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Half Bridge Driver Generates 100V, 10A, 4µs Pulses

Description

Lightning causes a large current spike when it strikes a telephone line. The output of a DSL driver could be destroyed by this surge current. To ensure robust operation, protection circuitry is used and the output of the driver needs to be tested to the "worst case" standard of 4kV. However, communication companies commonly use primary and secondary sets of protection circuitry so the actual assault on the line driver is reduced. DSL drivers must be tested to quantify what the output can withstand without failure. Since equipment that simulates the power in a lightning strike is not readily available, Figure 1 presents a circuit that combines a 5V trigger with a high-voltage supply to generate the power needed to test the resilience of a DSL driver's output.

Two MOSFETs, Q_1 and Q_2, are driven alternatively by pulses 1 and 2 through a half-bridge driver, the HIP2100. The half-bridge driver uses a charge pump and level shifters to provide larger pulses at its output pins, 3 and 8.

Schematic

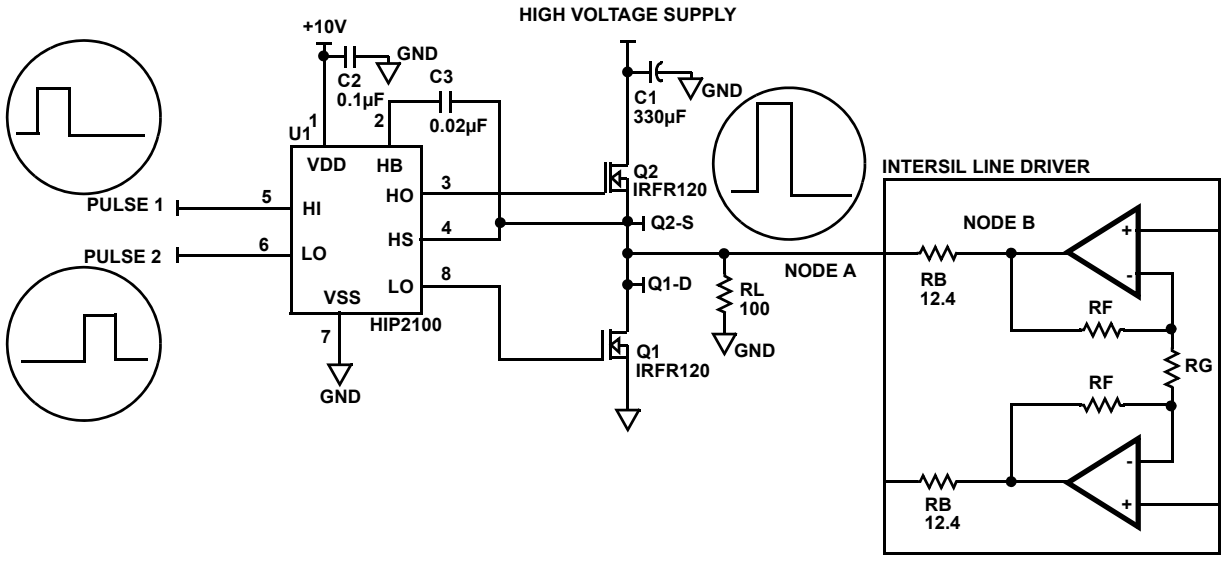

FIGURE 1. CIRCUIT DIAGRAM OF HIGH VOLTAGE, HIGH CURRENT PULSE GENERATOR WITH HIP2100

Figure 2 displays the time domain output of the power surge circuit. The top trace is displayed with 50V/division showing approximately $90V_{P-P}$. With $20V_{P-P}$ appearing on the amplifier side of the series backmatch resistor (and on the lower trace in Figure 2), the voltage drop allows calculation of the surge current and power.

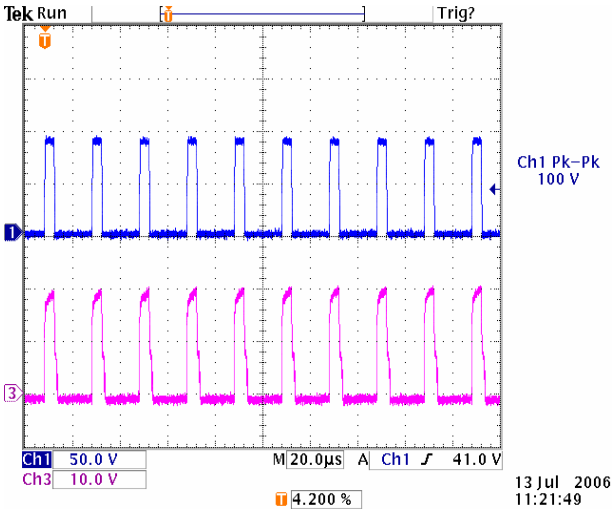

FIGURE 2. OUTPUT OF THE HIGH VOLTAGE, HIGH CURRENT PULSE GENERATOR

Current and Power Calculations

$$(90V - 20V)/12.4 = 5.6A \quad \text{(EQ. 1)}$$

$$20V \times 5.6A = 112W \quad \text{(EQ. 2)}$$

The current forced into the output of the amplifier causes a reverse bias of the PN junction of the transistors at the output stage. The reverse bias break down for the transistors at the output stage for each amplifier will depend on design and process. Some designers guarantee a maximum of 1A allowed surge current before the loss of regulation of the transistor. Better DSL line drivers can withstand surge currents up to 2.5A. For a DSL line driver to withstand anything above 2.5A is exceptional. Therefore, this circuit will adequately test the resilience of the line driver.

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