Keywords: current source, boost converter, DC-DC current source, boost current source, step-up converter, dc dc converters

APPLICATION NOTE 940

Feedback Circuit Enhances Efficiency of Boost-Converter Current Source

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Abstract: To implement a step-up converter with current output, the approach often taken is simply to connect the load in place of the top resistor in a resistive-divider feedback network. The bottom resistor then serves as a current-sense resistor. Though simple, this solution is not efficient. A simple circuit can reduce sense resistor losses and improve efficiency.

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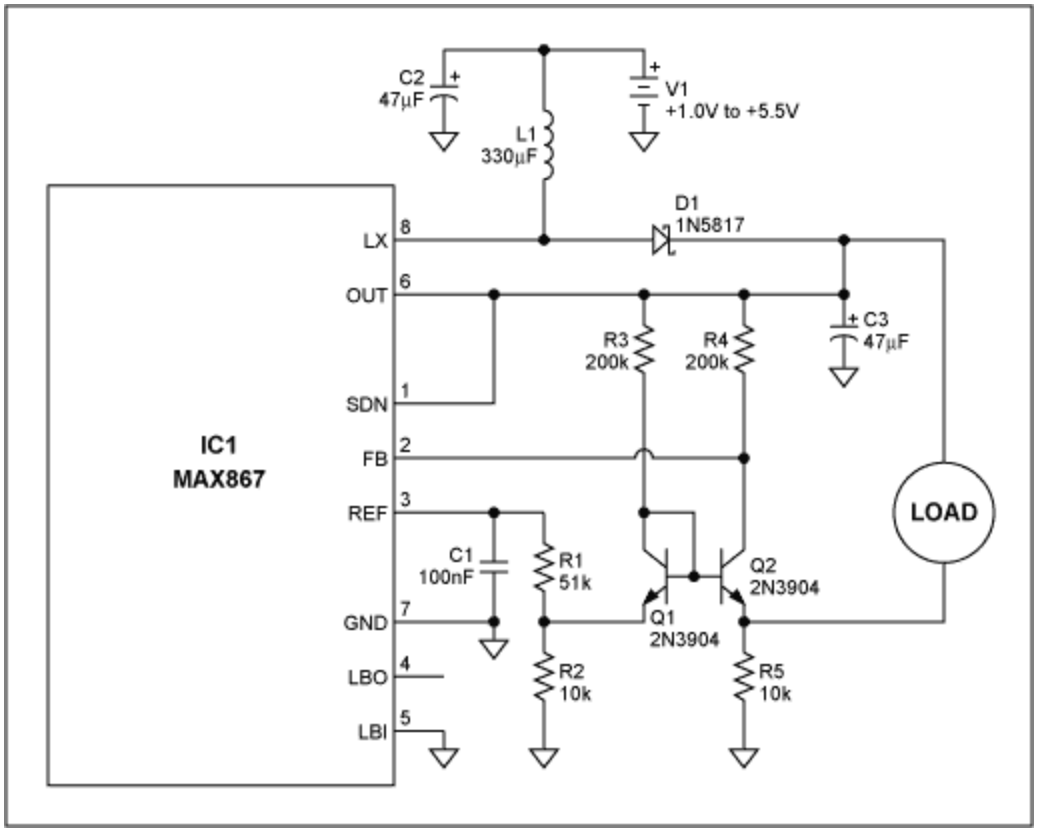

Figure 1. A low-cost feedback network (Q1, Q2, and associated resistors) improves the efficiency of this switchmode current source by a factor of six.

Low efficiency is caused by a relatively high-sense voltage. This is usually 1.25V but for some ICs, can be as high as 2.5V. In Figure 1, a switchmode DC-DC converter configured as a 20mA current source minimizes the efficiency loss by lowering the sense voltage to 200mV. Advantages of this circuit include the factor-of-6 gain in efficiency, minimal board area, and readily available low-cost components.

Applications include battery charging, LED driving, and general-purpose current sources. Certain ICs such as the MAX1698 and the MAX1848 are designed to efficiently drive LEDs in a manner similar to the one described here. As an extra benefit, the circuit allows deep discharge of single-cell alkaline batteries.

Resistors R1 and R2 form a voltage divider that derives 200mV from the IC's reference output. This sense voltage connects to one emitter of the current mirror formed by Q1 and Q2. Both collectors connect to the output voltage via 200kΩ resistors. The collector of Q2 also connects to the IC's feedback pin, and Q2's emitter connects to the low-side current-sense resistor (R5).

This feedback network appears to the IC's control loop as a common-base amplifier. Choosing a 2N3904 for Q2 yields sufficient emitter-to-collector gain, approximately 80V/V. Moreover, the network's wide bandwidth (characteristic of common-base configurations) prevents instability in the IC's control loop.

A similar version of this article appeared in the Jan 21, 1999 issue of *EDN* magazine.

Related Parts		
MAX1698	High-Efficiency Step-Up Current Regulator for LEDs	Free Samples
MAX1848	White LED Step-Up Converter in SOT23	Free Samples

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