Tapped inductor, boost regulator deliver high voltage

David Ng - July 20, 2006

When you face the task of generating a regulated voltage that's higher than the available power-supply voltage, you may consider a boost regulator. Although a boost converter can in theory generate almost any voltage that's higher than its input, practical considerations limit the output to approximately eight times its applied voltage. To generate an even higher voltage, consider using a tapped-inductor boost topology. Figure 1 shows an implementation of a converter that boosts a 3V input to 100V dc. The connections to the regulator chip are similar to those of a traditional boost converter, but, to achieve the high boost ratio, this design uses L₁, a 1-to-6-turns-ratio, tapped inductor.

The waveforms in Figure 2 show the input voltage, the voltage at power-switch IC₁'s output, Pin 5, and rectifier diode D₁'s anode voltage. As in any boost circuit, inductor L₁'s core stores energy when IC₁'s internal output switch conducts. When the switch turns off, the voltage across its terminals and L₁A goes higher than the input voltage. Due to inductive coupling and the larger number of turns that make up L₁B, the voltage at rectifier diode D₁'s anode and hence the output voltage goes much higher. Resistors R₁ and R₂ form a feedback-voltage divider that closes the regulation loop. The R₃-C₄ network forms a snubber circuit that suppresses the impact of diode D₁'s small parasitic capacitance. Without the network, power switch IC₁ "sees" a capacitance that's 36 times larger due to the multiplicative effect of the tapped inductor's turns ratio.

Measuring only 5.6×6×3.4 mm, Coiltronics' CTX02-17409 tapped inductor, L₁, and Linear Technology's LT1949 monolithic regulator, IC₁, available in an eight-lead MSOP package, present small pc-board footprints. When you implement the circuit on a single-layer pc board, the entire circuit occupies less than 1.9 cm² of board space (Figure 3). For best results, review the board-layout suggestions in the device's data sheet (Reference 1) and use multilayer-ceramic capacitors for C₁ and C₃.

Reference