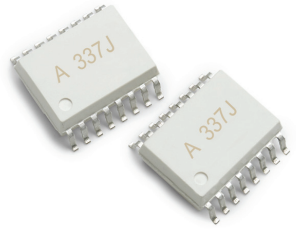
Reduce IGBT Gate Drive Design Costs and Space



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.

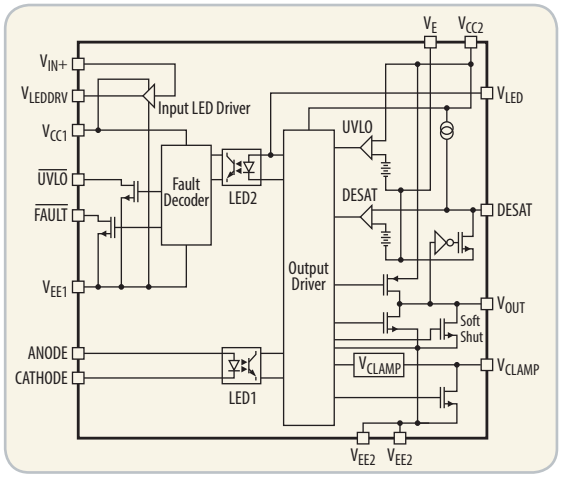


Figure 1. Functional diagram of the ACPL-337J gate drive optocoupler

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.

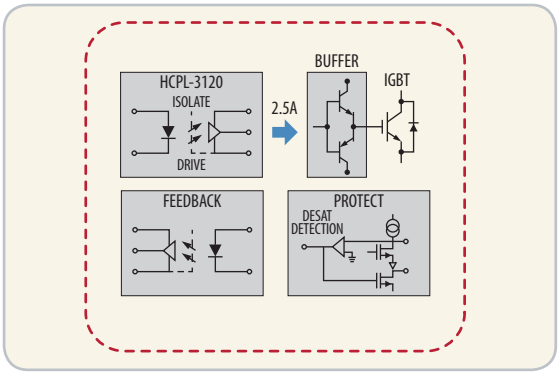


Figure 2. Basic gate driver optocoupler and discrete components to isolate, drive, protect and feedback IGBT's operation status

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.

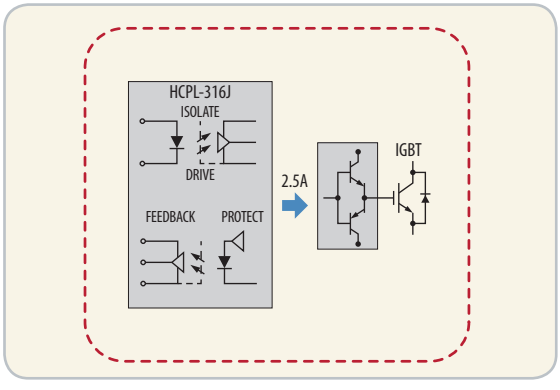


Figure 3. HCPL-316J, 2.5A gate drive optocoupler with integrated DESAT detection and isolated FAULT feedback

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.

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)

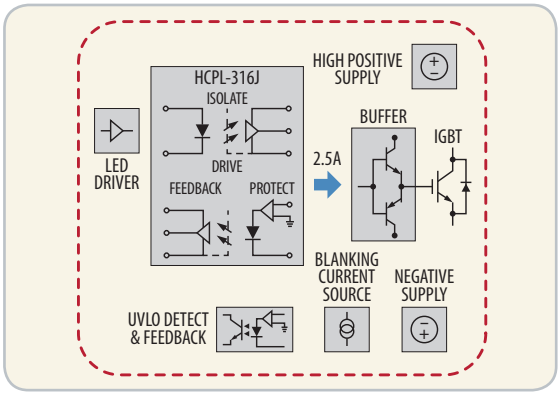


Figure 4. Peripheral circuits to improve the efficiency and reliability of the IGBT gate drive

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.

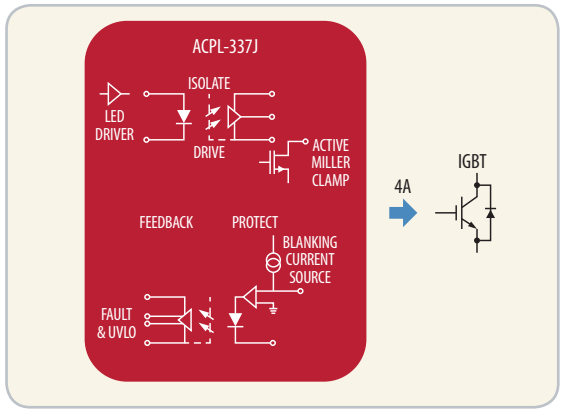


Figure 5. ACPL-337J, a compact gate drive optocoupler solution to simplify the design and board layout

The 4A high output current can be used to eliminate the current buffer and drive the IGBT directly. The rail-to-rail output can reduce the supply voltage and drive the gate of the IGBT without voltage drop. The integrated active Miller clamp can replace the negative supply by shunting parasitic Miller current away and prevent the IGBT from switching on accidentally. The internal DESAT blanking current source is increased by 4 times to charge a bigger blanking capacitor. A bigger blanking capacitor will be able to filter out transient noise more efficiently and prevent false fault triggering. The single isolated feedback path is able carry both DESAT and UVLO fault signal to the low voltage controller side. The controller can use the UVLO feedback as "Ready" signal to begin high voltage IGBT operation or to shut down the operation if the secondary side power supplies go into fault. Lastly, the integrated LED driver allows easy interfacing between the controller and the gate driver. The flexible configuration of the LED driver will allow direct access to the LED to balance its input impedance and improve the CMRR.

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.

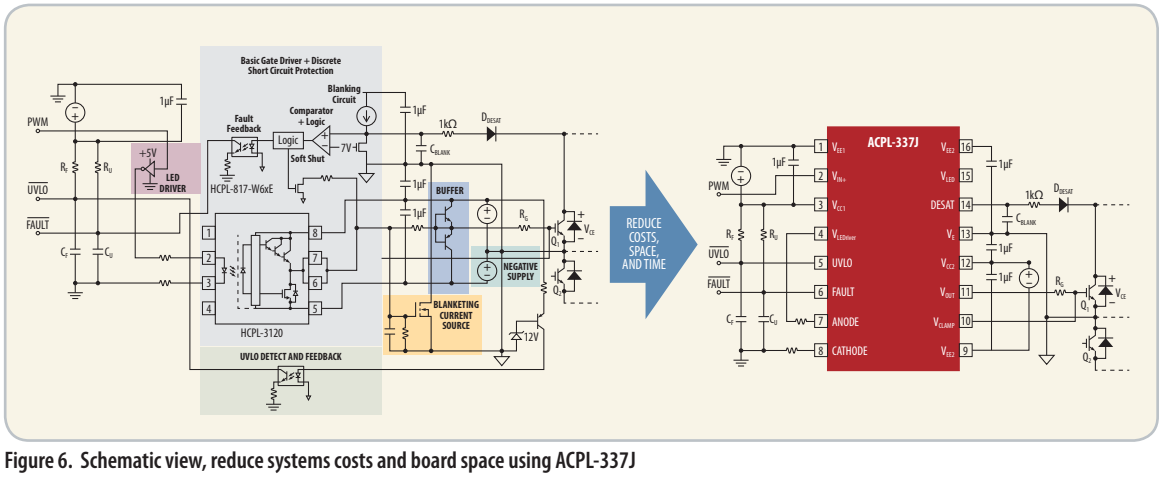


Figure 6. Schematic view, reduce systems costs and board space using ACPL-337J

Contact us for your design needs at: **www.avagotech.com/acpl-337J**

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