Isolated Gate Driver Outperforms Optocouplers

By David Morrison, Editor in Chief

Silicon Laboratories's Si823x ISOdriver family combines a two-channel isolator and dual gate driver within a single 16-pin wide-body SOIC. According to the vendor, this compact packaging of isolation and gate-drive functions dramatically shrinks pc-board space requirements, compared to optocoupler-based designs, while also improving power efficiency, reliability and noise immunity.

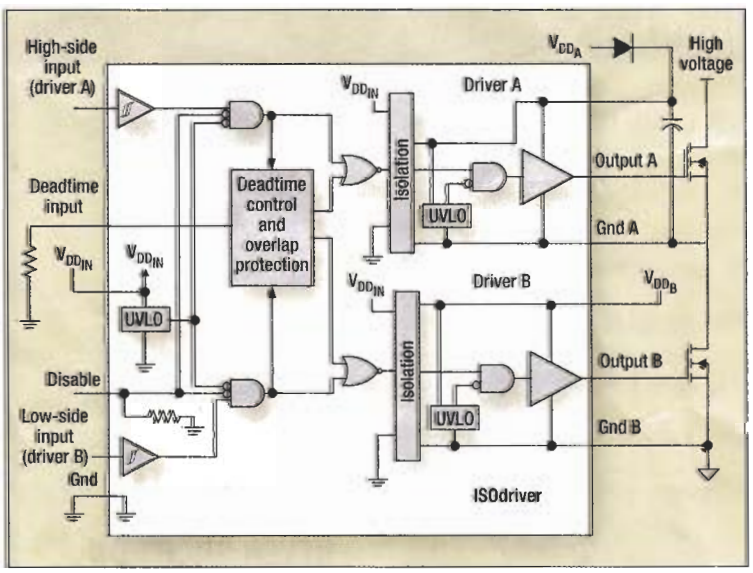
The ISOdriver devices offer high-side/low-side and dual low-side configurations in 0.5-A and 4-A peak output currents with either individual channel control inputs or a single PWM control input. Other features include programmable deadtime, undervoltage lockout on both the input and outputs, and overlap protection for models with high-side and low-side driver combinations. Because of all these capabilities, the ISOdriver devices are well suited for use in power supplies, motor control and lighting systems.

Traditionally, power-system designers have relied on expensive, complex multi-die optocouplers that use exotic process technologies and require a discrete bill of materials (BOM) that includes an external FET driver. But by integrating a CMOS isolator and driver within a single package, the ISOdriver external BOM is reduced to only three capacitors and a diode. As a result, an isolated high-side/low-side or dual low-side driver solution can be implemented in a footprint of only 200 mm^2.

Based on the company's RF isolator technology and CMOS gate-driver design, the ISOdriver is a multi-die rather than a monolithic device. As shown in the figure, everything to the left of the isolation barrier is implemented on one die. Then there are two other die to implement each of the two driver outputs to the right of the isolation barrier. Because each driver output has its own die, the outputs are isolated from each other as well as from the input. Consequently, it's possible to operate the low-side driver at a higher voltage than the high-side driver, which offers flexibility, according to the vendor.

The gate drivers are implemented in standard CMOS technology. However, the magnetic isolation is implemented by building a transformer on the three die using two layers of metal. (In the online version of this article, an additional figure illustrates the transformer structure and how the windings are interconnected. Breakdown voltage is 2.5 kVac rms or 600 Vdc.)

When compared with optocoupler-based solutions, the ISOdrivers deliver significant improvements in MOSFET turn-on and turn-off times. So less power is wasted during a FET switching cycle, enabling higher efficiency. Integrated overlap protection also improves efficiency by preventing high-side and low-side MOSFETs from being on at the same time. Programmable deadtime enables designers to further optimize efficiency.



The Si823x ISOdriver combines a two-channel isolator and dual gate driver within a 16-pin SOIC package, cutting board-space requirements and shrinking the BOM versus optocoupler-based designs.

Compared to typical optocoupler-based solutions with propagation delays of hundreds of nanoseconds, the ISOdriver's propagation delay of 50 ns (max) increases timing margins and improves control response for better overall system performance and reliability. Although optocouplers with short propagation delays are available, users may pay a premium for these parts.

In addition, even faster optocouplers are subject to change in performance over time and temperature unlike the ISOdriver devices. The ISOdriver family's CMOS-based design has the added benefit of providing tighter tolerances on unit-to-unit variations, eliminating the need for factory screening or calibration after system assembly.

Available now, the Si823x family is priced from $1.15 to $1.60 each in quantities of 1000, based on configuration and peak output current. For more information, visit www.silabs.com. **PETech**