

Switching regulator produces constant-current output

by Steven E. Summer
Hauppauge, N.Y.

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. □

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.

