Ideal Diode Combines 200V Busses

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As the power consumption of individual cards increases in rack-mounted systems, current consumption necessarily follows suit. A point is reached where the current delivered by the backplane becomes untenable, and the only solution is to increase the bus voltage. This point has been reached in even some 48V systems, leading to the use of bus voltages exceeding 100V.

The LTC4359 ideal diode controller is used in 12V, 28V and 48V battery, vehicular, line operated and solar power systems as a blocking diode and diode OR, achieving substantially lower power and voltage loss than is possible with a conventional diode. Its 100V absolute maximum rating would seemingly preclude use in higher voltage applications, but with the addition of a simple source follower clamp, this limitation is easily overcome.

Figure 1 shows a 200V, 7A ideal diode realized with the LTC4359. Two or more of these circuits are used to OR multiple busses. Q1 serves as the pass element. At 7A load current, Q1's dissipation is 1W; this beats a conventional rectifier by a factor of 5 to 10 and results in a substantial savings in board area. The LTC4359 is powered by a shunt regulator comprising D1, R1A and R1B. The use of large value resistors is made possible by the LTC4359's low, 200µA maximum supply current. With the values shown, the control circuit operates down to 50V input, and consumes about 200mW with a 200V input. If low voltage operation is not important, R1A and R1B can be increased to 200kΩ, reducing the total control circuit dissipation to 100mW, or about 10% of the circuit's total dissipation when operating with a 7A load.

When power is first applied, Q1's body diode passes current to the output. Q3, a 600V depletion mode device, turns on and connects the output voltage directly to the LTC4359's OUT pin. The IN and OUT pins sense V_{SD} across Q1 and drive the GATE pin in an attempt to hold the MOSFET's "forward" drop to 30mV. This condition is maintained up to about 1.5A, beyond which Q1 is driven fully on and the voltage drop is dictated by its 20mΩ $R_{DS(ON)}$.

If V_{SD} is less than 30mV, such as might be the case if the output is pulled up by a second, higher supply, the LTC4359's GATE pin turns the MOSFET off and blocks reverse current flow. If the input voltage drops significantly below the output, Q3's source-follower action protects the

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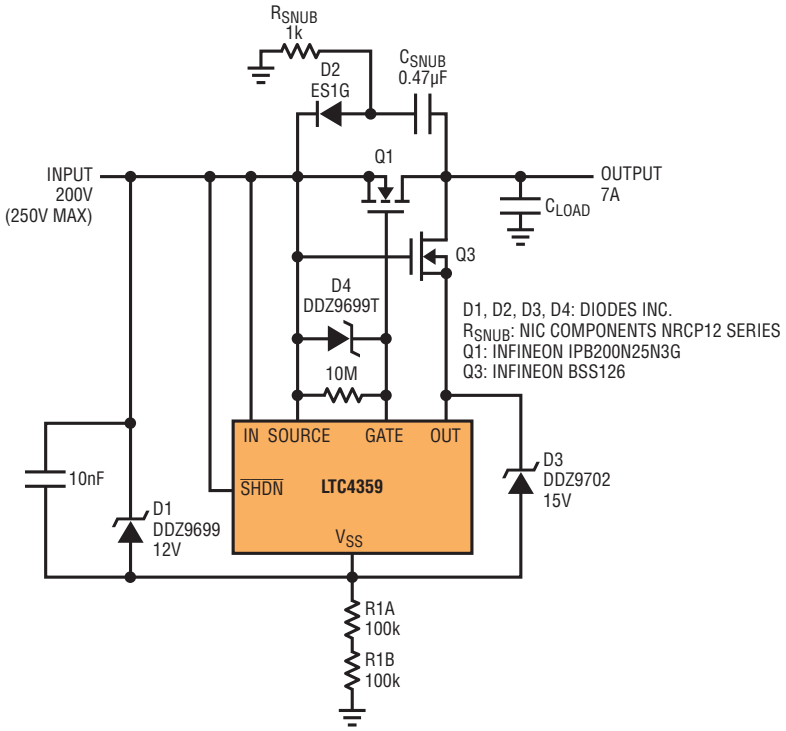
Figure 1. An LTC4359-based ideal diode for 200V busses



New Product Briefs

16A µMODULE REGULATOR CONFIGURABLE AS QUAD, TRIPLE, DUAL OR SINGLE OUTPUT POWERS FPGAs, ASICs & MICROPROCESSORS

The LTM4644 quad output step-down µModule® regulator is configurable as a single (16A), dual (12A, 4A or 8A, 8A), triple (8A, 4A, 4A) or quad (4A each) output regulator. This flexibility enables system designers to rely on a single compact µModule regulator for the variety of voltage and load current requirements of FPGAs, ASICs and microprocessors and other board circuitry.

The DC/DC controllers, power switches, inductors and compensation components are incorporated into the 9mm × 15mm × 5.01mm BGA package. Eight external ceramic capacitors (1206 or smaller case sizes) and four feedback resistors (0603 case size) complete four independently adjustable outputs between 0.6V to 5.5V. Separate input pins allow the four channels to be powered from different supply rails from 4V to 14V.

At an ambient temperature of 55°C, the LTM4644 delivers up to 13A at 1.5V from a 12V input or up to 14A with 200LFM airflow. The four channels operate at 90° out-of-phase to minimize input ripple whether at the 1MHz default switching frequency or synchronized to an external clock between 700kHz and 1.3MHz. With the addition of an external bias supply above 4V, the LTM4644 can regulate from an input supply voltage as low as 2.375V.

QUAD PHY INTERFACE ENABLES RUGGED MULTIPORT IO-LINK MASTERS

The LTC2874 IO-Link master IC provides the power and communications interface to four remote IO-Link devices (slaves). A rugged interface and rich feature set make the LTC2874 ideal for larger systems implementing IO-Link (IEC61131-9) in harsh, industrial environments. Managing four slaves per master IC, the LTC2874 reduces board space, design complexity and costs while increasing reliability.

Unique features of the LTC2874 include automatic wake-up request (WURQ) generation and an output supply current-boosting capability for slave start-up. The WURQ generator produces self-timed wake-up pulses of correct polarity, reducing demands on the microcontroller. Safety mechanisms manage multiport and repeat WURQs to prevent thermal overload and maintain error-free communication. The current-boosting pulse generator fully implements the start-up current pulse requirements added to the IO-Link v1.1.1 specification.

The onboard Hot Swap controller and external N-channel MOSFET in the power interface protect connected devices from inrush currents during start-up and fault conditions. Integrated ±50V blocking diodes in the data line interface protect against faults and high voltage excursions, making the LTC2874 well suited for the harsh PLC environment driving cables up to 20m long. ■

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LTC4359's OUT pin by keeping it within a few volts of the IN pin. Thus, it is Q3, with help from the floating supply architecture of D1 and R1A/B, that permits the 100V LTC4359 to operate comfortably at 200V. D3 is included to protect against brief, dynamic conditions that could otherwise damage Q3's gate pin.

Q1, a 250V-rated component, is chosen for its exceptional on-resistance of just 20mΩ. Another feature of this device is its advantageous C_{GS}/C_{RSS} ratio, which simplifies the gate drive requirements and precludes self-enhancement during Hot Swap events. Because Q1 is operated in triode, it is possible to parallel multiple devices for higher power applications.

Commutation spikes are clamped with a simple diode reset snubber. Q1 is generously rated at 320mJ avalanche energy, but the recommended peak avalanche current is only 47A. This figure is easily exceeded in high voltage systems where circuit faults may impress the full supply across small, parasitic inductances. Commutation spike energy is diverted away from Q1 and stored in CSNUB, then slowly dissipated by RSNUB.

Maximum operating voltage is limited by Q1 to 250V. Q3 is rated to 600V. Replacing Q1 with a suitable higher voltage unit and scaling R1A and R1B accordingly permits operation up to 600V. ■