

## Lighted Pushbutton Switch

## A3D

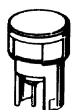
### Cylindrical 8-dia. Subminiature Series Feature Short Mounting Depth

- Round, square, and rectangular LED pushbutton units
- Models that can be used as an indicator also available.
- Requires only 18-mm mounting depth
- Efficiency in wiring improved by terminals arranged on the same surface.
- Lenses and legends replaceable without tools

## Ordering Information

When placing your order, specify the individual component part model numbers of the pushbutton unit, LED, lamp, and switch unit, as listed in the ordering tables below.

#### Lighted Type Pushbutton Unit



A3D j -500 j  
M2D j -500 j \*

#### Switch Unit



A3D j -7 j j j  
M2D j -7 j j j \*

\* Model number unique  
for indicator unit

#### Non-lighted Type Pushbutton Unit



A3D j -501 j

#### Switch Unit



A3D-7 j j j

### Pushbutton Unit

#### Lighted Type, Built-in LED

| Button color  | Rectangular | Square     | Round      |
|---------------|-------------|------------|------------|
|               |             |            |            |
| <b>Red</b>    | A3DJ-500R   | A3DA-500R  | A3DT-500R  |
| <b>Yellow</b> | A3DJ-500Y   | A3DA-500Y  | A3DT-500Y  |
| <b>Green</b>  | A3DJ-500GY  | A3DA-500GY | A3DT-500GY |
| <b>White</b>  | A3DJ-500W   | A3DA-500W  | A3DT-500W  |

### Indicator

| Button color  | Rectangular | Square     | Round      |
|---------------|-------------|------------|------------|
|               |             |            |            |
| <b>Red</b>    | M2DJ-500R   | M2DA-500R  | M2DT-500R  |
| <b>Yellow</b> | M2DJ-500Y   | M2DA-500Y  | M2DT-500Y  |
| <b>Green</b>  | M2DJ-500GY  | M2DA-500GY | M2DT-500GY |
| <b>White</b>  | M2DJ-500W   | M2DA-500W  | M2DT-500W  |

## Switch Unit

| Contact configuration      | Switch action | Terminal | Degree of protection: IP00                                                                       |                                                                                               |                                                                                              |
|----------------------------|---------------|----------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
|                            |               |          | Rectangular<br> | Square<br> | Round<br> |
| SPST-NO+<br>SPST-NC        | Momentary     | Solder   | A3DJ-7111                                                                                        | A3DA-7111                                                                                     | A3DT-7111                                                                                    |
|                            |               | PCB      | A3DJ-7112                                                                                        | A3DA-7112                                                                                     | A3DT-7112                                                                                    |
|                            | Alternate     | Solder   | A3DJ-7121                                                                                        | A3DA-7121                                                                                     | A3DT-7121                                                                                    |
|                            |               | PCB      | A3DJ-7122                                                                                        | A3DA-7122                                                                                     | A3DT-7122                                                                                    |
| For indication (no switch) |               | Solder   | M2DJ-7001                                                                                        | M2DA-7001                                                                                     | M2DT-7001                                                                                    |
|                            |               | PCB      | M2DJ-7002                                                                                        | M2DA-7002                                                                                     | M2DT-7002                                                                                    |

## Specifications

## Contact Ratings

|                     |                |
|---------------------|----------------|
| DC (resistive load) | 0.1 A, 30 VDC. |
|---------------------|----------------|

**Note:** The minimum permissible load is 1 mA, 5 VDC.

## Built-in LED Ratings

| Item                   |                           | Red    | Yellow | Green  |
|------------------------|---------------------------|--------|--------|--------|
| Forward voltage $V_F$  | Standard value (see note) | 1.7 V  | 2.2 V  | 1.7 V  |
|                        | Max. value                | 2.0 V  | 2.5 V  | 2.0 V  |
| Forward current $I_F$  | Standard value            | 20 mA  | 20 mA  | 20 mA  |
|                        | Absolute max. value       | 50 mA  | 50 mA  | 50 mA  |
| Permissible loss $P_D$ | Absolute max. value       | 100 mW | 125 mW | 122 mW |
| Reverse voltage $V_R$  | Absolute max. value       | 4 V    | 4 V    | 4 V    |

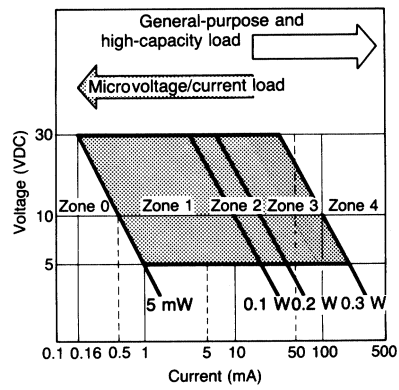
**Note:** Refer to  $V_F$  vs.  $I_F$  characteristics in Hints on Correct Use. Because no resistor is incorporated in the built-in LED, connect an appropriate external resistance within the above limit.

## Characteristics

|                       |                                                                                                                                                                                           |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating frequency   | Mechanical: Momentary-action type: 120 operations per minute max.<br>Alternate-action type: 60 operations per minute max.<br>Electrical: 20 operations per minute max.                    |
| Insulation resistance | 100 M $\Omega$ min. (at 500 VDC)                                                                                                                                                          |
| Dielectric strength   | 1,000 VAC, 50/60 Hz for 1 minute between terminals of same polarity<br>2,000 VAC, 50/60 Hz for 1 minute between terminals of different polarity and also between each terminal and ground |
| Vibration             | Mechanical/malfunction durability: 10 to 55 Hz, 1.5 mm double amplitude                                                                                                                   |
| Shock                 | Mechanical durability: 500 m/s <sup>2</sup> (approx. 50 G)<br>Malfunction durability: 150 m/s <sup>2</sup> (approx. 15 G)                                                                 |
| Ambient temperature   | Operating: -10_ to 55_ C                                                                                                                                                                  |
| Humidity              | 35 to 85% RH                                                                                                                                                                              |
| Life expectancy       | Mechanical: Momentary-action type: 1,000,000 operations min.<br>Alternate-action type: 100,000 operations min.<br>Electrical: 100,000 operations per minute max.                          |
| Weight                | Approx. 3 g (see note)                                                                                                                                                                    |

**Note:** The weight indicated here applies to the lighted type (SPST-NO).

## Applicable Load Range



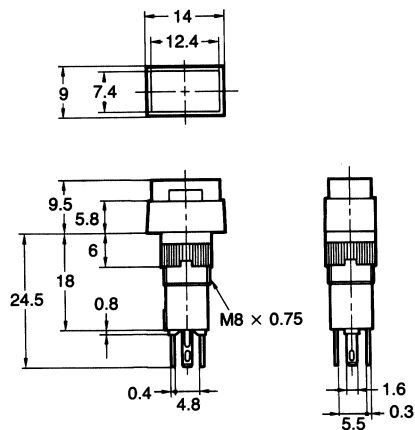
|          |            |
|----------|------------|
| OF max.  | 250 g      |
| RF min.  | 20 g       |
| TT       | 3.5±0.5 mm |
| LTA min. | 0.5 mm     |
| PT max.  | 2.5 mm     |

## Dimensions

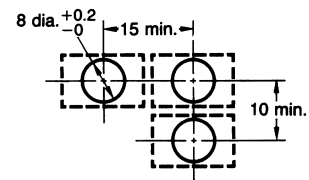
Unless otherwise specified, a tolerance of  $\pm 0.4$  mm applies to all dimensions.

The following dimensions apply to the switch unit with solder terminals.

### Rectangular A3DJ

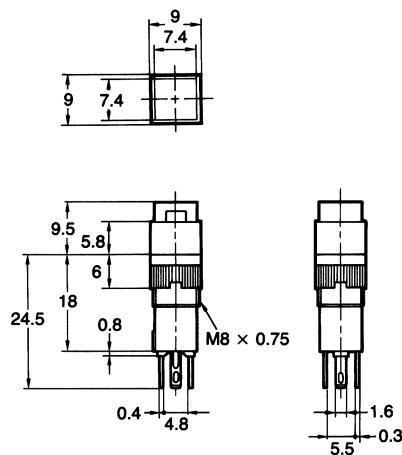


#### Panel cutout

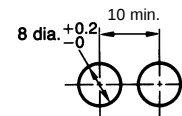


Note: Recommended panel thickness is 1.0 to 3.2 mm.

### Square A3DA

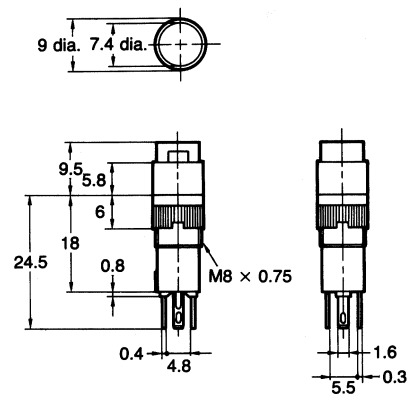


#### Panel cutout

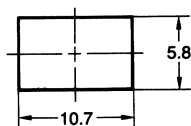


Note: Recommended panel thickness is 1.0 to 3.2 mm.

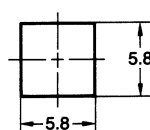
### Round A3DT



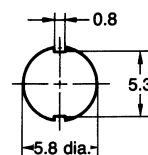
### Legend Plate A3DJ



### A3DA



### A3DT

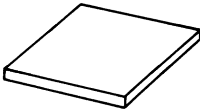


- Note:**
1. The thickness is 0.8 mm.
  2. Since the legend plate is made of polycarbonate, use alcohol-based paints such as melanin, phthalic acid, or acryl paint when marking the legend.

## Terminals/Connections

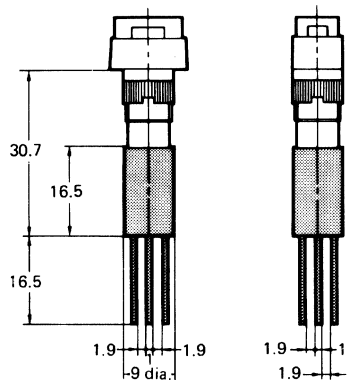
|                 | Type                                                                                                                                                                                                       |                                                                                                                                                                       |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 | SPST-NO                                                                                                                                                                                                    | Indicator                                                                                                                                                             |
| Solder terminal | <p>Lighted type, non-lighted type</p> <p>LED terminal 0.3 t</p> <p>(bottom view)</p> <p>Terminal hole</p>                                                                                                  | <p>Indicator</p> <p>LED terminal 0.3 t</p> <p>(bottom view)</p> <p>Terminal hole</p>                                                                                  |
| PCB terminal    | <p>Lighted type, non-lighted type</p> <p>LED terminal 0.3 t</p> <p>(bottom view)</p> <p>Mounting hole (bottom view)</p> <p>Four 0.8 dia. <math>^{+0.1}_{-0}</math> holes</p> <p>5.2±0.1</p> <p>5.8±0.1</p> | <p>Indicator</p> <p>LED terminal 0.3 t</p> <p>(bottom view)</p> <p>Mounting hole (bottom view)</p> <p>Two 0.8 dia. <math>^{+0.1}_{-0}</math> holes</p> <p>5.8±0.1</p> |

## Accessories (Order Separately)

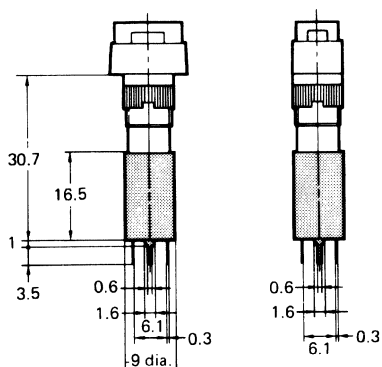
| Name             | Shape                                                                             | Classification     | Model     | Remarks                                                                  |
|------------------|-----------------------------------------------------------------------------------|--------------------|-----------|--------------------------------------------------------------------------|
| Socket           |  | Wire-wrap terminal | A3D-4101  | Cannot be used with insulation cover.                                    |
|                  |                                                                                   | PCB terminal       | A3D-4102  |                                                                          |
|                  |                                                                                   | Solder terminal    | A3D-4103  |                                                                          |
| Insulation Cover |  | ---                | A3D-3002  | Cannot be used with socket.                                              |
| Tightening Tool  |  | ---                | A3D-3004  | Useful for mounting switch units one after another. Do not over-tighten. |
| Legend Plate     |  | Rectangular        | A3DJ-5201 | One legend plate is supplied per standard switch unit.                   |
|                  |                                                                                   | Square             | A3DA-5201 |                                                                          |
|                  |                                                                                   | Round              | A3DT-5201 |                                                                          |

### Dimensions with Socket

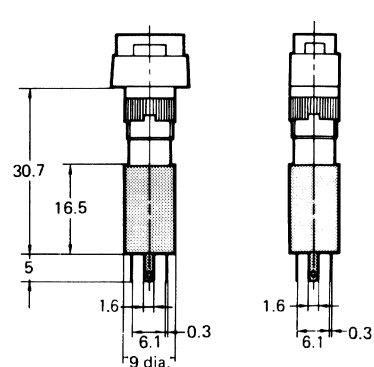
Wire-wrap Terminal



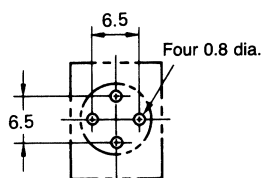
PCB Terminal



Solder Terminal

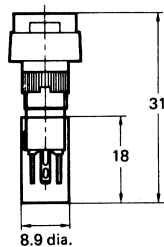


Mounting Hole (Bottom View)



### Dimensions with Insulation Cover

The illustration below shows the insulation cover fitted to a rectangular pushbutton switch.



Mount the switch unit on the panel with the mounting nut. To perform the wiring, first insert the lead wires into the hole of the insulation cover. Mount the insulation cover to the switch so that the side of the cover having a cylindrical hole faces the switch unit. Insert the lead wire in the insulation cover from the side of the insulation cover having a barrier.

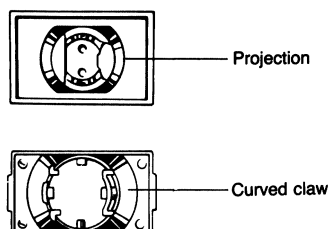
After performing the wiring, mount the insulation cover to the switch so that the projection of the switch fits in the hole on the insulation cover.

# Assembly/Disassembly

## Mounting Directions for Switch and Pushbutton Unit

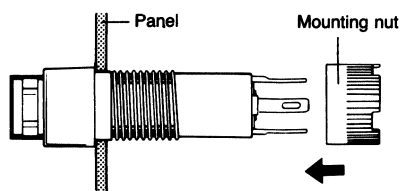
- Insert the pushbutton unit in the switch unit so that the circular-shaped claw outside the projection of the switch unit mates with the claw on the upper part of the switch unit.
- The pressure applied during insertion should be 2.5 kg max.

**Note:** If the LED terminal is bent, it may not align with the mating hole. Before insertion, check to see if any LED terminal is bent and, if so, straighten it.



## Mounting Switch Unit on Panel

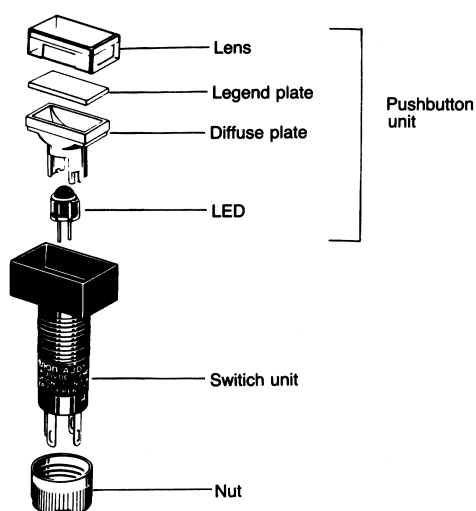
### Nut Mounting



## Wiring

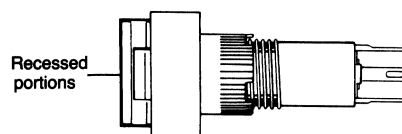
- Finish soldering within 5 seconds with a 30 watt soldering iron, or within 3 seconds at a solder temperature of 240 °C. For about a minute after soldering, do not apply any force to the switch unit to avoid deforming the softened plastic switch unit base.
- Use a non-corrosive, resin-based soldering flux.

## Construction



## Removing the Pushbutton Unit

- With your thumb and forefinger, while holding the recessed portions on both sides, firmly and steadily pull out the top of the pushbutton unit. Pulling out the cap with pliers or a similar tool will damage the cap.



- Insert the switch unit from the front of the panel and tighten the mounting nut inserted from the rear of the panel.
- Since a projection exists on the rear portion of the switch unit, if the mounting nut cannot be fitted into position, turn the nut slightly.
- The tightening torque of the mounting nut should be less than 5 kg-cm.
- Solder the terminals after mounting the nut. Otherwise, the terminals, when thickened by solder, may prevent the nut from being screwed down onto the switch unit.

## Hints on Correct Use

### LED

- Because no resistor is incorporated in the LED of the lighted pushbutton switch, connect an appropriate external resistor.
- Make sure that the resistance of the resistor is within the permissible range determined by the LED characteristics. The forward current of the LED must be 8 mA minimum.
- The resistance of the external resistor can be obtained by this equation:

$$R = (E - V_F) / I_F (\Omega)$$

where,

E: operating voltage (V)

$V_F$ : LED forward voltage (V)

$I_F$ : LED forward current (mA)

Determine the resistance of the external resistor that satisfies the characteristics of the LED. However, the average LED forward current must be 8 mA or more.

Example of resistance calculation

When using a red LED where  $E = 24 \text{ V}$ ,  $I_F = 20 \text{ mA}$ , and  $T_a = 25^\circ\text{C}$ , from the  $V_F$  vs.  $I_F$  characteristics on the right, forward voltage  $V_F$  is 1.7 V

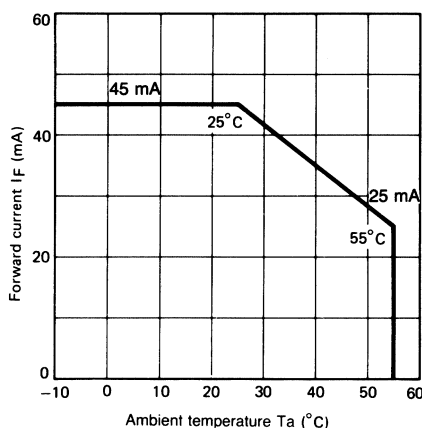
when 20 mA of  $I_F$  flows through the LED. Substituting these values for the variables in the above equation,

$$R = (24 \text{ (V)} - 1.7 \text{ (V)}) / 0.02 \text{ (A)} = 1111 (\Omega)$$

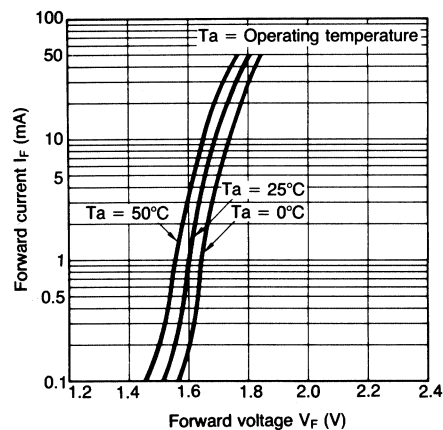
(or 20 mA) (or 1.1 k $\Omega$ )

Therefore, the estimated resistance is 1.1 k $\Omega$ , 1W.

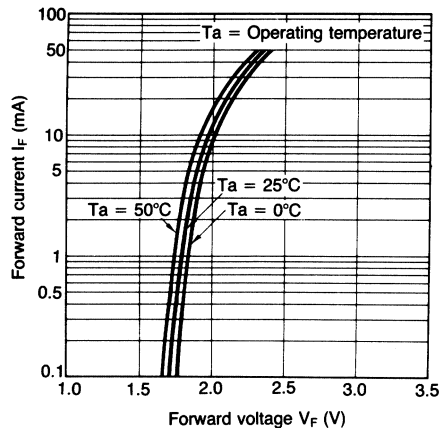
Decrease in Forward Current



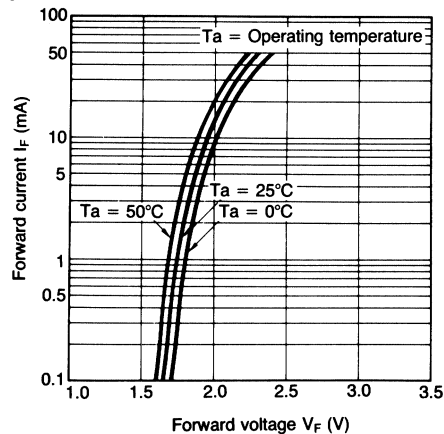
LED Characteristics ( $V_F$  vs.  $I_F$  Characteristics) (Red)



LED Characteristics ( $V_F$  vs.  $I_F$  Characteristics) (Yellow)



LED Characteristics ( $V_F$  vs.  $I_F$  Characteristics) (Green)



**ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.**

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

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

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