

Common Precautions for MOS FET Relays

WARNING

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



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



Precautions for Safe Use

1. Do not apply overvoltages or overcurrents to Relay input or output circuits. The Relay may fail or ignite.
2. Perform soldering and wiring correctly according to soldering conditions. Using the Relay with incomplete soldering may cause overheating when power is applied, possibly resulting in burning.

Precautions for Correct Use

● Derating design

Derating considerations are necessary towards attaining the required reliability of the system.

To ensure that MOS FET relays operate to a high degree of reliability, not only apply derating considerations to the maximum ratings and recommended operating conditions but also design derating with ample leeway, if possible, based on actual equipment tests under the working environment.

(1) Maximum rating

The maximum rating is the level that must not be exceeded even for an instant. When multiple maximum ratings are presented, none must be exceeded. Use beyond the maximum rating can lead to internal degradation of the MOS FET relay and chip damage. Therefore, in order to ensure that MOS FET relays operate to a high degree of reliability, design derating with due consideration for the maximum voltage, current and temperature.

(2) Recommended operating conditions

The recommended operating conditions ensure MOS FET relay operation and resetting.

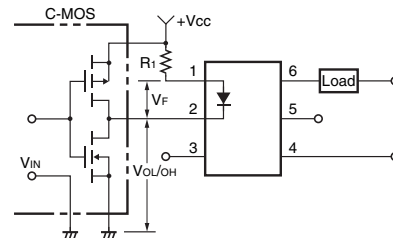
To ensure that MOS FET relays operate to a high degree of reliability, design circuits in consideration of the recommended operating conditions.

(3) Providing fail-safes

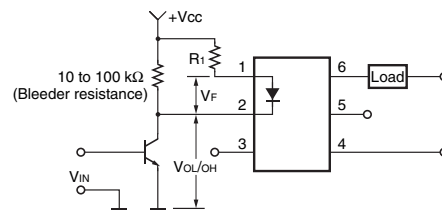
It is recommended to take fail-safe measures for the specific application, if failure, performance loss or malfunctioning of a MOS FET relay can seriously impair the safe operation of the system.

● 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.

Current limiting resistance

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

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

Must-release voltage (LED sequence direction)

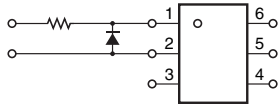
$$V_{F(OFF)} = V_{CC} - I_F R_1 - V_{OH} < 0.8V$$

Common Precautions for MOS FET Relays

● 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.

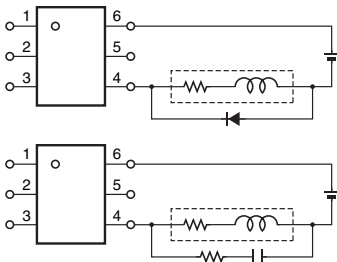
Surge Voltage Protection Circuit Example



● 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.

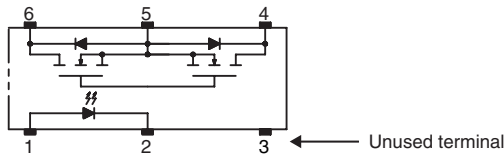
Spike Voltage Protection Circuit Example



● Unused Terminals (6-pin models only)

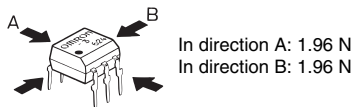
Terminal 3 is connected to the internal circuit. Do not connect anything to terminal 3 externally.

(Example of 6-pin models)



● Pin Strength for Automatic Mounting

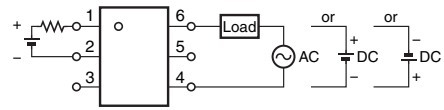
- In order to maintain the characteristics of the relay, the force imposed on any pin of the relay for automatic mounting must not exceed the following.



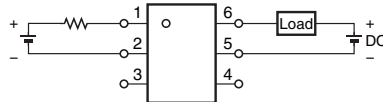
● Load Connection

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

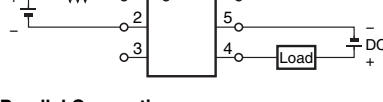
AC Connection



DC Single Connection



DC Parallel Connection



● Life expectancy

MOS FET relays made by OMRON use two types of LEDs. Life expectancy is determined by the type of LED.

Refer to the below tables for a correspondence between MOS FET relays and applied LEDs. Also, life expectancy data is provided on pages 3 to 4.

Life expectancy was estimated from long-term data on a single lot, therefore treat it as a "reference."

MOS FET relays that use GaAs LEDs

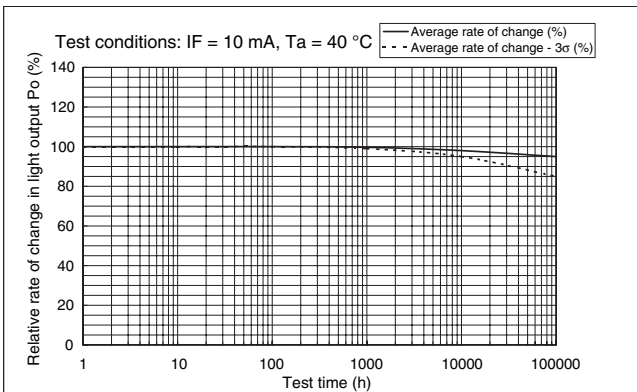
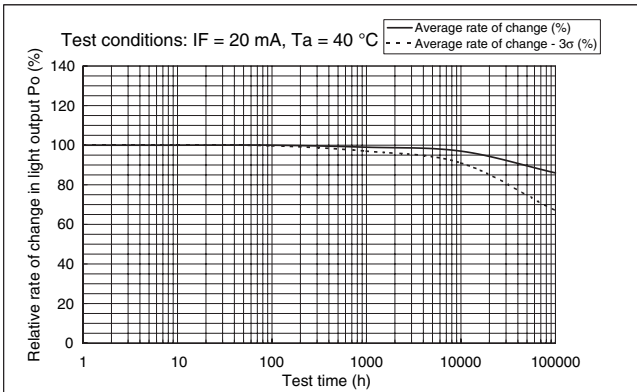
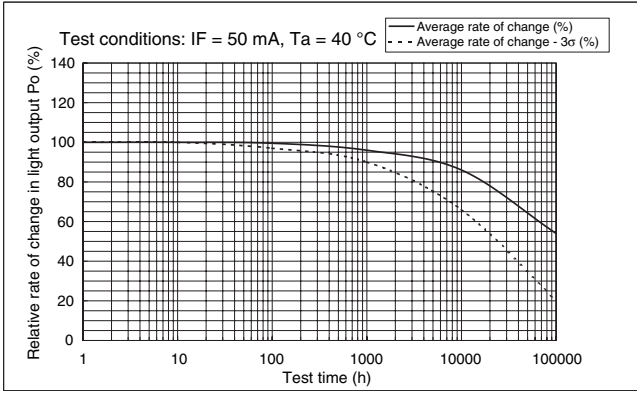
DIP	SOP		SSOP
G3VM-61A1/D1	G3VM-21GR	G3VM-201G	G3VM-21LR
G3VM-61B1/E1	G3VM-21GR1	G3VM-201G1	G3VM-21LR1
G3VM-62C1/F1	G3VM-41GR3	G3VM-S5	G3VM-41LR3
G3VM-2L/2FL	G3VM-41GR4	G3VM-201H1	G3VM-41LR4
G3VM-351A/D	G3VM-41GR5	G3VM-202J1	G3VM-41LR5
G3VM-351B/E	G3VM-41GR6	G3VM-351G	G3VM-41LR6
G3VM-352C/F	G3VM-41GR7	G3VM-351G1	G3VM-61LR
G3VM-353A/D, 353A1/D1	G3VM-41GR8	G3VM-351GL	G3VM-81LR
G3VM-353B/E, 353B1/E1	G3VM-61G1	G3VM-353G, 353G1	G3VM-101LR
G3VM-354C/F, 354C1/F1	G3VM-61G2	G3VM-351H	
G3VM-355C/F, 355CR/FR	G3VM-61VY	G3VM-353H, 353H1	
G3VM-WL/WFL	G3VM-61GR1	G3VM-352J	
G3VM-401A/D	G3VM-61H1	G3VM-354J, 354J1	
G3VM-401B/E	G3VM-62J1	G3VM-355J, 355JR	
G3VM-401BY/EY	G3VM-81G1	G3VM-401G	
G3VM-402C/F	G3VM-81GR	G3VM-401H	
G3VM-601BY/EY	G3VM-81GR1	G3VM-402J	
	G3VM-81HR	G3VM-601G	

MOS FET relays that use GaAlAs LEDs

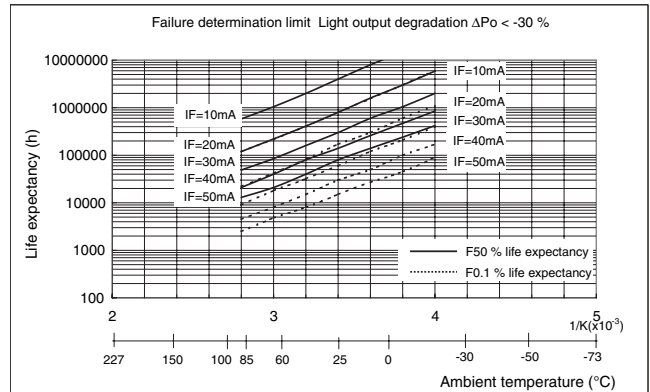
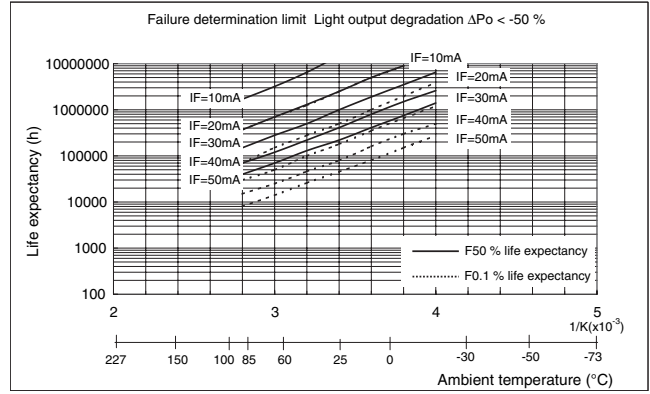
DIP	SOP	SSOP
G3VM-61BR/ER	G3VM-21HR	G3VM-21LR10
		G3VM-41LR10
		G3VM-41LR11

Common Precautions for MOS FET Relays

Estimated change in GaAs LED over time



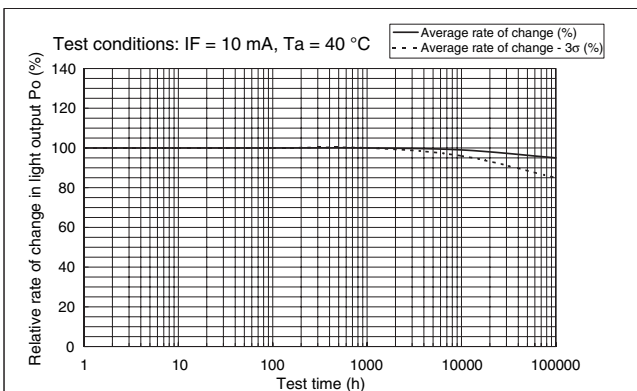
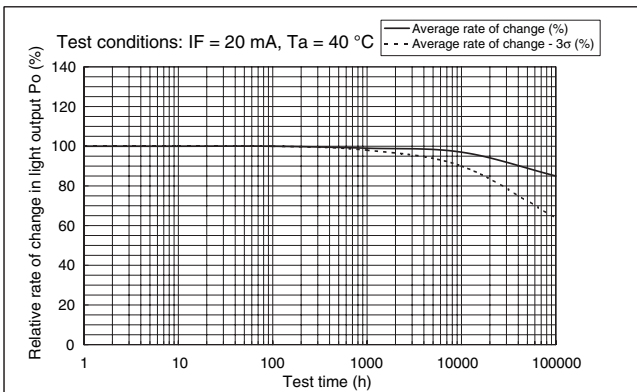
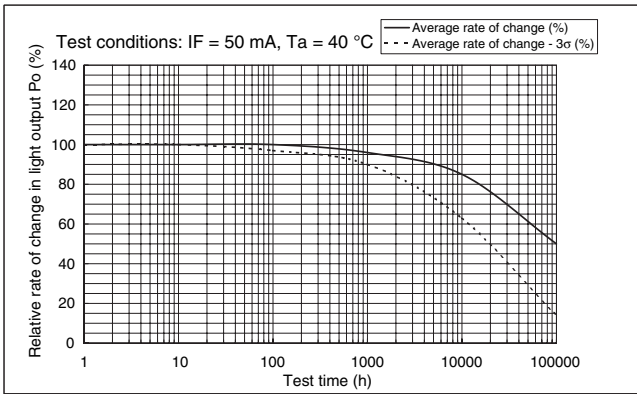
Life expectancy of GaAs LEDs



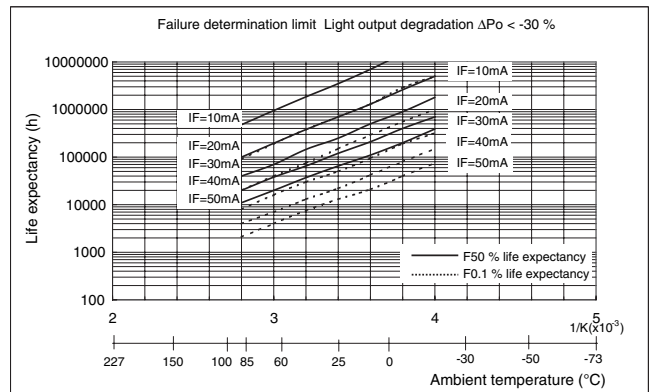
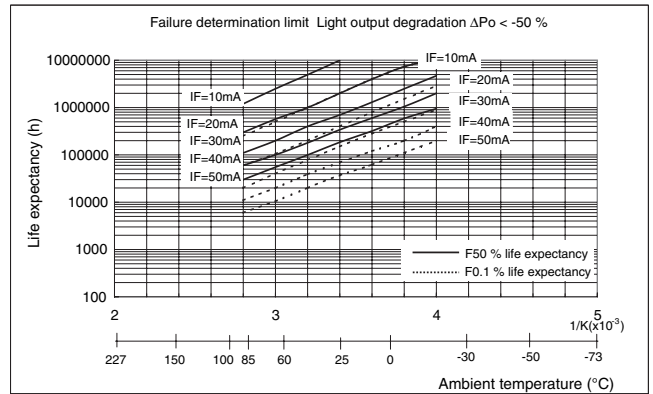
The above life expectancy data is based on long-term LED evaluation (single lot) and should be treated as reference. Also, operating conditions beyond ratings are included for some models, but operation outside of ratings is not guaranteed.

Common Precautions for MOS FET Relays

Estimated change in GaAlAs LED over time



Life expectancy of GaAlAs LEDs



The above life expectancy data is based on long-term LED evaluation (single lot) and should be treated as reference. Also, operating conditions beyond ratings are included for some models, but operation outside of ratings is not guaranteed.

Common Precautions for MOS FET Relays

● Flux washing

- (1) Wash flux so that there are no reactive ions like sodium or chlorine remaining.
Some organic solvents will react with water and form corrosive gases such as hydrogen chloride, which can degrade MOS FET relays.
- (2) Be particularly sure that there are no reactive ions like sodium or chlorine remaining when rinsing with water.
- (3) Do not rub indication marks with brushes or hands while washing or while cleaning solution adheres to the MOS FET relay. Actions of the sort may erase indication marks.
- (4) Washing by soaking, showering or steaming clean by the chemical action of the solvent. Soak or steam MOS FET relays for less than 1 min at a solution temperature of not more than 50°C because of the possible effects on the relay.
- (5) Keep ultrasonic washing short. Ultrasonic exposure for an extended period of time can weaken the adhesion between the molded resin and frame.
The recommended basic washing conditions are below.
(Recommended conditions for ultrasonic washing)
Frequency: 27 to 29 kHz
Ultrasonic wave output: 300 W or less (0.25 W/cm² or less)
Washing time: 30 sec or less
Also, float ultrasonic oscillators, printed circuit boards and MOS FET relays in the solvent so as not to touch them directly.

● Solder Mounting

Perform solder mounting under the following recommended conditions to prevent the temperature of the Relays from rising.

<Flow Soldering>

Through-hole Mounting (Once Only)

(Temperature setting of flow bath)

Solder type	Preheating	Soldering
Lead solder SnPb	150°C 60 to 120 s	260°C 10 s max.
Lead-free solder SnAgCu	150°C 60 to 120 s	260°C 10 s max.

Note: We recommend that the suitability of solder mounting be verified under actual conditions.

<Reflow Soldering>

Surface Mounting DIP or SOP Packages (Twice Max.)

(Surface temperature of package)

Solder type	Preheating	Soldering	
Lead solder SnPb	140→160°C 60 to 120 s	210°C 30 s max.	Peak 240°C max.
Lead-free solder SnAgCu	180→190°C 60 to 120 s	230°C 30 to 50 s	Peak 260°C max.

Surface Mounting SSOP Packages (Twice Max.)

(Surface temperature of package)

Solder type	Preheating	Soldering	
Lead solder SnPb	140→160°C 60 to 120 s	210°C 30 s max.	Peak 240°C max.
Lead-free solder SnAgCu	180→190°C 60 to 120 s	230°C 30 to 50 s	Peak 260°C max.

Note1: It is recommended to verify the customer's actual conditions of use before use.

Note2: SSOP products are normally delivered in aluminum moisture-proof packs, but products purchased as tape-cut SSOPs are packaged without humidity resistance. Use manual soldering to mount them. Reflowing connectors that have absorbed moisture can cause troubles such as package cracking due to heat stress.

Manual Soldering (Once Only)

Manually solder at 350°C for 3 s or less or at 260°C for 10 s or less.

● Storage conditions

- (1) Store relays where not exposed to water or direct sunlight.
- (2) Observe warning labels on the box when transporting and storing relays.
- (3) Store relays at normal temperature, humidity and pressure.
Temperature and humidity should be between 5 to 35°C and 45 to 75 %.
- (4) Store relays where not exposed to corrosive gases such as hydrogen sulfide, salt or dust that is visible to the eye.
- (5) Store relays where subjected to minimal temperature fluctuations. Sudden temperature changes during storage can cause condensation to form, which can oxidize leads, cause corrosion and adversely effect solder wettability.
- (6) Restore MOS FET relays that have been removed from their packaging in an antistatic package.
- (7) Do not apply force that can deform or deteriorate the quality of products.
- (8) The warranty period of products from OMRON is one year from the date of purchase or delivery to a specified location. It is recommended to check solderability before use if relays have been stored for one year or longer.

● Conditions of use

<Temperature>

The electrical characteristics of MOS FET relays are determined by the operating temperature.

If used outside the operating temperature range, not only may electrical characteristics be impaired but also the MOS FET relay may quickly degrade. For this reason, identify the temperature characteristics in advance and design circuits in consideration of derating *. (* Derating: To reduce stress)

The operating temperature range is based on the recommended operating temperature in consideration of derating.

<Humidity>

Extended use in highly humid environments can cause internal degradation of the chip and failure due to moisture infiltration. This kind of infiltration into boards or between leads of MOS FET relays can cause systems of high signal source impedance to malfunction. For such cases, examine moisture-proofing the surface of the MOS FET relay. In low humidity environments on the other hand, loss due to electrostatic discharge can be an issue, therefore use the relays in a 40 to 60 % humidity range especially if moisture-proofing is not done.

Common Precautions for MOS FET Relays

● SSOP Handling Precautions

<Humidity-resistant Packaging>

Component packages can crack if surface-mounted components that have absorbed moisture are subjected to thermal stress when mounting. To prevent this, observe the following precautions.

- (1) Unopened components can be stored in the packaging at 5 to 30°C and a humidity of 90% max., but they should be used within 12 months.
- (2) After the packaging has been opened, components can be stored at 5 to 30°C and a humidity of 70% max., but they should be mounted within 168 hours.
- (3) If, after opening the packaging, the humidity indicator turns pink to the 30% mark or the expiration data is exceeded, bake the components while they are still on the taping reel, and use them within 72 hours. Do not bake the same components more than once.

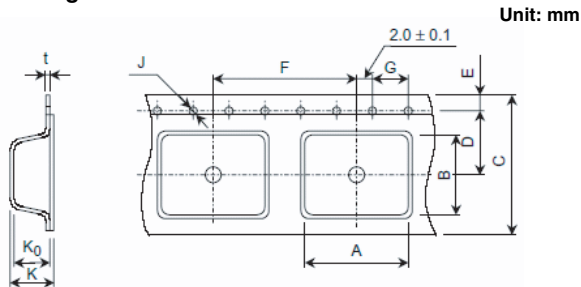
Baking conditions: 60±5°C, 64 to 72 h

Expiration date: 12 months from the seal date
(given on the label)

- (4) If the same components are baked repeatedly, the tape detachment strength will change, causing problems when mounting. When mounting using dehumidifying measures, always take countermeasures against component damage from static electricity.
- (5) Do not throw or drop components. If the laminated packaging material is damaged, airtightness will be lost.
- (6) Tape cut SSOPs are packaged without humidity resistance. Use manual soldering to mount them.

● Taping packaging

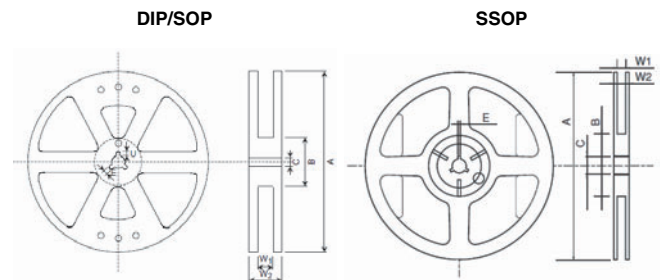
<Tape configuration and dimensions>



Unit: mm

Package classification	DIP4	DIP6	DIP8	SOP4 (Special)	SOP4	SOP6	SOP8	SSOP4	
Taping name	(TR)								
Dimension codes (Refer to the figure above.)	A	10.4±0.1		4.2±0.1	4.3±0.1	7.5±0.1		2.35±0.2	
	B	5.1±0.1	7.6±0.1	10.1±0.1	7.6±0.1	7.5±0.1	6.7±0.1	10.5±0.1	4.5±0.1
	C	16±0.3		12±0.3		16±0.3		12±0.3	
	D	7.5±0.1		5.5±0.1		7.5±0.1		5.5±0.1	
	E	1.75±0.1							
	F	12.0±0.1		8.0±0.1		12.0±0.1		4.0±0.1	
	G	4.0±0.1							
	J	1.5+0.1/-0							
	k	4.55±0.2		3.15±0.1	2.6±0.2	2.5±0.2	2.4±0.2	2.4±0.1	
	ko	4.1±0.1		2.8±0.1	2.4±0.1	2.3±0.1	2.2±0.1	2.1±0.1	
t	0.4±0.05			0.3±0.05					

<Reel configuration and dimensions>



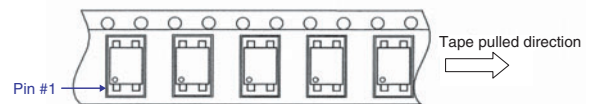
Unit: mm

Package classification	DIP4	DIP6	DIP8	SOP4 (Special)	SOP4	SOP6	SOP8	SSOP4	
Taping name	(TR)								
Dimension codes (Refer to the figure above.)	A	380±2 dia.			330±2 dia.			180+0/-4 dia.	
	B	80±1 dia.							60 dia.
	C	13±0.5 dia.							13 dia.
	E	2.0±0.5							2.0±0.5
	U	4.0±0.5							---
	W1	17.5±0.5		13.5±0.5		17.5±0.5		13±0.3	
	W2	21.5±1.0		17.5±1.0		21.5±1.0		15.4±1.0	

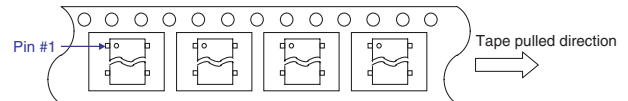
<Taping direction>

Products are oriented in the square hole recesses of the carrier tape as shown below.

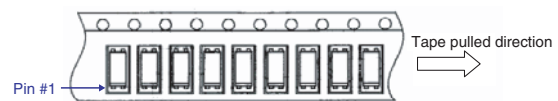
- (1) SOP 4-pin models



- (2) SOP 6/8-, DIP4/6/8-pin models



- (3) SSOP 4-pin models



<Relays per taping>

Package classification	DIP4	DIP6	DIP8	SOP4 (Special)	SOP4	SOP6	SOP8	SSOP4
Quantity (pcs)	1,500			3,000	2,500		1,500	

- Application examples provided in this document are for reference only. In actual applications, confirm equipment functions and safety before using the product.
- Consult your OMRON representative before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems or equipment that may have a serious influence on lives and property if used improperly. Make sure that the ratings and performance characteristics of the product provide a margin of safety for the system or equipment, and be sure to provide the system or equipment with double safety mechanisms.

Note: Do not use this document to operate the Unit.

OMRON Corporation

ELECTRONIC AND MECHANICAL COMPONENTS COMPANY

Contact: www.omron.com/ecb

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