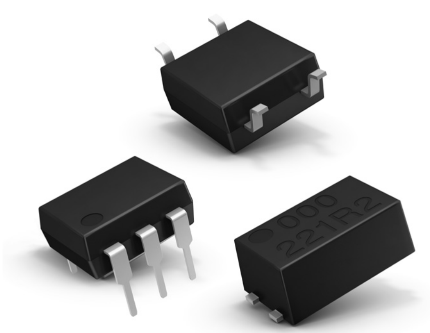
Panasonic
INDUSTRY

Photovoltaic MOSFET drivers

MOSFETs have become a popular choice as power semiconductors in many applications. To guarantee safe and efficient switching, the use of a driver can be necessary. Photovoltaic MOSFET drivers from Panasonic Industry provide galvanic isolation and reduce parts without the need for an additional power supply.

Application Note



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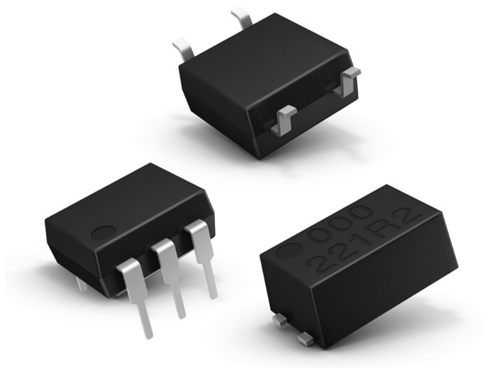
Galvanic isolation



Product

Photovoltaic MOSFET drivers APV***

Purpose

Switch MOSFETs galvanically isolated and more efficiently with photovoltaic MOSFET drivers

Features

Fast switching up to 0.1 ms

High isolation between 1,500 V and 5,000 V

Available as SSOP, SOP4-pin and DIP6-pin

Drop-out voltage (typ.) up to 8.7 V

Short-circuit current (typ.) up to 14µA

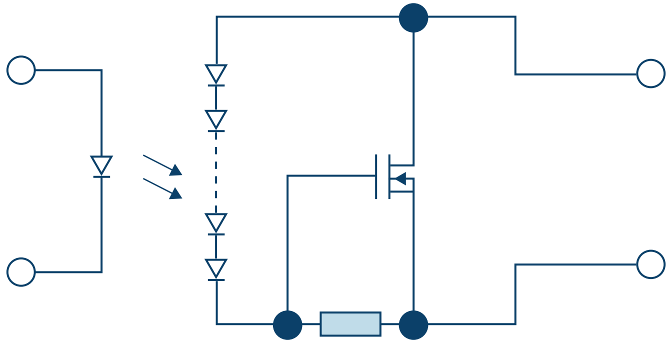
Galvanic isolation

Facts & Figures

From energy storage to manufacturing equipment and machinery – MOSFET power semiconductors will be an integral part of many future industries. For applications where galvanic isolation of the input and load circuit is required, Panasonic Industry offers a range of photovoltaic MOSFET drivers to help switch the load MOSFET. This driver minimizes the need of additional parts and power supplies while providing reliable isolation.

Essentially, the MOSFET driver functions as an isolated voltage source powered by an input LED. When current flows through the input side, the LED emits light to a photodiode array (PDA). To ensure galvanic isolation between the input and output circuits, the light travels through a transparent silicon resin.

Due to the p-n junction inside the solar cells of the PDA, the photons produce an electron-hole pair, resulting in a voltage drop. A load circuit can be powered with the voltage, but maximum current is determined by the number of electron-hole pairs created by the photons. If too much current is drawn out of the solar cells, the photovoltage will drop to zero. As a result, the solar cells show a nonlinear I-V characteristic. If the device's output is used as a power supply for electrical circuits, connecting the solar cells to the load circuit may be sufficient. When using the device for switching capacitive loads, a connection for discharging the load circuit must be supplied to enable fast turn-off times. This is achieved by the normally-closed MOSFET in the driver.

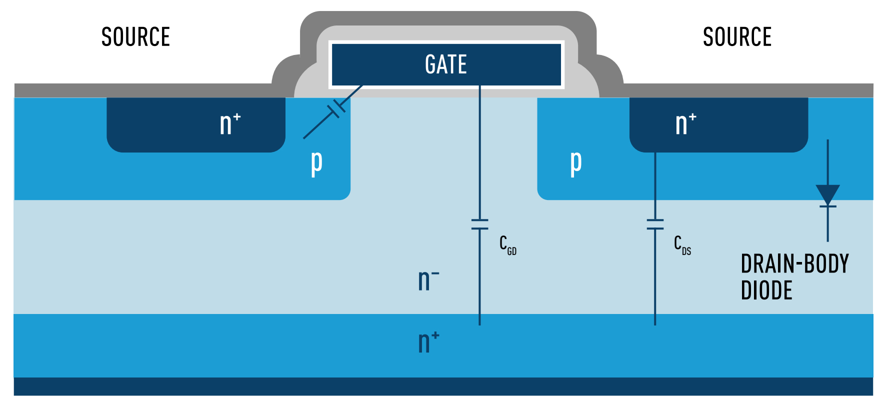


Galvanic isolation

Facts & Figures

This B-Form MOSFET is conductible in the default state and the generated current flows via its drain to the source. Since the current flows through the resistor, a gate-source voltage drop is caused and the MOSFET switches into an off-state. At this point, the generated photovoltage and current are available at the output pins of the device. If no more current is produced from the solar cells, a capacitive load will start discharging itself through the driver, and the current is reversed. This forces a positive gate-source voltage, making the internal MOSFET conductible and thus providing a path for discharging the load. The results are unusually fast turn-off times, which are extremely helpful when power MOSFETs are involved in the load circuit. The switching characteristics of these power MOSFETs are determined by the capacitors formed between the structures of gate, source and drain in each MOSFET cell. As the source and drain connections are on the top or bottom side of the wafer, cells can easily be connected in parallel to carry higher currents.

Once a certain threshold voltage is reached, the drain current of the power MOSFET increases to a full load current. In order to reach the required drain-source voltage to switch the MOSFET into an on-state, the drive current is now needed, and the gate-drain capacity has to be discharged. The value of this capacity, often referred to as the Miller capacity, is voltage-dependent and contributes most to the switching speed of the MOSFET. For a typical power MOSFET, switching speed is approximately 50 ns, but due to the control circuit inside the MOSFET driver, turn-off times of 0.1 ms can be achieved.



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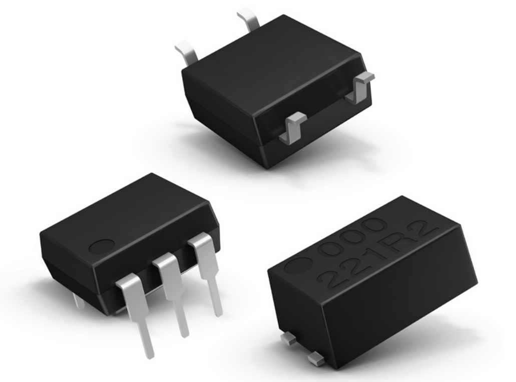
Get here the PhotoMOS® relay App!



Application Note - How to solve various tasks with Photovoltaic MOSFET drivers
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Contact: Panasonic Industry Europe GmbH, photomos@eu.panasonic.com
Notes: Data and descriptions in this document are subject to change without notice.
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