# G3VM Series MOSFET Relays
# Technical Information

## Introduction

New models and a wider range provide an array of solutions, meeting the needs of today's high performance applications.

Our new range of MOSFET relays, Type G3VM, set the benchmark in Solid State Relays (SSRs). Products are manufactured using the latest advances in automated production and include a variety of improved construction technologies within the areas of the input LED, PDA (Photo Diode Array used as a photocoupler) and MOSFET chips used in the load switching circuit. As a result, further reductions in package size and power requirements have been achieved.

Combining the advantages of mechanical and solid state technology, the new G3VM range gives you unprecedented capability to design. All models featured include a double MOSFET load circuit, enabling the designer complete versatility since it makes no difference whether an AC or DC load in either direction is connected (Connection A). Thus, the MOSFET relay is a fully functional alternative to an electromechanical relay with minimal additional drive circuitry.

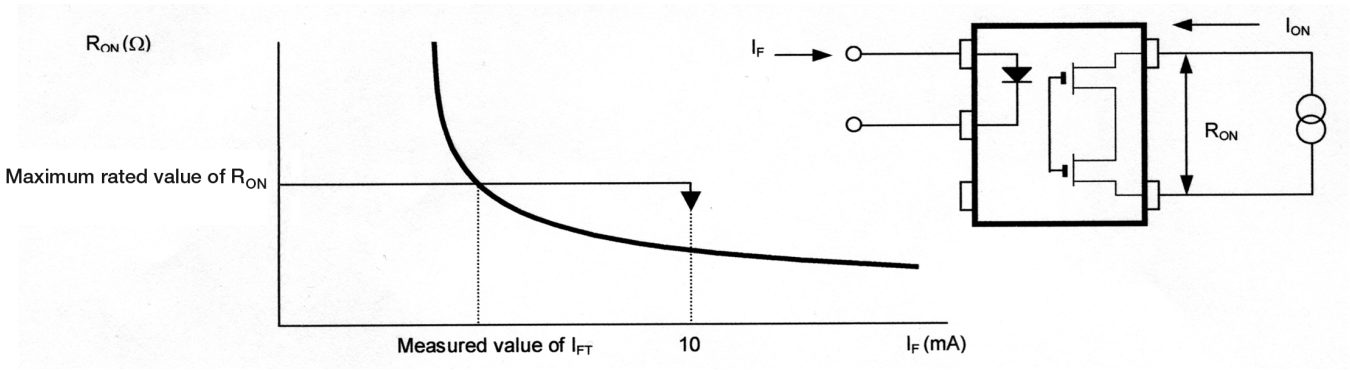
The built-in Current Limit Function (CLR models) has many uses. Traditionally used to clamp excessive over current fault conditions in telecom equipment, this feature can also be used to good effect to resist transient and short circuit conditions.

MOSFET relays are the ideal data and telecommunication solution for line seizing, line switching, hook switching, Data Access Arrangement (DAA) function, line transformer circuit control and other feature phone functions. Central office applications require high reliability and long life. Here G3VM is ideal for use in the areas of Subscriber Line Interfaces (SLICs) Multiplexers and Routers. In addition, Local Area Networks (LANs) and Network Termination Units (NTUs) including Set-Top Boxes (STBs) and Remote Metering Systems (RMS) can take advantage of the G3VMs' small size and low ON resistance.

Advances in performance and cost reduction enable MOSFET relays to be considered as good alternatives to Reed Relays in application areas such as security motion detectors (standard and anti-mask PIRs), other surveillance alarm equipment and associated systems.

## Glossary

| Term | Symbol | Description |
|---|---|---|
| LED forward current | $I_F$ | Rated current that can flow continuously in the forward direction of the LED |
| Repetitive peak LED forward current | $I_{FP}$ | Rated current that can flow momentarily in the forward direction of the LED |
| LED forward current reduction rate | $<I_F/°C$ | Rated change of forward current flowing through the LED relative to ambient temperature above 25°C |
| LED reverse voltage | $V_R$ | Rated reverse voltage that can be applied between the anode and the cathode |
| Connection temperature | $T_J$ | Rated temperature that can be allowed in the junction of the LED, Photodetector or MOSFET(s) |
| Output dielectric strength | $V_{OFF}$ | Rated voltage that can be applied between the MOSFET's output terminals in the OFF state |
| Continuous load current | $I_O$ | Rated current that can flow between the MOSFET's output terminals in the ON state |
| ON current reduction rate | $<I_{ON}/°C$ | Rated change of load current flowing between MOSFET(s) output terminals relative to ambient temperature above 25°C |
| Dielectric strength between input and output | $V_{I-O}$ | Isolation voltage between input and output terminals for a specified time |
| Operating temperature | $T_a$ | Ambient temperature range in which the relay may be operated without impairment |
| Storage temperature | $T_{stg}$ | Ambient temperature range in which the relay may be stored while not operating |
| LED forward voltage | $V_F$ | Voltage drop between the LED's anode and cathode at a certain forward current |
| LED reverse current | $I_R$ | Leakage current flowing in the LED's reverse direction (between cathode and anode) |
| Capacity between LED terminals | $C_T$ | Electrostatic capacitance between the anode and the cathode terminals of the LED |
| Trigger LED forward current | $I_{FT}$ | Minimum value of input current necessary to put the output MOSFET(s) in to the ON state |
| Maximum resistance with output ON | $R_{ON}$ | Resistance between the MOSFET's output terminals specified with reference to ON state current |
| Current leakage when the relay is open | $I_{LEAK}$ | Leakage current flowing between the MOSFET's output terminals in the OFF state |
| Capacity between I/O terminals | $C_{I-O}$ | Electrostatic capacitance between the input and output terminals of the relay |
| Insulation resistance | $R_{I-O}$ | Resistance between the input and output terminals at the specified voltage value |
| Turn-ON time | $_tON$ | Time required for the output waveform to change from 0 (100%) to 90 (10%) after input goes from OFF to ON state |
| Turn-OFF time | $_tOFF$ | Time required for the output waveform to change from 0 (100%) to 90 (10%) after input goes from ON to OFF state |
| Output dielectric strength | $V_{DD}$ | Rated load voltage that can be applied between the MOSFET's output terminals |




**Relationship between $R_{ON}$ and $I_{FT}$**

# ■ Precautions when Mounting Devices on PCBs

## Soldering

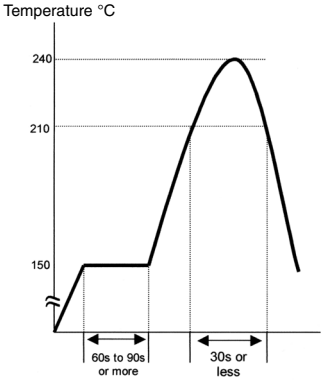
As far as it is possible, avoid raising the temperature of the device by observing the following restrictions.

### Soldering leads directly

260°C max, 10 seconds max

### Reflow soldering

- Lead temperature: 210°C max, 30 seconds max
  Atmospheric temperature close of mold body surface: 240°C max, 10 seconds max
- Recommended temperature profile




- Precautions when heating

  The soldering time (as shown above) must be kept as short as possible.

  When using a halogen lamp of infrared heater, please do not irradiate the mold body surface directly.

### Dip soldering (flow soldering)

- Reflow soldering is recommended because the thermal stress involved is much less than that inherent in other soldering methods.
- If you plan to use dip soldering, please contact OMRON first.

## Cleaning

When ions in the flux enter into the product during soldering, fluctuation in device performance or corrosion may occur. Be sure to wash away any flux residue which contains Cl or Na ions.

The following types of solvents are recommended for cleaning the flux:

- Asahi Clean AK-225AES
- Kao Cleanthru 750H
- Pine-Alpha ST-100S

### Cleaning Conditions

Cleaning conditions and precautions may vary according to product specifications.

#### General precautions for dip cleaning

Dipping time varies according to the solvent used.

However, as a general guideline, it is recommended that the dip time be limited to three minutes.

#### General precautions for ultrasonic cleaning

When ultrasonic cleaning is conducted for an excessively long time, contact between the product resin and the metal leads may lessen. Also, excessive ultrasonic stress may cause cracks in the pellet.

It is recommended that the applied stress be minimized.

#### Recommended conditions for standard ultrasonic cleaning

| | |
|---|---|
| Frequency: | 27kHz to 29kHz |
| Output: | 0.25 W/cm$^2$ or less |
| Time: | 30 seconds or less |
| Temperature: | 50°C (may vary according to the type of solvent used) |

Cleaning must be conducted with the printed circuit board or device floating on the solvent, so as to avoid direct contact between the PCB or device and the ultrasonic vibrator.

### Handling Precautions

Do not touch the device's mark-bearing surface with your hand or with a brush while cleaning or applying cleaning liquid to the device. This may erase device markings. It is important to confirm that neither the solvent used for cleaning nor the cleaning conditions will damage the device package.

# Precautions

**⚠ WARNING**

Be sure to turn OFF the power when wiring the Relay, otherwise an electric shock may be received.

**⚠ WARNING**

Do not touch the charged terminals of the SSR, otherwise an electric shock may be received.

**⚠ Caution**

Do not apply overvoltage or overcurrent to the I/O circuits of the SSR, otherwise the SSR may malfunction or burn.

**⚠ Caution**

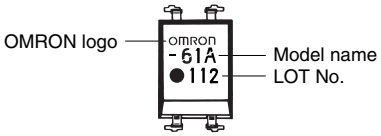
Be sure to wire and solder the Relay under the proper soldering conditions, otherwise the Relay in operation may generate excessive heat and the Relay may burn.

**⚠ Caution**

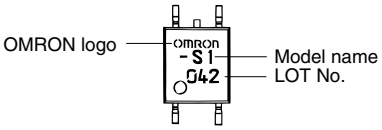
Electrostatic sensitive devices. Keep in original packaging until required to use. Avoid touching device terminals. Take static handling precautions during processing.

Appearance Examples

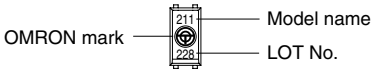
DIP (Dual Inline Package)




SOP (Small Outline Package)



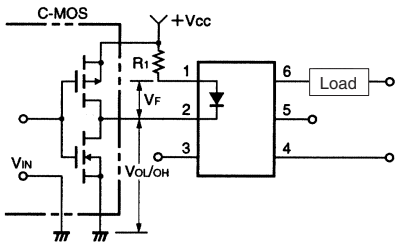

SSOP (Shrink Small Outline Package)



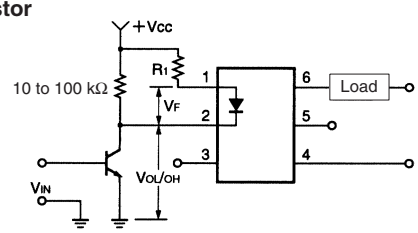

Note: "G3VM" is not printed on the actual product.

**Typical Relay Driving Circuit Examples**

**C-MOS**




**Transistor**




Use the following formula to obtain the LED current limiting resistance value to assure that the relay operates accurately.

$$R_1 = \frac{V_{CC} - V_{OL} - V_F\,(ON)}{5 \text{ to } 20 \text{ mA}}$$

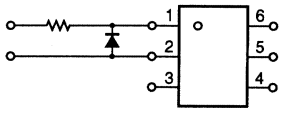
Use the following formula to obtain the LED forward voltage value to assure that the relay releases accurately.

$$V_{F\,(OFF)} = V_{CC} - V_{OH} < 0.8 \text{ V}$$

## Protection from Surge Voltage on the Input Terminals

If any reversed surge voltage is imposed on the input terminals, insert a diode in parallel to the input terminals as shown in the following circuit diagram and do not impose a reversed voltage value of 3 V or more.

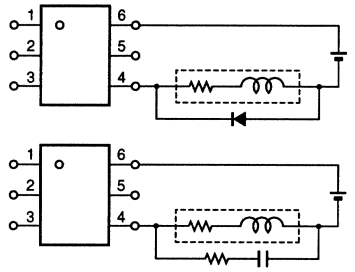
**Surge Voltage Protection Circuit Example**



## Protection from Spike Voltage on the Output Terminals

If a spike voltage exceeding the absolute maximum rated value is generated between the output terminals, insert a C-R snubber or clamping diode in parallel to the load as shown in the following circuit diagram to limit the spike voltage.

**Spike Voltage Protection Circuit Example**

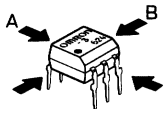



## Unused Terminals (6-pin models only)

Terminal 3 is connected to the internal circuit. Do not connect anything to terminal 3 externally.

## Pin Strength for Automatic Mounting

In order to maintain the characteristics of the relay, the force imposed on any pin of the relay for automatic mounting must not exceed the following.

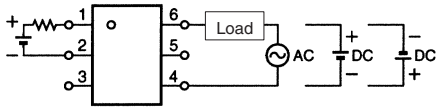



In direction A: 1.96 N
In direction B: 1.96 N

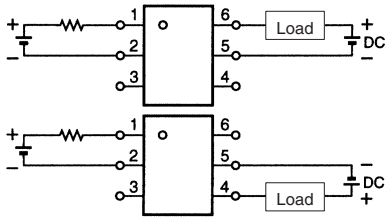
## Load Connection

Do not short-circuit the input and output terminals while the relay is operating or the relay may malfunction.

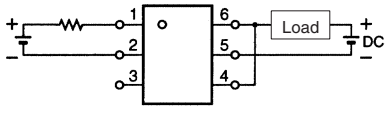
**AC Connection**




**DC Single Connection**




**DC Parallel Connection**




## Solder Mounting

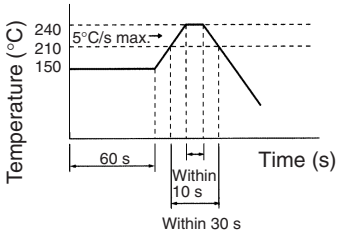
Maintain the following conditions during manual or reflow soldering of the relays in order to prevent the temperature of the relays from rising.

### Pin Soldering

Solder each pin at a maximum temperature of 260°C within 10 s.

### Reflow Soldering

- Solder each pin at a maximum temperature of 260°C within 10 s.
- Make sure that the ambient temperature on the surface of the resin casing is 240°C max. for 10 s maximum.
- The following temperature changes are recommendable for soldering.



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To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.


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