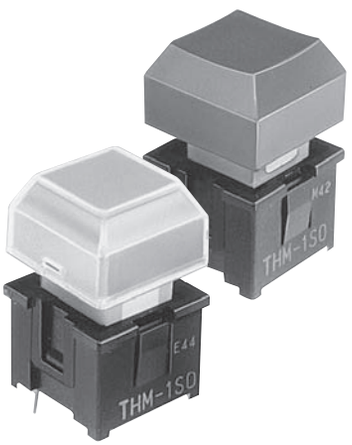
Sunmulon

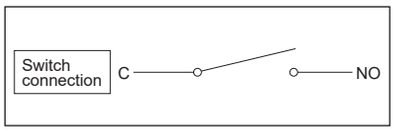
TH Illuminated Pushbutton Switch

TH

Keyboard type
Built-in reed switch for Dual-Color emission.



- Depth behind panel：Only 13 mm
- LED Full-Face, Dual-Color illumination available.
- Terminal shape：IC pitch & Flux-prevention
- Switch part：Built-in reed switch enable 10 million operations
- Button design：Clear and colored button can be selected by application.



CHARACTERISTICS

Button Size		Square：□18 mm
Contact Material		Reed switch used
Rating (Resistive Load)	Operating Power	5 W
	Operating Voltage	DC 100 V
	Operating Current	0.3 A
	Conventional Free Air Thermal Current	0.5 A
Insulation Resistance		More than 100 MΩ at DC 100 V
Dielectric Strength		DC 200 V RMS between NC and NO terminal for 1 sec. AC 1500 V RMS between terminals and ground for 60 sec. 50/60 Hz at normal ambient temperature and humidity
Contact Resistance		Less than 150 mΩ (Initial value)
Mechanical Life		More than 10,000,000 operations
Electrical Life (Resistive Load)		More than 10,000,000 operations at DC 5 V 10 mA
Operating Force		2.0 N max.
Total Travel		4.5 mm max.
Weight		8 g
Ambient Operating Temperature		−15℃ to 50℃ (No Freeze, No Condensation)
Ambient Operating Humidity		80%RH max. (No Condensation)
Ambient Storage Temperature		−25℃ to 65℃ (No Freeze, No Condensation)
Ambient Storage Humidity		80%RH max. (No Condensation)

https://www.sunmulon.co.jp/english/products/switch_e/th.html

◇Demensions：page TH-3
◇Ordering code：page TH-4～5
◇Internal connection arrangements：page TH-7
◇LED specifications：page TH-8
◇Terminals / PCB hole cutout：page TH-9
◇Mounting design / Panel cutout：page TH-9

SPECIFICATIONS

Illumination type	Full-Face	A
	Dual-Color	A
	Non-illumination	A
Contact	SPST	A
Terminal	PCB	A
RoHS (10 Substances)		Conform to standards

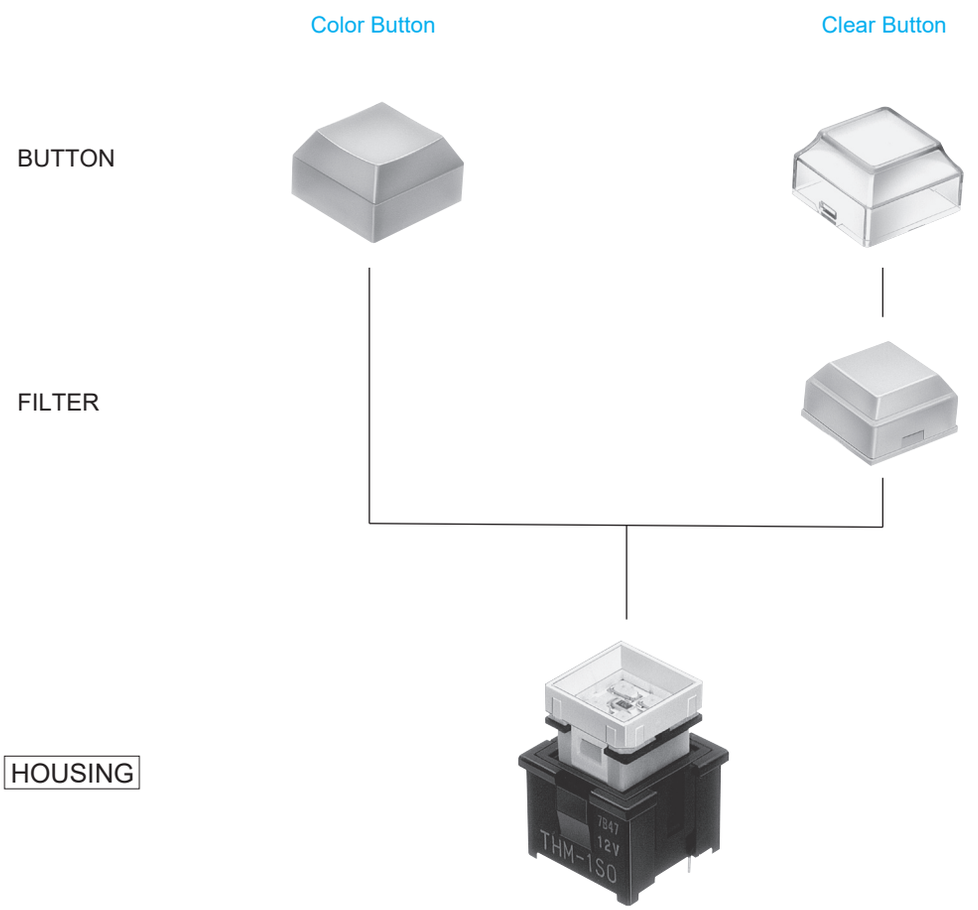
A : Applicable

CONTACT RATINGS

● Reed switch

Operating Power	5 W
Operating Voltage	DC 100 V
Operating Current	0.3 A
Conventional Free Air Thermal Current	0.5 A

STRUCTURE

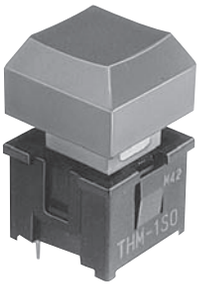


ILLUMINATION TYPES

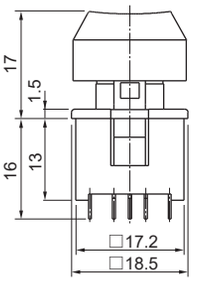
LED color symbol	7 Red　8 Green　9 Yellow ※ Yellow (9) is actually “ORANGE Yellow” not Lemon Yellow.
Full-Face	7　8　9
Dual-Color	7・8

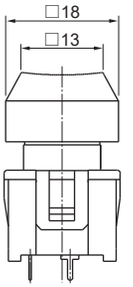
DIMENSIONS

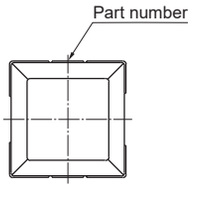
Color Button



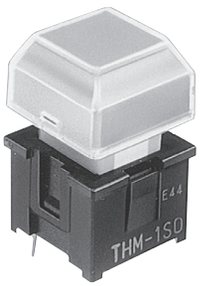
3D
DXF



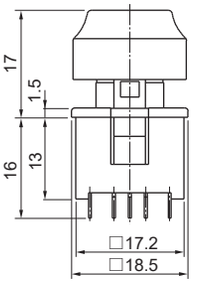


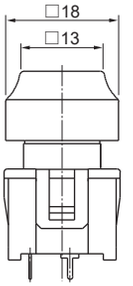


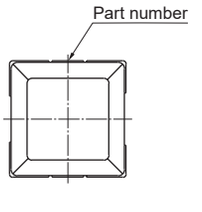
Clear Button



3D
DXF







3D・DXF data download site ： **https://www.sunmulon.co.jp/download/**

Tolerance : ± 0.4 mm

ORDERING CODE 【Full-Face】

Assembled Part

TH □ — □ S0 □ □ □ C □

● OPERATION

L	Indicator
M	Momentary

● CONTACT

0	Indicator
1	SPST・Normally Open

● ILLUMINATION TYPE

S0	Full-Face

● LED COLOR

7	Red	
8	Green	
9	Yellow	※1)
X	Without LED	

● BUTTON COLOR

R	Red	
G	Green	
Y	Yellow	※1)
M	Milk-white	
C	Clear	
X	Without button	※2)

● Supply Voltage to LED

1	DC 5V Built-in resistor
2	DC12V Built-in resistor
3	DC24V Built-in resistor
4	DC 5V Non-resistor
5	DC12V Non-resistor
6	DC24V Non-resistor
X	Without LED

For Non-resistor type,
use external protective resistor.

● LED TERMINAL

C	With terminals

● FILTER COLOR

1	Red	
2	Green	
3	Yellow	※1)
4	Milk-white	
X	Without filter	※2)

Filters cannot be used for
buttons other than clear button.

● NOTES

※1) The color of “Yellow” for LED (9), button (Y) and filter (3) is actually “Orange Yellow” not Lemon Yellow.
※2) For without button (X), specify without filter (X).

◇Demensions：page TH-3
◇Internal connection arrangements：page TH-7
◇LED specifications：page TH-8
◇Terminals / PCB hole cutout：page TH-9
◇Panel cutout：page TH-9

ORDERING CODE 【Dual-Color】

Assembled Part

TH □ – □ S3 78 □ □ C □

● OPERATION

L	Indicator
M	Momentary

● CONTACT

0	Indicator
1	SPST・Normally Open

● ILLUMINATION TYPE

S3	Dual-Color

● LED COLOR

78	Red・Green

● BUTTON COLOR ※1)

C	Clear
M	Milk-white
X	Without button ※2)

● Supply Voltage to LED ※3)

1	DC 5V Built-in resistor
2	DC12V Built-in resistor
3	DC24V Built-in resistor
4	DC 5V Non-resistor
5	DC12V Non-resistor
6	DC24V Non-resistor

For Non-resistor type,
use external protective resistor.

● LED TERMINAL

C	With terminals

● FILTER COLOR ※1)

4	Milk-white
X	Without filter ※2)

Filters cannot be used for
buttons other than clear button.

● NOTES

※1) Button should be C (Clear) with Milk-white filter (4) or M (Milk-white) without filter (X).

※2) For without button (X), specify without filter (X).

※3) With DC5V, Simultaneous lighting is possible for both Built-in resistor type and Non-resistor type.
With DC12V and DC24V, please select Non-resistor type and apply required external resistor for simultaneous lighting.

◇Demensions：page TH-3
◇Internal connection arrangements：page TH-7
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◇Terminals / PCB hole cutout：page TH-9
◇Panel cutout：page TH-9

REPLACEMENT PARTS

● Full-Face BUTTON／FILTER

	Red	Green	Yellow	Milk-white	Clear
BUTTON	TH-2009-LR	TH-2009-LG	TH-2009-LY	TH-2009-LM	TH-2010-CC
FILTER	TH-2011-LR	TH-2011-LG	TH-2011-LY	TH-2011-LM	

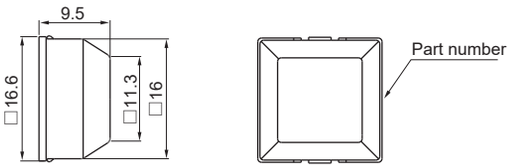
※ Filters cannot be used for buttons other than clear button. When using filters, select clear button.

● Dual-Color BUTTON／FILTER

	Milk-white	Clear
BUTTON	TH-2009-LM	TH-2010-CC
FILTER	TH-2011-LM	

※ Filters cannot be used for buttons other than clear button. When using filters, select clear button.

FILTER DIMENSIONS

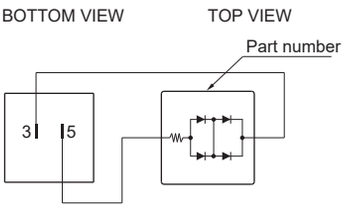
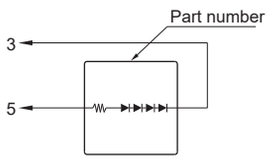


TH-2011

Tolerance : ± 0.4 mm

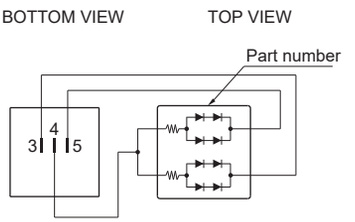
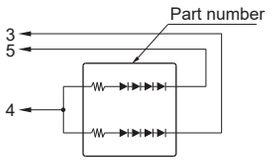
INTERNAL CONNECTION ARRANGEMENTS

● Full-Face

Voltage	
DC 5V	
DC12V DC24V	

※ These are all internal connection diagrams for built-in resistor type.
※ For Non-resistor type, the resistor part in the diagram should be short- circuited.

● Dual-Color

Voltage	
DC 5V	
DC12V DC24V	

● Dual-Color combination (Common for each voltage)

Terminals	LED Color
4-3	Red
4-5	Green

LED SPECIFICATIONS 【Full-Face】

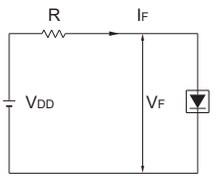
● BUILT-IN RESISTOR

Voltage	Rated Current (mA)
DC 5V ±5%	40
DC 12V ±5%	20
DC 24V ±5%	17

● NON-RESISTOR (EXTERNAL RESISTOR)

Supply Voltage		DC5V			DC12V・24V		
LED Color		Red	Green	Yellow	Red	Green	Yellow
Max. Forward Current I_{FM} (mA)		50	50	50	25	25	25
DC Reverse Voltage V_R (V)		10	10	10	20	20	20
Forward Voltage V_F (Typ.)【IF=20mA】 (V)		3.6	4.2	4.2	7.2	8.4	8.4
Derating (Operating temperature) (over 25℃ working temperature) (mA/℃)		0.4					
Pulse Lighting	Pulse Width PW (μs)	100					
	Duty Ratio DR	10^{-1}					
	Allowable forward current I_{FP} (mA)	100					

● Wiring Diagram



Refer to the following formula
to calculate external resistance values.

$$R = \frac{V_{DD} - V_F}{I_F}$$

V_{DD} : Supply Voltage
V_F : Forward Voltage
I_F : Forward Current

IF (Forward Current) :
Refer to the Rated Current of BUILT-IN RESISTOR type,
and be sure to set less than IFM (Max. Forward Current).

LED SPECIFICATIONS 【Dual-Color】

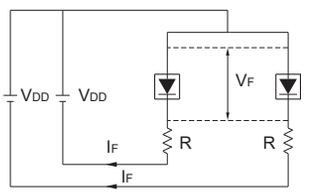
● BUILT-IN RESISTOR

Voltage	Rated Current (mA)
DC 5V ±5%	37
DC 12V ±5%	17
DC 24V ±5%	17

● NON-RESISTOR (EXTERNAL RESISTOR)

Supply Voltage	DC5V		DC12V・24V	
LED Color	Red	Green	Red	Green
Max. Forward Current I_{FM} (mA)	40	40	20	20
DC Reverse Voltage V_R (V)	5	5	10	10
Forward Voltage V_F (Typ.)【IF=20mA】 (V)	4.2	4.4	8.4	8.8
Derating (Operating temperature) (over 25℃ working temperature) (mA/℃)	0.6			

● Wiring Diagram



Refer to the following formula
to calculate external resistance values.

$$R = \frac{V_{DD} - V_F}{I_F}$$

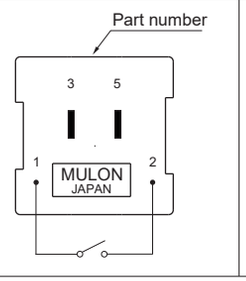
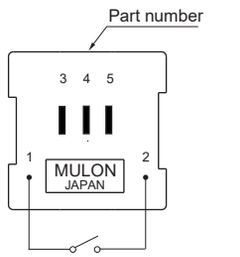
V_{DD} : Supply Voltage
V_F : Forward Voltage
I_F : Forward Current

IF (Forward Current) :
Refer to the Rated Current of BUILT-IN RESISTOR type,
and be sure to set less than IFM (Max. Forward Current).

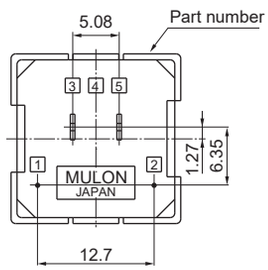
For resistance value calculation
https://www.sunmulon.co.jp/english/products/led.html
The resistance value can be calculated just by entering the items.

TERMINALS／PCB HOLE CUTOUT

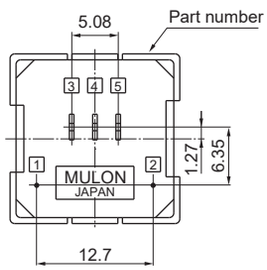
● TERMINALS LAYOUT (BOTTOM VIEW)

Full-Face・Non-illumination	Dual-Color
	

● TERMINALS DIMENSIONS (BOTTOM VIEW)

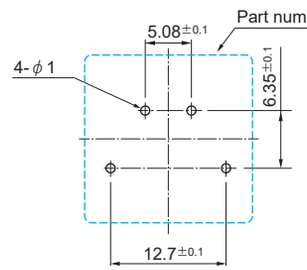


Full-Face・Non-illumination

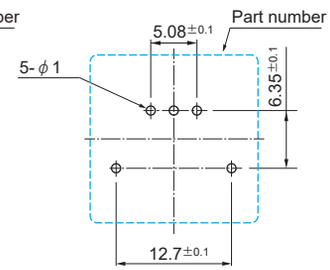


Dual-Color

● PCB hole cut-out (TOP VIEW)

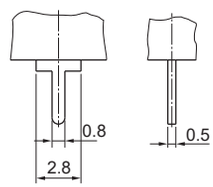


Full-Face・Non-illumination

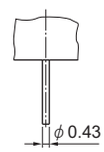


Dual-Color

TERMINAL SHAPE



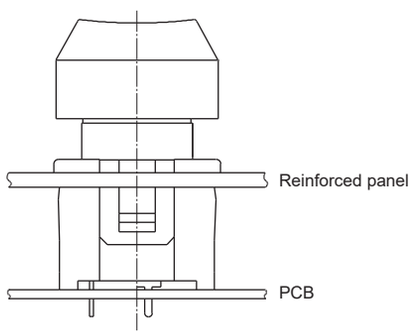
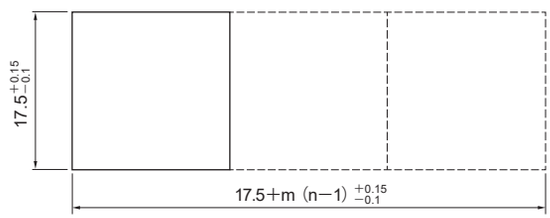
LED terminal



Switch terminal

PANEL CUT DIMENSIONS（REINFORCED PANEL）

By using the reinforced panel it is possible to prevent direct application of force to the printed circuit board.
Please use reinforced panel thickness 1-2 mm.

Mounting diagram	Panel cut dimensions
	

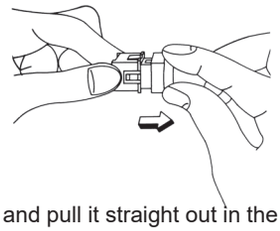
n : Number of Units　m : Pitch between each switch（m≧19）

※ After the panel-cutting process, make sure to remove burrs on the surface.

Tolerance : ± 0.4 mm

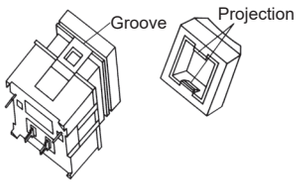
ASSEMBLY & DISASSEMBLY

1. Removing Button



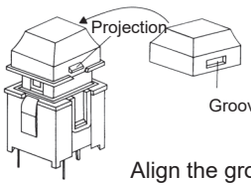
Hang the button and pull it straight out in the direction of the arrow.

2. Fitting Color Button & Fitting Filter



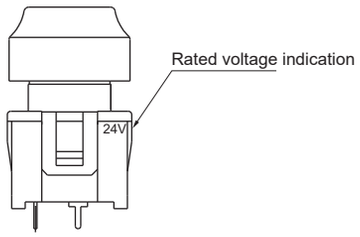
Align the projection in the button (filter), the groove on the switch, and fit the button onto the switch.

3. Fitting Clear Button



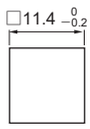
Align the groove on the button, the projection on the filter and fit the button.

4. Indication of rated voltage



PRECAUTIONS FOR CORRECT USE

1. Solder quickly and correctly at 380℃ 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 rated voltage is shown on the side of the housing, so be sure before use.
4. Do not apply an excessive force of more than 0.01 N·m to the switch terminals as it will cause deformation.
5. Character films are not included. If preparing the character film separately, use a heat-resistant film with a thickness of 0.1 mm. For dimensions, please refer to the figure on the right.
6. Take care to avoid impact as the characteristics may change due to impacts such as dropping.
7. Although the shape is keyboard type, it is not designed for tapping operation. Do not apply an excessive force.
8. TH is flux-prevention, but that is only terminal part. Take care to prevent flux from penetrating the sliding parts.



※ For handling instructions and precautions other than the above, please refer to “Safety Precautions for All Illuminated Pushbutton Switches”.

Tolerance : ± 0.4 mm

As of April 2023

Safety Precautions for All Illuminted Pushbutton Switches

1. Notes on contents of Catalogs

(1) Rated values, performance values, and specification values of Sumulon 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 improvemnet 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, satndards, or laws to which your machinery, equipment, ect. 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 Sumulon 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 equipmnt (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 cause 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) Be careful of electrostatic breakdown when handling.

(3) Do not drop or otherwise apply strong force to the switch.

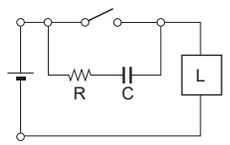
(4) Do not place heavy objects on the switch.

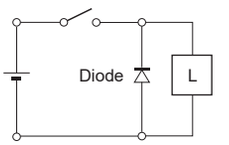
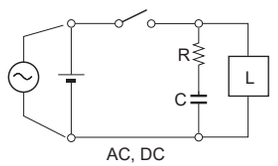
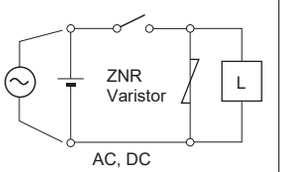
(5) Do not operate or use the housing (switch unit) by itself. Use the switch with assembled the illuminated part (LED module or button).

(6) Pushbutton switches are designed to be operated by fingertips. Operating the switch using a sharp object (screwdrivers, tweezers, etc.), hard object (metal, etc.), or with a large or sudden force, may cause deform or damage the switch.

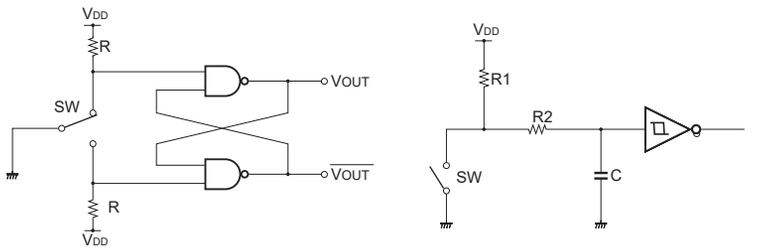
(7) Do not use the switch under loads that exceed the rated switching capacity or other contact ratings. Doing so may result in welding of the contact, or burnout accidents.

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

<table>
<tr><th>Circuit</th><th>Element selection</th><th>Circuit</th><th>Element selection</th></tr>
<tr><td> 
</td><td rowspan="2">C：1 to 0.5 μF × switch current (A)
R：0.5 to 1 Ω × switch voltage (V)

The values may change according to the characteristics of the load. Determine ideal capacitance and resistance values through testing.</td><td> 
</td><td>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.</td></tr>
<tr><td> 
</td><td> 
</td><td>Use a varistor that can withstand the power supply voltage sufficiently. (1.5 times or more)</td></tr>
</table>

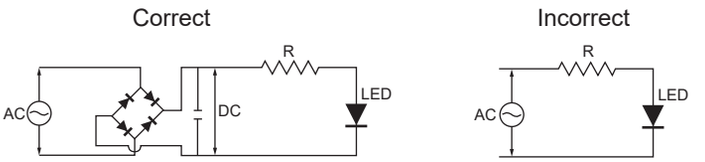
(9) Following circuits show examples of an anti-chattering circuit.



(10) Illumination

(a) Do not apply a voltage between the LED terminal that is greater than the rated voltage. Doing so may damage the LED, cause lighting failure.

(b) LEDs cannot be lit directly by AC circuit should be provided rectifier smoothing circuit for products other than AC input type.



(c) When wiring, pay attention to the polarity of the terminals.

(d) Simultaneous lighting may not be possible with Dual-Color illumination or Split-Face illumination (2, 3, or 4 split illumination), check the catalog.

(e) Apply voltage directly to LEDs of Non-built-in resistor type will damage the LEDs, so connect an appropriate external resistor.

(11) Wiring

(a) Do not apply a soldering iron to the switch housing. Doing so may deform the terminals and cause defects.

(b) See catalog for models compatible with flux prevention measures terminal. Be careful not to allow flux to panetrate sliding parts such as buttons. Use non-corrosive rosin solution as flux for dip soldering.

(c) For soldering other than flux-preventive models, hand solder with the terminals facing down to prevent flux from penetrating into the switch.

(d) The housing of KA, K2, and K9 series are designed for reflow soldering.

(e) 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.

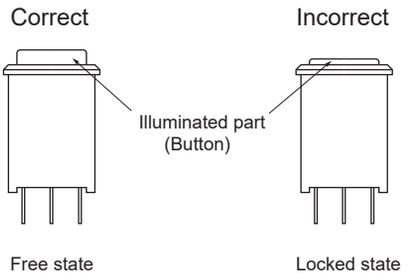
(f) After wiring is completed, maintain an appropriate insulation distance.

(12) 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) Provide appropriate protection when using the product in places where it is exposed to water, oil, metal powder, or dust.
(d) Do not use the product in a place subject to vibration or shock. It may cause malfunction or damage.
(e) When installed in a close grouping or continuously lit, the ambient temperature may exceed the specified value due to heat generation. Take measures such as ventilation and lowering the operating voltage.
(f) When checking the actual equipment, load conditions and operating environment should be the same as the actual operating conditions.
(g) The ambient temperature for storage is －25℃ to 65 ℃ (No freeze, no condensation).

(13) When wiping off dirt on the exterior of the switch and accessories such as side plates, wipe lightly with a soft, dry cloth. Organic solvents such as thinner, benzene, alcohol, or other acidic chemicals may cause deformation, discoloration, or malfunction.

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

(15) When removing the illuminated part (or button) from the alternate switch housing, switch state should be in a free state.



Removal in a locked state may cause malfunction or damage to alternate switch.

(16) 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.

(17) Service scope
The price of Sunmulon products do not include the cost of services, such as dispatching technicians.