

# SPDT MOSFET Relay Module (P/N: G3VM-66M)

# OMRON

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## The New SPDT MOSFET Relay Module provides Longer Operating Life, Reduces Mounting Space and Design Time

### Overview

Semiconductor Equipment and Test Technologies are making rapid progress in terms of scale and performance. Along with it, the requirements to reduce the total cost of test by improving tester time and efficiency have challenged Test & Measurement technology to become more complex, by adding a higher number of test channels. From the perspective of the tester and handler interface board, many connection points in it's circuits are required to measure various functions of device under test. The test channels are optimized to measure the various functions for each device under test. As a result, difficulty of component placement in high density circuit design has increased.

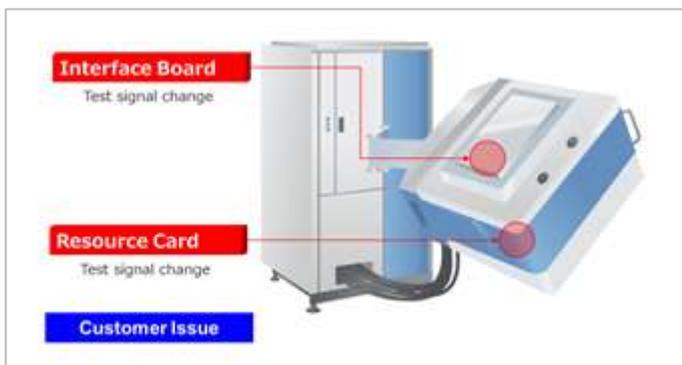


Figure 1

ATE consists of functional modules, and they are categorized by the functions they perform. For example: mechanical moving parts, motion control, electrical control, etc.. The "Interface Board" and "Resource Card" are inside of the equipment and their function is to control measurement. Within their application, they have many connection change points in their circuit to measure various semiconductor functions (**Figure1**) and in order to perform this task, these boards generally utilize commercial Reed Relays or MOSFET Relays ( as per OMRON survey).

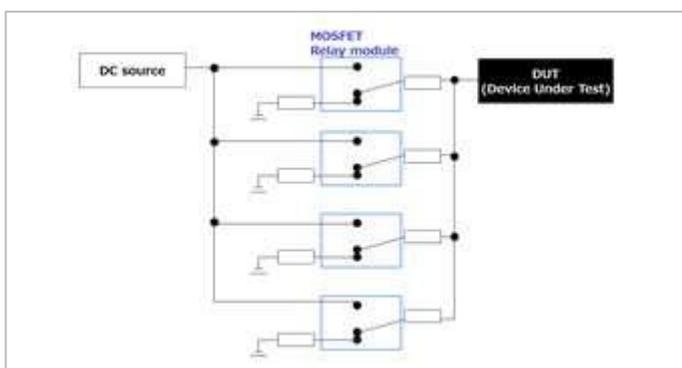


Figure 2

One example of measurement circuit in ATE is shown in (**Figure2**). The available DC voltage for measurement depends on the number of points connected to the DC source. If higher DC voltage is required for testing, more points will need to be connected; conversely, the lower the required DC voltage, the fewer connection points are needed. This connect/disconnect function is performed by a Relay.

The measurement circuit design is based on the semiconductor's product specification.

### Development introduction

Engineers are required to invest much time to design the measurement circuits for ATE and unfortunately, some of the components such as Reed Relays, have life cycle issues, requiring them to be replaced periodically due to wear-out failure of the parts. To solve this challenge, Omron has developed the new MOSFET module G3VM-66M with SPDT contact configuration offering the following benefits:

1. Reduction of Design Time
2. Reduction of Mounting Space
3. Longer Operating Life

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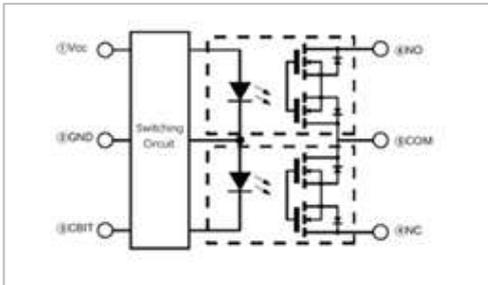


Figure 3

Our new module is a 6 pin device. **(Figure3)**  
PIN①~③ are input side and PIN④~⑥ are output side.

- ① Vcc
- ② GND
- ③ CBIT
- ④ NO (Normally Open)
- ⑤ CCM
- ⑥ NC (Normally Close)

### Feature1: Reduction of Design Time

As one solution to remove the costly issue of periodically replacing reed relays, the designer can select a MOSFET relay to be used at the connection change point. However, when selecting a MOSFET relay, it is necessary to select the outer load resistance to control it as well. Furthermore, it is also necessary to design the wiring pattern to create the SPDT circuit for verification purposes.

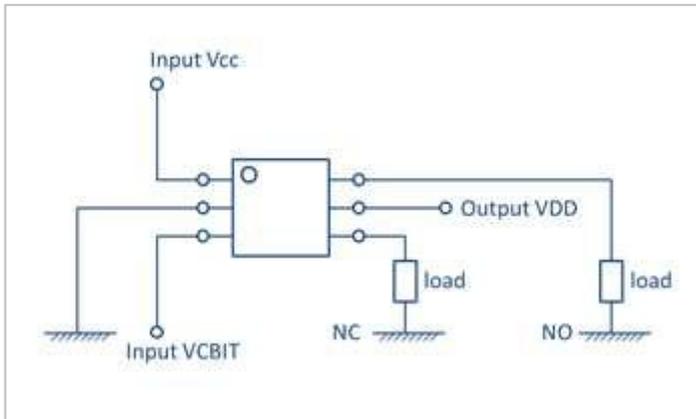


Figure 4

Omron's new MOSFET module offers embedded resistance so designers are released from the above burden, which will in turn lead to the shortening of the design cycle.

An example of circuit design is indicated in **(Figure4)**  
Three voltage supplies are needed to operate the module. Two are for the input side and one is for the output side. "Input Vcc" and "output VDD" are required. The timing diagram of the MOSFET module is described in the data sheet.

### Feature2: 80% Reduction of Mounting Space



Figure 5

As ATE Technology becomes more demanding and measuring circuits more complex, a higher number of test channels is required, increasing the amount of components utilized on the PCB. For this reason, reduction of mounting space is a constant concern. Generally, the footprint lay out of a SPDT product (comprised of 6 components) is about 250mm<sup>2</sup>\*. In response to this challenge, Omron has developed the new MOSFET module measuring a mere 50 mm<sup>2</sup>; providing customers with about 80% space saving and aiding wiring design process. **(Figure5)**

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### Feature3: Longer Operating Life

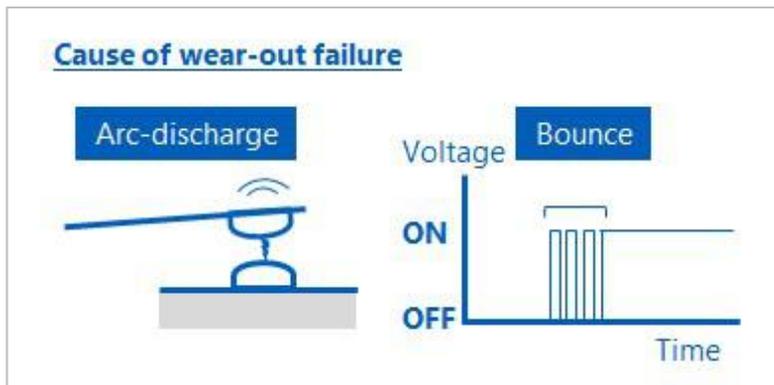


Figure 6

This new module is solid state so there is no concern of mechanical contact failure so the life of the product is very long compared to relay with mechanical contacts.

It is common knowledge that relays with mechanical contacts, such as reed relays, will wear out and fail much sooner than a solid state device under the same load conditions.

This wear-out failure occurs due to an arc-discharge that is created between the contacts when they are about to touch. Upon closing and opening the contacts, this electrical arc will wear down the contacts and can even cause welding. In addition, when contacts are closing, they can bounce which can cause excessive arcing premature contact failure. (Figure 6)

### Additional Feature: High speed switching

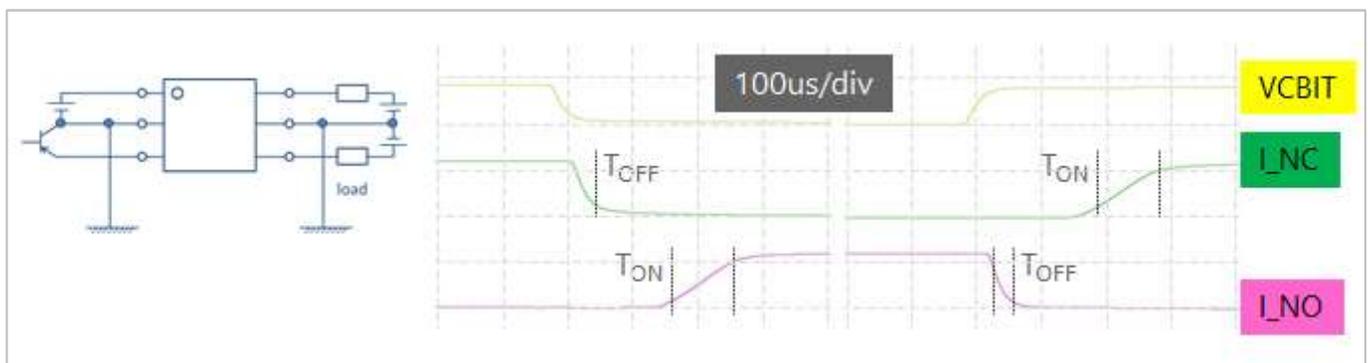


Figure 7

As more functions are required to the tester, the longer is the testing period. For this reason, it is important to improve testing time and efficiency in order to reduce the cost of testing. Omron's new module contributes to High Speed Switching by having a typical Turn-ON and Turn-OFF times much smaller than typical reed relays. (Figure 7)

The measurement circuit is shown on the left side of the above diagram and the switching wave form is shown on the right side. As per the data sheet, our module can be controlled by changing the VCBIT level with Vcc steady input. If VCBIT is in low level, the NC line immediately turns off and the NO line turns on. Conversely if VCBIT is in high level, the NO line immediately turns off and the NC line turns on. The actual value of the turn on time is lower than 0.3ms for both the NO and NC lines, and the turn off time is lower than 0.1ms for both the NO and NC circuits. Our switching time specification is decided with some tolerance margin. All products shipped are guaranteed to meet the specified operate time and release time, each with a maximum time of 1.0ms.

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### Additional Feature: Low leakage Current

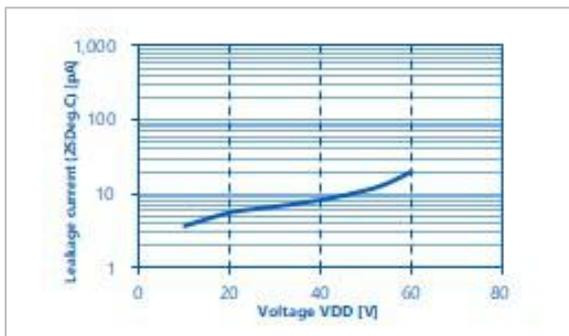


Figure 8

A common concern with utilization of MOSFET Relays is its leakage current, and that it might cause the system to malfunction. However, the G3VM-66M has good leakage current characteristics, shown in **(Figure 8)**

The lateral line indicates VDD and the vertical line indicates leakage current. Even when Vdd reaches maximum load voltage, the leakage current value is extremely low. We guarantee a maximum leakage current (<2nA) assuring a stable behavior to the application.

### Additional Feature: Different connection is possible

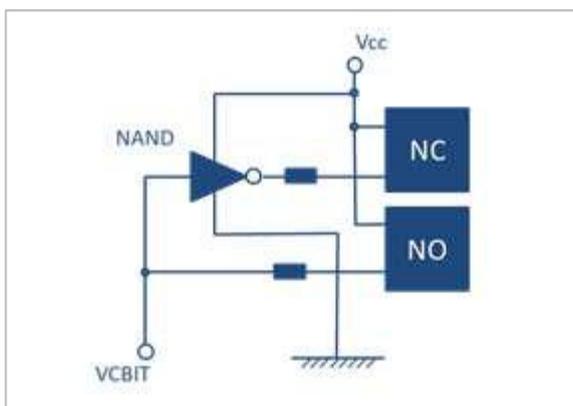


Figure 9

The G3VM-66M has 1 form C contact configuration, which function is to switch the output line by changing VCBIT input as described in the datasheet. The input side circuit of our new MOSFET module is indicated in **(Figure 9)**

The function of switching the output line is achieved by a NAND configuration.

If VCBIT is in high level while Vcc has steady input, the NAND doesn't output and connects GND; Then NC line works by Vcc input and NO line doesn't work. Conversely, by making VCBIT low level with Vcc steady input, NAND output high level, so NC line is disconnected and NO line connects.

### Special Remarks:

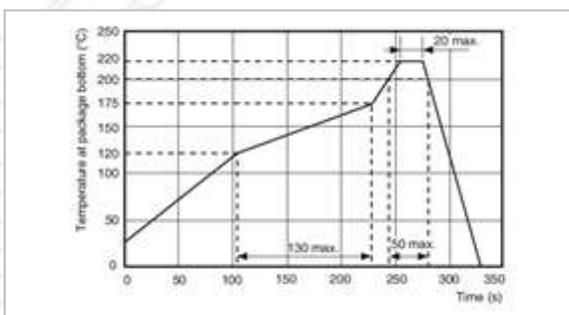


Figure 10

Please follow recommended soldering conditions. Incomplete soldering procedure can lead to abnormal heat generation during operation and result in heat damage to internal components. Soldering should be performed within the recommended conditions shown on **(Figure 10)** to prevent the temperature rise of the main body as much as possible.

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