Regulator for standby supply handles large load currents

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A simple voltage regulator for a standby-power source can supply amperes of current at whatever voltage is required. Additionally, the circuit, which includes current-limiting and short-circuit protection (current foldback), can produce large current pulses.

There are many systems that require noninterruptible power sources—for example: gyro test stands involving long test sequences, volatile semiconductor memories, and computer systems or test systems where a power failure cannot be tolerated because it may destroy components or mean going through long start-up sequences.

If the primary dc supply fails, either because of internal malfunctions or because of some line disturbance that momentarily causes an interruption in its ac source, the standby power supply cuts in and continues to supply the necessary load current. Usually, the power source for this standby or backup supply is a bank of storage batteries. However, the voltage level provided by these storage batteries is not normally the voltage

vel needed by the backup supply for the system.

The regulator in the figure offers ample voltage and current capability. And it can be conveniently and easily tailored to suit a specific application. (The figure also contains plots of the regulator's dc-output characteristic and pulse-current performance.)

The zener voltage of the zener diode determines the output voltage at which the regulator begins to conduct. Current limiting is provided by the combination of control transistor Q_1 and field-effect transistor Q_2, which acts as a voltage-variable resistor. The current-limit level is set by the ratio of resistor R_1 to resistor R_2:

$$I_{max} = 3.1[1 + (R_1/R_2] \text{ amperes}$$

The current foldback of the regulator is obtained through transistor Q_3 and resistor R_3. The voltage level (V_f) at which foldback begins is determined by the ratio of resistor R_4 to resistor R_5:

$$V_f = [R_5/(R_4+R_5)](V_B - V_Z - 2V_{BE3} \text{ volts}$$

where V_B is battery voltage, V_Z is zener voltage, and V_{BE3} is base-emitter voltage of Q_3. The slope of the current foldback curve is set by the ratio of R_1 and R_3.

$$\Delta V/\Delta I = 0.2R_3/R_1 \text{ V/A}$$

Since the regulator will normally be operating into a large-capacity load that will probably exhibit large dv/dt variations initially, it should be able to supply a significantly larger amount of charge during turn-on. This pulse current capability is provided by the capacitor, which delays the feedback current so that transistor Q_1 does not conduct for several hundred microseconds. The magnitude of this pulse current is determined by the value of resistor R_6. □

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Watchdog backup power source. Readily adaptable regulated standby-power supply can produce several amperes of current at the desired voltage level, as shown by its output characteristic. The circuit's pulse-current capability (also plotted) is ample and able to satisfy large initial turn-on load current demands. Both current limiting and current foldback are included to protect the regulator circuit.