Keywords: Power-Boost Circuit Powers Cellular Handset

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APPLICATION NOTE 1177

Power-Boost Circuit Powers Cellular Handset

Powering the RF power amplifier in a European GSM or DCS1800 cellular-telephone handset presents some challenges. Circuitry other than the RF PA operates on 3V, but the PA usually needs 5V minimum to produce the 1W-to-2W peak antenna power required.

Also, the difficulty in designing the necessary boost regulator usually dictates a bulky 5-cell battery in place of the preferred 3-cell NiCd or NiMH battery. The PA connects to the 5-cell battery directly, and the 3V components connect either to a step-down regulator or to a high-dissipation linear regulator (the inefficient but technically simpler approach).

Fortunately, the handset's TDMA (time-division multiple access) operation, which produces 577µs transmissions every 4.6ms and draws as much as 1.5A per burst, requires a much lower *average* current. The **Figure 1** alternative, therefore, combines a 3-cell battery with a relatively small, low-cost boost converter. A large reservoir capacitor of 2000µF (C2 and C3) stores the power needed during a transmission burst, and the boost converter delivers an average current of approximately 180mA for charging the capacitor. The capacitor supplies 1.5A peak loads at the 5.8V output with only 450mV of droop (Figure 1).

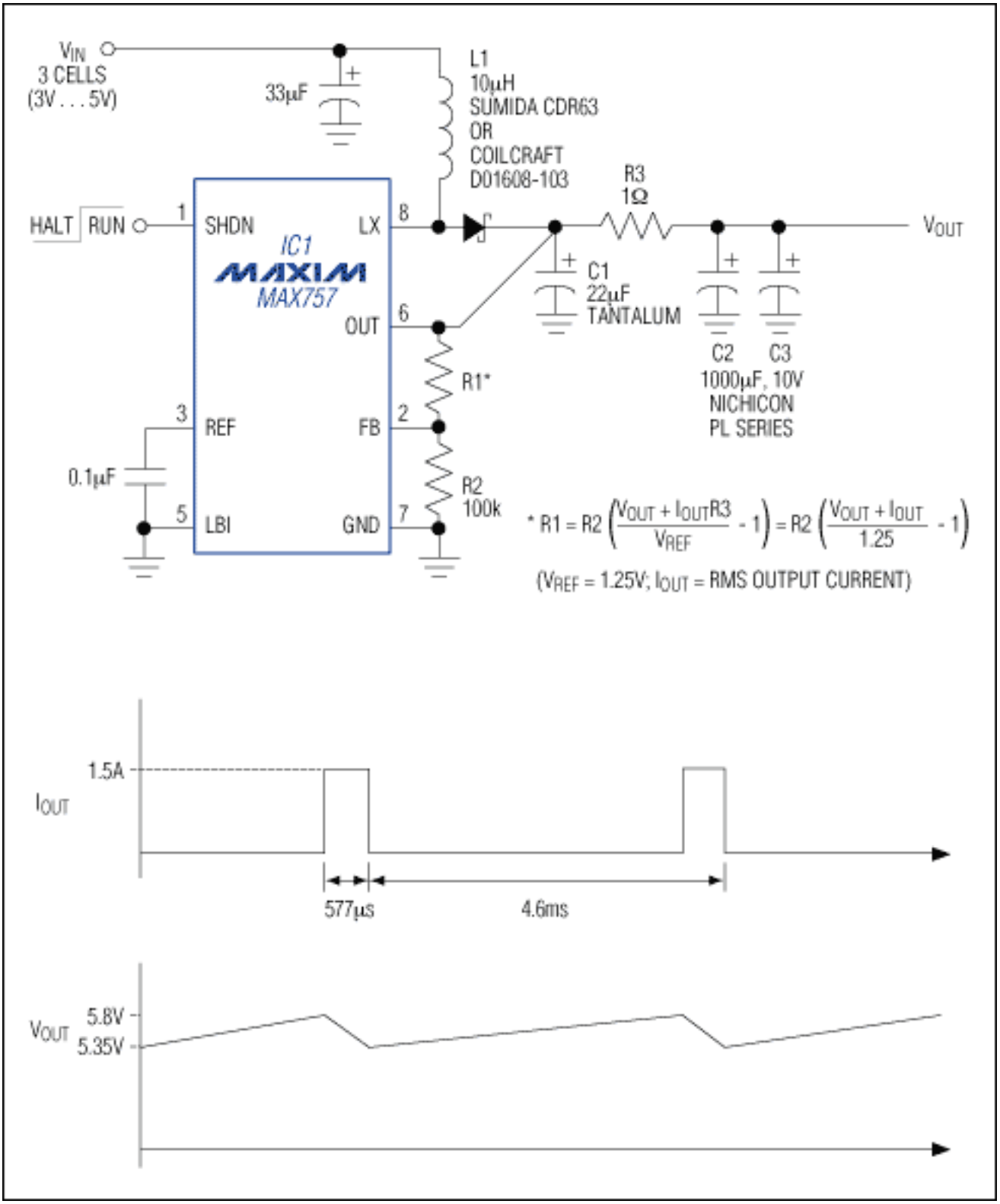

Figure 1. This boost converter's large output capacitor (C2-C3) enables it to supply 1.5A peak currents to the power amplifier in a GSM or DCS1800 cellular handset.

Though physically large, the output capacitor is smaller and cheaper than the two extra cells required to form a 5-cell pack. IC1 provides other advantages: its high switching frequency (500kHz) enables use of a small and inexpensive inductor (L1), and its internal switching MOSFETs minimize the number of external components. The 1Ω resistor (R1) isolates the regulator output from peak-load requirements.

The circuit shown produces 5.8V (adjustable) from inputs of 1.8V to 6V. The peak output current for this configuration is 1.5A. Power-up time is 20ms, and the minimum input voltage for startup is 2V. The quiescent supply current (60µA) drops to 20µA during shutdown. Power-conversion efficiency is 81% for 300mA peak currents, 80% for 800mA peaks, and 79% for the maximum 1.5A peaks.

This circuit produces the switching noise expected in a dc-dc converter. If necessary, you can eliminate the noise during critical periods of the TDMA frame by pulling active-low SHDN low, temporarily halting the converter.

A similar idea appeared in the 4/96 issue of Microwaves & RF.
