Originally published in the January 5, 1989, issue of *EDN*

Technique maximizes converter efficiency

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For a designer wishing to use a Linear Technology LT1072 switching regulator in the buck mode and being forced to deal with high input voltages, achieving the highest efficiency possible poses a problem. If, for example, you need to convert 20V to 5V at a relatively low power level of 1.25W, the quiescent current of the device itself (typically 6 mA) will become an important part of the circuit's power consumption.

Because the quiescent current is relatively unaffected by the input voltage, the power that the IC consumes is directly proportional to its applied supply voltage. If your system has an external low-voltage supply available, you could run the IC from it—the LT1052 operates down to 2.6V. If such an auxiliary supply is absent, you can operate the IC from its own output by incorporating a switch-over circuit (**Figure 1**). Adding this feature boosts the supply's overall efficiency from 77% to 83%.

When you first apply power to the supply, the regulator has no output: R_8 and D_7 hold C_6 discharged and the gate of MOSFET Q_4 at ground. Because Q_4 is turned off, the rising supply voltage pulls the gate of Q_3 up via R_5. As the supply voltage rises, Q_3 turns on, applying the full input voltage to the IC and allowing the regulator to begin operation.

Once the regulator starts and the output voltage rises, C_6 begins charging through R_8. When the voltage on the gate of Q_4 reaches about 2.5V, Q_4 turns on, pulling the gate of Q_3 to ground and shutting it off. This shutoff removes the input voltage from the IC. As C_5 discharges into the IC, D_5 becomes forward-biased and supplies voltage from the output to the IC.

AS C_5 DISCHARGES INTO THE IC, D_5 BECOMES FORWARD-BIASED AND SUPPLIES VOLTAGE FROM THE OUTPUT TO THE IC.

If a power glitch or a momentary short circuit causes the output voltage to drop below the minimum that the LT1072 needs to operate, diode D_7 will rapidly discharge C_6, allowing the input voltage again to be applied to the IC. When the voltage rises again, normal operation will resume. EDN

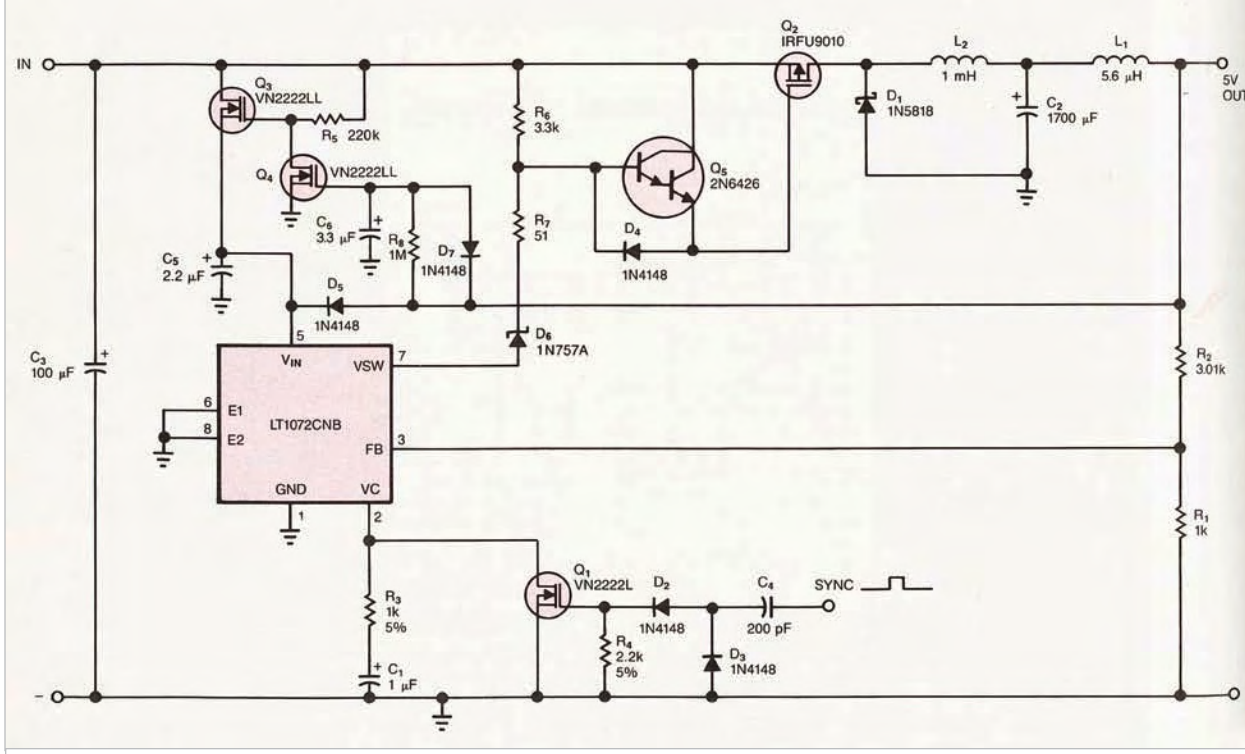

Figure 1 This switch-over circuit powers the regulator IC from the supply's output after the supply starts up. Running the IC from the lower-voltage output instead of the input raises the supply's efficiency from 77% to 83%.