

APPLICATION NOTE 1875

# Triple Capacitive Voltage Inverter with the MAX871

*Abstract: A -3X voltage inverter is made with a SOT charge-pump IC and diode-capacitor network. Up to -15V at 10mA can be generated from 5V.*

This design idea is based on a customer request for a cheap, and not very accurate, negative voltage supply of about -12V to -15V with a low output current of < 5mA and an input voltage of 5V. This application might be used for negative op-amp supply. **Figure 1** shows the typical operation circuit with the flying capacitor C1 and C2. The output voltage on pin 1 is  $-V_{IN}$ . Four additional capacitors (C3 to C6) and four additional diodes (D1 to D4) triple the negative output voltage at the OUT pin from  $-V_{IN}$  to  $-3V_{IN}$ . C5 and C6 decreases the voltage with every step by  $-V_{IN}$ . Without any diode voltage drop C3 got  $-2V_{IN}$  and C4 charges ideally to  $-3V_{IN}$ . It is possible to add more of these cascades but with every step the voltage drop of the diodes will reduce the effort.

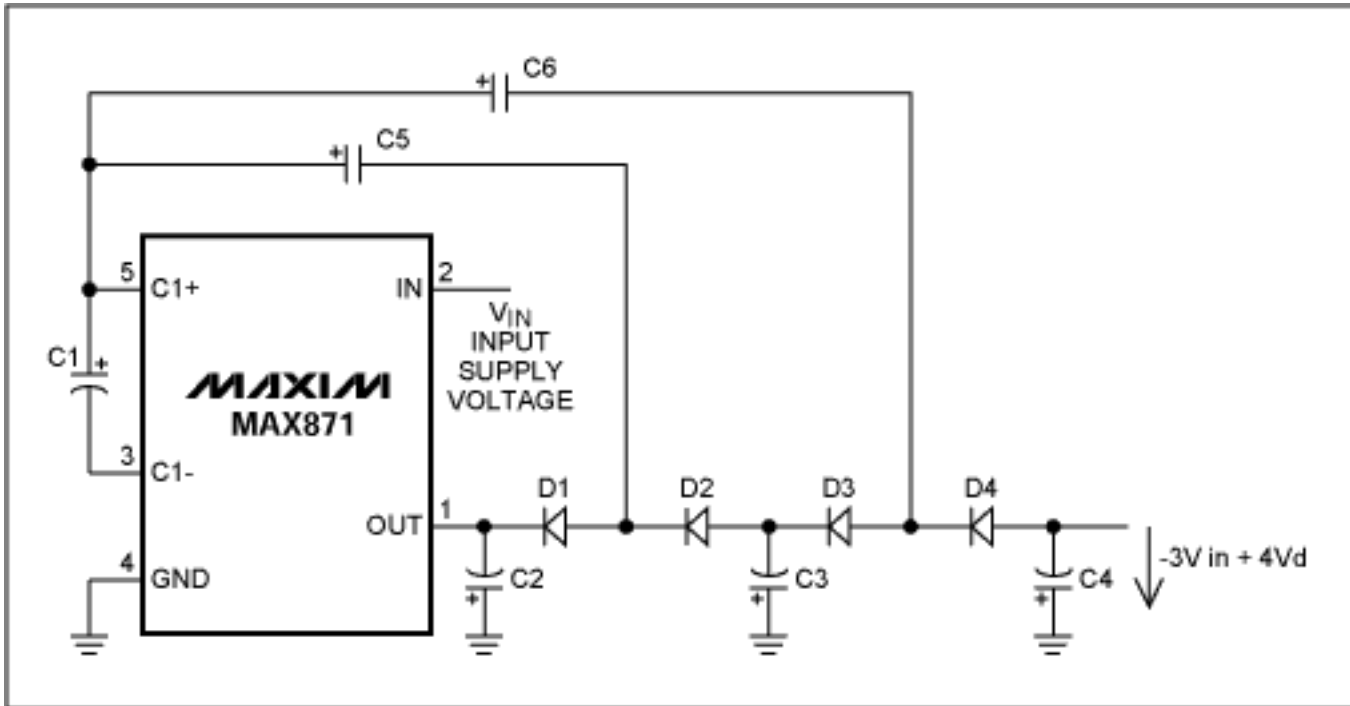


Figure 1. Triple voltage inverter with MAX871.

The schematic of the design idea has been tested with 4.5V and 5V input voltage. **Figure 2** shows load current vs. output voltage. The general voltage drop on  $V_{OUT}$  is caused by the forward voltage of the external diodes of typically 0.3V to 0.4V per diode, depending on the load current.  $V_{OUT}$  is:

$$V_{OUT} = -3 \times V_{IN} + 4 \times V_D$$

$V_D$ : typically 0.3V to 0.4V

$V_{IN}$  is the input voltage on pin 2.  $V_D$  is the forward voltage drop of diode D1 to D4. If Schottky diodes are used  $V_D$  is typically 0.3V to 0.4V.

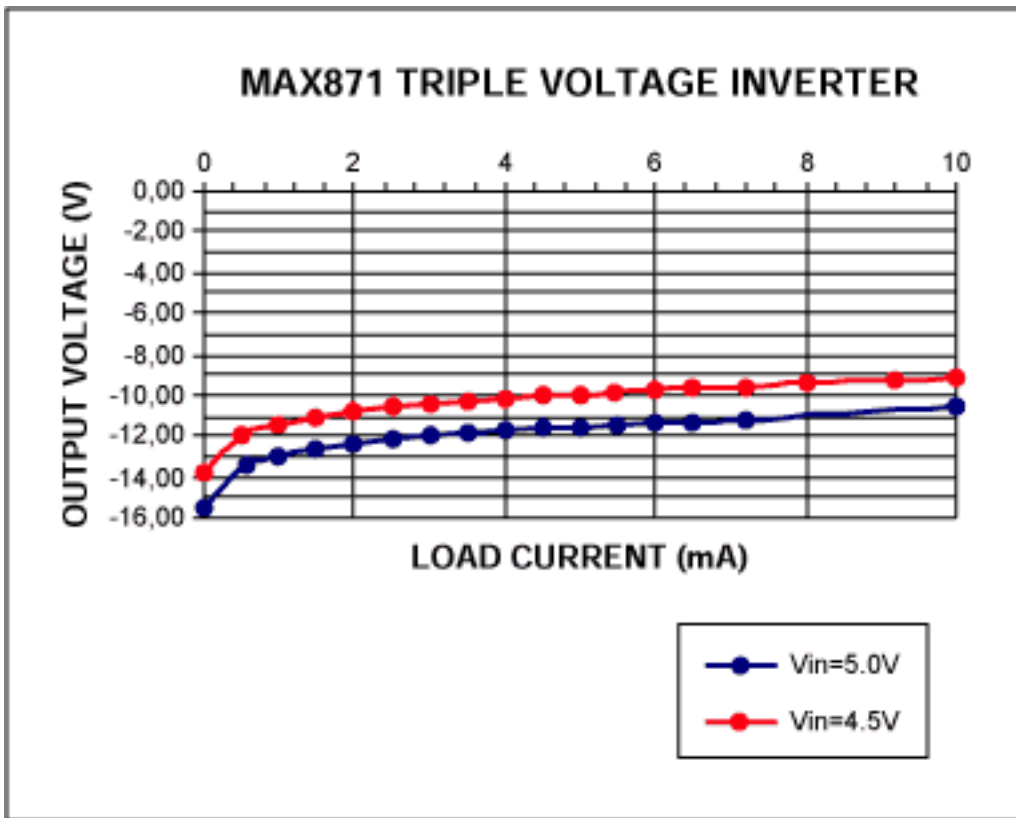


Figure 2. Load current vs. output voltage.

Component List	
C1 - C6	470nF ceramic
C input	10 $\mu$ F
D1 - D4	BAT41

A similar version of this article appeared in the October 25, 2001 issue of *Electronic World* and *Wireless World* magazine.

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