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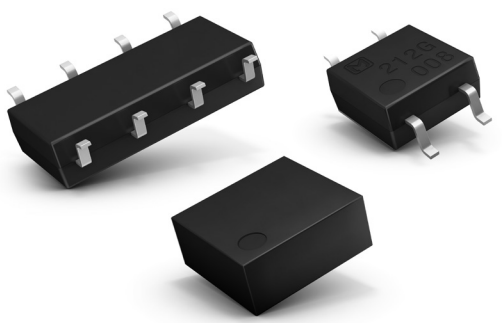
Normally-closed PhotoMOS® relays

From air conditioning to gas valves: Normally-closed relays are the norm in most emergency cut-off applications. Panasonic Industry brings the performance of PhotoMOS® relays to type switching.

Application Note



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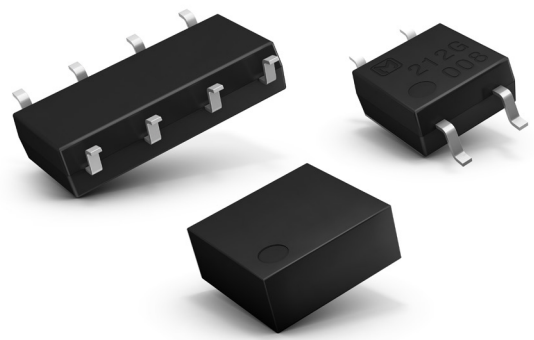
Emergency cut-off



Product

Normally-closed PhotoMOS® relays AQ*4***

Purpose

Reliable switching for applications that require an alarm contact setting or time-delay relays.

Features

1 Form B or 2 Form B output configuration

Available in SSOP, SOP, DIP, Power DIP and SIL packaging

Power dissipation between 75mW and 550mW

4 pin, 6pin or 8 pin

Max. load voltage up to 400V

AC/DC switching

Safety standards UL/C-UL, VDE, or BSI

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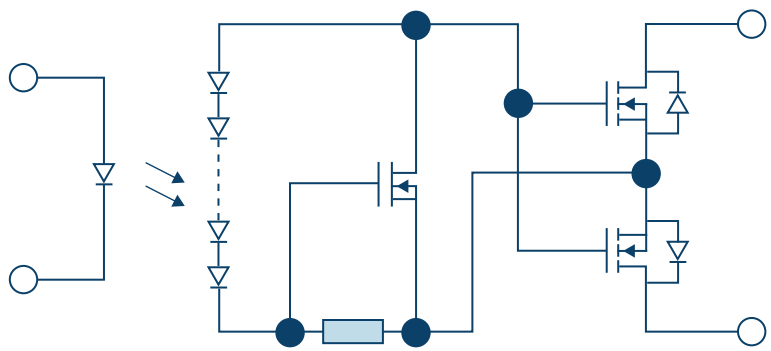
Facts & Figures

Reduced size and weight, low power consumption, longer lifetime, and higher reliability – PhotoMOS® relays bring many advantages to a wide range of switching applications. With its range of normally-closed PhotoMOS® relays, Panasonic Industry brings the power of a semiconductor relay to scenarios that use an emergency cut-off or a delayed relay response, such as air conditioning or applications involving volatile or explosive materials.

A PhotoMOS® relay consists of several elements: An LED diode on the input side emits light to a photodiode array (PDA), which converts the incoming light into electrical current and voltage. These in turn drive two power MOSFETs on the output side. An intermediate control circuit is responsible for the safe and reliable turn-on and turn-off of the output MOSFETs once a certain trigger current is reached.
While this basic topology is true for all kinds of PhotoMOS® relays, the special characteristics of a normally-closed (also known as Form-B type) relay require some adjustments. During normal operation, no input signal is supplied – the switch is conductible and closed. Only in case of a malfunction will the relay be activated and the load side interrupted until the fault is cleared.

In order to achieve this, two depletion-type MOSFETs are used on the output side to keep them in a conducting state at zero input current. This type of MOSFET has a thin layer of n-type Si just below the gate-insulating layer, which forms a conducting channel between source and drain. Therefore, a current can occur even without gate-source voltage. Due to this structure, the on-resistance is higher than for normally-open types, leading to a smaller load current while maintaining the same switching voltage.



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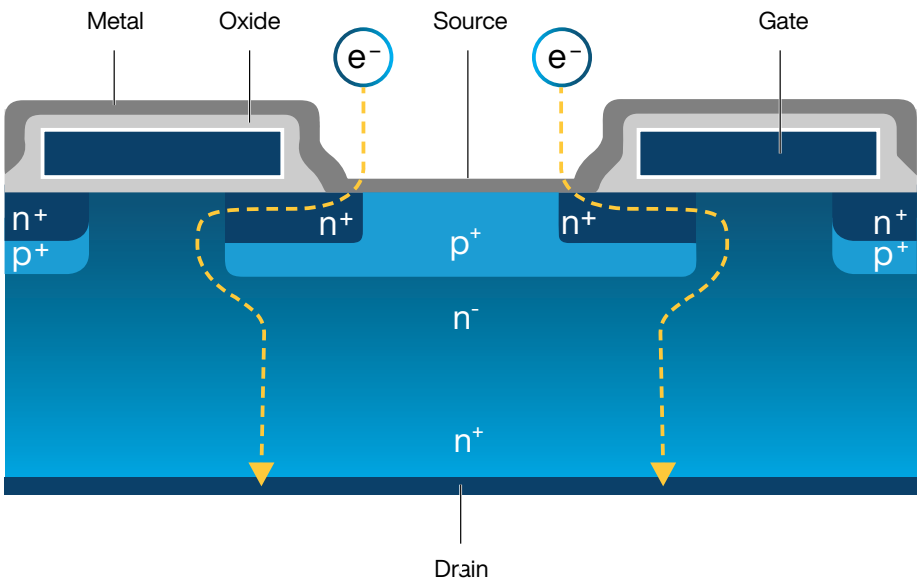
Facts & Figures

The gate of the MOSFET is operated with the help of the control circuit by optimizing turn-on and turn-off time. A normally-closed PhotoMOS® relay employs an array of solar cells with a control circuit to apply a voltage between the gate and source of the output transistors. The gate voltage is negative in reference to the source pins of the coupled transistors. Activation time depends on the time required to charge the MOSFET's gate capacity. Therefore, operation time depends on the LED current supplied.

Normally-closed PhotoMOS® relays are available in a variety of packaging sizes and load voltages, making the relays suitable for a broad range of applications. For example, the MOSFET's on-resistance can be reduced by connecting several transistor cells in parallel, thus increasing overall size. Because of the different heat transfer characteristics, the package also determines the maximum allowable power dissipation.

While typically used for alarm contacts, normally-closed PhotoMOS® relays can also be combined with a normally-open relay to realize changeover contacts (1-Form-C).

In such configurations, however, a delay element, e.g. a speed-down circuit, usually needs to be inserted in the control unit.



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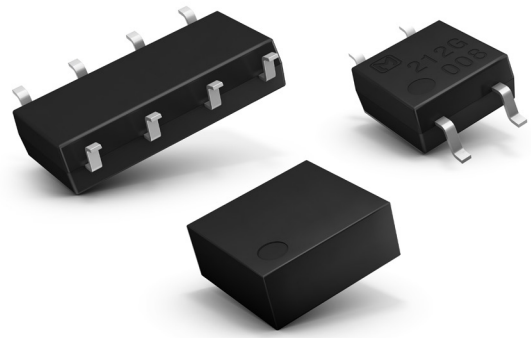
more about PhotoMOS® technology

Get
here the PhotoMOS® relay App!



Application Note - How to solve various tasks with normally-closed PhotoMOS® relays
Date: April 2024
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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