

Generate bipolar supply voltages with single-inductor circuit

By Perwez Nawabi
Applications Engineer
Maxim Integrated Products Inc.

Many circuit techniques can generate bipolar supply voltages from a single positive voltage, but most of them require multiple inductors. In Figure 1, a single inductor and three Schottky diodes derive +15 V/-14 V from a +5 V source, while reducing the circuit size and minimising cost.

The circuit is capable of meeting the demands of most analogue circuitry, including audio, instrumentation, and industrial applications. It provides output currents up to 200mA with low output ripple (100 mVpp), and drives several amplifiers drawing 5mA to 10mA each.

A voltage-mode, step-up switching converter requiring no expensive current-sense resistors (U1) generates the +15 V output using a fixed on-time and minimum off-time. The negative rail is generated by an external charge pump consisting of D2, D3, C5, and C6. Because the negative rail is not regulated, it is not as stable as the positive rail, and varies with current drawn from the positive supply (**Figure 2**). Note also, that U1's latched-fault mode shuts down the controller in response to a short circuit.

The +15 V output delivers as much as 200mA, with efficiencies up to 85% and about 44 mV of output ripple (**Figure 3**).

Load regulation for both outputs is shown in Figure 4.

As for all switching converters, a good printed circuit board (PCB) layout is essential for low-noise operation.

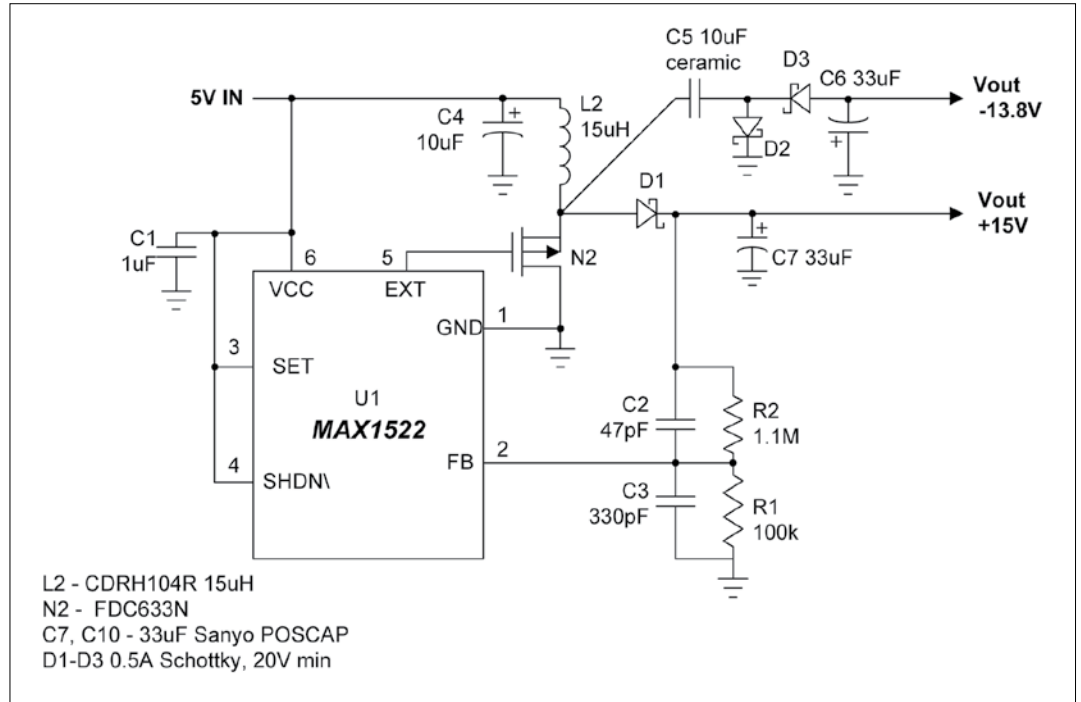


Figure 1: This single-inductor, 200mA power supply derives +15V/-14V from +5V.

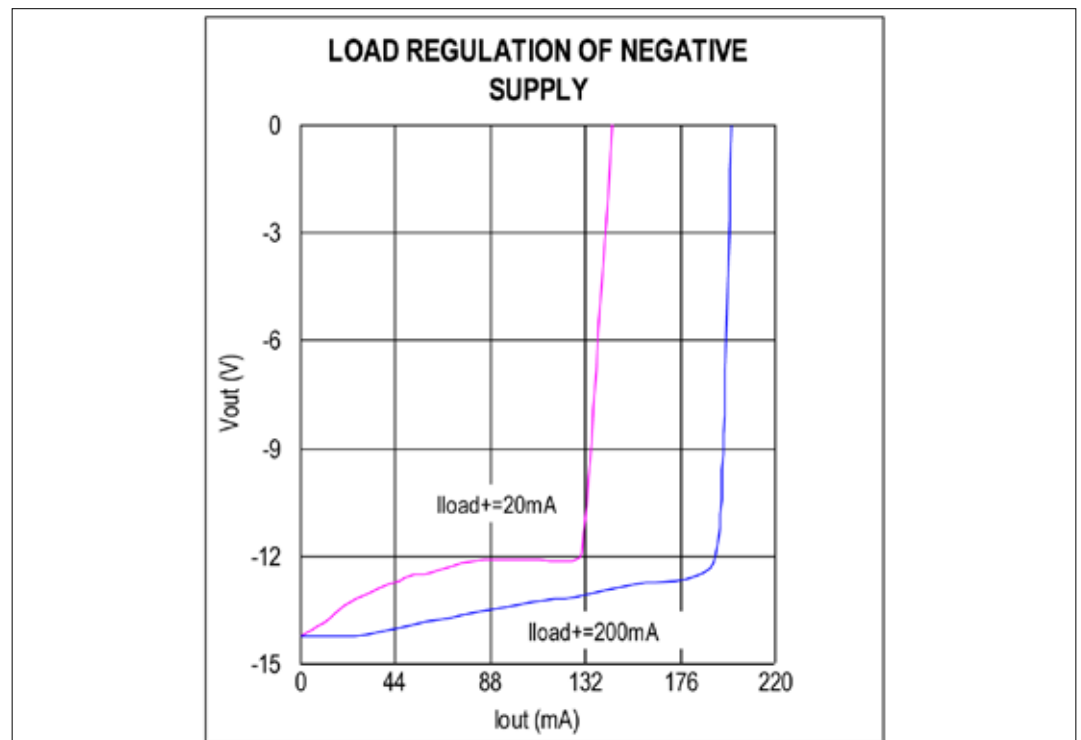


Figure 2: Load regulation for the -14 V output in Figure 1 depends on load current drawn from the +15 V output (curves shown are for 20mA and 200mA drawn from +15V).

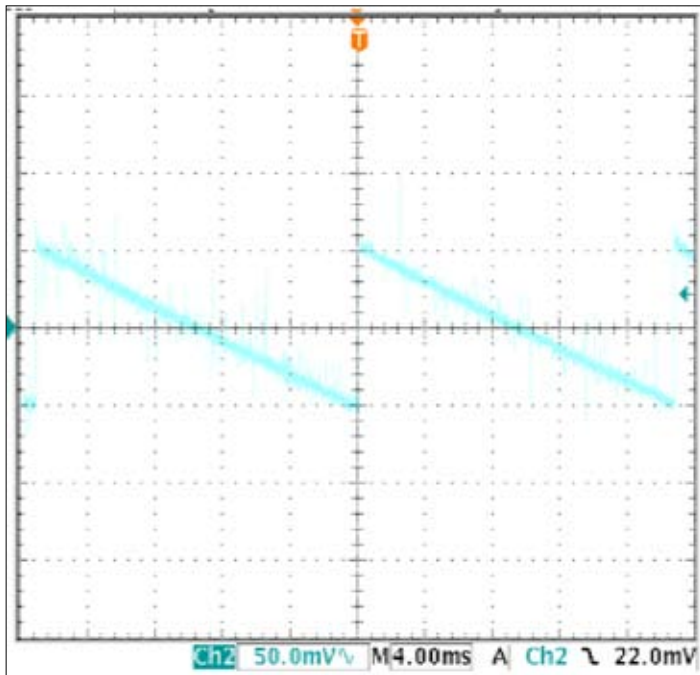
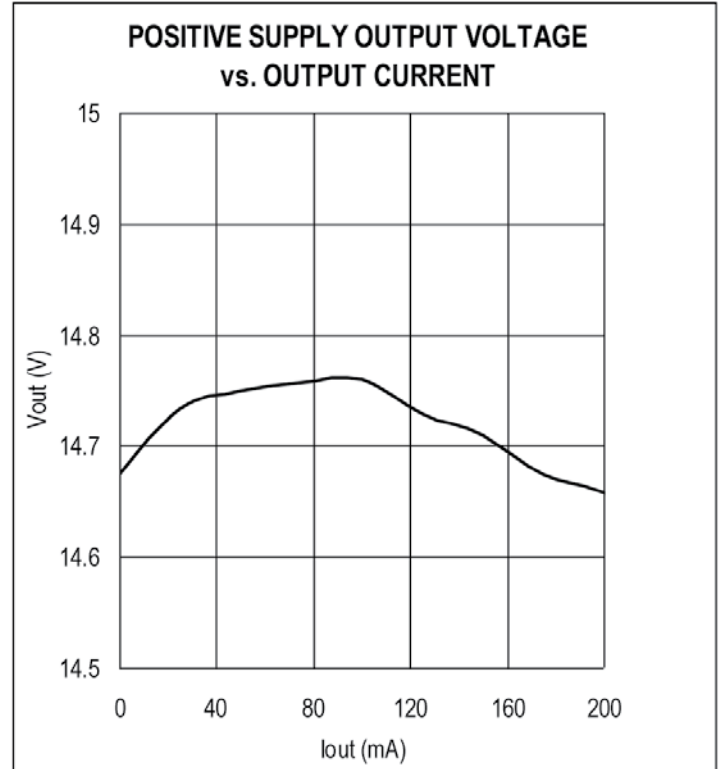
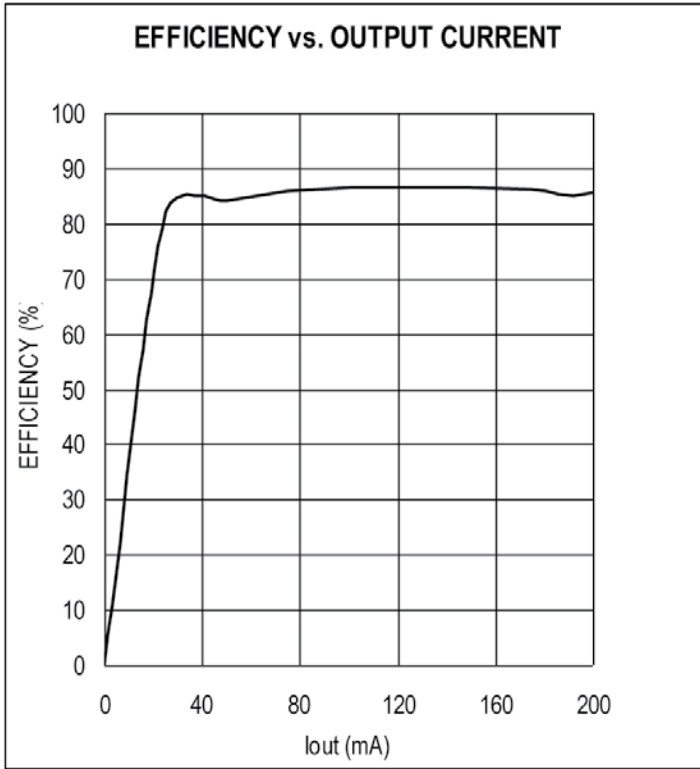


Figure 3: Output efficiency (a-upper) and ripple (b-lower) are as shown for the +15 V output in Figure 1, loaded with 200mA.

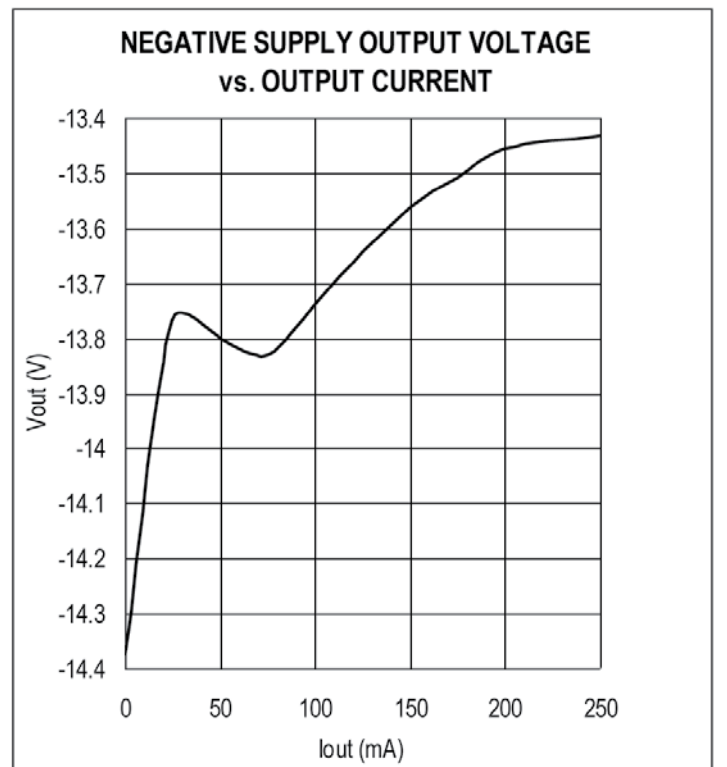


Figure 4: These curves from Figure 1 show the output regulation for +15 V, with 200mA load on -14 V (a-upper), and the output regulation for -14 V, with 200mA load on +15 V (b-lower).