

## Overview

The TRS Thermal Reed Switch is a highly reliable, precise temperature-sensitive switch ideal for energy conservation. The screw mounting package of TRS-P makes it easy to set up in the application, by just screwing it in the device that needs temperature detection or overheat monitoring.

Its unique proprietary design features a magnet and a temperature-sensing soft ferromagnetic substance called Thermorite®. The material's magnetic flux density decreases as the temperature increases turning it into a paramagnetic substance at the Curie temperature.

These products have also been attested by the International Relay Association.

## Applications

Typical applications include radiator water detection and overheat detection for industrial and agricultural engines.

## Benefits

- High reliability for on/off operations
- High-speed response
- Long operational life
- Excellent environmental durability
- Extremely simple circuit design with the screw mounting
- Compact, light, and easy to handle
- Dust, explosion and corrosion-proof
- Wide range of operating temperatures available from 80°C to +120°C
- Excellent temperature accuracy of  $\pm 3^{\circ}\text{C}$
- RoHS/REACH compliant

TRS-P1 Type



TRS-P2 Type



## Ordering Information

| TRS    | 1-                                | 80  |  | M                     | PR                       | 001                        |
|--------|-----------------------------------|---|--|-----------------------|--------------------------|----------------------------|
| Series | Maximum Opening/Closing Power (W) | Operating Temperature (°C)                                      |  | Contact Type          | Shape Classification     | Lead Type                  |
| TRS    | 1 = 10 W                          | 80 = 80°C<br>85 = 85°C<br>90 = 90°C<br>95 = 95°C<br>100 = 100°C | 105 = 105°C<br>110 = 110°C<br>115 = 115°C<br>120 = 120°C | B = Break<br>M = Make | PR = P shape<br>PT screw | 001 = PT1/8<br>002 = PT3/8 |

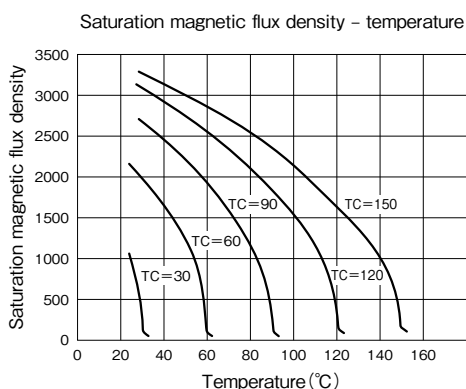
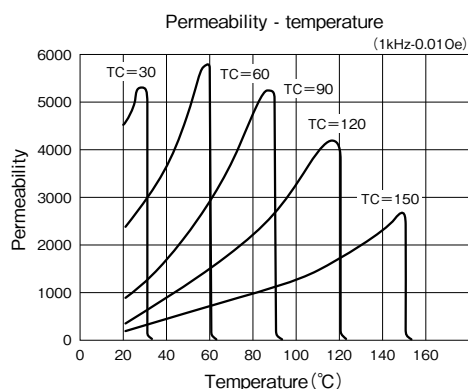
## Structures and Principles of Operation

Thermal Reed Switches (TRS) are temperature-sensing switches composed of a magnet and a temperature-sensing soft ferromagnetic substance called Thermorite. This material's saturation magnetic flux density decreases as the temperature increases, and it turns into a paramagnetic substance at its Curie temperature.

### Thermorite properties

- Thermorite changes its magnetic property rapidly at its Curie temperature, providing quick response times.
- The Curie temperature of Thermorite does not vary with time, as it is based on a compounding ratio.
- Thermorite is stable against moisture and hazardous gas.

Thermal property of Thermorite



TC=Curie temperature

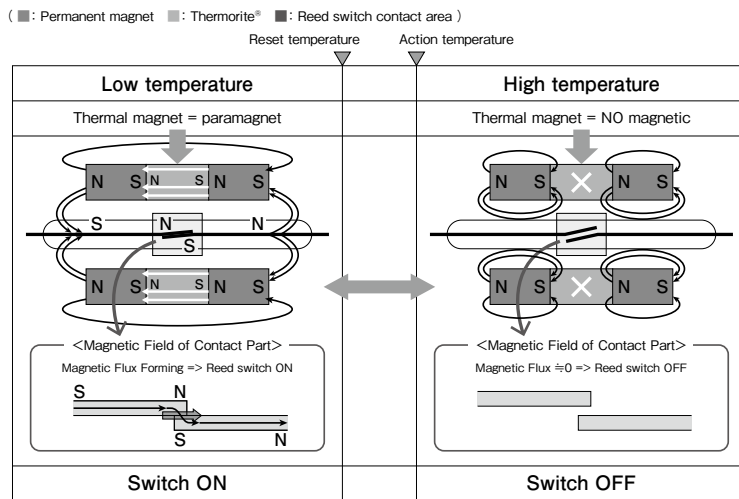
## Structures and Principles of Operation cont.

### Reed switch structure

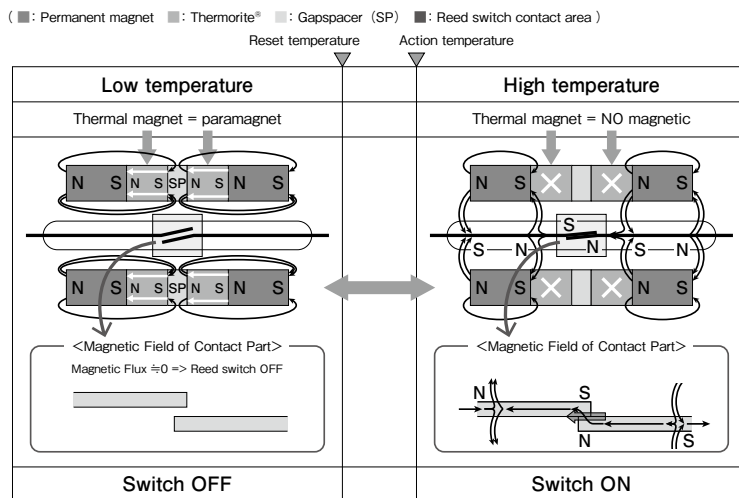
- The reed switch is a contact switch comprised of a pair of Fe-Ni alloy reeds encased in a glass tube with inactive gas. The reeds are switched on or off by the magnetic field of a permanent magnet or magnet coil.
- The reeds in the glass tube become magnetized from the magnetic field, allowing the two reeds to make contact and connect (switch on). When the magnetic field disappears, the reeds separate and disconnect (switch off).
- The glass encasement of the reeds ensures high environmental resistance and a long operational life.



### TRS principle: Break (B) type



### TRS principle: Make (M) type

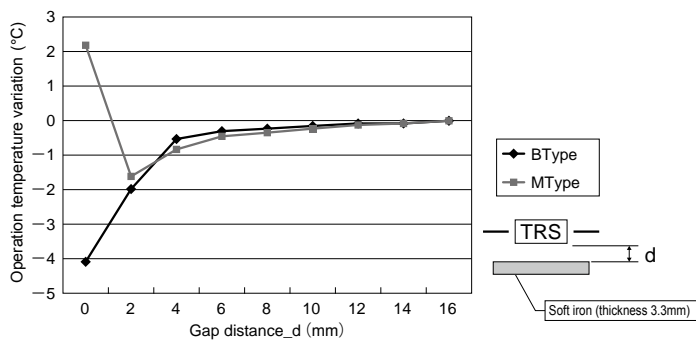


## External Magnetic Field

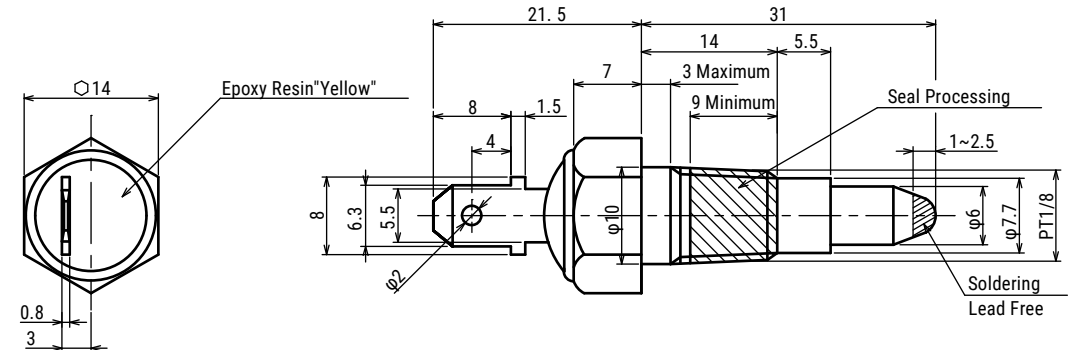
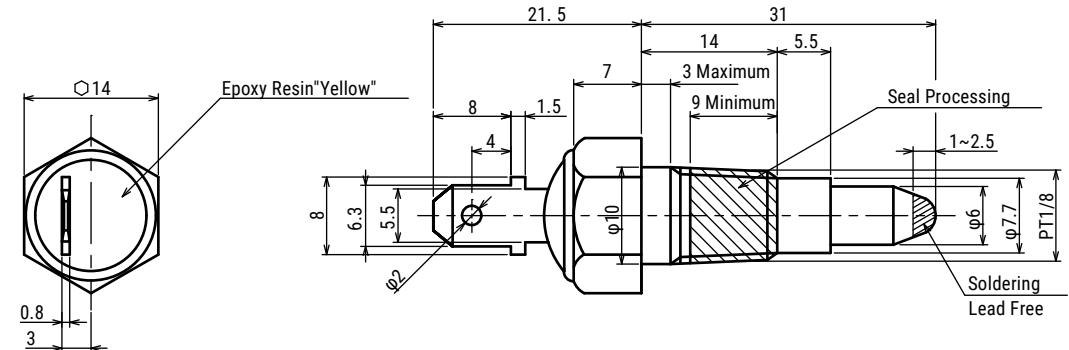
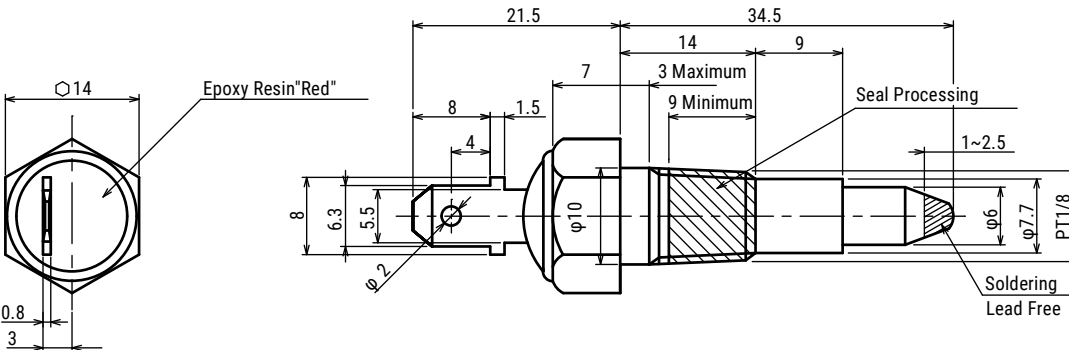
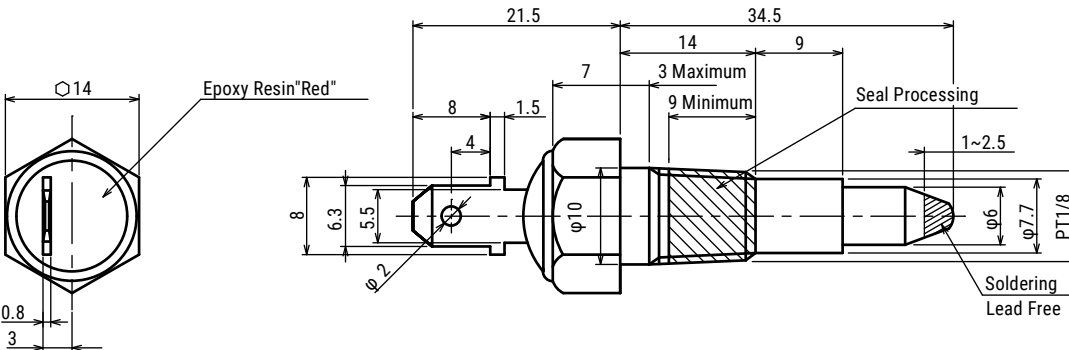
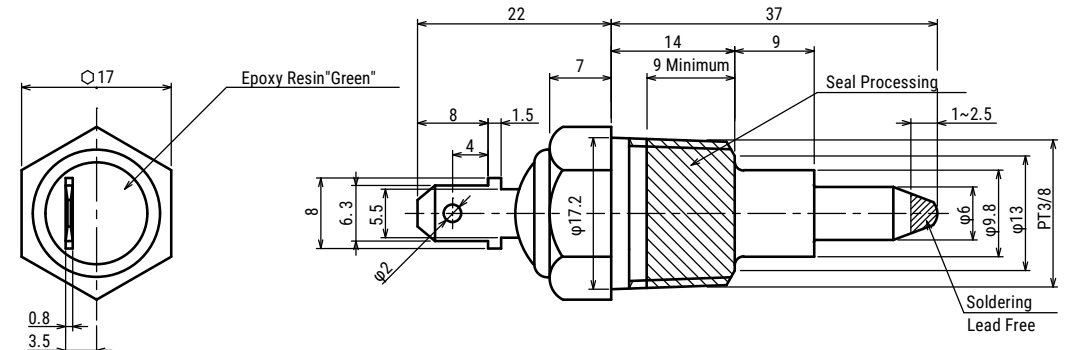
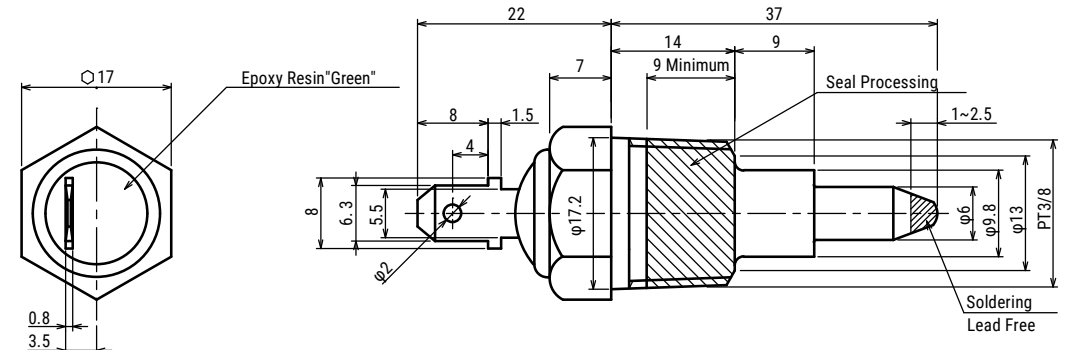
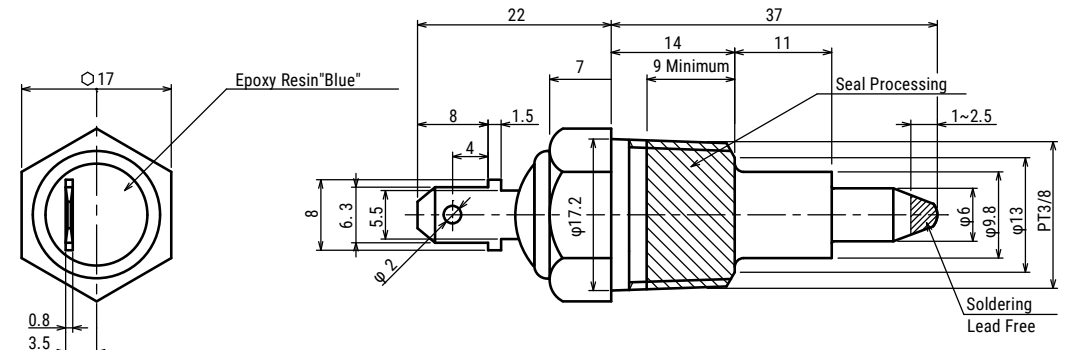
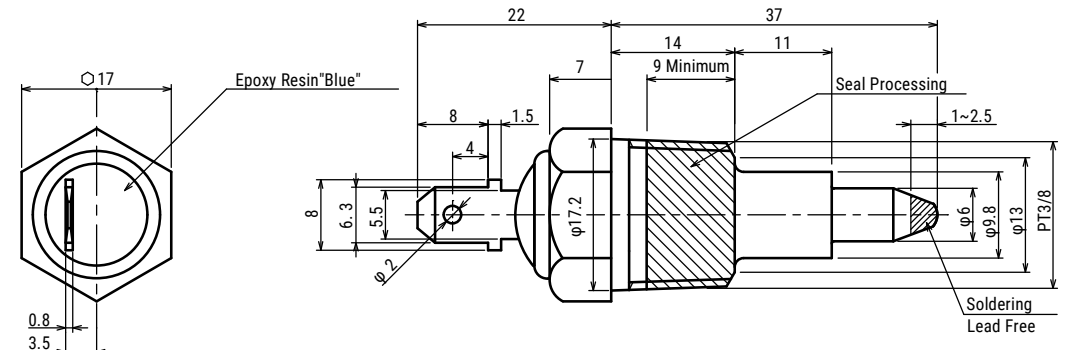
### TRS Installation in External Magnetic Field



### Ferromagnetic Material Influence



## Dimensions – Millimeters

| Part Type   | Dimensions - Millimeters  |
|---|---|
| <p>TRS1-***BPR001</p>  <p>Epoxy Resin "Yellow"</p>  |  <p>Epoxy Resin "Yellow"</p>  |
| <p>TRS1-***MPR001</p>  <p>Epoxy Resin "Red"</p>    |  <p>Epoxy Resin "Red"</p>    |
| <p>TRS1-***BPR002</p>  <p>Epoxy Resin "Green"</p> |  <p>Epoxy Resin "Green"</p> |
| <p>TRS1-***MPR002</p>  <p>Epoxy Resin "Blue"</p>  |  <p>Epoxy Resin "Blue"</p>  |

## Environmental Compliance

All KEMET Thermal Sensors are RoHS compliant.



## Performance Characteristics

| Item                        | Performance Characteristics |  |
|-----------------------------|-----------------------------|--|
| Operations                  | All types                   | 100,000 times  |
| Condition                   | All types                   | 1) Power supply voltage: 13.5 VDC<br>Connection load: lamp<br>Drive: On = 1 second, Off = 29 seconds<br>2) 14 VDC – 28 Ω (purely resistive load) |
| Judgement                   | All types                   | 1) No stick<br>2) Contact resistance be within 500 mΩ  |
| Screw Torque Recommendation | TRS-P1 type                 | 7.35 N•m maximum (75 kgf•cm maximum)<br>Use a torque wrench or nut runner as a tightening tool   |
|                             | TRS-P2 type                 | 34.3 N•m maximum (350 kgf•cm maximum)<br>Use a torque wrench or nut runner as a tightening tool  |

## Insulation & Temperature Characteristics

| Shape Type       | Operating Temperature Range | Switching Temperature Range | Switching Temperature Precision <sup>1</sup> | Differential Temperature <sup>2</sup> |
|------------------|-----------------------------|-----------------------------|--|---------------------------------------|
| P shape PT screw | -20°C to +130°C             | 80°C to +120°C              | ±3.0°C                                       | 10°C Maximum                          |

<sup>1</sup> Switching temperature precision does not include measurement error.

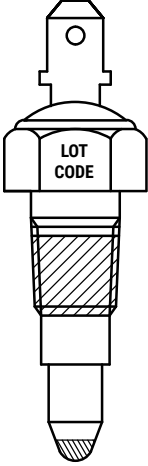
<sup>2</sup> The differential temperature is also referred to as the hysteresis temperature on thermal sensors.

**Table 1 – Ratings & Part Number Reference**

| Part Number    | Switching Temperature (°C) | Maximum Differential Temperature (°C) | Contact Type | Maximum Opening/Closing Voltage (V) | Maximum Opening/Closing Current <sup>1</sup> (A) | Maximum Opening/Closing Power <sup>1</sup> (W) | Minimum Opening/Closing Current | Maximum Contact Resistance (mΩ) | Weight (g) |
|----------------|----------------------------|---------------------------------------|--------------|-------------------------------------|--|--|---------------------------------|---------------------------------|------------|
| TRS1-80BPR001  | 80°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-85BPR001  | 85°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-90BPR001  | 90°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-95BPR001  | 95°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-100BPR001 | 100°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-105BPR001 | 105°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-110BPR001 | 110°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-115BPR001 | 115°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-120BPR001 | 120°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 15.0       |
| TRS1-80MPR001  | 80°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-85MPR001  | 85°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-90MPR001  | 90°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-95MPR001  | 95°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-100MPR001 | 100°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-105MPR001 | 105°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-110MPR001 | 110°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-115MPR001 | 115°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-120MPR001 | 120°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 16.2       |
| TRS1-80BPR002  | 80°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-85BPR002  | 85°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-90BPR002  | 90°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-95BPR002  | 95°C ±3°C                  | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-100BPR002 | 100°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-105BPR002 | 105°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-110BPR002 | 110°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-115BPR002 | 115°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-120BPR002 | 120°C ±3°C                 | 10°C                                  | Break        | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 34.0       |
| TRS1-80MPR002  | 80°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-85MPR002  | 85°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-90MPR002  | 90°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-95MPR002  | 95°C ±3°C                  | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-100MPR002 | 100°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-105MPR002 | 105°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-110MPR002 | 110°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-115MPR002 | 115°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| TRS1-120MPR002 | 120°C ±3°C                 | 10°C                                  | Make         | 100 DC                              | 0.500 DC   | 10.0 DC  | 5 mA/1 VDC                      | 500                             | 35.0       |
| Part Number    | Switching Temperature (°C) | Maximum Differential Temperature (°C) | Contact Type | Maximum Opening/Closing Voltage (V) | Maximum Opening/Closing Current <sup>1</sup> (A) | Maximum Opening/Closing Power <sup>1</sup> (W) | Minimum Opening/Closing Current | Maximum Contact Resistance (mΩ) | Weight (g) |

<sup>1</sup> Lamp load (13.5 V – 3.4 W lamp), 50 VA, 0.5 A in rush 3 A.

## Marking

| Lot Code 1112 445   |                       |                |  |
|---|-----------------------|----------------|--|
|  | Operating Temperature | (1) 2-3 digits | 80 = 80°C<br>95 = 95°C<br>110 = 110°C  |
|   | Contact Type          | (2) 1 digit    | B = Break<br>M = Make  |
|   | Month of the Year     | (4) 2 digits   | 01 = January<br>09 = September<br>10 = October<br>11 = November<br>12 = December |
|   | Year                  | (5) 1 digit    | A = 2017<br>B = 2018<br>C = 2019<br>D = 2020<br>Except I and O                   |

## Packaging

| Series | Packaging Type | Pieces per Package | Pieces per Box |
|--------|----------------|--------------------|----------------|
| TRS-P  | Tray           | 100                | 100            |

## Handling Precautions

### Precautions to be taken when using Thermal Reed Switches (Please read these precautions before using our products)

- Do NOT use in close proximity to strong magnetic parts.
- Do NOT use product under mechanical weight load.
- Do NOT use if dropped or severely shocked.
- Do NOT use with a greater load than specified.
- Avoid stress (especially torsion) in case of additional processing.
- Thermal Reed Switches have a specific resonance frequency.  
Please contact a KEMET representative if an oscillation is added.