# Technical Notes The Avago Advantage



## Smart Gate Drive Optocoupler with Integrated Flyback Controller



### Introduction

The new ACPL-302J is a smart gate drive optocoupler that improves isolated power supply and simplifies gate drive design. The ACPL-302J features an integrated flyback controller for DC-DC converters and a full set of fail-safe IGBT diagnostics, protection, and fault reporting, providing a complete cost-effective gate drive solution (Figure 1). With a 2.5A rail-to-rail output, the device is ideal for driving IGBTs and power MOSFETs in industrial power inverters and motor drives. The end result is an easy-to-use, compact, and affordable IGBT gate drive optocoupler solution.



Figure 1: Functional diagram of ACPL-302J gate drive optocoupler

## **The Centralized Power Supply**

Gate drive optocouplers are used to provide high voltage reinforced galvanic insulation and deliver high output current to switch the IGBTs in motor drives or inverters. Discrete components like voltage comparators and transistor switches are used to protect expensive IGBTs during short circuit faults while digital optocouplers are used to provide isolated feedback. Avago Technologies has integrated these discrete components into the smart gate drive optocouplers like the ACPL-302J.

An isolated high-side power supply is required to provide static and switching power source for gate drivers and some miniature isolation amplifiers for current sensing (Figure 2). The common design uses a centralized power supply topology made up of a bulky 3-phase transformer and feedback controller to achieve a stable 3-phase DC source for the isolated high-side power supply.



Figure 2: Basic gate driver optocoupler with isolated high side power supply to drive and protect IGBT in motor drives and inverter.

In a centralized power supply system, the isolated high side power supply powers six gate drivers using a single large transformer. The transformer houses four secondary windings, three for the floating supplies for each phase of the top gate drivers and a common supply for the bottom gate drivers (Figure 3). In addition to the large transformer are large capacitors for filtering and large transistors for the primary winding switching are needed. These large devices impact real estate size and height. Also a centralized supply has inherent problems like electromagnetic interference (EMI) and noise coupling between IGBT channels due to the longer traces required to reach all six gate drivers.



Figure 3: The centralized power supply topology.

## The Avago Advantage Technical Notes

### **The Distributed Power Supply**

The ACPL-302J device was developed to improve isolated power supplies and simplify gate drive design. The device is optimized for distributed power supply topology (Figure 4 and 5). It is a 2.5A rail-to-rail smart gate drive optocoupler with an integrated flyback controller for DC-DC converters. By integrating the flyback controller, the ACPL-302J enables integration of smaller high-efficiency transformers to be placed next to the device (Figure 6). As a result, the designer can reduce the overall footprint, minimizing electromagnetic interference (EMI) and noise coupling between IGBT channels. With a smaller transformer, the primary winding switching transistor is integrated in the ACPL-302J and smaller capacitors can be used for filtering.



Figure 4: The distributed power supply topology.



Figure 5: ACPL-302J, 2.5A gate drive optocoupler with integrated flyback controller, active miller clamp, DESAT and UVLO detection.

### Summary

By integrating the flyback controller, the ACPL-302J device allows fewer discrete components and smaller transformers and capacitors to be placed next to the device, thus reducing the overall footprint of the design and minimizing electromagnetic interference (EMI) and noise coupling between IGBT channels. By reducing these elements of the design, there is a notable cost savings the designer can realize.



Figure 6: The board level view of the distributed power supply topology using ACPL-302J and benefits.

Contact us for your design needs at: **www.avagotech.com/smartgatedrive** 

Avago, Avago Technologies and the Avago logo are trademarks of Avago Technologies in the United States and other countries. All other trademarks are the property of their respective companies. Data subject to change. Copyright © 2014 Avago Technologies AV00-0304EN 12/19/14

