Reduce IGBT Gate Drive Design Costs and Space

Introduction
The ACPL-337J is an advanced highly integrated gate drive optocoupler, designed to ISOLATE, DRIVE, PROTECT and FEEDBACK the IGBT’s operational status.

It has a rail-to-rail output that can deliver 4A of maximum current capable of driving high power IGBT directly. The integrated DESAT detection protects the IGBT during short circuit condition and the isolated feedback reports this fault to the controller.

In addition to these basic functions, the ACPL-337J integrates more new features to further reduce external discrete components used by designers to improve the system overall power efficiency and reliability. The end result is an easy-to-use, compact and affordable IGBT gate drive optocoupler solution.

In the Beginning
Optocouplers are used to provide high voltage reinforced galvanic insulation and noise isolation in inverter or motor drives applications. Basic gate drive optocouplers which can deliver high output current are usually used to charge and discharge the gate capacitance of the IGBT in order to switch the IGBT on or off quickly. A current buffer is sometime used when driving higher power IGBT.

IGBT desaturation sensing circuit, which is made up of discrete components like voltage comparator, constant current source and transistor switches are used to protect the expensive IGBT during short circuit fault. This fault will give feedback to the low voltage controller side through another galvanic isolated path, usually a digital optocoupler.

The Avago Advantage
The ACPL-337J can be used in various applications such as drive, protect, and feedback the IGBT’s operational status.

The First Integration
Avago Technologies first integrated the complete gate drive solution to isolate, drive, protect and give feedback into the HCPL-316J. The HCPL-316J is the first 2.5A gate drive optocoupler with integrated DESAT (desaturation) detection and isolated FAULT feedback.

To further maximize design flexibility, the HCPL-316J also comes with undervoltage lockout (UVLO) to prevent insufficient gate voltage from driving the IGBT and “soft” IGBT turn-off to prevent high voltage turn off transient stress across the IGBT.

Figure 1. Functional diagram of the ACPL-337J gate drive optocoupler

Figure 2. Basic gate driver optocoupler and discrete components to isolate, drive, protect and feedback IGBT’s operation status

Figure 3. HCPL-316J, 2.5A gate drive optocoupler with integrated DESAT detection and isolated FAULT feedback
Over the years, designers have been adding more peripheral circuits to meet the increasing demand of higher power, better efficiency and reliability in inverter and motor drives. The circuits include:

**To Improve Efficiency**
- Current buffer to switch the IGBT faster for lower switching loss
- Higher positive supply to compensate for current buffer voltage drop to achieve optimum gate voltage

**To Improve Reliability**
- Negative supply to ensure IGBT switch off safely
- Extra blanking current source to prevent false DESAT fault detection
- UVLO feedback to report insufficient supply causing low IGBT gate voltage
- Direct LED drive with split resistors network to improve the common mode rejection ratio (CMRR)

**More Integration**
The new ACPL-337J is Avago’s response to customer feedback for a compact gate drive optocoupler solution to further integrate peripheral circuits.

**Summary**
The ACPL-337J highly integrated features reduce external components greatly, providing a complete cost-effective gate drive solution for motor control and power inverter applications.