Switching regulator produces constant-current output

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The high efficiency that can be achieved with switching regulators need not be restricted solely to voltage regulators. By taking advantage of the convenience of a monolithic voltage regulator, a free-running constant-current switching regulator having a 1-ampere output can be built for applications like battery charging.

A 723-type IC regulator acts as the circuit's reference and comparator. The IC's 7.15-volt internal reference is scaled to approximately 3 V by the voltage divider formed by resistors R_1 and R_2. These resistors also feed the IC's noninverting input, while resistors R_3 and R_4 drive the IC's inverting input. The lower end of resistor R_4 is connected to shunt resistor R_5, and approximately 1 V appears across this shunt when the IC's comparator terminals are nearly balanced.

A hysteresis voltage of around 28 millivolts is applied to the IC's noninverting input through resistor R_6. This sets the minimum output ripple of the circuit at 28 milliamperes peak to peak. But if the storage time of output transistor Q_1 is significant, the ripple current will be higher.

When the circuit's feedback loop calls for a current increase, the output stage of the IC regulator conducts and a current pulse of 12 mA flows into the V_C terminal. (The size of the current pulse is determined by resistor R_7.) This current pulse drives transistor Q_1.

The zener diode (D_1) is used to bias the output stage of the IC regulator, while the junction diode (D_2) operates as a freewheeling diode. Inductor L_1 and capacitor C_1 filter the switched waveform. The circuit's maximum operating frequency depends on the size of the load and is typically 20 kilohertz. □

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Constant-current source. Switching regulator circuit provides a 1-ampere constant-current output that has a peak-to-peak ripple of 28 milliamperes. The integrated 723-type voltage regulator functions as a reference source and a comparator. Transistor Q_1 is a current booster, while inductor L_1 and capacitor C_1 filter the switched waveform. The circuit's operating frequency can be as high as 20 kilohertz.