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To power a load that requires a high-compliance current source (for example, a plasma tube, such as an ion laser), a circuit must provide very accurate current control with a wide bandwidth and a voltage compliance of several hundred volts. You can use a high-speed linear-regulator controller to perform just such a function **Figure 1** . The bandwidth of this circuit measures more than 1 MHz. Because no part of the control circuit connects to the input supply, only the selected MOSFET and the ratings of the input supply's bypass capacitors limit the voltage compliance.

The typical application of the LT1575 linear regulator (IC_1) is to drive a MOSFET as an overdriven source follower, providing a high-speed and accurately regulated output voltage. The internal error amplifier and output buffer drive the large capacitive loads presented by MOSFET gates with an open-loop bandwidth of more than 15 MHz. You can implement a current source by replacing the output-voltage feedback divider with a current-sense resistor. The internal reference is nominally 1.21V with an accuracy of ±0.6%. Thus, you can program very accurate currents. IC_1 continuously adjusts the FET's gate voltage to maintain a constant load current, regardless of the voltage across Q_1. The input capacitors' voltage rating limits the circuit to 100V. The FET has a rating of 250V. Only the voltage ratings of the FET and input capacitor limit the circuit's compliance.

With a current-command voltage of 0V, the load current is approximately 1A. As the current command increases, the load current decreases. At approximately 2.42V, the load current drops to zero. By changing the values of R_1, R_3, and R_5, you can alter the scale factor. R_2, C_1, and C_2 provide loop compensation. R_4 and C_4 compensate for a slight drop in gain between approximately 80 and 200 kHz. These values are likely to depend on layout and may need adjusting in another implementation. When a high-compliance voltage is necessary, C_3 connects from the FET's drain to ground. The FET's drain-to-source capacitance decreases substantially at high stand-off voltages. C_3 swamps the FET capacitance, ensuring stability under all conditions.

Obviously, Q_1 needs a substantial heat sink if high voltage and even moderate currents are simultaneously present. If the power dissipation level becomes unmanageable, you can achieve a manageable level by making as many identical stages parallel as necessary to reduce each stage's current. (DI #2234) EDN

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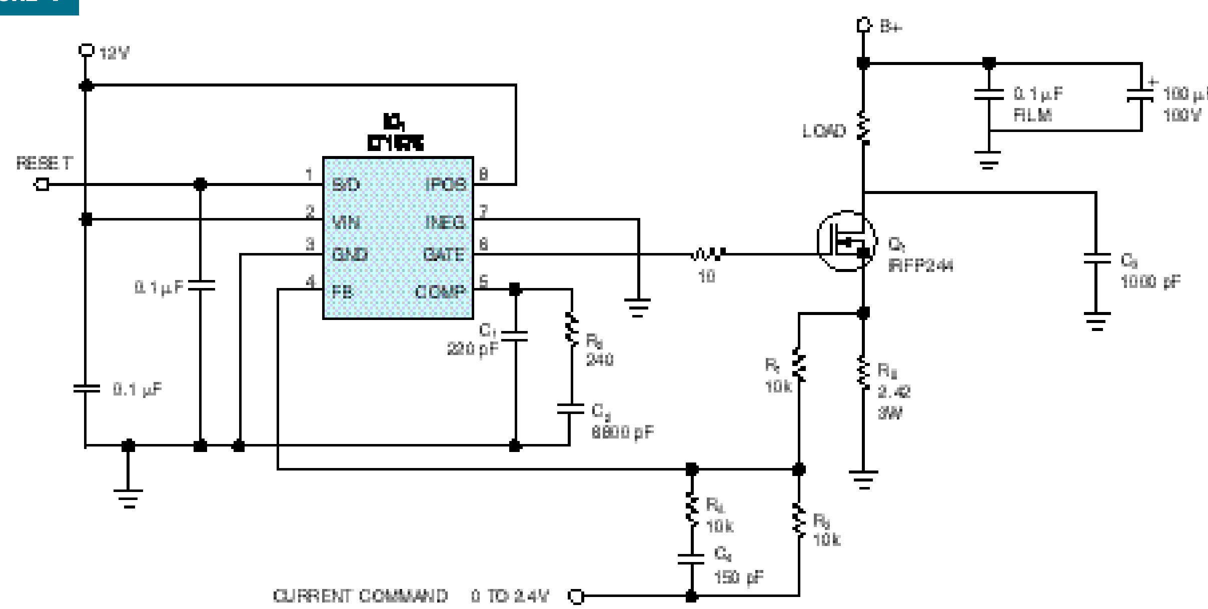
FIGURE 1



A high-speed linear regulator (IC_1) can provide accurate current control with a wide bandwidth and a voltage compliance of as many as several hundred volts.