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Keywords: Transformer-Driver IC Controls Bidirectional Switch

APPLICATION NOTE 1096

Transformer-Driver IC Controls Bidirectional Switch

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The circuit of **Figure 1** is simply an on/off switch that connects V_{SUPPLY} to a load. V_{SUPPLY} can be positive, negative, or AC, with magnitude limited only by the MOSFETs' maximum V_{DS} rating. For the device shown, that limit is 50V.

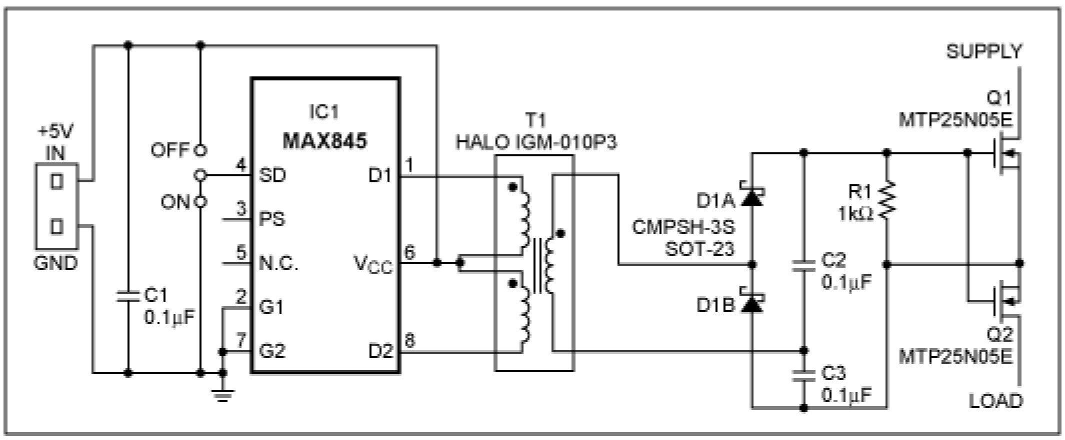

Figure 1. This bidirectional power switch handles moderately high positive, negative, and AC supply voltages.

The transformer's primary winding and driver IC operate on 5V, generating an isolated secondary waveform that is rectified by D1 and D2 to produce a 10V V_{GS} for the n-channel MOSFETs. V_{GS} is isolated, constant, and unaffected by changes in V_{DS} with respect to ground. Because the combination of a single MOSFET and negative V_{GS} would allow current flow in the off state (due to forward bias on its internal parasitic diode), two MOSFETs are connected source-to-source. Their internal diodes are then opposed, blocking unwanted current flow of either polarity in the off state.

Shutting down the IC turns off the switch by removing V_{GS} from the MOSFETs (SD = 5V turns the switch off; SD = 0V turns it on). The speed of this turn-off depends on the value of R1; lower values reduce turn-off delay at the expense of higher supply current. (For R1 = 1kΩ, the supply current is 24mA.) If speed is not an issue, reduce the supply current to 5mA by substituting a larger R1. **Figure 2** shows this circuit operating with a 40V, 1.2A load.

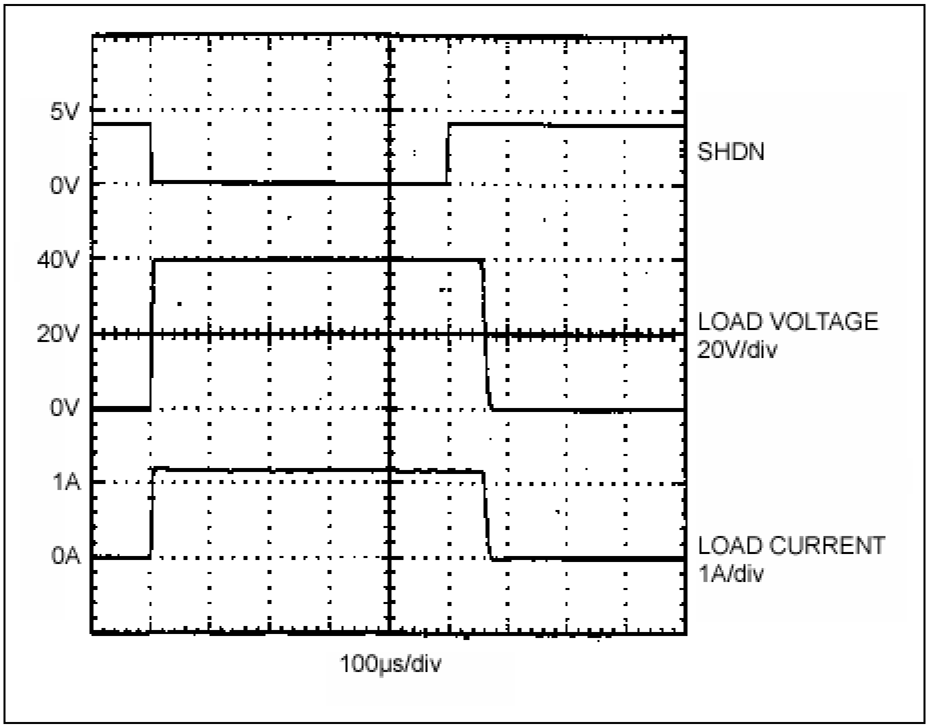

Figure 2. This scope plot shows the Figure 1 circuit operating with a 40V, 1.2A load.

Other switching techniques have drawbacks. Relays, for instance, have switch bounce and high power consumption (about 0.5W). The maximum V_{GS} rating for most power MOSFETs (approximately 20V for standard devices, 15V for logic-level devices) makes it difficult to withstand voltages greater than 15V. It can be accomplished by level-shifting the gate voltage, but that approach wastes power. In addition, the larger gate resistor required for higher voltages slows the switching speed.

A similar idea appeared in the July 17, 1997 issue of *EDN*.

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