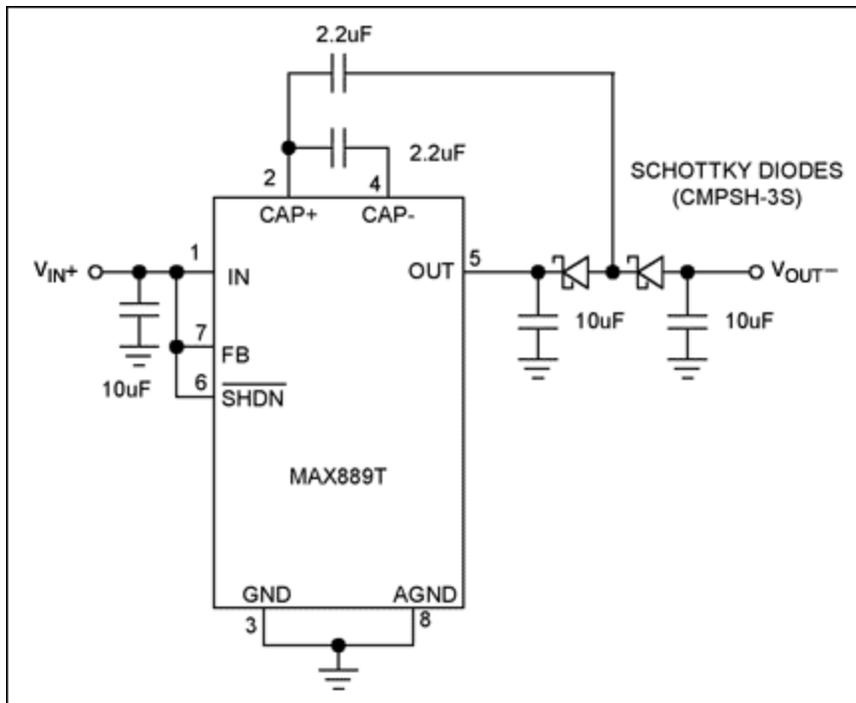


Figure 1. This simple circuit derives -10V from +5V.

The expected output is $V_{OUT} = -(2xV_{IN} - 2V_D - I_{OUT} \cdot R_O)$, where V_D is the voltage drop across a diode,

I_{OUT} is the output current, and R_O is the output resistance. While the maximum expected voltage is -10V, overshoot across the capacitors due to parasitic inductance in the capacitors and traces produces more than -11V at no load (**Figure 2**).

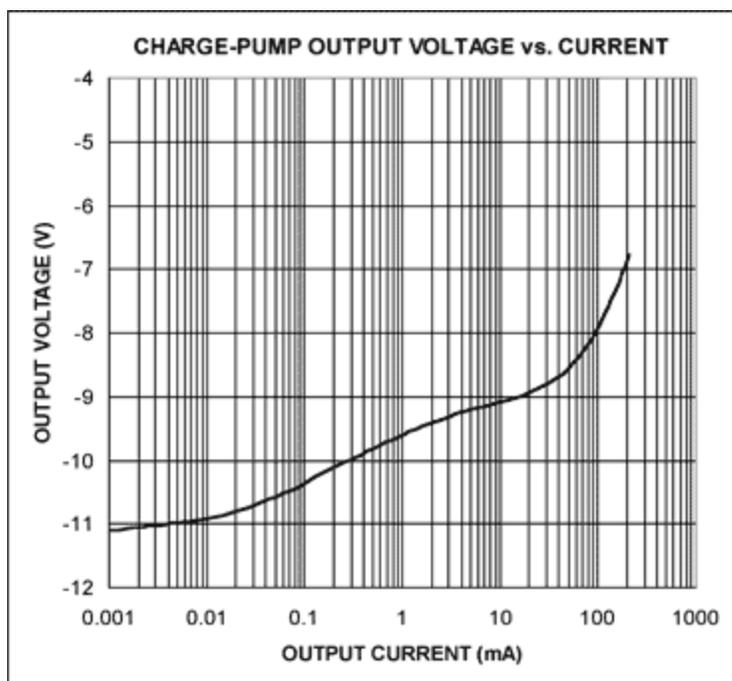


Figure 2. The circuit in Figure 1 above produces more than -10V at no load, and more than 200mA while the output voltage remains greater than the input.

This design idea appeared in the May 26, 2005 issue of *EDN* magazine.

Related Parts

MAX889

High-Frequency, Regulated, 200mA, Inverting Charge Pump

[Free Samples](#)

More Information

For Technical Support: <http://www.maximintegrated.com/support>

For Samples: <http://www.maximintegrated.com/samples>

Other Questions and Comments: <http://www.maximintegrated.com/contact>

Application Note 3659: <http://www.maximintegrated.com/an3659>

APPLICATION NOTE 3659, AN3659, AN 3659, APP3659, Appnote3659, Appnote 3659

Copyright © by Maxim Integrated Products

Additional Legal Notices: <http://www.maximintegrated.com/legal>