OMRON

# High Power PCB Relay for Automotive and DC12 V Applications

# G8PM Relay

## High Load Relay for Motor/Resistive/Lamp Control Applications

- Can replace Mini ISO Plug-in type relay
- Small size & High heat resistance enable for usage in engine room
- Can support 60 A Fuse
- PIP reflow compliant
- Temperature range -40°C to +125°C
- Latching model available

## Model Number Legend

**■Single Stable Model**

G8PM-□□□□□
1 2 3 4 5

**1. Number of Contact Poles**
1: 1-pole

**2. Contact Form**
A: SPST (1 Form A)

**3. Contact structure**
W: Double contact

**4. Protective structure**
7: Flux tight (Open vent hole) (RT II IEC61810)

**5. Special function**
R: Pin in paste compliant type

**■Latching Model**

G8PM-□□□□□□□
1 2 3 4 5 6 7

**1. Functional classification**
K: 2-winding latching

**2. Number of Contact Poles**
1: 1-pole

**3. Contact Form**
A: SPST (1 Form A)

**4. Contact structure**
Blank: Single contact

**5. Protection structure**
7: Flux tight (Open vent hole) (RT II IEC61810)

**6. Polarity of coil**
Blank: Normal polarity, positive voltage on Terminal 3 & 6
1: Reversed polarity, negative voltage on Terminal 3 & 6

**7. Special function**
R: Pin in paste compliant type

## Application Examples

- DC motor/resistive/lamp application control
- Automotive DC applications (Smart Junction Box, Main power, Radiator fan, EPS, DC/DC converter, Head lamp, etc.)

## Ordering Information

**■Single Stable Model**

| Classification | Contact form | Protective structure | Rated coil voltage (V) | Model | Minimum Packing unit (Tube packing) |
|---|---|---|---|---|---|
| Single Stable | SPST 1 Form A double contact | Flux tight (open vent hole) (RT II IEC61810) | DC12 | **G8PM-1AW7R DC12** | 1200 pcs. / box (40 pcs. x 30 tubes) |

**■Latching Model**

| Classification | Contact form | Protective structure | Rated coil voltage (V) | Model | Minimum Packing unit (Tube packing) |
|---|---|---|---|---|---|
| 2-winding latching | SPST 1 Form A single contact | Flux tight (open vent hole) (RT II IEC61810) | DC12 | **G8PM-K1A7R DC12** | 1200 pcs. / box (40 pcs. x 30 tubes) |
| | | | | **G8PM-K1A71R DC12** | |

**Note.** Above models are not certificated for the safety standards of UL or CSA, etc.



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# Ratings

## ●Coil

| Classification | Rated voltage (V) | Rated current (mA) | | Coil resistance (Ω) | | Must-operate voltage (V) | Must-release voltage (V) | Permissible voltage Range (V) | Rated Power consumption (mW) | | Model |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Single Stable | DC12 | 53.3 | | 225 | | 7.2 Max. | 0.8 Min. | 10 to 16 | 640 | | **G8PM-1AW7R DC12** |
| 2-winding latching | | (Set) | (Reset) | (Set) | (Reset) | (Set) | (Reset) | 10 to 16 | (Set coil) | (Reset coil) | **G8PM-K1A7R DC12** |
| | | 210 | 268 | 57.2 | 44.8 | 7.2 Max. | 7.2 Max. | 10 to 16 | 2520 | 3210 | **G8PM-K1A71R DC12** |

**Note 1.** The rated current and coil resistance are measured at a coil temperature of 20°C with a tolerance of ±10%.
**Note 2.** The operating characteristics are measured at a coil temperature of 20°C.

## ●Contacts

| Item / Classification | | Single Stable | Latching |
|---|---|---|---|
| Model | | **G8PM-1AW7R DC12** | **G8PM-K1A7R DC12**<br>**G8PM-K1A71R DC12** |
| Contact type | | Double | Single |
| Contact material | | Ag-alloy (Cd-free) | |
| Maximum carrying current *1 | 20°C | 60 A, DC14 V, Continuous/<br>81 A, DC14 V, 1 Hour/<br>120 A, DC14 V, 2 Min. | 40 A, DC14 V, Continuous/<br>54 A, DC14 V, 1 Hour/<br>81 A, DC14 V, 2 Min. |
| | 125°C | 40 A, DC14 V, Continuous/<br>70 A, DC14 V, 30 Min. | 20 A, DC14 V, Continuous/<br>46 A, DC14 V, 30 Min. |
| Max. switching current *2 | | 150 A Inrush, 80 A break | 100 A Inrush, 40 A Break |
| Min. switching current | | DC12 V, 0.1 A | DC12 V, 1 A |

*1. Measured with reference connection conditions as below,
T1.6 mm FR4 epoxy PCB (Double-sided), Trace: T140 um x L50 mm x W13.2 mm, Cable: 6 $mm^2$
The time limitation doesn't guarantee the repeated current carrying. Please confirm the performance with the specific conditions.
*2. Measured 100 operations with the resistive load at room temperature.



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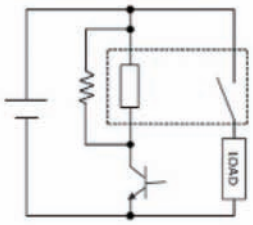
## Characteristics

| Classification | | | Single Stable | Latching |
|---|---|---|---|---|
| Item | | | G8PM-1AW | G8PM-K1A7R/G8PM-K1A71R |
| Contact resistance (See *1.) | | | Typ. 2.5 mΩ, max. 50 mΩ | Typ. 3.0 mΩ, max. 50 mΩ |
| Operate time | | | 10 ms max.<br>(DC12 V, not including bounce time) | 15 ms max.<br>(DC12 V, not including bounce time) |
| Release time | | | 5 ms max.<br>(DC12 V) | 15 ms max.<br>(DC12 V) |
| Insulation resistance (See *2.) | Between coil and contacts | | 100 MΩ min. | |
| | Between contacts of the same polarity | | 100 MΩ min. | |
| Dielectric strength | Between coil and contacts | | AC500 V 1 min | |
| | Between contacts of the same polarity | | AC500 V 1 min | |
| Vibration resistance | Destruction | | 33 Hz, 45 m/s² | |
| | Malfunction | | 10 to 500 Hz, 45 m/s² (detection time 10 µs min) | |
| Shock resistance | Destruction | | 1,000 m/s² (pulse duration: 6 ms) | |
| | Malfunction | | 100 m/s² (pulse duration: 11 ms, detection time: 10 µs) | |
| Mechanical endurance (See *3.) | | | 1,000,000 ops. min. | |
| Electrical endurance (See *4.) | | Resistive Load | 45 A, DC14 V, 100,000 operations min.<br>(1 s ON/1 s OFF) | 40 A, DC14 V, 100,000 operations min.<br>(1 s ON/1 s OFF) |
| | | Lamp Load | 100 A Inrush/<br>20 A break, DC14 V,<br>100,000 operations min.<br>(1 s ON/9 s OFF) | 60 A Inrush/<br>12 A break, DC14 V,<br>100,000 operations min.<br>(1 s ON/9 s OFF) |
| Ambient operating temperature | | | -40 to 125°C (without freezing or condensation) | |
| Ambient operating humidity | | | 35% to 85%RH | |
| Weight | | | Approx. 7.6 g | Approx. 7.0 g |

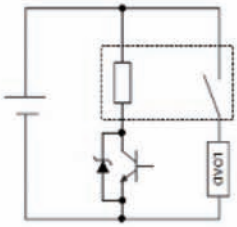
**Note.** The above values are initial values at an ambient temperature of +20°C unless otherwise specified.
*1. The contact resistance was measured with 10 A at DC12 V using the voltage drop method.
*2. The insulation resistance was measured with a DC500 V megohmmeter.
*3. The mechanical endurance was measured at a switching frequency of 18,000 operations/hr.
*4. Please connect N.O. terminal to the +BATT side on Electrical use and connect surge suppression element in parallel with between coil based on recommended circuit.

Recommended circuit: (a), (b), (c)
Not-recommended circuit: (d)

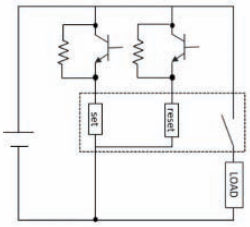
(a)




(b1)

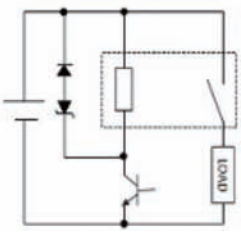



(b2)

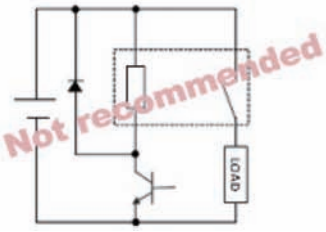



**Note 1.**
OMRON recommends coil driver circuit (b) and (c) for coil surge suppression. However the circuit (d) is not recommended because it may negatively affect the durability performance.

(c)




(d)




**Note 2.**
OMRON recommends to install a surge voltage protection on both of set coil and reset coil of the latching relay.
(Reference components: Resistor withstanding 10 W or Zener diode cutting over 30 V.)



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# Reference Technical Data

## ■Single Stable Model

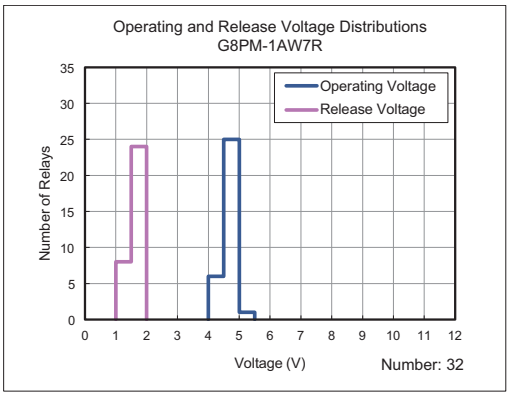
### ●Actual Electrical performance (reference)

| Model | Application | Load voltage | Inrush current | Steady current | Break current | Inductance | Ambient temperature | Switching frequency | | Required cycles (min.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (V) | (A) | (A) | (A) | (mH) | (°C) | On (s) | Off (s) | Total |
| **G8PM-1AW7R DC12** | Radiator Fan | 13.5 | 150 | 50 | 50 | 0.14 to 0.17 | -40 to 110 | 3.0 | 9.0 | 156,000 |
| **G8PM-1AW7R DC12** | Lamp | 14.0 | 150 | 30 | 30 | - | -40 to 110 | 0.5 | 5.5 | 156,000 |
| **G8PM-1AW7R DC12** | Resistive | 14.0 | 45 | 45 | 45 | - | -40 to 125 | 2.0 | 2.0 | 100,000 |
| **G8PM-1AW7R DC12** | Fuel pump | 14.7 | 75 | 1 | 1 | - | 90 | 3.0 | 7.0 | 200,000 |
| **G8PM-1AW7R DC12** | Starter Motor | 14.5 | 35.2 | 7.4 | 7.4 | 1.1 | -40 to 105 | 2.0 | 4.0 | 215,000 |

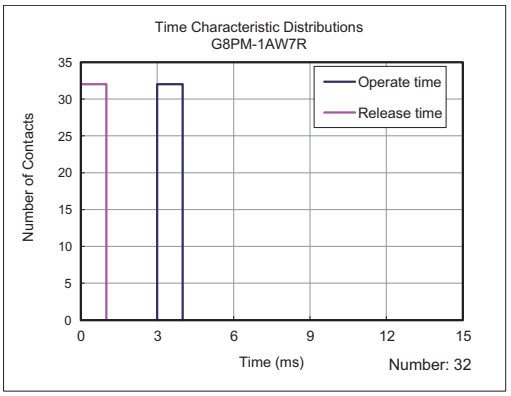
### ●Overcurrent (reference)

| Model | Load & Coil voltage | Current | Fuse rating | Type | Ambient temperature | Overcurrent time | Result |
|---|---|---|---|---|---|---|---|
| | (V) | (A) | (A) | | (°C) | (s) | |
| **G8PM-1AW7R DC12** | 14 | 81.0 | 60 | Micro | 25 | 3,600 | Passed |
| **G8PM-1AW7R DC12** | 14 | 120.0 | 60 | Micro | 25 | 120 | Passed |
| **G8PM-1AW7R DC12** | 14 | 75.0 | 60 | Case Fuse | 85 | 1,800 | Passed |
| **G8PM-1AW7R DC12** | 14 | 111.0 | 60 | Case Fuse | 85 | 60 | Passed |
| **G8PM-1AW7R DC12** | 14 | 333.0 | 60 | Case Fuse | 85 | 1 | Passed |

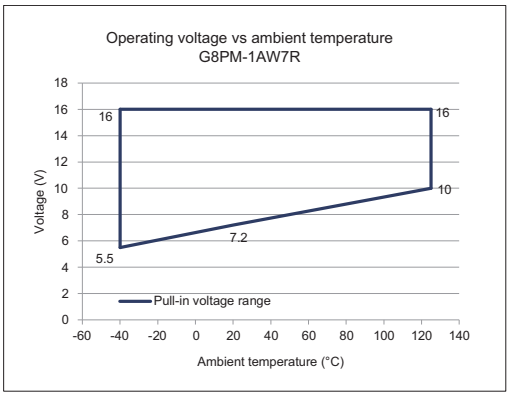
### ●Operating Voltage and Release Voltage Distributions (Number of Relays × Voltage)




### ●Time Characteristic Distributions (Number of Contacts × Time (ms))

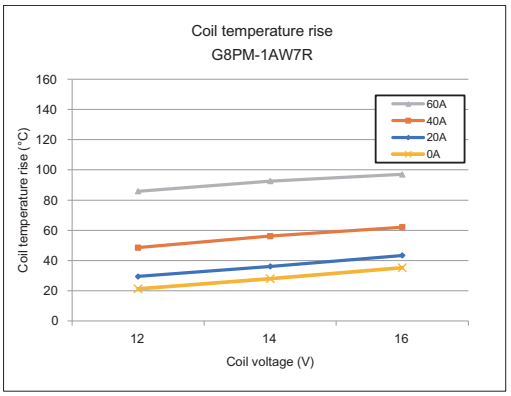



### ●Operating voltage vs ambient temperature (Cold start)




### ●Coil temperature rise [degC] at 20°C

(For using under a higher ambient temperature, please select the proper current carrying condition to avoid a possible excessive temperature rising.)



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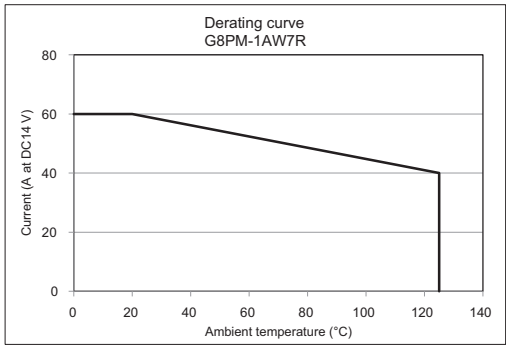
●Derating curve




## ■Latching Model

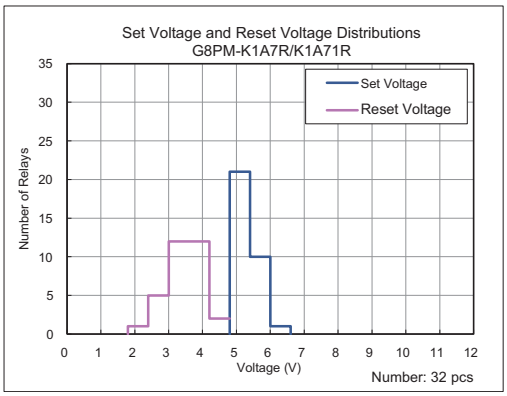
●Actual Electrical performance (reference)

| Model | Application | Load voltage | Inrush current | Steady current | Break current | Inductance | Ambient temperature | Switching frequency | | Required cycles (Min.) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | (V) | (A) | (A) | (A) | (mH) | (°C) | On (s) | Off (s) | Total |
| **G8PM-K1A7R DC12** | Resistor | 14.0 | 40 | 40 | 40 | - | 20 | 1.0 | 1.0 | 100,000 |
| **G8PM-K1A7R DC12** | Lamp | 14.0 | 60 | 12 | 12 | - | 20 | 1.0 | 9.0 | 100,000 |
| **G8PM-K1A7R DC12** | Radioator fan | 14.0 | 50 | 20 | 20 | 0.4 | 20 | 2.0 | 6.0 | 100,000 |

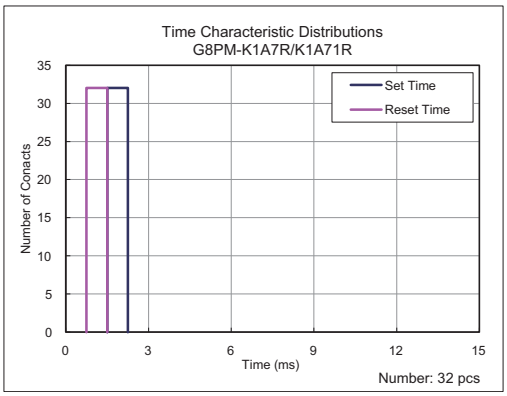
●Overcurrent (reference)

| Model | Load & Coil voltage | Current | Fuse rating | Type | Ambient temperature | Overcurrent time | Result |
|---|---|---|---|---|---|---|---|
| | (V) | (A) | (A) | | (°C) | (s) | |
| **G8PM-K1A7R DC12** | 14 | 54.0 | 40 | Micro | 23 | 3,600 | Go |
| **G8PM-K1A7R DC12** | 14 | 240.0 | 40 | Micro | 23 | 1 | Go |
| **G8PM-K1A7R DC12** | 14 | 46.0 | 40 | Micro | 125 | 1,800 | Go |
| **G8PM-K1A7R DC12** | 14 | 70.0 | 40 | Micro | 125 | 60 | Go |
| **G8PM-K1A7R DC12** | 14 | 206.0 | 40 | Micro | 125 | 1 | Go |

●Set Voltage and Reset Voltage Distributions
(Number of Relays × Voltage)




●Time Characteristic Distributions
(Number of Contacts × Time)



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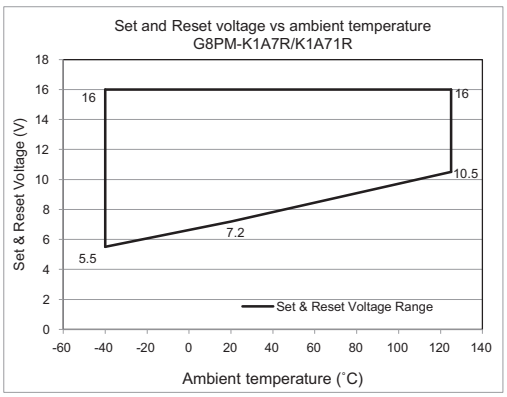
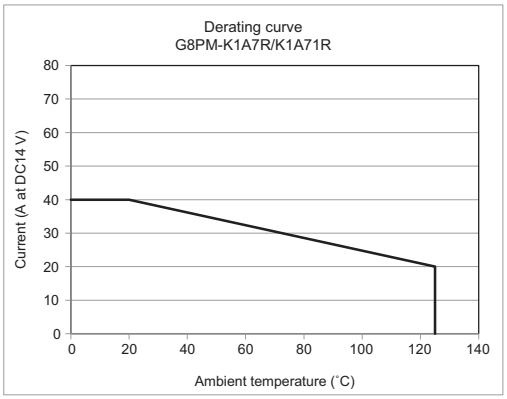
## ●Set and Reset voltage vs ambient temperature (Cold start)




## ●Derating curve



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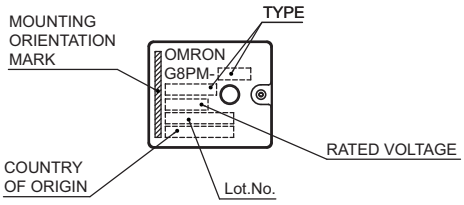
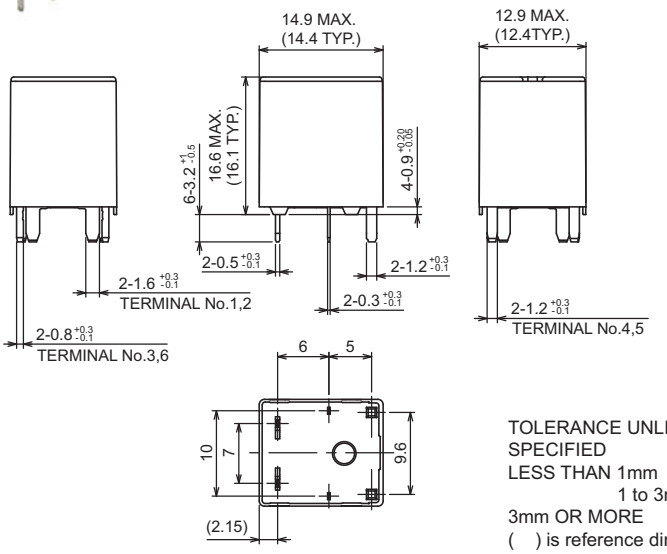
## Dimensions

CAD Data Please visit our website, which is noted on the last page. **(Unit: mm)**

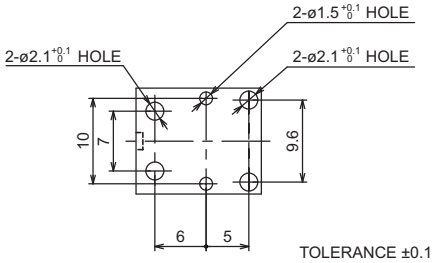
### G8PM-1AW




TOLERANCE UNLESS OTHERWISE SPECIFIED
LESS THAN 1mm : ±0.1mm
1 to 3mm : ±0.2mm
3mm OR MORE : ±0.3mm
( ) is reference dimension

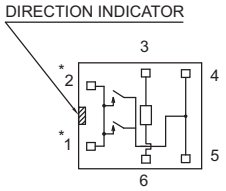
**PCB Mounting Holes**
(Bottom View)




TOLERANCE ±0.1

*Please study & choose other appropriate hole diameters if confirmed the diameter values recommended above don't work with the soldering process.

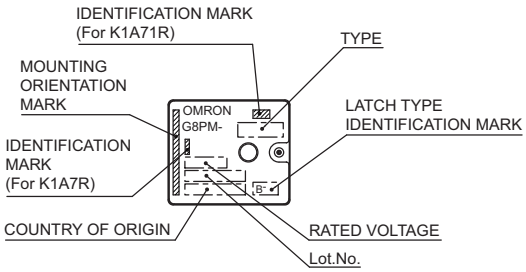
**Terminal Arrangement/ Internal Connections**
(Bottom View)

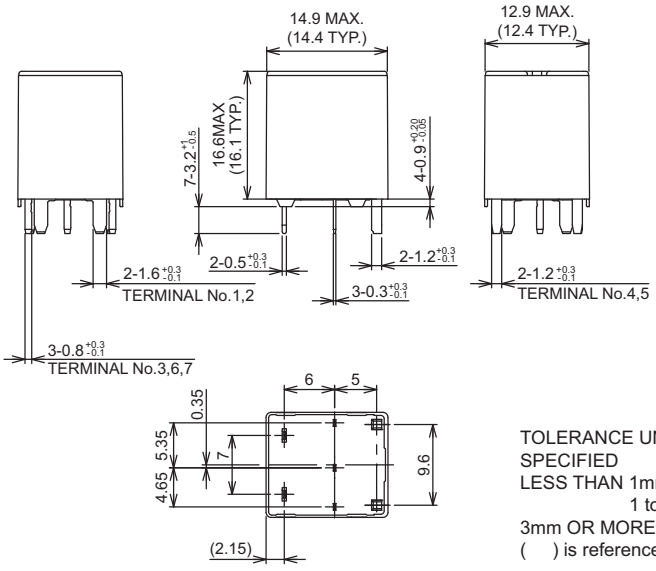



NOTE: *TERMINAL 1&2 CONNECT TO +BATT

CAD Data

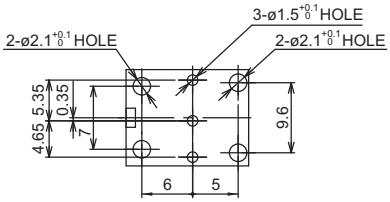
### G8PM-K1A




TOLERANCE UNLESS OTHERWISE SPECIFIED
LESS THAN 1mm : ±0.1mm
1 to 3mm : ±0.2mm
3mm OR MORE : ±0.3mm
( ) is reference dimension

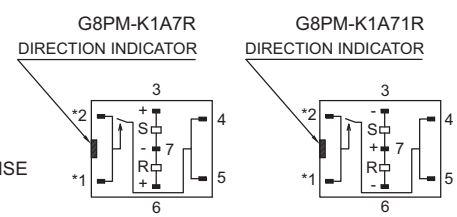
**PCB Mounting Holes**
(Bottom View)




TOLERANCE ±0.1

*Please study & choose other appropriate hole diameters if confirmed the diameter values recommended above don't work with the soldering process.

**Terminal Arrangement/ Internal Connections**
(Bottom View)




NOTE: *TERMINAL 1&2 CONNECT TO +BATT

CAD Data



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# Precautions

**●Please refer to "Safety Precautions for ALL Automotive and DC small power relay" for correct use.**

## Precautions for Safe Use

**●Notice to ensure safety**

- Refer to the specification and confirm that the relay meets the application before using any relay from this catalog.
- Confirm acceptability for safety critical applications by appropriate testing or contact Omron.
- Do not use the relay for loads which exceed the rated values given in the data sheet. Failure to do so may result in unforeseen consequences such as insulation failure, smoking, breakdown of operation, etc.
- Do not apply over-voltage to the relay coil. Do not apply AC power to a DC relay coil. Be careful not to exceed the temperature ratings of the relay.
- Do not make incorrect connections to the relay terminals.
- Endurance (Lifetime) is significantly affected by changes to the load and switching condition. When using the relay, check the relay behavior with an actual product under actual conditions. Use the relay within timing characteristics it can meet according to the data sheet.
- Carry out the proper number of confirmation tests with an actual product for each application or contact Omron.
- A relay is a precision part. Do not apply vibration and shock beyond the specified value. Do not drop the relay. Do not use a relay that has been dropped.
- Do not remove the case of a relay or modify the terminals in any way.
- Do not touch the relay terminal or opposing mating terminal while applying current. Electric shock may occur.
- Do not use a relay under any environment that contains flammable or explosive gas. Fire or an explosion may result.

**●When using a relay**

- As with all technologies, relays may not always behave as expected. Therefore, evaluation under actual application conditions is always best.
- Each performance rating in this catalog is based on the value under controlled conditions (i.e. temperature, humidity, etc 86 to 106 kPa) unless otherwise specified. Confirm not only load condition but also actual environmental conditions for actual use.
- Reference data in the catalog is based on measurement values from sampling of production. The values are as accurate as possible and believed to be correct at the time of publication. Due to production necessity or other reasons, specifications may change without notice.
- When a relay is used outside the recommended conditions, there is no way for Omron to predict the failure mode or results of the failure. Omron will remain blameless for the results of applying relays outside of the recommended parameters described in this catalog.

## Storage and Usage Environment

When using, storing and transporting relays, avoid direct sunlight and keep normal temperature, humidity and pressure.

- Oxides or sulfurized films may accumulate on the contact surface if the relay is exposed to high temperature and humidity for long periods of time. That could be a root cause of failure like contact defect.
- Condensation may occur inside the relay if the ambient temperature changes sharply from a high temperature and humidity to a lower temperature. Condensation should be avoided because it may cause insulation failure. Furthermore, bluish-green compounds may be generated inside of the relay due to relatively strong arc discharge associated with contact switching at high humidity. Best overall relay performance is attained at low humidity.
- When relays have been stored for a long period of time, it is possible for various oxides to form on the terminals and contacts. Therefore, if such a situation were to occur, it is necessary to evaluate the readiness of relays for use.



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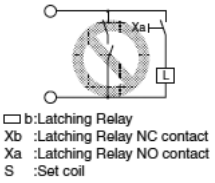
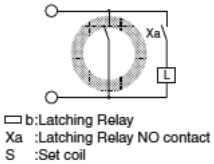
## Latching Type Correct Use

1. Coil Polarity for DC-operated Latching Relays
   Check the catalog for the terminal numbers and polarity of applied power to correctly connect the Relay. Applying voltage with reversed polarity to DC-operated Latching Relays may resulting malfunctions, set failure, or reset failure.
2. Drive Circuit
   Energizing due to self-contact may prevent normal latching.
   Do not use Latching Relays in the following type of circuit. Use the type of circuit shown in the following figure.

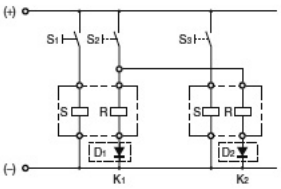


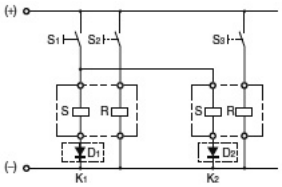

3. Applying Voltage Simultaneously to Set and Reset Coils
   Do not apply voltage at the same time to the set and reset coils. Simultaneously applying voltage to the set and reset coils for an extended period may result in abnormal coil heating, fire, or incorrect operation.
4. DC Input Circuit Design
   Reverse voltage of a Relay coil or solenoid may cause operation failure if other Relay coils or solenoids are connected in parallel to the set coil or reset coil. As a countermeasure, change the circuit or connect diodes as shown in the following figures.

   Circuit Precautions

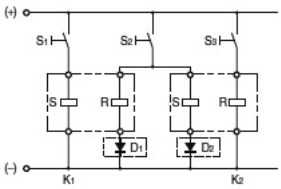
Reset Coil Parallel Connection Circuit



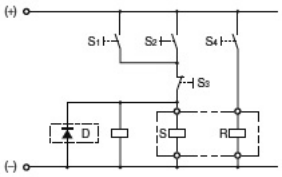

Set Coil Parallel Connection Circuit




Set/Reset Coil Parallel Connection Circuit




Circuit with Other Relay Coil in Parallel to Set Coil




5. Degradation over Time of Latching Relay Holding Ability
   If a Magnetic Latching Relay is used left set for an extended period, changes over time will degrade the magnetic force, and the reduction in holding ability may cause the set status to be released. This is also because of the properties of semi-hard magnetic material, and the rate of degradation over time depends on the ambient environment (e.g., temperature, humidity, vibration, and presence or absence of external magnetic fields). Perform maintenance at least once a year by resetting, applying the rated voltage again, and then setting.
6. Mounting Latching Relays
   Operate the Latching Relay so that the vibration and shock from other devices (e.g., Relays) on the same panel or board generated when setting or resetting do not exceed the catalog values. Exceeding the values may cause the set or reset state to be released.
   Latching Relays are shipped in the reset status, but abnormal vibration or shock may cause them to change to the set status. Be sure to apply a reset signal before using the Latching Relay.



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