Dual-polarity supply provides ±12V from one IC

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Well-regulated, dual-polarity power supplies find wide use in disk-drive, handheld-device, automotive, and notebook-computer applications. In these applications, board space and allowable component heights are continually shrinking. So, power-supply designers face the challenge of providing split rails with as few parts as possible, thus saving board space and cost. Some dual-polarity dc/dc-converter topologies—for example, overwindings and flyback converters with multiple-winding transformers—require excessive board space, component height, or both; offer poor load regulation; or provide limited load current. Figure 1 shows an alternative approach that uses a single boost regulator using a dual-polarity SEPIC (single-ended, primary-inductanc- -converter) architecture. The circuit saves space and offers good regulation and current-handling capability. The boost regulator, IC₁, usually figures in step-up-converter configurations, but the low-side power switch in IC₁ allows the use of the IC in both SEPIC and negative-SEPIC circuits.

The combination of the two topologies creates a dual-polarity SEPIC, an excellent source for multiple-rail bias power. The circuit provides well-regulated ±12V outputs at varying load currents (5W power with 12V input and 3.6W with 5V input). Figure 2 shows the maximum available current at V₁ as a function of the load current at V₁. Figure 3 shows the efficiency of the converter as a function of the load current at V₁. Although the positive feedback comes from V₁, V₂ maintains excellent regulation (Figure 4 and Figure 5). The circuit maintains the regulation as long as each load draws a minimum of 5-mA current. The SEPIC topology accommodates input voltages both above and below the output voltage. The use of three small power inductors as opposed to a transformer keeps the component height below 3 mm, reduces board space, and allows layout flexibility. The high-frequency, current-mode boost-regulator IC uses all ceramic capacitors, thus minimizing ripple and overall cost.

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