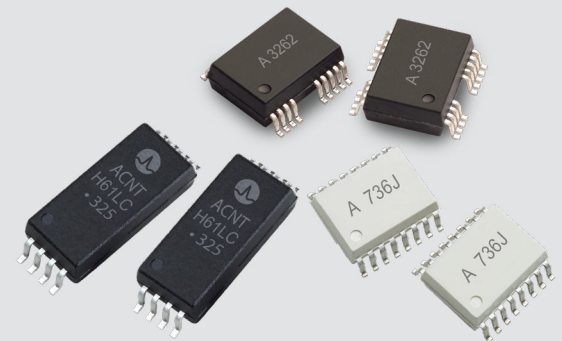




## Going Green?

Protect with Broadcom Optocouplers



# Broadcom Optocouplers

## Enabling Green Energy Applications

Broadcom optocouplers are used in an array of **green applications** ranging from **solar** and **wind inverters**, **energy storage**, **automotive electric vehicles** and **charging** and **power supplies**. The primary purpose of an optocoupler is to provide both electrical insulation and signal isolation.

Optocouplers eliminate the effects of electrical noise caused by crosstalk, power glitches and electrical interference. They provide high voltage isolation allowing safe interface between high and low voltages in electrical circuits.

Broadcom's key optocoupler products include gate drivers for driving power switches like IGBT, SiC and GaN, isolation amplifiers for phase current and bus voltage measurements, high speed digital optocoupler for data transmission and communication.

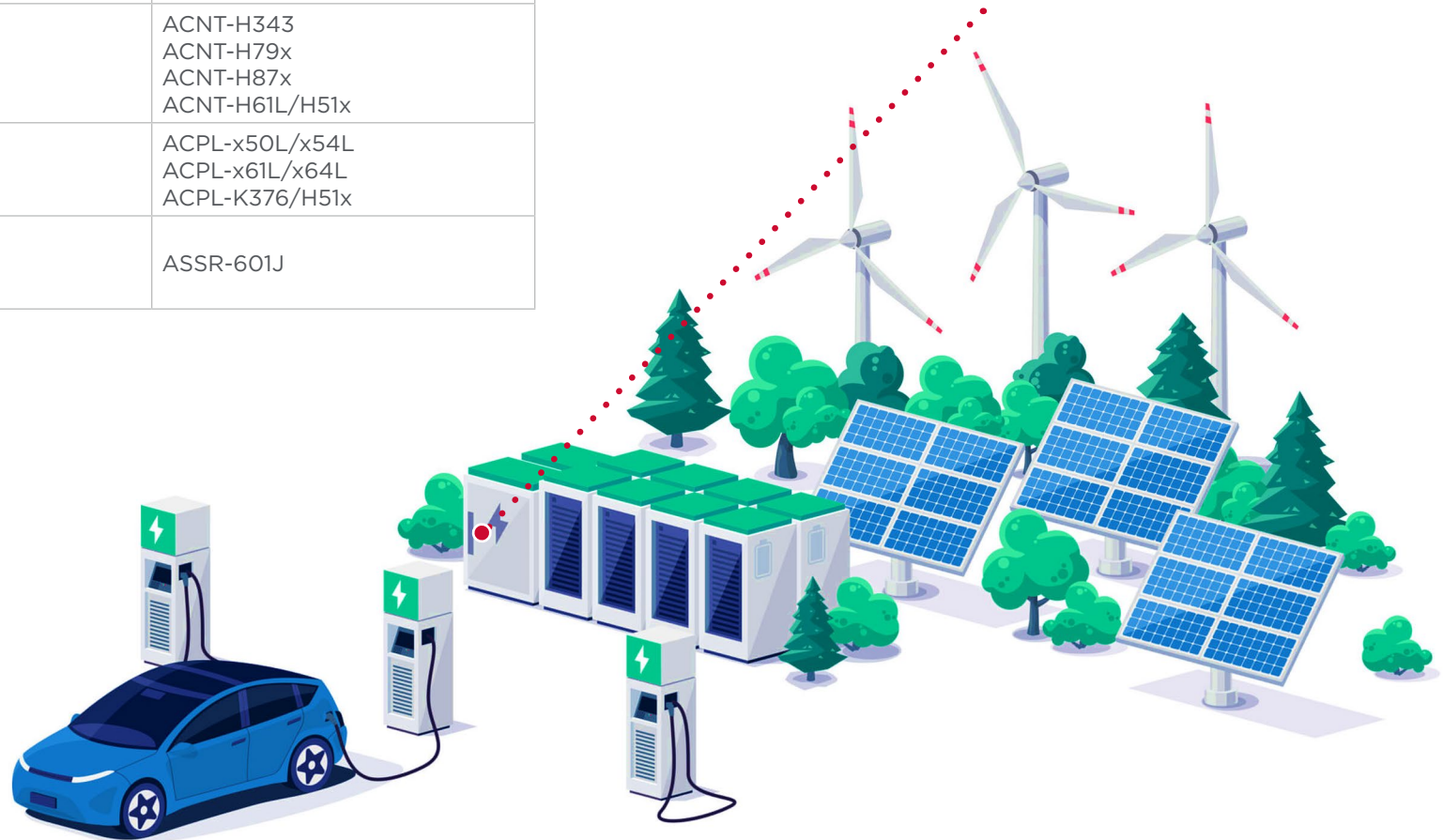
The popularity of Broadcom optocouplers in these green applications is due to their ability to **drive inverters more efficiently**, to **reduce copper losses by providing high insulation voltage** and to **consume less power during current sensing and data transmission**.



# Industrial Applications

Product Family	Part Number
10A Gate Driver	ACPL-355C ACFL-3161 ACFJ-3262
+/- 50mV Isolation Amplifier	ACPL-C72B/A/0 ACPL-736J
ACNT 15mm	ACNT-H343 ACNT-H79x ACNT-H87x ACNT-H61L/H51x
Low Power Digital	ACPL-x50L/x54L ACPL-x61L/x64L ACPL-K376/H51x
Solid State Relays	ASSR-601J

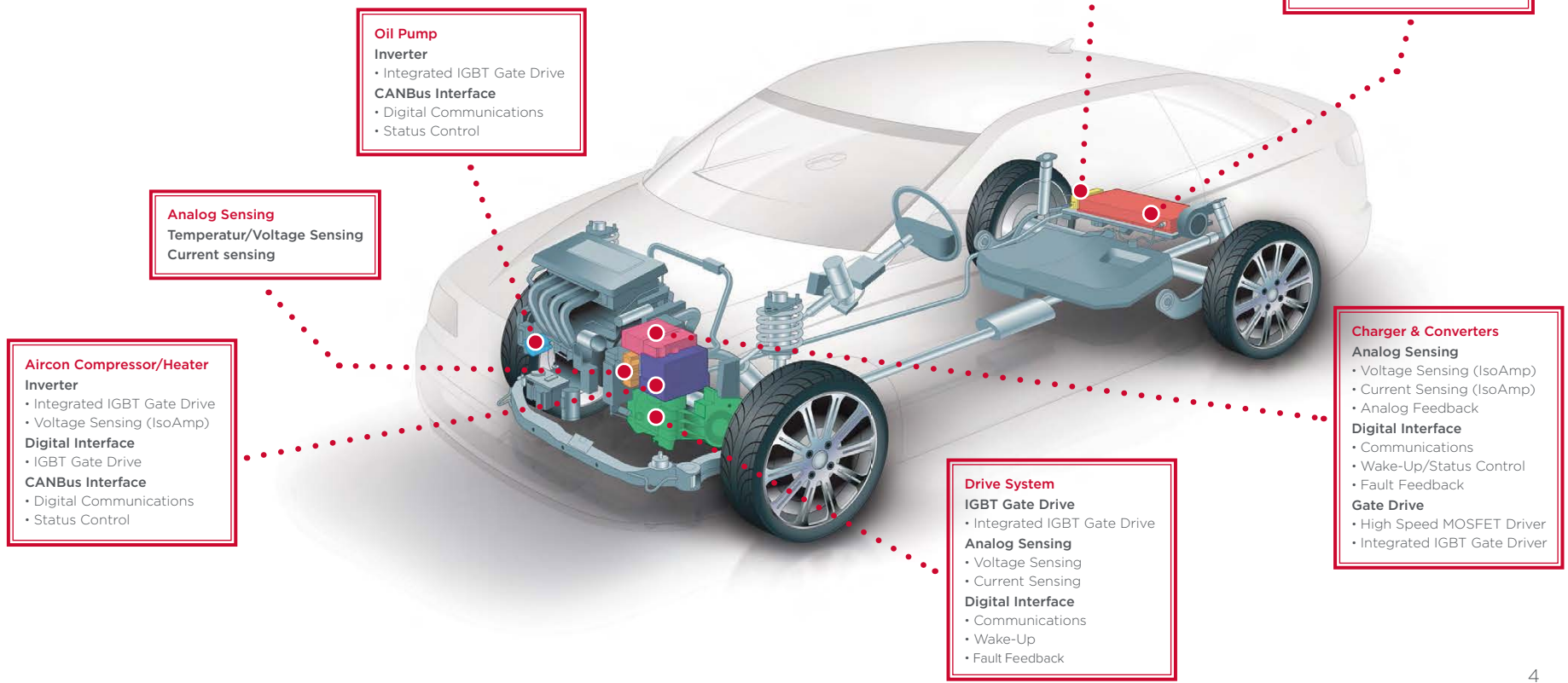
Green Energy Conversion  
Protect with Broadcom Optocouplers



# Automotive Applications

## Supporting the reduction of carbon emission

	Gate Driver	Voltage / Current Sensor	Digital	Photo MOSFET
Charger	✓	✓	✓	✓
Inverter	✓	✓	✓	✓
HVAC*	✓	✓	✓	✓
DC/DC	✓	✓	✓	✓
Oil Pump			✓	✓
BMS		✓	✓	✓



**Aircon Compressor/Heater Inverter**

- Integrated IGBT Gate Drive
- Voltage Sensing (IsoAmp)

**Digital Interface**

- IGBT Gate Drive

**CANBus Interface**

- Digital Communications
- Status Control

**Analog Sensing**

- Temperatur/Voltage Sensing
- Current sensing

**Oil Pump Inverter**

- Integrated IGBT Gate Drive

**CANBus Interface**

- Digital Communications
- Status Control

**CANBUS Interface**

- Digital Communications
- Status Control

**Battery Management System**

**Battery Pack Monitoring**

- Voltage Sensing (IsoAmp)

**Battery Cell Management**

- Digital Communications
- Wake-Up/Status Control
- Fault Status Feedback

**CANBus Interface**

- Digital Communications
- Status Control

**Drive System**

**IGBT Gate Drive**

- Integrated IGBT Gate Drive

**Analog Sensing**

- Voltage Sensing
- Current Sensing

**Digital Interface**

- Communications
- Wake-Up
- Fault Feedback

**Charger & Converters**

**Analog Sensing**

- Voltage Sensing (IsoAmp)
- Current Sensing (IsoAmp)
- Analog Feedback

**Digital Interface**

- Communications
- Wake-Up/Status Control
- Fault Feedback

**Gate Drive**




- High Speed MOSFET Driver
- Integrated IGBT Gate Driver

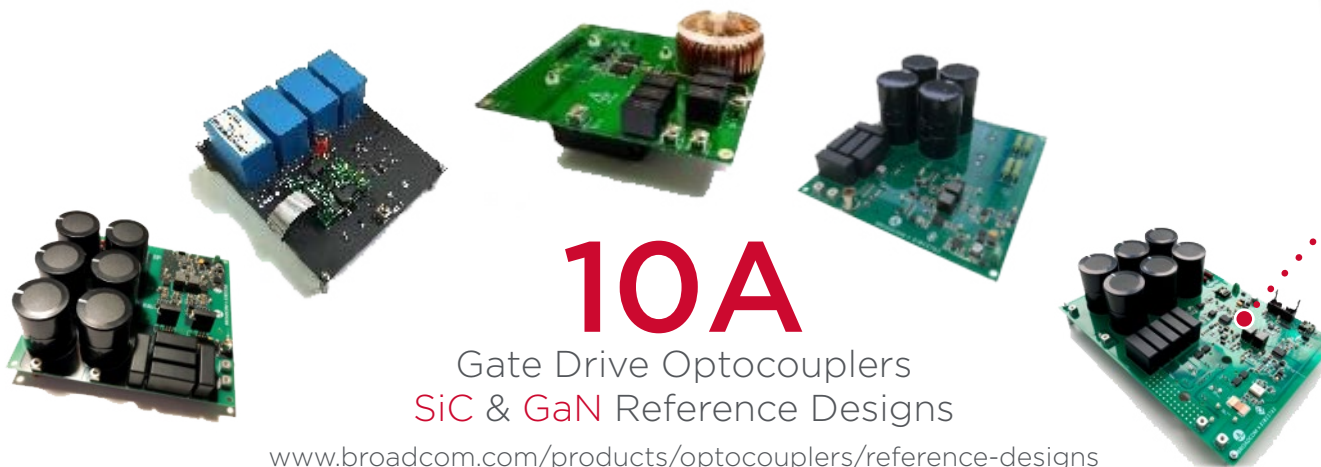
# Gate Drive Optocouplers

## 10A gate drive optocouplers enable efficient green power conversion

The green energy harnessed needs to be conditioned before it can be used for household needs, for charging electric vehicles or be fed into the grid. The conditioning process is done using a power inverter or converter which consists of power switches like the IGBT. With the emergence of **wide bandgap semiconductors, Silicon Carbide (SiC)** and **Gallium Nitride (GaN)** power switches, **the efficiency of power conversion has reached new heights of 99%.**

To enable SiC and GaN power switches, Broadcom has released **10A gate drive optocouplers** to drive them efficiently, with **low conduction and switching losses**. These 10A drivers come with **smart FAULT protection** features, in **single or dual channels**, and can withstand more than **100kV/ $\mu$ s of noise immunity (dv/dt)**.

Gate Drive Optocouplers	Features & Benefits
ACPL-355JC with DESAT Protection	• 10A • 100kV/ $\mu$ s of noise immunity (dv/dt) • High insulation voltage up to 2262V <sub>PK</sub>
Single Channel : ACPL-3161T  , ACFL-3161	
Dual-Channel : ACFJ-3262T  , ACFJ-3262	
ACFJ-3439T with DESAT Protection 	• Up to 17A



[www.broadcom.com/products/optocouplers/reference-designs](http://www.broadcom.com/products/optocouplers/reference-designs)

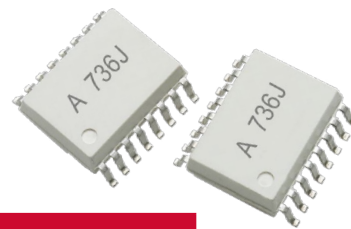
# Isolation Amplifiers

## ±50mV isolation amplifiers designed for efficient high current sensing

Isolation amplifiers are widely used for current and voltage sensing in renewable energy systems such as solar inverter systems and wind power converter systems

In a typical solar inverter system, voltage sensors are used to measure the bus voltage of the DC-AC inverter while current sensors are used to measure the output current of the DC-AC inverter. They have a **high gain accuracy of ± 0.5%** and excellent linearity for precise, stable and accurate measurements.

Our **±50mV** linear input range isolation amplifiers are capable of **lower shunt power dissipation while measuring high current**. They are available in compact packages that meet worldwide safety approvals and are RoHS compliant.



Isolation Amplifier Optocouplers	Features & Benefits
ACPL-C72B/A/O	• ±50mV linear input range
ACPL-736J	• High gain accuracy of ±0.5% / ±1% / ±3%
ACPL-C87BT/AT	• Very low shunt power dissipation
	• DC Voltage Sensor (+2.0V, 0.5% /1%)



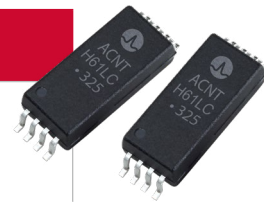
# ACNT Optocouplers

## 15mm package technology enables high voltage applications to achieve high power conversion efficiency

In renewable energy generation, storage and rail traction control systems, there is a trend for higher DC bus operation and transient over voltage requirements. For example, new solar systems have been upgrading to 1500VDC in recent years with the target of increasing the power density by increased voltage. This allows the system to **achieve high power conversion efficiency by not increasing current which will result in copper losses**. The key challenge of the 1500V system is sourcing components that meets the high voltage electrical safety and worldwide certification standards.

This can be overcome with Broadcom's innovative ACNT package which features 15mm wide creepage in a compact package footprint, and can provide enhanced high voltage protection ( $2262V_{PK}$ ) and signal isolation in tight spaces. It also improves common mode transient immunity (CMTI) greater than  $100\text{ kV}/\mu\text{s}$  for gate drive products, thus effectively minimizing erroneous switching failures. The ACNT package is an ideal fit for such high voltage applications.

Optocouplers in ACNT package	Features & Benefits
ACNT-H343 Gate Drive	ACNT Package <b>15mm Creepage</b> Highest Working Voltage $2262V_{PK}$
ACNT-H79B/A/O Current Sense	
ACNT-H87B/A/O Voltage Sense	
ACNT-H61L/H61LC 10MBd	
ACNT-H50L/H511/H511C 1MBd	

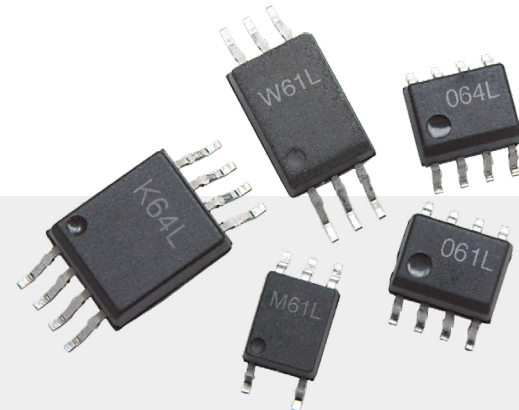


# Digital & Specific Function Optocouplers

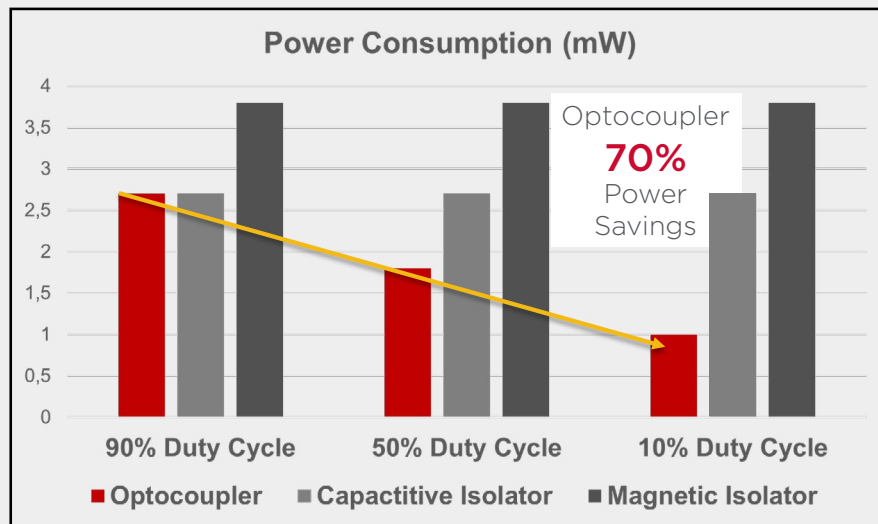
## Unique low-power features for power-efficient applications


Broadcom's LED-input optocouplers **consume very little** power especially when they are not transmitting, **unlike capacitive and magnetic-based isolators** which are in a continuous on state, regardless of the output logic. This unique feature makes optocouplers the **most power-efficient** choice for applications operating in extended standby mode, or where duty cycles are low.

Even when the optocouplers are actively transmitting, the low input current (~1.6mA) coupled with a low turn on voltage (~1.3V) of the LED ensures that optocouplers are always energy efficient and cool to operate.



Optocouplers lead in low power consumption!



Low Power Optocouplers	Description
ACPL-M50L/054L/W50L/K54L	1MBd, Open-collector output
ACPL-M61L/064L/W61L/K64L	10MBd, CMOS output
ACPL-K376	AC/DC Voltage/Current Detector
ACPL-M417T/M419T	80V Transistor Output. Low IF with high gain 



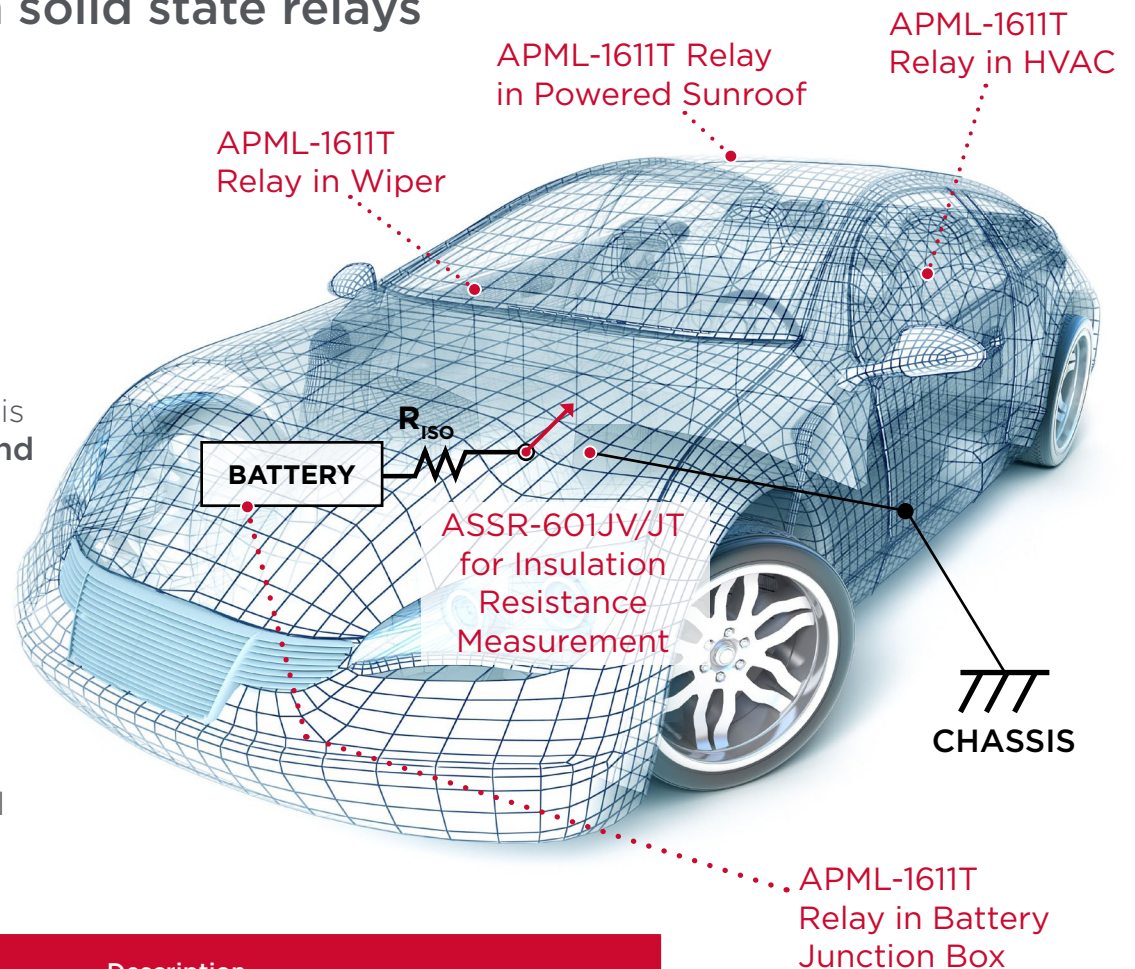
# Photovoltaic MOSFET & Driver in Electric Vehicles




## Replace mechanical relays with solid state relays

**Solid state relays (SSR)** have been replacing mechanical relays because of their higher reliability, faster switching time, absence of switching bounce, and smaller size. However, some designers are reluctant to switch from mechanical relays to their solid state equivalent because some solid state relays have higher relative ON resistance and cost more. One alternative, that addresses both of these issues, is to use a combination of a **photovoltaic driver and discrete MOSFETs to form a solid state relay.**

With the competitive prices of MOSFETs in the market today, using a photovoltaic driver combined with one or two discrete MOSFETs to form a solid state relay is a good choice to replace mechanical relays.

When combined with two back-to-back MOSFETs, the combination forms a bidirectional switch and the SSR becomes equivalent to 1FormA Electromechanical Relays (EMR).

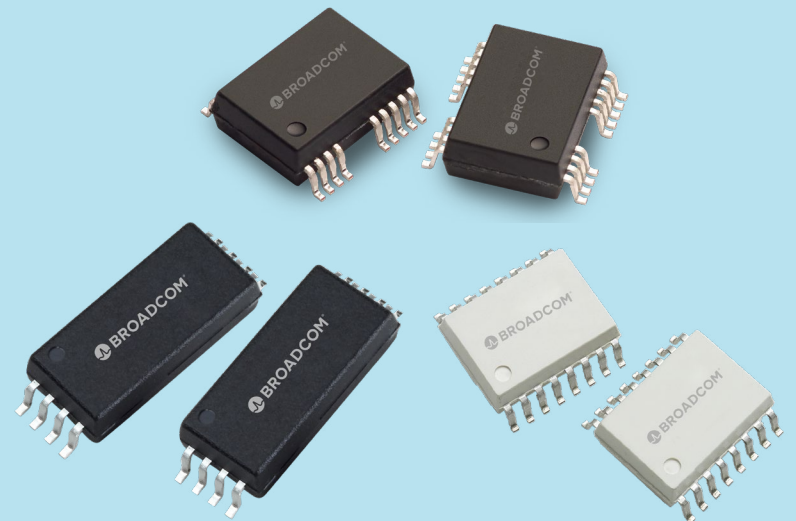


Photovoltaic MOSFET & Driver	Description
ACPL-K30T 	Photovoltaic MOSFET Driver. 7V open circuit voltage at $I_c = 10$ mA
ASSR-601JV/JT 	1500V Photo MOSFET with 1uA leakage current
APML-1611T 	60V/2.5A Photo MOSFET to replace low voltage expensive mechanical relays

# Optocouplers Product Stewardship

Broadcom strives to provide the highest quality products while ensuring compliance with the relevant regulatory requirements, including RoHS, REACH and regulations related to Conflict Minerals. Refer to [Broadcom's Environmental, Social & Governance \(ESG\) report](#) for more information on environmental stewardship.

-  RoHS
-  REACH
-  TSCA
-  China VOC



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