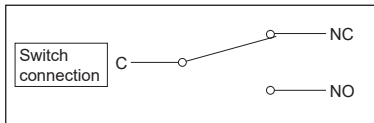


VM Micro Switch

Long Life, High current Switch



CHARACTERISTICS

Part no.	VM-11P • VM-11PK	VM-21P • VM-21PK	VM-43P • VM-43PK
Rating (Resistive Load)	AC 125 V 15 A AC 250 V 15 A		AC 125 V 5 A AC 250 V 5 A
Insulation Resistance	More than 100 MΩ at DC 500 V		
Dielectric Strength	AC 1000 V RMS between NC and NO terminal AC 2000 V RMS between terminals and ground ※1) 50/60 Hz for 60 sec. at normal ambient temperature and humidity		
Contact Resistance	Silver contact : Less than 15 mΩ DC 6 V 1 A Silver contact (Gold-Plated) : Less than 50 mΩ Milliohm meter		
Shock Resistance ※2)	300 m/s ² max. (Malfunction) 500 m/s ² max. (Destruction)		
Vibration Resistance ※2)	10 to 55 Hz, Amplitude 1.5 mm		
Operating Speed ※2)	0.1mm~1m/sec		
Operating Frequency	300 operations / min		
Mechanical Life	More than 2 million operations	More than 10 million operations	More than 10 million operations
Electrical Life (Resistive Load)	More than 100,000 operations		
Weight	6.1g ※2)		
Ambient Operating Temperature	-15°C to +70°C (No Freeze)		
Ambient Operating Humidity	80%RH Max. (No Condensation)		
Ambient Storage Temperature	-25°C to +65°C (No Freeze)		
Ambient Storage Humidity	80%RH Max. (No Condensation)		

※1) The values are for the Soldering terminal. The screw terminal is AC1500V.

※2) The values are for the pin plunger models.

OPERATING CHARACTERISTICS

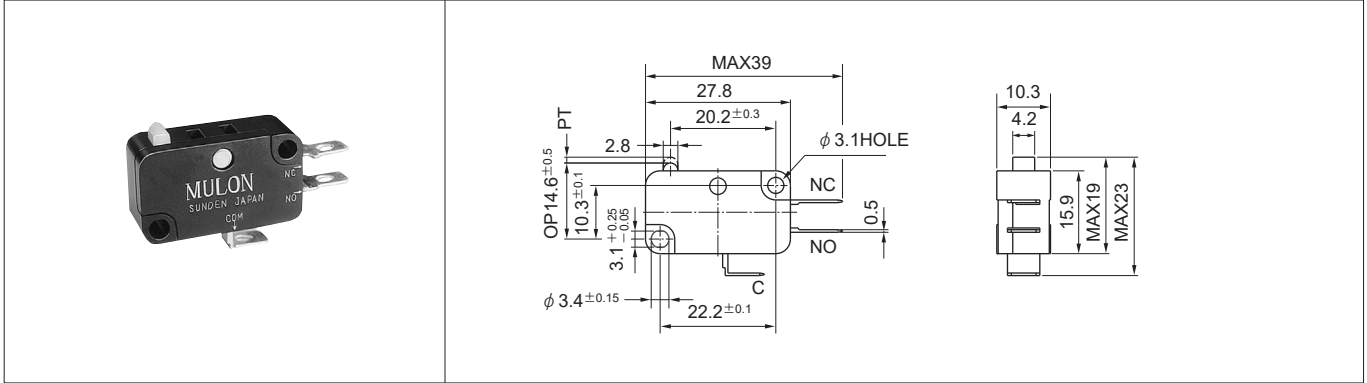
Part no.	Pin Plunger			Hinge Lever			Long Hinged Lever			Simulated Hinge Lever		
	VM-1□	VM-2□	VM-43	VM-1□DM1	VM-2□DM1	VM-43DM1	VM-1□DL1	VM-2□DL1	VM-43DL1	VM-1□DM3	VM-2□DM3	VM-43DM3
Operating force max.	3.92N	1.96N	0.49N	3.92N	1.96N	0.49N	1.18N	0.59N	0.15N	2.16N	1.18N	0.29N
Release force min.	0.98N	0.49N	0.10N	0.98N	0.49N	0.10N	0.20N	0.10N	0.02N	0.29N	0.15N	0.03N
Pretravel max.	1.5mm	1.5mm	1.5mm	1.8mm	1.8mm	1.8mm	7.4mm	7.4mm	7.4mm	3.6mm	3.6mm	3.6mm
Overtravel min.	0.3mm	0.3mm	0.3mm	0.3mm	0.3mm	0.3mm	1.2mm	1.2mm	1.2mm	0.6mm	0.6mm	0.6mm
Movement Differential max.	0.4mm	0.4mm	0.4mm	0.5mm	0.5mm	0.5mm	2.2mm	2.2mm	2.2mm	1.2mm	1.2mm	1.2mm

◇Dimensions : page VM-2

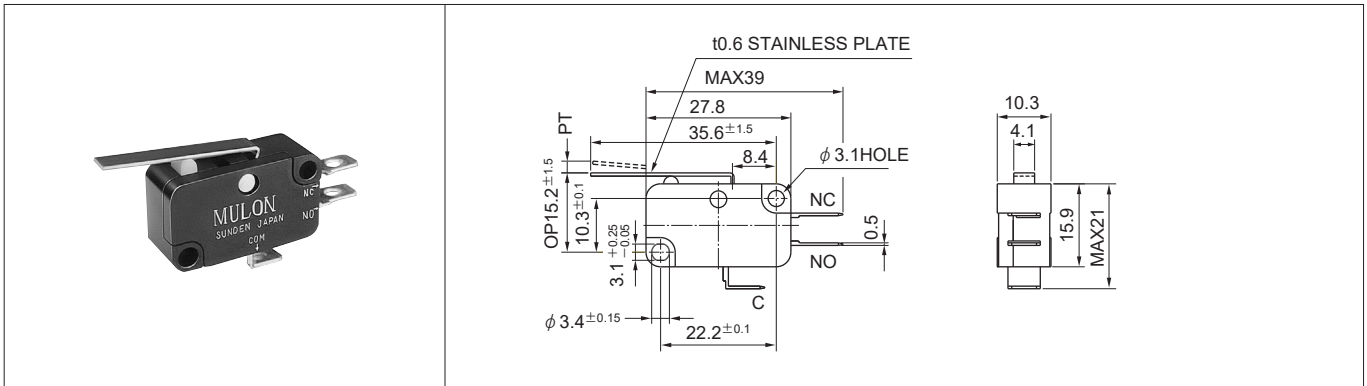
◇Order code : page VM-3

DIMENSIONS

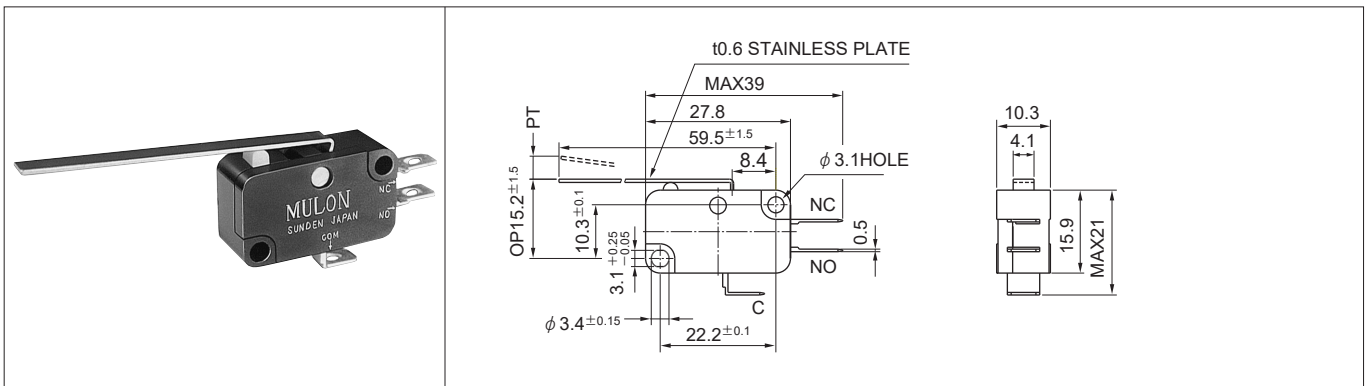
● Pin Plunger



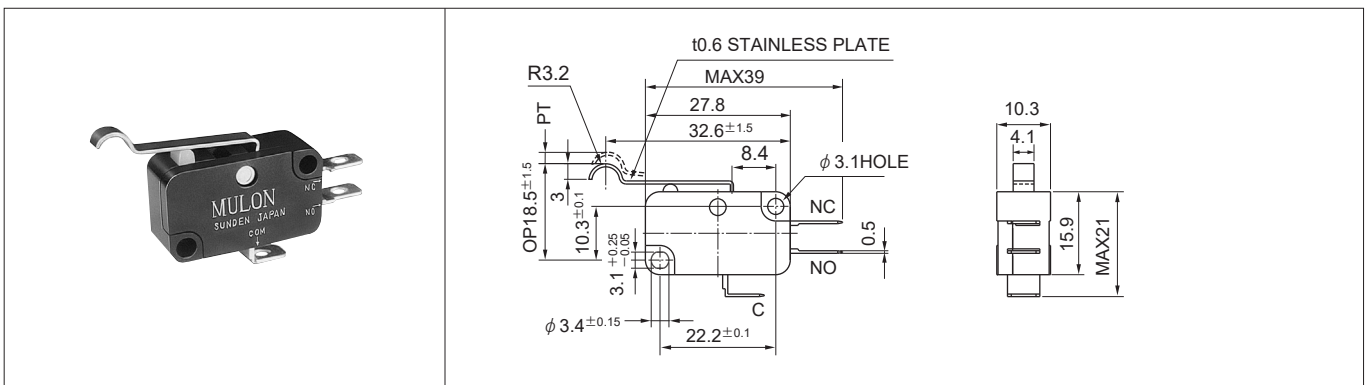
● Hinge Lever



● Long Hinged Lever



● Simulated Hinge Lever



Tolerance : ± 0.4 mm

ORDERING CODE

Assembled Part

VM —

● **OF**

1	Max. 3.92N
2	Max. 1.96N
4	Max. 0.49N

● **RATINGS**

1	15A
3	5A

● **TERMINAL**

Blank	Soldering
P	# 187 Tab • Soldering
B	Screw

● **ACTUATOR**

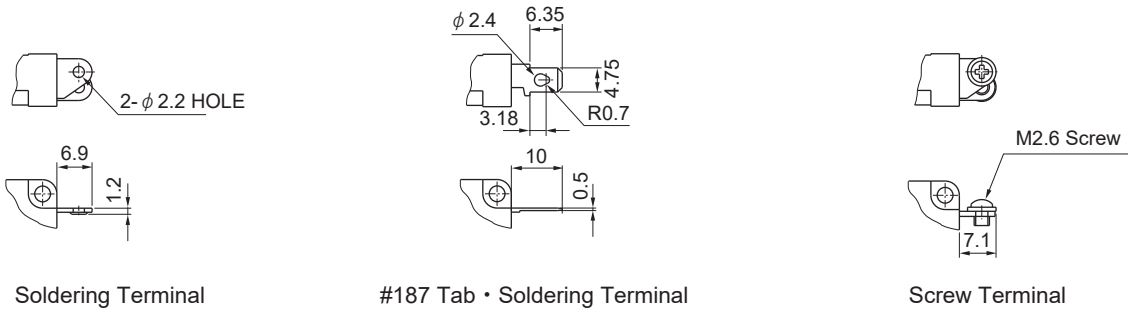
Blank	Pin Plunger
DM1	Hinge Lever
DL1	Long Hinged Lever
DM3	Simulated Hinge Lever

● **CONTACT MATERIAL**

Blank	Silver
K	Silver (Gold-Plated)

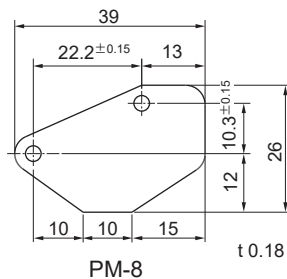
VM-11□□□, VM-13□□□, VM-21□□□, VM-23□□□, VM-43□□□ combinations only can be produced.
VM-41□□□ can not be produced.

TERMINALS



PRECAUTIONS FOR CORRECT USE

1. Solder quickly and correctly at 380°C max. and for 3 seconds or less.
Be careful not to touch the soldering iron to the main body.
2. Wait for one minute during and after soldering before exerting any external force on the solder.
3. The tightening of the mounting nut when attaching to the panel should be 0.588 N·m or less with M3 screw.
4. When installing on a metal body, be sure to use a separator of 0.18 mm or more in thickness between the switch and the body of the switch insulation. Refer to the figure below for dimensions. A special separator (PM-8) is available for the VM.



※ For handling instructions and precautions other than the above, please refer to "Safety Precautions for All Micro Switches".

Tolerance : ± 0.4 mm

As of March 2024

Safety Precautions for All Micro Switches

1. Notes on contents of Catalogs

- (1) Rated values, performance values, and specification values of Sunmulon products listed in this catalog are values acquired under respective conditions in independent testing, and do not guarantee values gained in combined conditions.
- (2) The ambient operating temperature(humidity) is guaranteed by evaluation based on characteristics, and does not guarantee continuous use for a long period of time near the upper or lower limit of the ambient operating temperature(humidity) or permanent use at that temperature(humidity).
- (3) Reference data and reference values listed in catalogs are for reference purposes only, and do not guarantee that the product will always operate appropriately in that range.
- (4) The specifications / appearance and accessories of Sunmulon products listed in catalogs are subject to change or termination of sales without notice, for improvement or other reasons.
- (5) The content of catalogs is subject to change without notice.

2. Note on applications

- (1) If using Sunmulon products in combination with other products, confirm the following suitability by yourself. Sunmulon shall provide no guarantees regarding the combination suitability.
 - (a) Regulations, standards, or laws to which your machinery, equipment, etc. must conform
 - (b) Functionality and safety of your machinery and equipment
- (2) Wiring and installation that ensures the Sunmulon product used in your system, machine, device, or the like can perform and function according to its specifications.
- (3) When using Sunmulon products, be cautious when implementing the following.
 - (a) Use of Sunmulon products with sufficient allowance for rating and performance.
 - (b) Safety design, including redundant design and malfunction prevention design that prevents other danger and damage even in the event that Sunmulon product fails.
- (4) Sunmulon products are designed and manufactured as general-purpose products for general industrial products. They are not intended for use in the following applications, and in the event that you use Sunmulon product for these applications, unless otherwise agreed upon between you and Sunmulon, Sunmulon shall provide no guarantees whatsoever regarding Sunmulon products.
 - (a) Safety devices intended for human body protection
 - (b) Direct control of transport equipment (railroads / airplanes / ships / vehicles / vehicle instruments, etc.)
 - (c) Space equipment, submarine equipment
 - (d) Nuclear power control equipment, radiation related equipment
 - (e) Combustion equipment, electric heat equipment
 - (f) Disaster prevention and security equipment
 - (g) Elevating equipment
 - (h) Amusement facilities
 - (i) Facilities subject to government or industry regulations
 - (j) Use in applications that require a high degree of safety, any other equipment, instruments, or the like that could endanger life or human health

3. Warranty

- (1) The warranty period for Sunmulon products shall be 1 year after purchase or delivery to the specified location.
- (2) Warranty scope should a failure occur in Sunmulon product during the above warranty period for reasons attributable to Sunmulon, then Sunmulon shall provide that product, free of charge, the same quantity. Further, in no event shall liability of Sunmulon exceed the individual price of the product on which liability is asserted.
- (3) Failures caused by the following reasons shall be deemed outside the scope of this warranty.
 - (a) The product was handled or used deviating from conditions / environment listed in the catalogs
 - (b) The failure was caused by reasons other than Sunmulon product
 - (c) Modification or repair was performed by a party other than Sunmulon
 - (d) Replacement of maintenance parts, installation of accessories, or the like was not performed properly in accordance with the user's manual and catalogs
 - (e) The failure could not have been predicted with the scientific and technical standards at the time when the product was shipped from Sunmulon
 - (f) The failure was due to other causes not attributable to Sunmulon (including cases of force majeure such as natural disasters and other disasters)
- (4) The warranty listed in this Safety Precautions is the full and complete warranty for Sunmulon products, and Sunmulon shall bear no liability whatsoever regarding special damages, indirect damages, incidental damages, or passive damages that occurred due to Sunmulon product.

4. Handling precautions for switch

- (1) Do not perform wiring with power supplied to the switch. Do not touch the terminals or other charged parts of the switch while power is being supplied. Doing so may result in electric shock.
- (2) Use within the specified range for switching speed and frequency. If the switching speed is extremely slow, the contacts may not be switched smoothly, which may result in a contact failure or contact welding. Extremely fast switching speed may cause shock operation, resulting in premature breakdown. If the switching frequency is too high, the contacts may not be able to keep up with the speed.
- (3) Do not drop or otherwise apply strong force to the switch.
- (4) Never modify or disassemble the switch as it may cause malfunction or accidents.
- (5) Do not lubricate sliding parts such as actuators. It may penetrate into the inside of the actuator, resulting in malfunction.
- (6) Do not use the switch under loads that exceed the rated switching capacity or other contact ratings. Doing so may result in welding of the contact, or burnout accidents.

Safety Precautions for All Micro Switches

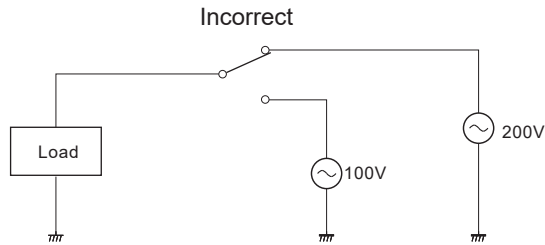
(7) Type of Load vs. Inrush Current

Some types of load have a great difference between normal current and inrush current. Make sure that the inrush current is within the permissible value.

- (a) Resistive load A resistive load is a load with only a resistive component and a power factor of 1 ($\cos=1$). The ratings shown in the catalog are for this resistive load.
- (b) Inductive load Inductive loads such as transformers, solenoids, and relays generate reverse voltages, and the higher the voltage or the lower the power factor of the load, the greater the reverse voltage and the greater the contact wear transition.
- (c) Lamp load If the lamp filament is switched on while it is cold, a transient current of 10 to 15 times the steady-state current flows, causing contact welding.

Type of Load \ Current	Inrush Current
Motor	4 to 10 times higher than the steady-state current
Inductive	4 to 6 times higher than the steady-state current
Lamp	10 to 15 times higher than the steady-state current

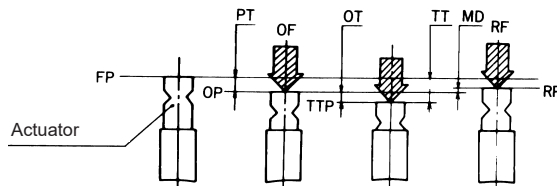
(8) Connection of different power supplies



Do not design a circuit where voltage is imposed between contacts, otherwise contact weld may result.

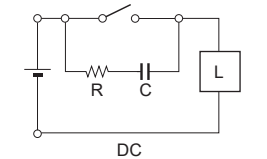
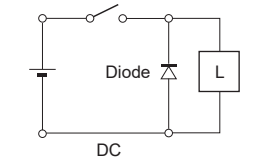
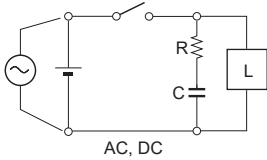
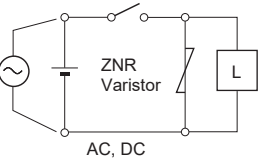
(9) Terminology explained

- (a) Micro switch Micro switch is a small switch with a very small contact gap and snap-action mechanism and with a contact structure that switches for a specified movement and specified force enclosed in a case with an actuator provided on the exterior of the case.
- (b) Actuator A part of a switch in which external force applied to it is transmitted by an internal spring mechanism to move the movable contacts to open and close the switch.
- (c) Free Position (FP) The initial position of the actuator when no external force is applied.
- (d) Operating Position (OP) The position of the actuator at which the contacts snap to the operated contact position when external force is applied from the position.
- (e) Total Travel Position (TTP) The position of the actuator when it reaches the stopper.
- (f) Release Position (RP) The position of the actuator at which the contacts snap from the operated contact position to their free position.
- (g) Operating Force (OF) The force applied to the actuator required to operate the switch contacts from the free position to the operating position.
- (h) Release Force (RF) The value to which the force on the actuator must be reduced to allow the contacts to return to the normal position.
- (i) Pretravel (PT) The distance or angle through which the actuator moves from the free position to the operating position.
- (j) Overtravel (OT) The distance or angle of the actuator movement beyond the operating position to the total travel position.
- (k) Movement Differential (MD) The distance or angle of the actuator from the operating position to the releasing position.
- (l) Total Travel (TT) The distance or angle of the actuator movement from the free position to the total travel position.

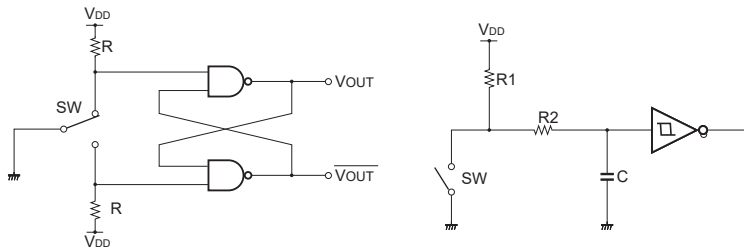


Safety Precautions for All Micro Switches

(10) For inductive load, the arc by back EMF may cause contact failure. Insertion of arc prevention circuit as the following is recommended.

Circuit	Element selection	Circuit	Element selection
 <p style="text-align: center;">DC</p>	<p>C : 1 to 0.5 μF \times switch current (A) R : 0.5 to 1 Ω \times switch voltage (V)</p> <p>The values may change according to the characteristics of the load. Determine ideal capacitance and resistance values through testing.</p>	 <p style="text-align: center;">DC</p>	<p>The diode must withstand a peak inverse voltage 4 times higher than the power supply voltage and regarding a forward current must as high or higher than the load current.</p>
 <p style="text-align: center;">AC, DC</p>		 <p style="text-align: center;">AC, DC</p>	<p>Use a varistor that can withstand the power supply voltage sufficiently. (1.5 times or more)</p>

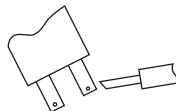
(11) Following circuits show examples of an anti-chattering circuit.



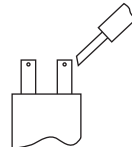
(12) Wiring

- (a) Do not apply a soldering iron to the switch housing. Doing so may deform the terminals and cause defects.
- (b) For soldering other than flux-preventive models, hand solder with the terminals facing down to prevent flux from penetrating into the switch.

Correct



Incorrect



- (c) Use the appropriate wire size for the applied voltage and current, and solder properly. Use of the product with incomplete soldering may cause abnormal heat generation, resulting in a fire hazard.
- (d) After wiring is completed, maintain an appropriate insulation distance.

(13) Usage environment

- (a) Do not use in the presence of flammable or explosive gases such as gasoline, thinner, LPG, etc.
- (b) Avoid using the product in places where corrosive or silicon gas is generated, high temperature, high humidity, sea breeze or direct sunlight.
- (c) Do not use the product in a place subject to vibration or shock. It may cause malfunction or damage.
- (d) When checking the actual equipment, load conditions and operating environment should be the same as the actual operating conditions.
- (e) The ambient temperature for storage is -25°C to 65°C (No freeze, no condensation).

(14) Store the product away from malignant gases, dust, high temperature and high humidity, and keep it in our packing condition.

(15) Periodic inspection and replacement

- (a) Although mechanical and electrical durability are listed in the specifications column, deterioration of various parts (deterioration of resins and corrosion of metal parts) is possible due to the operating environment and method of use. We ask that you implement inspections for Sunmulon products to prevent accidents from occurring by conducting periodic inspections and replacements.
- (b) When the switch is left unused or stored for long periods, contact reliability may deteriorate due to oxidation of contacts, which may cause continuity failure, etc. Therefore, it is necessary to check the operation before use.

(16) Service scope

The price of Sunmulon products do not include the cost of services, such as dispatching technicians.