Positive-to-Negative Converter Powers –48V Telecom Circuits

by Mitchell Lee

If you’re designing a system that interfaces to telecom equipment, chances are you’ll need a –48V supply. The circuit in Figure 1 supplies up to 6W at –48V and scales to more than 12W with higher power components. Based on the Cuk topology, the converter exhibits excellent efficiency over a wide range of loading conditions (see Figure 2).

The LT1171’s error amplifier is designed for positive-boost applications, and hence its gain and reference are of the wrong phase and polarity for sensing an inverted output. In this application, the error amplifier is simply bypassed and feedback is applied at the compensation (V_C) pin. Zener diode D2 senses the output, pulling down on Q1 and the V_C pin, in response to small increases in output voltage. Pulling down on the V_C pin reduces peak switch current, and constitutes negative feedback. If the output is a little low, the Zener’s diminished feedback signal is overcome by an internal 200µA current source at the V_C pin, thereby increasing peak switch current and restoring the output voltage.

The combination of the LT1171 and the VP-2 series VERSA-PAC™ coil (CTX02-13836) are suited for 120mA output current as shown. For lighter loads of up to 60mA, use the LT1172 and a VP-1-series equivalent to the coil shown. For up to 15W, use the LT1171 and a VP-5 equivalent. High voltage versions of the LT1170 family (-HV) allow inputs of up to 20V without exceeding the peak switch-voltage rating.

This converter starts working at 2.7V and will regulate –48V at reduced power. You can add undervoltage lock-out by inserting a Zener diode (V_Z = V_LOCKOUT – 2.7V) between the input supply and the LT1172’s VIN pin.

Figure 1. 12V to –48V features good efficiency over a wide range of loads.

Figure 2. Converter efficiency rises to 80% at only 20mA load.

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