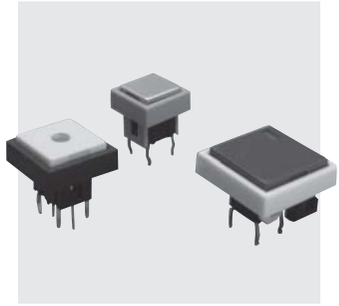
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# TM & TR

## Ultra-Miniature Illuminated Pushbutton Switches



RoHS Compliant

## ■Series

Conductive Rubber Contact（**TR** type）
Mettal Contact（**TM** type）

## ■Features

1. **Two Types of Contacts**
   TR series: Conductive rubber contact for soft tactile feel.
   TM series: Metal contact for sharp tactile feel.
2. **PC Board Mount**
   Terminal pitch is in inches (multiples of 2.54 mm) for all models. The unique terminal shape prevents the terminal pins from coming loose from the PC board during dip soldering.
3. **Enhanced Resistance to Soldering Heat**
   Improved terminal structure protects the contacts from soldering heat.
   In addition, each pole has two terminals which can be used as a jumper wire.
4. **Ultra-Miniature Switch with LED**
   LED is built into miniature housing.
5. **Wide Variety of Accessories**
   A wide variety of accessories are available, including color buttons and mounting frames.
6. **Compatible With Lead-Free Soldering (TM Series)**
   Heat-resistant resin for lead-free soldering.

## ■ Specifications

| | | |
|---|---|---|
| Rating | **TR**：10mA 12VDC max. 10 μ A Min. | |
| | **TM**：1VA max.（50mA max.48VDC max） | 0.5mA min. |
| | **TMG**：1VA Max.（50mA max.48VDC max.） | 10 μ A min. |
| Initial contact resistance | **TR**：500 Ω max.（1mA 2VDC at 1.47N｛150gf｝）<br>**TM**：100m Ω max<br>（1.5mA 200 μ VAC at 1.96N｛200gf｝） | |
| Dielectric strength | 250VAC 1 minute | |
| Insulation resistance | 100MΩ min （100VDC） | |
| Electrical life | **TR**：100,000 operations<br>**TM**：300,000 operations | |
| Contact Bounce | **TR**：3 msec. max.（Initial value）<br>**TM**：10 msec. max.（Initial value） | |
| Travel | **TR**：1 mm<br>**TM**：0.25 mm | |
| Operating force（at peak force） | **TR**：0.98±0.39N<br>**TM**：1.37±0.39N | |
| Operating temperature range | −25～+70℃ | |
| Storage temperature range | −40～+70℃ | |

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## ■Part Numbering

**T M G 2 — 21 — L2**

- T M: Type of contact
- G: Contact plating
- 2: Structure
- 21: LED luminance
- L2: LED color•LED location

## ■Type of Contacts and Contact Plating

| Code | Type of contact | Contact Plating |
|---|---|---|
| **R** | Conductive rubber contact | Gold plated |
| **M** | Metal contact | Silver plated |
| **MG** | Metal contact | Gold plated |

Note : The contacts of TR series are all gold-plated.

## ■LED Specifications

### TR2—21 • TM2—21

| Simbol | Color | Forward Current (IF) | Forward V (VF) | | Reverse Voltage (VR) |
|---|---|---|---|---|---|
| | | | nom. | max. | |
| 2 | Red | 30mA | 2.0V | 2.5V | DC5V |
| 5 | Green | 25mA | 2.2V | 2.5V | DC5V |
| 6 | Blue | 30mA | 3.8V | 4.5V | DC5V |
| 8 | Yellow | 30mA | 2.1V | 2.5V | DC5V |

### TR3—21 • TM3—21

| Simbol | Color | Forward Current (IF) | Forward V (VF) | | Reverse Voltage (VR) |
|---|---|---|---|---|---|
| | | | nom. | max. | |
| 2 | Red | 20mA | 2.0V | 3.0V | DC3V |
| 5 | Green | 25mA | 2.1V | 3.0V | DC3V |
| 8 | Yellow | 20mA | 2.1V | 3.0V | DC3V |

## ■Operating Force vs. Stroke Characteristics

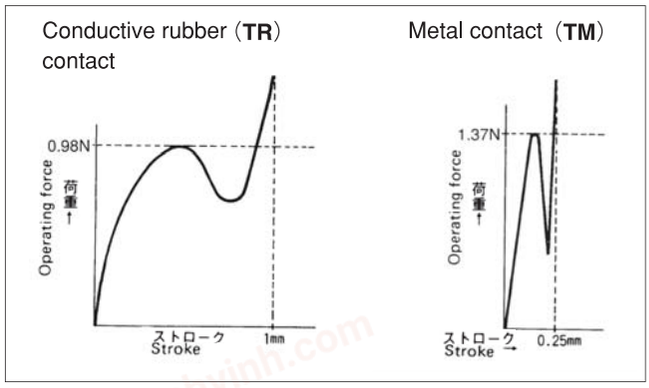



Fig.**A**

## ■Structure

| Fig. | 1 | 2 | 3 |
|---|---|---|---|
| Construction |  Without LED |  With LED in button stem |  With LED in side frame |

## ■LED Location

| Symbol | ※LED location | |
|---|---|---|
| | TR2 • TM2 | TR3 • TM3 |
| L■ |  |  |
| LO■ | |  |
| LOO■ | |  |
| L■O■ | |  |

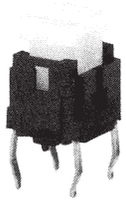
※When color button is mounted.

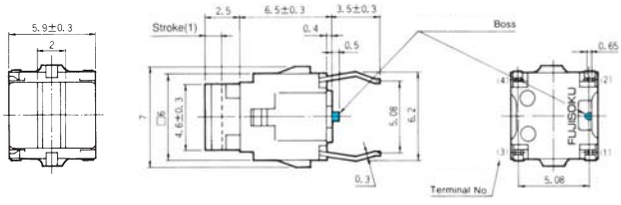
LED color to be specified in ■

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## TR (Conductive Rubber Contact)

### TR1 SPST



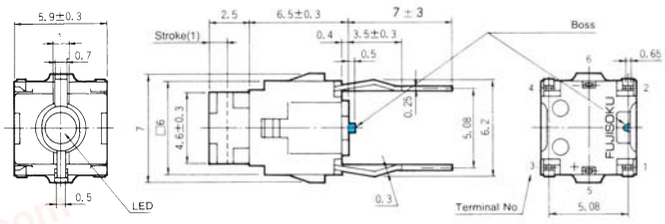



| Part No. | Switching function | | Circuit diagrams |
|---|---|---|---|
| | | Push | |
| TR1−01 | OFF | (ON) | |
| Connecting terminals | —— | 1 — 3<br>2 — 4 | |

Terminal numbers are not shown on the switch.

### TR2 SPST

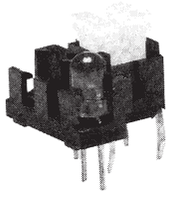


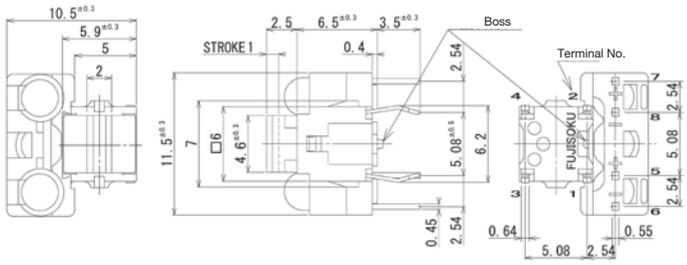



| Part No. | Switching function | | Circuit diagrams |
|---|---|---|---|
| | | Push | |
| TR2−21−L■ | OFF | (ON) | |
| Connecting terminals | —— | 1 — 3<br>2 — 4 | |
| LED circuit | 5 (+) ○ | ○ (−) 6 | |

Terminal numbers are not shown on the switch.

### TR3 SPST






The photo shows
TR3—21—L■

| Part No. | Switching function | | Circuit diagrams |
|---|---|---|---|
| | | Push | |
| TR3−21−L■<br>(−LO■、LOO■<br>−L■O■) | OFF | (ON) | |
| Connecting terminals | —— | 1 — 3<br>2 — 4 | |
| LED circuit | Single LED | (+) ○ | ○ (−) |
| | Dual Color separate LED | 5 ○ (+) | ○ 6<br>(−)<br>7 ○ ○ 8 |

Terminal numbers are not shown on the switch.

(ON) : Momentary

LED color to be specified in ■

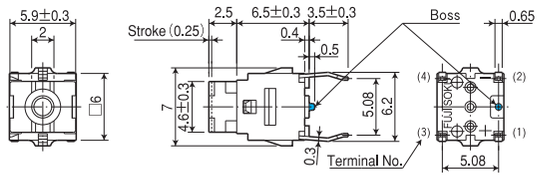
■ : Refer to “Table of Part Numbers” on P.169 for a full list of part numbers.

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## TM (Metal Contact)

### TM1 SPST



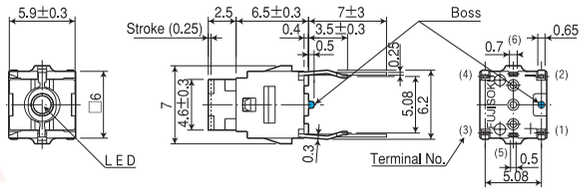



| Part No. | Switching function | | Circuit diagrams |
|---|---|---|---|
| | ■ | ↓Push ■ | |
| **TM1−01**<br>**TMG1−01** | OFF | (ON) | (1) (3) (2) (4) |
| Connecting terminals | —— | 1 — 3<br>2 — 4 | |

Terminal numbers are not shown on the switch.

### TM2 SPST

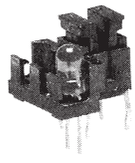


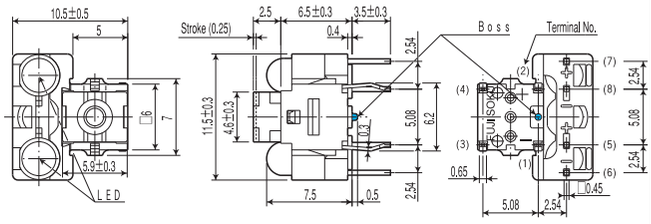



| Part No. | Switching function | | Circuit diagrams |
|---|---|---|---|
| | ■ | ↓Push ■ | |
| **TM2-21-L ■**<br>**TMG2-21-L ■** | OFF | (ON) | (1) (3) (2) (4) |
| Connecting terminals | —— | 1 — 3<br>2 — 4 | |
| LED circuit | 5 (+) ▷\|◁ (−) 6 | | |

Terminal numbers are not shown on the switch.

### TM3 SPST






| Part No. | Switching function | | Circuit diagrams |
|---|---|---|---|
| | ■ | ↓Push ■ | |
| **TM3−21−L■**<br>(−LO■、LOO■<br>−L■O■)<br>**TMG3−21−L■**<br>(−LO■、LOO■<br>−L■O■) | OFF | (ON) | (1) (3) (2) (4) |
| Connecting terminals | —— | 1 — 3<br>2 — 4 | |
| LED circuit | Single LED | (+) ▷\|◁ (−) | |
| | Dual Color separate LED | 5 ▷\|◁ 6 (+) (−) 7 ▷\|◁ 8 | |

Terminal numbers are not shown on the switch.

The photo shows
TM3−21−L ■

★ : Made to order products.

(ON) : Momentary

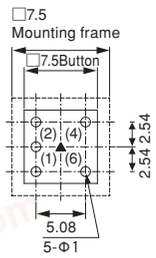
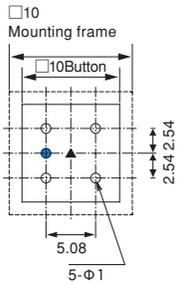
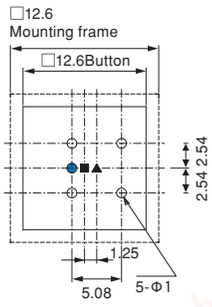
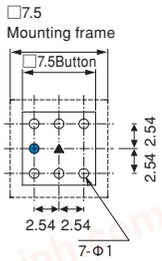
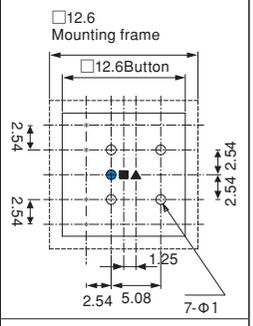
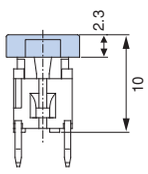
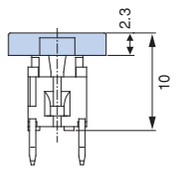
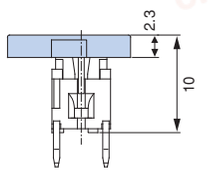
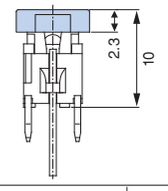
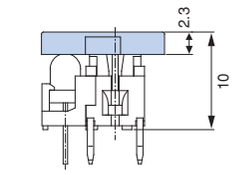
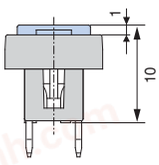
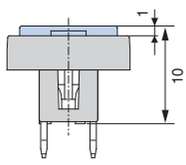
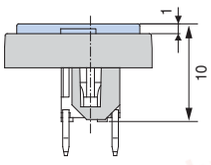
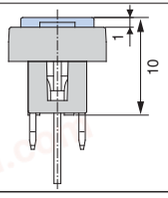
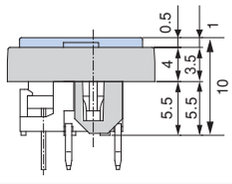
LED color to be specified in ■

Refer to “Table of Part Numbers” on P.169 for a full list of part numbers.

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## ■ Mounting Dimension

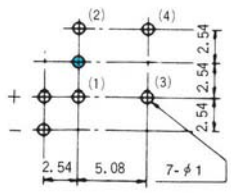
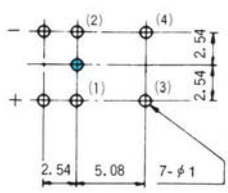
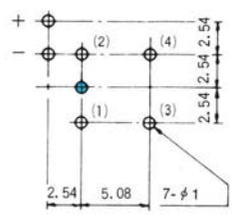
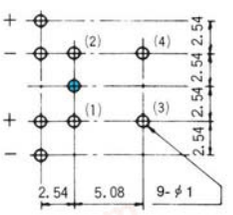
| Part No. | TR1・TM1・TMG1<br>□7.5/**Button**<br>□7.5/**Mounting Frame** | TR1・TM1・TMG1<br>TR2・TM2・TMG2<br>□ 10/**Button**<br>□ 10/**Mounting Frame** | TR1・TM1・TMG1<br>□12.6/**Button**<br>□12.6/**Mounting Frame** | TR2・TM2・TMG2<br>□7.5/**Button**<br>□7.5**Mounting Frame** | TR3・TM3・TMG3<br>□12.6/**Button**<br>□12.6/**Mounting Frame** |
|---|---|---|---|---|---|
| Mounting<br>(Top view) |  |  |  |  |  |
| Button<br>+<br>switch |  |  |  |  |  |
| Button<br>+<br>Mounting<br>Frame<br>+<br>switch |  |  |  |  |  |

※▲ : The center of the switch ■ : The center of the button ● : Boss

○ When the switch is used only with the button and without the mounting frame, be sure to give designing consideration to guide the button with the mounting panel, considering rattling, etc.
(Reference: Standard cutout size = Button size + 0.4 ~ 0.5 mm)

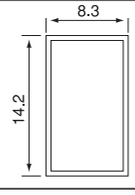
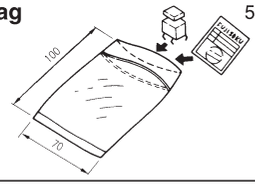
## ■ PC Hole Layouts (TR3・TM3・TMG3)

(Top view)

| Type | TR/TM3 – L■・TMG3 – L■ | TR/TM3 – LO■・TMG3 – LO■ | TR/TM3 – LOO■・TMG3 – LOO■ | TR/TM3 – L■O■・TMG3 – L■O■ |
|---|---|---|---|---|
| Hole Layouts |  |  |  |  |

●Pay attention to the polarity of the LED.
●LED color to be specified in ■

## ■ Packaging Specifications

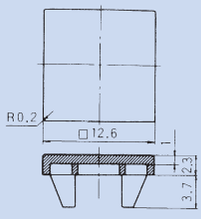
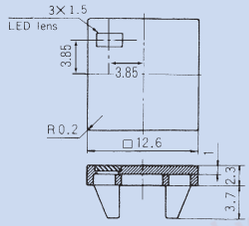
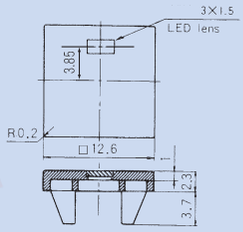
| Series | TM1・TMG1・TR1 | TM2・TR2・TMG2・ TM3・TR3・TMG3・ |
|---|---|---|
| Specifications | **Stick**  100 pcs/stick<br>ℓ =**630** | **Zipper Plastic Bag**  50 pcs/pack |

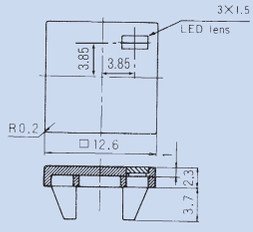
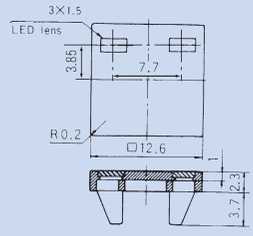
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## ■Optional Accessories

《Sold Separately》

| Part Name | □12.6 Color Button | | |
|---|---|---|---|
| | TR1<br>TM1 | TR3－L■<br>TM3－L■ | TR3－L0■<br>TM3－L0■ |
| Dimensions<br>(ABS) |  |  |  |
| Dark gray | 140000480720 | 140000481301 | 140000481302 |
| Gray | 140000480721 | 140000481330 | 140000481337 |
| Light gray | 140000480722 | 140000481331 | 140000481338 |
| Ivory | 140000480723 | 140000481332 | 140000481339 |
| Silver | 140000480766 | 140007480085 | 140007480103 |
| Red | 140000480752 | 140000481333 | 140000481340 |
| Green | 140000480754 | 140000481335 | 140000481342 |
| Blue | 140000480753 | 140000481334 | 140000481341 |
| Brown | 140000480755 | 140000481336 | 140000481343 |

| Part Name | □12.6 Color Button | |
|---|---|---|
| | TR3－L00■<br>TM3－L00■ | TR3－L■0■<br>TM3－L■0■ |
| Dimensions<br>(ABS) |  |  |
| Dark gray | 140007480086 | 140007480104 |
| Gray | 140007480087 | 140007480105 |
| Light gray | 140007480088 | 140007480106 |
| Ivory | 140007480089 | 140007480107 |
| Silver | 140007480094 | 140007480112 |
| Red | 140007480090 | 140007480108 |
| Green | 140007480092 | 140007480110 |
| Blue | 140007480091 | 140007480109 |
| Brown | 140007480093 | 140007480111 |

■ Notes For Operating the Switch ⋯ Refer to P.183

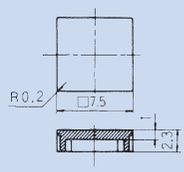
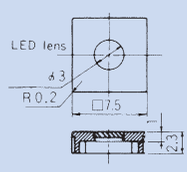
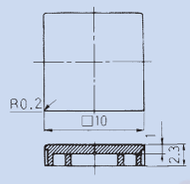
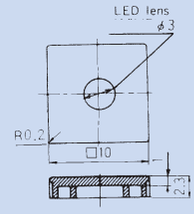
: Optional Accessories

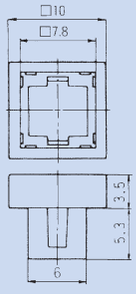
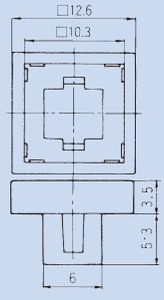
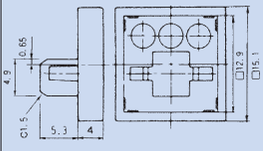
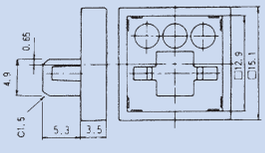
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## ■Optional Accessories

《Sold Separately》

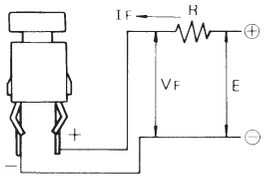
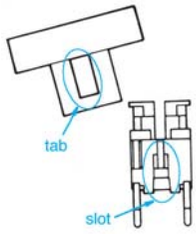
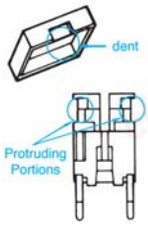
| Part Name | □7.5 Color Button | | □10 /Color Button | |
|---|---|---|---|---|
| | TR1・TM1 | TR2・TM2 | TR1・TM1 | TR2・TM2 |
| Dimensions (ABS) |  |  |  |  |
| Dark gray | 140000480712 | 140007480068 | 140000480716 | 140007480117 |
| Gray | 140000480713 | 140007480069 | 140000480717 | 140007480118 |
| Light gray | 140000480714 | 140007480070 | 140000480718 | 140007480119 |
| Ivory | 140000480715 | 140007480071 | 140000480719 | 140007480120 |
| Silver | 140000480764 | 140007480076 | 140000480765 | 140007480125 |
| Red | 140000480744 | 140007480072 | 140000480748 | 140007480121 |
| Green | 140000480746 | 140007480074 | 140000480750 | 140007480123 |
| Blue | 140000480745 | 140007480073 | 140000480749 | 140007480122 |
| Brown | 140000480747 | 140007480075 | 140000480751 | 140007480124 |

| Part Name | □7.5 Button type **Mounting Frame** | □10 Button type **Mounting Frame** | □12.6 Button type **Mounting Frame** | |
|---|---|---|---|---|
| | TM1・TM2・TR1・TR2 | TM1・TM2・TR1・TR2 | TM1・TM3 | TR1・TR3 |
| Dimensions (ABS) |  |  |  |  |
| Dark gray | 140000340143 | 140000340147 | 140000340215 | 140000340151 |
| Gray | 140000340144 | 140000340148 | 140000340216 | 140000340152 |
| Light gray | 140000340145 | 140000340149 | 140000340217 | 140000340153 |
| Ivory | 140000340146 | 140000340150 | 140000340218 | 140000340154 |

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## ■Handling Precautions

| | |
|---|---|
| LED circuit | Current to be applied to the LED must be lower than the forward current (IF) indicated in the LED Specifications of each switches. Resistance value R should be calculated using the formula on the right.<br><br><br>Calculation Example : **E** = 5 V, $I_F$ = 2.0mA<br>$R=\frac{E-V_F}{I_F}$ $R=\frac{5-2.0}{0.02}=150\Omega$<br>Use $V_F$=2.0V to calculate. |
| Accessories mounting | <br><br>1.Installing the mounting frame<br>Install the mounting frame so that the tab on the frame is in the same direction as the slot on the switch.<br><br><br>2.Installing the button<br>Install the button so that the recess on the button is in the same direction as the protruding portion on the switch.<br>The mounting frame cannot be installed with the switch button installed. |

## ■Ambient Conditions

(1)In case of switches with silver-plated contacts, do not use in an environment where there is corrosive gas such as sulfuric or ammonia gas which may affect the silver plating.

(2)**TM** and **TR** series are open-structure switches and should not be used in a dusty environment.

## ■Soldering Specifications

| Series | TM | TR |
|---|---|---|
| Manual soldering | 380℃ Max.<br>3sec. Max. | 380℃ Max.<br>3sec. Max. |
| Auto soldering | 275℃ Max.<br>6sec. Max. | 265℃ Max.<br>6sec. Max. |

- Preheating in the flow line should be 80° C to 120° C and within 120 seconds.

Do not dip solder the switches with **color buttons** or **mounting frames** attached.
Soldering heat may deform the accessories or cause ingress of flux.

## ■Flux Cleaning

(1)Solvents : Fluorine or Alcohl type

(2)The **TM**/**TR** series are not washable. To wash the PC board, clean the soldering surface of the PC board with a brush so that the switch is not exposed to the cleaning solution.

(3)After soldering, wait until the temperature of the terminals cool down to 90℃ or below or until the parts are exposed to room temperature for more than 5 min. before washing.

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## ■Table of Part Numbers

| Series / Contact plating / LED /Located | | | TM1—01 | | TR1—01 | TM2—21 | | TR2—21 |
|---|---|---|---|---|---|---|---|---|
| | | | Silver Plated | Gold Plated | Gold Plated | Silver Plated | Gold Plated | Gold Plated |
| Non-illuminated | | | TM1—01 | TMG1—01 | TR1—01 | ——— | ——— | ——— |
| Illuminated | LED color | 2 Red | —— | —— | —— | TM2—21—L2 | ☆ TMG2—21—L2 | ☆ TR2—21—L2 |
| | | 5 Green | —— | —— | —— | TM2—21—L5 | TMG2—21—L5 | TR2—21—L5 |
| | | 6 Blue | —— | —— | —— | ☆ TM2—21—L6 | ▲ TMG2—21—L6 | ☆ TR2—21—L6 |
| | | 8 Yellow | —— | —— | —— | TM2—21—L8 | TMG2—21—L8 | ☆ TR2—21—L8 |

| Series / Contact plating / LED color | | TR3—21 |
|---|---|---|
| | | Gold Plated |
| LED color | 2(Red) | ☆TR3—21—L2 |
| | 5(Green) | ☆TR3—21—L5 |
| | 8(Yellow) | ☆TR3—21—L8 |
| | 2 | ★TR3—21—L02 |
| | 5 | ☆TR3—21—L05 |
| | 8 | ☆TR3—21—L08 |
| | 2 | ★TR3—21—L002 |
| | 5 | ☆TR3—21—L005 |
| | 8 | ▲TR3—21—L008 |
| TM3 TR3 ① ② ↓ ↓ | ①2 ②5 | ★TR3—21—L205 |
| | 2 8 | ▲TR3—21—L208 |
| | 5 2 | ▲TR3—21—L502 |
| | 5 8 | ☆TR3—21—L508 |
| | 8 2 | ——— |
| | 8 5 | ▲TR3—21—L805 |
| | 2 2 | ▲TR3—21—L202 |
| | 5 5 | ☆TR3—21—L505 |
| | 8 8 | ☆TR3—21—L808 |

| Series / Contact plating / LED color | | TM3 plated—21 | |
|---|---|---|---|
| | | Silver Plated | Gold Plated |
| LED color | 2 | TM3—21—L2 | ☆TMG3—21—L2 |
| | 5 | TM3—21—L5 | ★TMG3—21—L5 |
| | 8 | ☆TM3—21—L8 | ★TMG3—21—L8 |
| | 2 | ☆TM3—21—L02 | ☆TMG3—21—L02 |
| | 5 | TM3—21—L05 | ——— |
| | 8 | ☆TM3—21—L08 | ☆TMG3—21—L08 |
| | 2 | ☆TM3—21—L002 | ——— |
| | 5 | TM3—21—L005 | ★TMG3—21—L005 |
| | 8 | ★TM3—21—L008 | ——— |
| TM3 TR3 ① ② ↓ ↓ | ①2 ②5 | ☆TM3—21—L205 | ☆TMG3—21—L205 |
| | 2 8 | ★TM3—21—L208 | ▲TMG3—21—L208 |
| | 5 2 | ▲TM3—21—L502 | ▲TMG3—21—L502 |
| | 5 8 | ▲TM3—21—L508 | ——— |
| | 8 2 | ☆TM3—21—L802 | ——— |
| | 8 5 | ☆TM3—21—L805 | ——— |
| | 2 2 | ☆TM3—21—L202 | ★TMG3—21—L202 |
| | 5 5 | ☆TM3—21—L505 | ▲TMG3—21—L505 |
| | 8 8 | ★TM3—21—L808 | ——— |

●The above part numbers do not include accessories. Buttons and mounting frames need to be ordered separately.

▲ : Inquiry products. ☆ : Semi-standard products. ★ : Made to order products.