Summary

The IRS260xD family of single-phase high-voltage gate driver ICs features an integrated, high-performance bootstrap diode functionality that eliminates the need for external bootstrap circuitry (diode + resistor) in a wide variety of inverter modulation schemes in the latest generation appliances. Sophisticated system diagnostic logic and advanced switching circuitry is employed in the IRS260xD to provide a unique bootstrap functionality.

One-stop Solution for Integrated Boot-strap Functionality

Fans, Pumps and Appliances: The Design Challenge

With energy costs rising around the world, energy efficiency is a critical requirement for modern washer, fan and pump manufacturers as they strive to deliver products with more and more features cost-effectively. While increased use of state-of-the-art electronics enable these goals, the escalating system complexity and associated concerns of reliability are key design issues. The IRS260xD solution from International Rectifier effectively addresses these issues by offering simplicity in design and added value at the same overall system cost.

Features

• Floating channel designed for bootstrap operation
• Fully operational to +600 V
• Integrated bootstrap diode
• IRS2607,8 suitable for BLDC (trapezoidal) motor control
• Tolerant to negative transient voltage, dV/dt immune
• Gate drive supply range from 10 V to 20 V
• Under-voltage lockout for both channels
• 3.3 V, 5 V, and 15 V input logic compatible
• Matched propagation delay for both channels
• Lower dv/dt gate driver for better noise immunity
• Gate drive input signal differentiation within family
• RoHS compliant

Typical Applications

• Motor control
• Air conditioners/washing machines
• General purpose inverters
• Micro/inverter drives

IRS260xD bootstrap functionality is applicable for both Sinusoidal and Trapezoidal inverter commutation schemes

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The IRS260xD’s bootstrap functionality is applicable not only to simple sinusoidal modulation schemes, but also to the more complex trapezoidal modulation schemes where the long-off-times of the low-side switch and extended tri-state conditions render bootstrap circuit design difficult. Thus, the IRS260xD family offers an excellent one-stop solution for appliance manufacturers with different PWM schemes.

The proprietary bootstrap functionality in IRS260xD delivers superior performance compared to competing solutions (see figure above). Under identical conditions, IRS2607 allows the bootstrap capacitor to maintain a much higher VBS voltage than competing devices, thus ensuring adequate gate drive to the MOSFET and IGBT with reduced conduction losses.

The IRS260xD also offers superior bootstrap functionality by maintaining higher VBS. Further, gate-drive input signal differentiation offered across the three devices in the IRS260xD family allows for a wide variety of microcontroller options. Higher Reliability

The IRS260xD devices are part of the latest family of gate drivers designed to be the most rugged in the market for hard switching environments such as motion control circuits. The typical problem in voltage source inverters with inductive loads is that the hard switching generates negative voltage spikes whose amplitude and duration depend on the switches and on the layout of the application PCB. Each of these spikes occurs at PWM frequency, so in some operating conditions, they can occur 16000 times per second. In the IRS260xD datasheet, the Safe Operating Area for this HVIC under these conditions is specified.

Overall Benefits
- Reduced component count because the high-voltage clamping diodes used in other solutions are no longer necessary.
- Fewer field returns because the robust IR HVIC does not fail in an unpredictable manner unlike other solutions.

Input filters have been re-designed to prevent small pulse commands reaching the gates of the switches in the inverter. This is one of the sources of problems in the field and usually it is difficult to find. The typical effect is that sometime inverters return from the field damaged with one destroyed leg without an apparent root cause. The IRS2607 embeds filters that solve this issue.

In addition, the IRS260xD family of HVICs offer dedicated UVLO protection for both the floating and fixed bias supplies, cross-conduction prevention logic (not IRS2607D) for shoot-through immunity and matched propagation delay between channels for highest levels of safety.

Advanced Input Filtering in IRS260xD

**Example 1**

Small pulses to the gate of the switches may cause inverter damage.

**Example 2**

COMPETITOR’S HVIC

IRS260x(D) HVIC

**Compatibility with IRS260x Gate Driver Family**

- IRS2607D: High-Low Driver, HIN and LIN are both Active High polarity
- IRS2608D: Half-Bridge Driver, HIN is Active High polarity, LIN is Active Low polarity
- IRS2609D: Half-Bridge Driver, Dedicated shut-down pin with Active Low polarity
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Higher Reliability

The IRS260xD devices are part of the latest family of gate drivers designed to be the most rugged in the market for hard switching environments such as motion control circuits. The typical problem in voltage source inverters with inductive loads (as in the motion control domain) is that the hard switching generates negative voltage spikes whose amplitude and duration depend on the switches and on the layout of the application PCB. Each of these spikes occurs at PWM frequency, so in some operating conditions, they can occur 16000 times per second. In the IRS260xD datasheet, the Safe Operating Area for this HVIC under these conditions is specified.

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IRS260xD Safe Operating Area under repetitive negative spikes

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