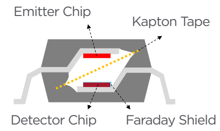
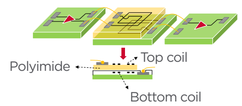
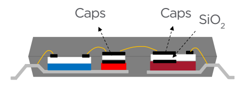
Go with Gate Drive Optocoupler

Contents

Isolation Technologies and Comparisons

Isolator / Coupler Types	Broadcom Optocoupler	Magnetic Isolator	Capacitive Isolator
Isolation Construction			
Insulation Material	**3 layers** (Silicone / Kapton / Silicone)	**1 layer** (Polyimide)	**1 layer** (Silicon Dioxide)
Insulation Thickness	**0.08mm to 2mm**	Up to ~0.02mm for single coil; ~0.04mm for double coil	Up to ~0.014mm for single cap; ~0.028mm for double cap
Insulation Strength	**Very Good**	Fair	Weak
Component Certification | Test Method	**IEC-60747-5-5** (reinforced - passed min. 10kV surge) **Partial Discharge**	**IEC-60747-17** (basic or reinforced - passed min. 10kV surge) **Partial Discharge** Lifetime failure mechanism / predictions assessed only in type test	
Lifetime and Reliability Failure Mechanism	**Partial Discharge** No lifetime failures - guaranteed by 100% PD test at final production test (VDE option)	**Space Charge Degradation** Allowable failure in time Reinforced < 1 ppm Basic < 1,000 ppm	**TDDB** Allowable failure in time Reinforced < 1 ppm Basic < 1,000 ppm
Insulation Vulnerability	**Robust thick insulation** with proven track record	Thin film insulation vulnerable to electrical and thermal stress. Insulation damage due to delamination causing early TDDB	
UL1577 V_{ISO} Withstand Voltage	**Double Protection** (Passed Type Test min. 20kV 50 discharges)	Single Protection	Single Protection
EMI/EMC Susceptibility	**Very Good** (Faraday Shield implemented at detector side)	Weak	Fair

- ✓ Optocoupler is the dominant isolation technology in the industry
- ✓ Optical isolation is preferred choice for high voltage isolation and better noise immunity performance
- ✓ Optical isolation technology proven track record of more than 50 years

- ✗ Broadcom Isolation Products currently not supporting IEC60747-17
- ✗ IEC60747-17 specifies statistical failure rate
- ✗ IEC-60747-17 currently only recognizes Polyimide and Silicon Dioxide as the insulation materials

Robust and reliable optical isolation technology enables high noise rejection and safety

Optical Isolation Technology

Figure 2 shows the construction of a Broadcom optical isolator. An infrared LED on the primary side is used to transmit information across the multi-layer insulation barrier to a detector IC over the galvanically isolated secondary side.

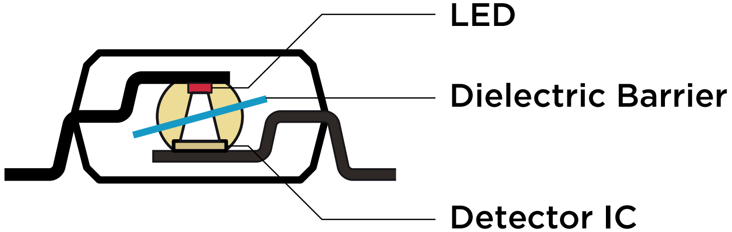
The use of optical isolation technology allows for an optimum design tradeoff between low power consumption and separation distance.

The multi-layer and large distance through insulation (DTI) are keys to (common mode) noise rejection and insulation capability in high voltage environments. They are also keys to the protection of the insulation barrier from external fault events. The white paper "Robust Construction of the Optoisolator" explains how power supply fault can damage the on-chip capacitive isolator that use same monolithic IC process.

Common Mode Transient Immunity (CMTI)

The internal separation and Faraday shield covering the detector IC reduces the coupling capacitance across the isolator. This low capacitance, combined with optical isolation technology provide leading industry CMTI performance of up to 150kV/µs.

Figure 2. Optical isolator construction



Reinforced insulation suitable for failsafe design

Robustness to Long Term High Voltage Stress

As isolators are often used in applications with specific electrical safety requirements, it is extremely important to ensure – by construction and testing - that the insulation capability of products do not degrade over time when subjected to high continuous or transient voltages.

The relevant aging mechanism used for the insulation construction in optical isolators, presented in this booklet is called **Partial Discharge.** All Broadcom gate drive optocouplers (or with VDE option) have 100% partial discharge testing at the rated working and transient voltages.

Other known aging mechanisms, such as space charge degradation (thin spin-on polyimides) or time dependent break down (SiO_2) are not activated or applicable to Broadcom optically isolated products.

More information on safety and isolation technologies can be found in the Broadcom white paper "Safety Considerations When Using Optocouplers and Alternative Isolators for Providing Protection Against Electrical Hazards".

Resistance to ESD and Other High Voltage Transients

One important aspect of an isolator is the transient voltage rejection, not only between inputs and ground but also between the two isolated grounds. The surge test for Broadcom optocouplers, measured across the isolation barrier is > 16kV.

Reliability and Quality of LEDs

The LEDs used in Broadcom gate drive optocouplers are dimensioned so that they pose no limitation on the end product life time. The infrared LED technology used for optocouplers is a core competency for Broadcom that has been developed over 50 years. Broadcom continues to do R&D and LED production in house to maintain it's technological leadership, reliability and quality.

Gate drive optocouplers, whose performance and reliability depend on quality LED technology, are available in industrial and automotive grade (125°C), and space/military grade (hermetic, 125°C) versions.

Leading gate drive solutions for industrial applications

Target Applications

- IGBT, SiC and GaN MOSFET gate drive
- AC and servo motor drives
- Renewable energy inverter and storage
- Robotics and factor automation
- Heating, ventilation and air conditioning
- Power supply

Broadcom optocouplers have been used in an array of isolation applications ranging from power supply and motor control circuits to data communications and digital logic interface circuits for more than 50 years.

The primary purpose of an optocoupler is to provide both electrical insulation and signal isolation. The popularity of Broadcom optocouplers is due to cost effective innovations in these areas.

In typical motor drive and renewable energy power conversion systems, there are several signals between the power devices and the microcontroller that need isolation and additional customized functions such as gate drive and current/voltage sensing. Broadcom's gate drive optocouplers provide low cost, high performance solutions for such applications.

GO with OPTO!
BROADCOM® OPTOCOUPLERS
50 YEARS

Highly integrated gate drive optocouplers

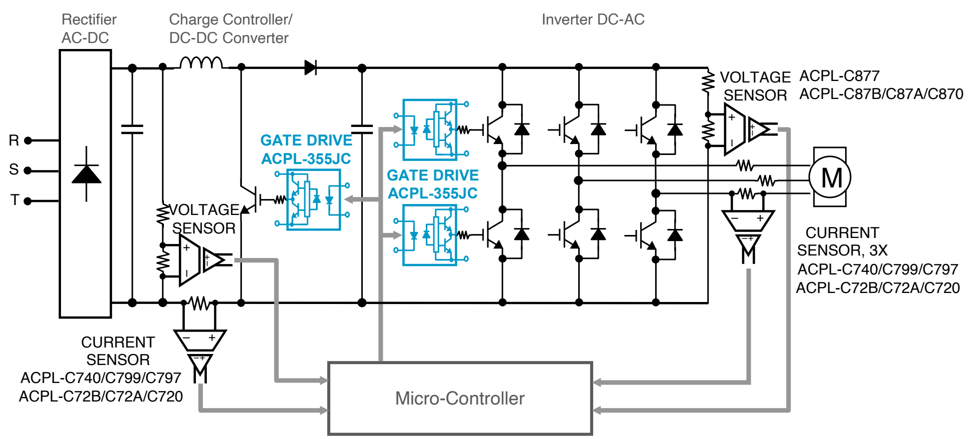
Introduction

High performance motor drives require precision timing for turning on and off the power devices on the inverter while renewable energy inverter needs to be reliable and efficient when converting DC-link voltage to usable AC power output. The microcontroller that controls these functions needs to be isolated from the high voltage inverter.

Broadcom offers a variety of optocouplers that have built-in gate drive capability. These gate drive optocouplers come in wide range of output current from 0.4A to 12A, and selected parts with integrated protection features such as slew rate control, short circuit or over-current detection, functional safety reporting, active Miller clamp and under voltage lockout.

Beside protection features, Broadcom has also integrated DC-DC controller for floating power supply and LED driver to make design more compact and affordable.

Figure 1. Gate drive optocouplers in a three phase motor drive application



Product Selection Trees

Highly Integrated Smart Gate Drive Optocoupler NPI Product Tree

Isolator Type	Highly Integrated Smart Gate Drive Optocoupler							
Power Switch	IGBT	IGBT	IGBT	IGBT	Power MOSFET	IGBT Si/GaN MOSFET	IGBT/SiC	IGBT
Output Current	1A+MOSFET BUFFER	2.5-3A	2.5-3A	4A	2.5A	5A	10A	12A
Part Number	ACPL-339J	ACPL-336J ACPL-334J ACPL-338J	ACPL-302J	ACPL-337J	ACPL-335J	ACPL-352J	ACPL-355JC	ACFJ-3405^
Working Insulation Voltage	1414Vpeak	1414Vpeak	1230Vpeak	1414Vpeak	1230Vpeak	1414Vpeak	2262Vpeak	1414Vpeak
Function Short Circuit	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Output with Slew Rate Control	No	No	No	No	No	No	No	Yes
Active Miller Clamp	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Functional Safety Reporting	No	No	No	No	No	Yes	Yes	Yes
Power Switch GATE Status Feedback	No	No	No	No	No	Yes	No	Yes
DC-DC Controller for Floating Power Supply	No	No	Yes	No	No	No	No	No

^Advance information subject to change

Basic Gate Drive Optocoupler NPI Product Tree

Isolator Type	Basic Gate Drive Optocoupler											
Output Current	1A	1A	2.5-3A	2.5-3A	2.5-3A	4A-5A	4A-5A	4A-5A	4A-5A	4A-5A	10A	10A
Switch	IGBT/SiC	MOSFET/GaN	IGBT/SiC	IGBT/SiC	MOSFET/GaN	IGBT/SiC	IGBT/SiC	IGBT/SiC	MOSFET/GaN	MOSFET/GaN	IGBT/SiC	MOSFET/GaN
Working Insulation Voltage	891-1140Vpeak	891-1140Vpeak	891-1140Vpeak	1414Vpeak	891-1140Vpeak	891-1140Vpeak	1414Vpeak	2262Vpeak	891-1140Vpeak	1414Vpeak	1230Vpeak	1230Vpeak
Part Number	ACPL-P340 ACPL-W340 ACPL-P347 ACPL-W347	ACPL-P345 ACPL-W345	ACPL-K342 ACPL-H342 ACPL-P341 ACPL-W341 ACPL-P349 ACPL-W349	ACNU-3410	ACPL-P346 ACPL-W346	ACPL-P343 ACPL-W343	NEW ACNU-3430 ACPL-C361^ ACPL-C362^ ACFJ-302C^ (Dual-Channel)	NEW ACNT-H343 ACNT-H343C^	ACPL-P346 ACPL-W346	NEW ACFJ-332B (Dual-Channel)	NEW ACFL-3161	NEW ACFJ-3262 (Dual-Channel)

^Advance information subject to change

Driving SiC and GaN power semiconductors

The rise of SiC and GaN power semiconductors

SiC and GaN are now widely recognized as a reliable alternative to silicon IGBT. Their ability to increase overall system efficiency and switching speed can help reduce the overall system size and costs. Major suppliers are ramping up their production with packages and pinouts that can replace existing IGBTs easily. This drives the costs of SiC and GaN power semiconductors to a very competitive level, which is probably the most important factor that makes adoption take off.

The standardization of SiC and GaN power semiconductors

SiC and GaN power semiconductors specifications have evolved to be easily driven and protected by gate drivers.

The first specification would be gate-source voltage, V_{GS}. The optimum V_{GS} for SiC FET operations has reduced from 20V to the same level as the V_{GE} of IGBTs, at 15 V. Likewise, the V_{GS} of GaN FET has increased from 4V to 10V, the same level as silicon power MOSFET. The difference in V_{GS} will require the output of gate driver to have different under voltage lockout(UVLO) threshold.

The second specification is the total gate charge, Q_G. Q_G of SiC and GaN FETs is more than 2 to 3 times smaller to their equivalent silicon counterparts. This allows them to switch quickly, reducing the switching losses and increasing the operating frequency. A lower Q_G also implies a lower gate current, which helps to eliminate a current buffer stage.

The third specification is the slew rate or dv/dt which measures how fast the SiC & GaN FETs switch from zero to the BUS voltage within the shortest time. Although fast switching is critical to reduce switching losses, the high dv/dt generated can be a nuisance and causes noise to the control. The ability for the gate driver to reject the dv/dt noise is specified by the common mode transient immunity (CMTI). SiC and GaN FETs are capable to switch 100 V/ns and requires a gate driver with CMTI rating of more than 100 kV/µs.

The last specification is the short circuit withstand time (SCWT). Silicon IGBTs in general have superior SCWTs to SiC or GaN FETs. Hence, any short circuit fault current in the SiC FET needs to be extinguished faster before the switch is destroyed. Typically, the rule of thumb is 1 to 3 µs for SiC and GaN FETs, as compared to 5 to 10 µs for IGBTs.

Gate drive optocouplers for SiC and GaN power semiconductors

With the understandings of gate-source voltage, gate charge, slew rate and short circuit withstand time, table 1 shows the gate drive optocouplers and their specifications suitable for driving SiC or GaN power semiconductors. It is to note that these gate drivers can be used to drive the silicon counter parts of IGBT and power MOSFET.

Table 1. Power semiconductors and gate drive optocouplers

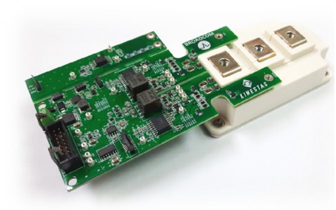
Power Semiconductor	Gate Drive Optocoupler	Under Voltage Lockout	Output Current (max.)	CMTI (kV/µs)	Features
SiC MOSFET IGBT	ACPL-355JC	13V	10A	100	DESAT sensing with adjustable blanking time for SCWT
	ACFL-3161	13V	10A	100	Separate source and sink outputs
	ACFJ-302C	12V	4A	150	Active Miller Clamp
GaN FET Power MOSFET	ACFJ-3262	8V	10A	100	Separate source and sink outputs
	ACFJ-332B	8V	4A	150	Active Miller clamp

Reference designs for SiC and GaN power semiconductors

Broadcom develops reference designs to help customers shorten design cycle and speed up time-to-market. Broadcom has partnered with key SiC and GaN FETs suppliers or our channel partners who have in depth system and product knowledge in their respective field, for most of the reference designs. The SiC and GaN FETs reference designs include schematics, layouts, BOMs and test results to demonstrate best engineering and industrial practices.

www.broadcom.com/products/optocouplers/reference-designs

Figure 3. Reference designs for SiC and GaN power semiconductors



ACPL-355JC

Infineon

62mm SiC 1200/350A-500A Module

- FF2MR12KM1
- FF3MR12KM1
- FF6MR12KM1

ACPL-355JC

Wolfspeed

62mm SiC 1200/300A-400A Module

- WAB300M12BM3
- WAB400M12BM3

ACPL-355JC

Infineon

Half-Bridge 1200V SiC module

- FF23MR12W1M1_B11
- FF11MR12W1M1_B11

ACPL-355JC

Wolfspeed

FM3 Half-Bridge 1200V SiC module

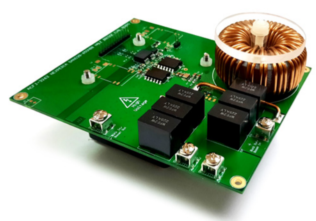
- CAB011M12FM3
- CAB016M12FM3

ACFL-3161

STM, Wolfspeed and Nexperia

TO247 1200V SiC Discreet

- SCTWA70N120G2V
- C3M0021120K
- NSF080120L4A0

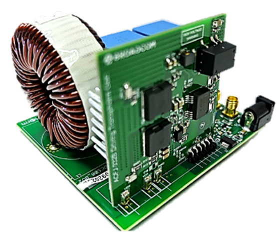


ACFJ-3262

Nexperia

CCPAK 650V GaN Discreet

- GAN039-650NBB



ACFJ-332B

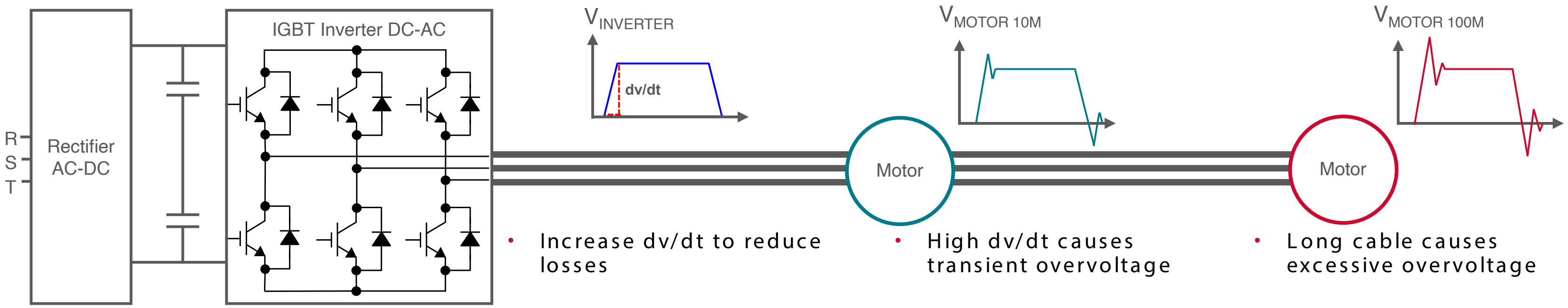
Transphorm

TOLL 650V SuperGaN FET Discrete

- TP65H035G4QS

Improve motor lifetime with slew rate control gate driver

Figure 4. High dv/dt causes excessive overvoltage with long cable between drive and motor



Excessive overvoltage with long cable between drive and motor

Pulse-width modulation or PWM is a method of reducing the average power delivered by an electrical signal, by effectively converting analog to digital signals . To keep the losses in the inverter low, the switching times of the power semiconductors are kept as short as possible.

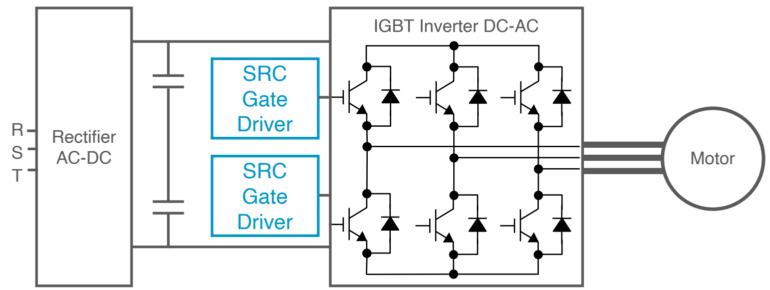
This results in the increase of slew rate or dv/dt, especially with the new generation of IGBTs. In many industrial applications, induction motor and inverter are placed at different locations and need long cable connection. The high dv/dt of the inverter output pulses, through the long cable, doubles at motor terminal due to voltage reflection phenomena.

The overvoltage appearing across the motor terminal stresses the motor insulation and finally leads to motor insulation failure.

According to IEC and NEMA standards of admissible voltages for various motor type, a dv/dt of around 5kV/us is considered permissible for most application.

Slew rate control gate driver

Figure 5. Slew rate control gate driver



The most commonly used dv/dt mitigating technique is a passive dv/dt filter between the inverter and motor. The passive dv/dt filter consisting of inductor, capacitor and resistor slow down the PWM and reduce the dv/dt. Such passive filters are usually large, expensive and cause losses.

Slew rate control (SRC) gate driver offers a simple, small and cost-effective alternative to dv/dt filter. Based on IGBT current feedback loop, the gate driver will control its output current dynamically through the gate resistors. By varying the gate resistors, the dv/dt of the IGBT can be controlled and not to exceed the permissible dv/dt.

Slew rate control gate drive optocoupler

The operation of slew rate control gate drive optocoupler

Figure 6. The operation of slew rate control gate driver

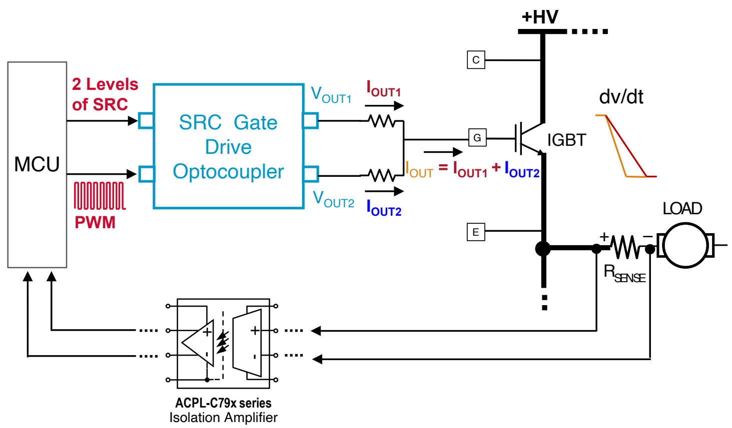


Figure 6 shows typical application diagram of the slew rate control(SRC) gate driver. The SRC gate drive optocoupler receives the PWM and SRC signals from the microcontroller. The PWM signals is then transmitted to across the isolation barrier of the gate driver. The SRC signal will then select the outputs, V_{OUT1} or V_{OUT2}, in which the PWM signal will be sent to the gate of the IGBT. The microcontroller decides which mode of SRC levels based on the feedback of the IGBT or load current.

Figure 7 maps the IGBT current, I_C to the required gate current, in order to keep the dv/dt below the permissible dv/dt of 5kV/us. At low IGBT current, for example 40A, the gate driver will deliver a low output current, I_{OUT1} to keep the IGBT slew rate at 2500V/us. On the other hand, in a design without slew rate control, a high gate current might cause the dv/dt to exceed the permissible limits at 5kV/us at 40A.

When the IGBT is switching at a higher current, for example 120A.The gate driver will deliver a higher gate current, $I_{OUT1}+I_{OUT2}$, to switch the IGBT at a higher slew rate but still within the permissible target. But doing do, the dv/dt will be higher but optimized(green dotted line), to reduce the switching losses.

Figure 7. The relationship of dv/dt, IGBT current(IC) and gate current

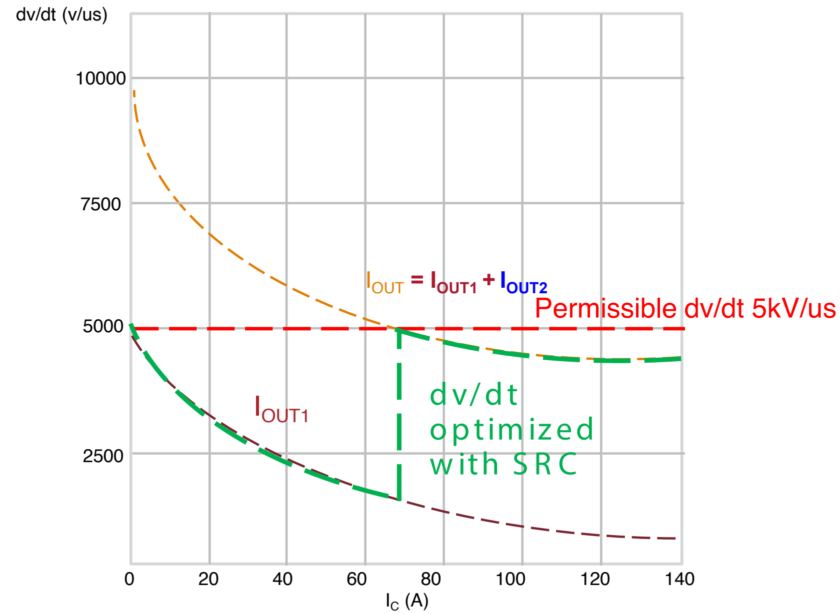


Table 2. Gate drive optocouplers with slew rate control

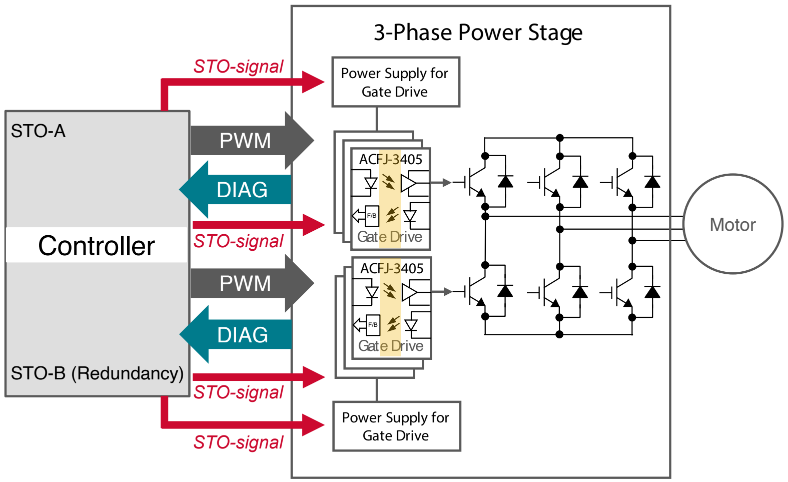
Gate Drive Optocoupler	Selectable Output Current (max.)	Other Features
^ACFJ-3405	12A, 4A	• DESAT detection with soft shut down • Adaptive DESAT blanking • Deadtime control • Functional safety
^ACPL-C361	5A, 2.5A	-
^ACPL-C362	5A, 2.5A	Active Miller clamp

^ Advance information subject to change.

Functional safety for motor drive with ACFJ-3405

Safe Torque Off (STO)

Figure 8. Motor drive functional safety with STO-signal



Motor drive functional safety standard, IEC 61800-5-2 defines STO (Safe Torque Off) as the function to prevent force producing power to be provided to the motor. Two of such functions are:

- Function to disable power supply to gate drive
- Function to disable gate drive at the power stage

STO-signal can be sent to these two functions to stop the motor if faults at the power supply or the power stage are detected. The ACFJ-3405, slew rate control gate driver, has integrated functional safety features which can provide diagnostic(DIAG) feedbacks for the controller to issue the necessary STO-signal.

Table 3. ACFJ-3405 features for functional safety

ACFJ-3405 Features	Description of Fault and Actions	DIAG Signal	STO-Signal
Power Supply			
UVLO2	V_{CC2} under voltage. Gate driver locks output and reports status.	/UVLO /DIAG	Disable secondary power supply
OV2	V_{CC2} overvoltage. Gate driver reports status.	/UVLO	
UVLO1	V_{CC1} under voltage. Gate driver ignores PWM signal and reports status.	/UVLO	EN – Disable gate drive to prevent faulty primary IC PWM signal from driving LED1
Power Stage			
DESAT	Short circuit faults at the IGBT or Motor causing IGBT to desaturate. Gate driver softshuts IGBT and reports status.	/INT	EN – Disable gate drive to prevent damaging other IGBTs and motor
Gate Fault	Gate(Input) of IGBT is at different logic vs PWM signal. IGBT is not switching according to PWM. Gate driver reports status.	/DIAG	EN – Disable gate drive to prevent IGBT from driving the motor wrongly

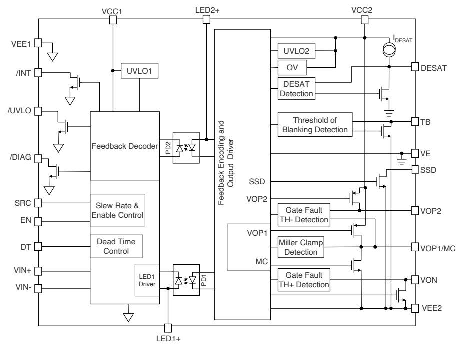
The ACFJ-3405 also has a built-in self test (BIST) feature to check the integrity of the DIAG feedbacks. If the LEDs of the PWM or DIAG signaling are not working, LED faults will also be feedback to the controller via /DIAG signal.

New product highlights – smart gate drive optocouplers

^ACFJ-3405

Slew rate control & functional safety

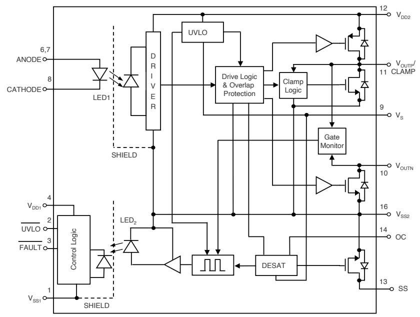
- 2-level(4A & 12A) of output drive
- Adaptive DESAT blanking
- DESAT detection with Soft shutdown protection and fault feedback
- Dead time control
- Gate status fault feedback
- UVLO/OV feedback
- Built-in Self-Test for LED1 & LED2
- -40ºC to +125ºC operating temperature



ACPL-355JC

10A peak output current

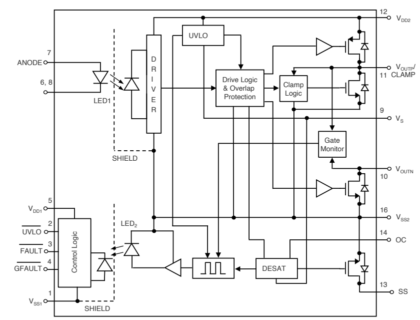
- CTI > 600V, material Group I package
- V_{IORM}=2262V_{PEAK} continuous working voltage
- Over current FAULT protection & feedback
- UVLO & feedback
- Integrated active Miller clamp
- CMTI >100 kV/µs



ACPL-352JC

5A peak output current

- Rail-to-rail dual output
- Over current FAULT protection & feedback
- UVLO & feedback
- Gate status fault feedback
- Adjustable soft shut
- Integrated active Miller clamp
- CMTI >100 kV/µs

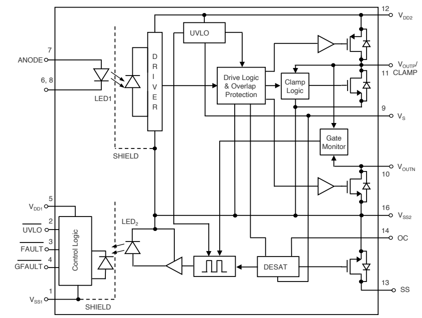


^ Advance information subject to change.

ACPL-339J

To drive external MOSFET buffer

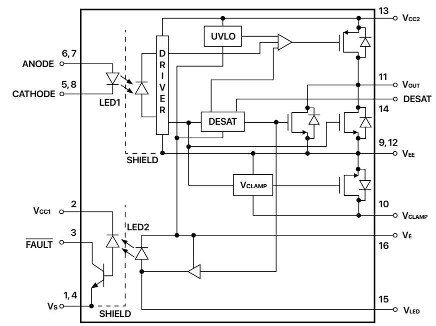
- Dual rail-to-rail output
- 1A peak output current
- Active timing control to prevent cross conduction in MOSFET buffer
- DESAT and UVLO detection with isolated fault feedback
- Adjustable soft shut down



ACPL-334J/338J

3A peak output current

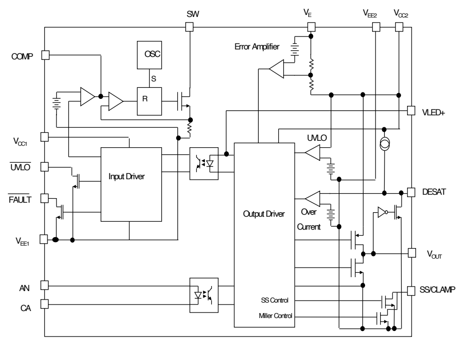
- Pin-to-pin drop-in to ACPL-332J/331J and ACPL-333J/330J
- Integrated active Miller clamp
- CMTI >100 kV/µs
- -40ºC to +125ºC operating temperature range



ACPL-302J

Integrated flyback controller for isolated DC-DC converter

- 2.5 A peak output current
- Rail-to-rail output voltage
- DESAT and UVLO detection with isolated fault feedback
- Integrated active Miller clamp



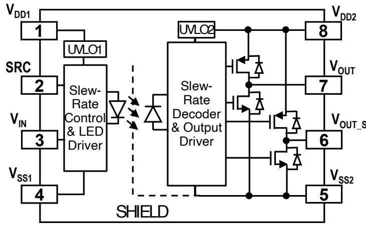
New product highlights – basic gate drive optocouplers

^ ACPL-C361/C362

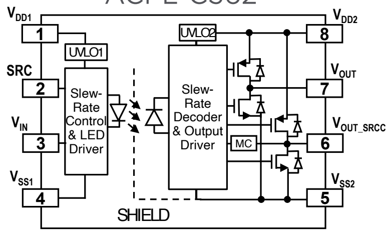
Slew rate control & miller clamp

- 2-level ON/OFF (2.5A & 5A) of output drive
- Compact SSO-8 package
- ACPL-C362 integrated with active miller clamp
- CMTI >100 kV/µs
- -40ºC to +125ºC operating temperature

ACPL-C361



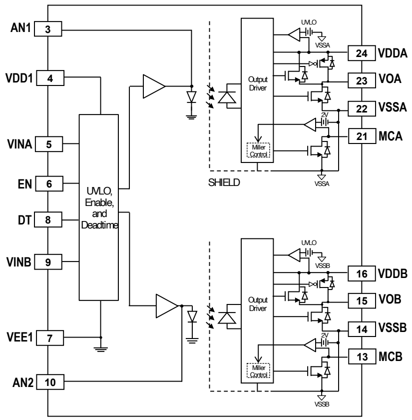
ACPL-C362



^ ACFJ-332B/302C

Dual Channel 4A peak output current with dead time control

- Dual channel gate drive
- Programmable dead time
- Fast propagation delay >65ns
- EN pin for enhanced safety
- Integrated active Miller clamp
- 3.5-mm creepage between 2 output drivers
- V_{IORM}=1414V_{PEAK} continuous working voltage
- High CMTI >150 kV/µs
- -40ºC to +125ºC operating temperature
- UVLO options
  - ACFJ-332B = 8V
  - ACFJ-302C = 12V

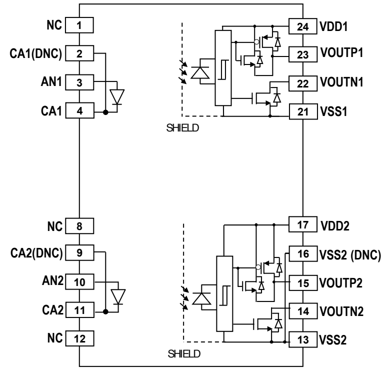


^ Advance information subject to change.

ACFJ-3262

Dual Channel 10A peak output current

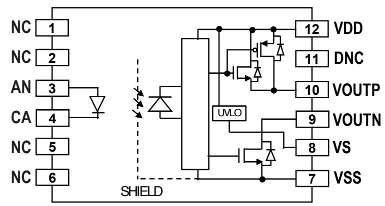
- Dual channel gate drive
- Separate source and sink pins
- Direct LED input
- Fast propagation delay >95ns
- 2.8-mm creepage between 2 output drivers
- CMTI >100 kV/µs
- CTI > 600V, material Group I package
- -40ºC to +125ºC operating temperature



ACFL-3161

Single Channel 10A peak output current

- Separate source and sink pins
- Direct LED input
- Fast propagation delay >95ns
- CMTI >100 kV/µs
- CTI > 600V, material Group I package
- -40ºC to +125ºC operating temperature



Smart Gate Drive Product Selection

Part No.	Package	$I_{F(ON)}$ mA Min.	I_{OUT} A Min.	I_{OUT} A Max.	t_{PLH} µs Max.	t_{PHL} µs Max.	P_{DD} µs Max.	V_{CC} V Max.	CMR - V/µs@V_{CM} CMR V/µs (Min.)	 V_{CM} V	V_{ISO} V_{RMS} Min.	V_{IORM} V_{PEAK}
NEW ACFJ-3405^	SO24	--	10	12	0.14	0.14	0.06	30	30000	1000	5000	1414
	- 2-Level output for slew rate control - Level 1 = 4A max. - Level 2 = 12A max. - Integrated DESAT protection - Functional safety FAULT reporting - Adaptive DESAT blanking - 4A active Miller clamp - Deadtime control											
NEW ACPL-355JC	SO16	8	7.5	10	0.14	0.14	0.075	30	100000	1500	5000	2262
	- 10A gate drive optocoupler for IGBT and SiC MOSFET - High working insulation voltage of $2262V_{PEAK}$ - Material group I with CTI >600V - Integrated active Miller clamp - Over current and UVLO detection with functional safety reporting											
ACPL-352J	SO16	8	4.5	5.0	0.15	0.15	0.075	30	100000	1500	5000	1414
	- 5A max. peak output current - Rail-to-rail dual output - Low propagation delay (<150ns) - SiC/GaN MOSFET ready - Functional safety reporting - Integrated active Miller clamp											
ACPL-302J	SO16	10	-	2.5	0.25	0.25	0.16	25	30000	1500	5000	1230
	– Integrated DC-DC Controller for floating power supply – Integrated short circuit protection and fault feedback – Under Voltage Lockout (UVLO) protection with feedback – Integrated active Miller clamp											
ACPL-339J	SO16	6	1.0	-	0.30	0.30	0.2	30	25000	1500	5000	1414
	– Scalable & Efficient gate drive design – Dual Rail-to-Rail output to drive external MOSFET buffer – Active timing control to prevent cross conduction in MOSFET buffer – Integrated short circuit protection and fault feedback											
ACPL-337J	SO16	9	3.0	4.0	0.22	0.25	0.15	30	30000	1500	5000	1414
ACPL-336J	SO16	9	2.0	2.5	0.22	0.25	0.15	30	30000	1500	5000	1414
	– Rail-to-rail output voltage – Integrated short circuit protection and fault feedback – Under Voltage Lockout (UVLO) protection with feedback – Integrated active Miller clamp and LED driver											
ACPL-335J	SO16	10	2.5	2.0	0.25	0.25	0.10	20	50000	1500	5000	1230
	– 2.5A MOSFET gate drive optocoupler – UVLO threshold for MOSFET protection – Over current threshold for MOSFET protection – Hard shut down for fast MOSFET protection											

Part No.	Package	$I_{F(ON)}$ mA Min.	I_{OUT} A Min.	I_{OUT} A Max.	t_{PLH} µs Max.	t_{PHL} µs Max.	P_{DD} µs Max.	V_{CC} V Max.	CMR - V/µs@V_{CM} CMR V/µs (Min.)	 V_{CM} V	V_{ISO} V_{RMS} Min.	V_{IORM} V_{PEAK}
NEW ACPL-334J ACPL-338J	SO16	8	2.0	3.0	0.135	0.135	0.005	30	100000	1500	5000	1414
	- ACPL-334J, drop-in replacement for ACPL-331J/ACPL-332J - ACPL-338J (auto-reset), drop-in replacement for ACPL-330J/ACPL-333J - 3A max. peak output current - Rail-to-rail output - -40°C to +125°C operating temperature range											
ACPL-333J ACPL-332J	SO16	8	2.0	2.5	0.25	0.25	0.15	30	50000	1500	5000	1414
	- 2.5A highly integrated gate drive optocoupler with active Miller clamp, over-current protection and fault feedback - Under Voltage Lockout (UVLO) protection with Hysteresis - Automatic fault reset after fixed delay time (for ACPL-333J-000E only)											
ACPL-331J ACPL-330J	SO16	8	1.0	1.5	0.25	0.25	0.15	30	50000	1500	5000	1414
	- 1.5A highly integrated gate drive optocoupler with active Miller clamp, over-current protection and fault feedback - Under Voltage Lockout (UVLO) protection with Hysteresis - Automatic fault reset after fixed delay time (for ACPL-330J-000E only)											
HCPL-316J	SO16	-	2.0	2.5	0.5	0.5	0.3	30	15000	1500	5000	1414
	- 2.0A highly integrated gate drive optocoupler with over-current protection and fault feedback - CMOS compatible - Under Voltage Lockout (UVLO) protection with Hysteresis											

^ Advance information subject to change.

Basic Gate Drive Product Selection

Part No.	Package	$I_{F(ON)}$ mA Min.	I_{OUT} A Min.	I_{OUT} A Max.	t_{PLH} µs Max.	t_{PHL} µs Max.	P_{DD} µs Max.	V_{CC} V Max.	CMR - V/µs@V_{CM} CMR V/µs (Min.)	V_{CM} V	V_{ISO} V_{RMS} Min.	V_{IORM} V_{PEAK}
NEW ACPL-C361^	Stretched SO8	-	2.1	4.2	0.16	0.16	0.06	30	100000	5000	5000	1414
NEW ACPL-C362^	Stretched SO8	-	2.1	4.2	0.16	0.16	0.06	30	100000	1500	5000	1414
NEW ACFL-3161	SO12	10	6.0	10	0.095	0.095	0.035	30	100000	1000	5000	1230
NEW ACNT-H343 ACNT-H343C^	15mm Stretched SO8	12	4.0	5.0	0.15	0.15	0.09	30	100000	1500	7500	2262
ACNU-3430	11mm SSO8	7	4.0	5.0	0.15	0.15	0.09	30	100000	1500	5000	1414
ACNU-3410	11mm SSO8	7	2.5	3.0	0.15	0.15	0.09	30	100000	1500	5000	1414
ACNW-3430	400 mil DIP	8	4.0	5.0	0.15	0.15	0.09	30	100000	1500	5000	1414
ACNW-3410	400 mil DIP	8	2.5	3.0	0.15	0.15	0.09	30	100000	1500	5000	1414
ACNT-H313	15mm Stretched SO8	7	2.0	2.5	0.5	0.5	0.35	30	40000	2000	7500	2262
ACNV-3130	500 mil DIP	12	2.0	2.5	0.5	0.5	0.35	30	40000	1500	7500	2262
ACPL-P349	Stretched SO6	7	2.0	2.5	0.11	0.11	0.05	30	100000	1500	3750	891*
ACPL-W349	Stretched SO6	7	2.0	2.5	0.11	0.11	0.05	30	100000	1500	5000	1140*
ACPL-P346	Stretched SO6	7	2.0	2.5	0.12	0.12	0.05	20	100000	1500	3750	891*
ACPL-W346	Stretched SO6	7	2.0	2.5	0.12	0.12	0.05	20	100000	1500	5000	1140*
ACPL-P347	Stretched SO6	7	0.8	1.0	0.11	0.11	0.05	30	100000	1500	3750	891*
ACPL-W347	Stretched SO6	7	0.8	1.0	0.11	0.11	0.05	30	100000	1500	5000	1140*
ACPL-P345	Stretched SO6	7	0.8	1.0	0.12	0.12	0.05	20	100000	1500	3750	891*
ACPL-W345	Stretched SO6	7	0.8	1.0	0.12	0.12	0.05	20	100000	1500	5000	1140*
ACPL-P343	Stretched SO6	7	3.0	4.0	0.20	0.20	0.1	30	35000	1500	3750	891*
ACPL-W343	Stretched SO6	7	3.0	4.0	0.20	0.20	0.1	30	35000	1500	5000	1140*
ACPL-P341	Stretched SO6	7	2.5	3.0	0.20	0.20	0.1	30	35000	1500	3750	891*
ACPL-W341	Stretched SO6	7	2.5	3.0	0.20	0.20	0.1	30	35000	1500	5000	1140*
ACPL-P340	Stretched SO6	7	0.8	1.0	0.20	0.20	0.1	30	35000	1500	3750	891*
ACPL-W340	Stretched SO6	7	0.8	1.0	0.20	0.20	0.1	30	35000	1500	5000	1140*
ACPL-H342	Stretched SO8	7	2.0	2.5	0.35	0.25	-0.2	30	40000	1500	3750	891*
ACPL-K342	Stretched SO8	7	2.0	2.5	0.35	0.25	-0.2	30	40000	1500	5000	1140*
ACPL-312U	300 mil DIP	7	2.0	2.5	0.5	0.5	0.35	30	25000	1500	3750	630
ACPL-H312	Stretched SO8	7	2.0	2.5	0.5	0.5	0.35	30	15000	1500	3750	891*
ACPL-K312	Stretched SO8	7	2.0	2.5	0.5	0.5	0.35	30	15000	1500	5000	1140*

Part No.	Package	$I_{F(ON)}$ mA Min.	I_{OUT} A Min.	I_{OUT} A Max.	t_{PLH} µs Max.	t_{PHL} µs Max.	P_{DD} µs Max.	V_{CC} V Max.	CMR - V/µs@V_{CM} CMR V/µs (Min.)	V_{CM} V	V_{ISO} V_{RMS} Min.	V_{IORM} V_{PEAK}
ACPL-P302	Stretched SO6	7	0.2	0.4	0.7	0.7	0.5	30	10000	1000	3750	891*
ACPL-P314	Stretched SO6	8	0.4	0.6	0.7	0.7	0.5	30	25000	1000	3750	891*
ACPL-W302	Stretched SO6	7	0.2	0.4	0.7	0.7	0.5	30	10000	1000	5000	1140*
ACPL-W314	Stretched SO6	8	0.4	0.6	0.7	0.7	0.5	30	25000	1000	5000	1140*
ACNW3190	400 mil DIP8	10	4.0	5.0	0.5	0.5	0.3	30	15000	1500	5000	1414
ACNW3130	400 mil DIP8	10	2.0	2.5	0.5	0.5	0.35	30	40000	1500	5000	1414
ACPL-3130	300 mil DIP8	7	2.0	2.5	0.5	0.5	0.35	30	40000	1500	3750	630*
ACPL-J313	300 mil DIP8	7	2.0	2.5	0.5	0.5	0.35	30	40000	1500	3750	1230
ACPL-T350	300 mil DIP8	7	2.0	2.5	0.5	0.5	0.35	30	15000	1500	3750	630*
HCNW3120	400 mil DIP8	10	2.0	2.5	0.5	0.5	0.3	30	25000	1500	5000	1414
HCPL-J312	300 mil DIP8	7	2.0	2.5	0.5	0.5	0.35	30	25000	1500	3750	1230
HCPL-J314	300 mil DIP8	8	0.4	0.6	0.7	0.7	0.5	30	25000	1500	3750	891
HCPL-T250	300 mil DIP8	7	0.5	1.5	0.5	0.5	-	30	5000	600	3750	630*
HCPL-T251	300 mil DIP8	8	0.1	0.4	1.0	1.0	-	30	10000	600	3750	-
HCPL-0302	SO8	7	0.2	0.4	0.7	0.7	0.5	30	10000	1000	3750	566*
HCPL-0314	SO8	8	0.4	0.6	0.7	0.7	0.5	30	25000	1000	3750	566*
HCPL-3020	300 mil DIP8	7	0.2	0.4	0.7	0.7	0.5	30	10000	1000	3750	630*
HCPL-3120	300 mil DIP8	7	2.0	2.5	0.5	0.5	0.35	30	25000	1500	3750	630*
HCPL-3140	300 mil DIP8	8	0.4	0.6	0.7	0.7	0.5	30	25000	1000	3750	630*
HCPL-3150	300 mil DIP8	7	0.5	0.6	0.5	0.5	0.35	30	15000	1500	3750	630*
HCPL-3180	300 mil DIP8	10	2.0	2.5	0.2	0.2	0.09	20	10000	1500	3750	630*
NEW ACFJ-3262	SSO24	4.2	6.0	10	0.095	0.095	0.025	25	100000	1000	5000	1230
NEW ACFJ-332B (8V UVLO)	SSO24	0.16	2.4	4.0	0.065	0.065	0.03	25	150000	1500	5000	1414*
NEW ACFJ-302C^ (12V UVLO)	SSO24	0.16	2.4	4.0	0.065	0.065	0.03	25	150000	1500	5000	1414*
HCPL-314J	SO16	0.06	0.4	0.6	0.7	0.7	0.5	30	25000	1500	5000	1414
HCPL-315J	SO16	30	0.5	0.6	0.5	0.5	0.35	30	15000	1500	5000	1414

*with IEC/EN 60747-5-5 Option 060.

^ Advance information subject to change.

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