

## Type TCR Series

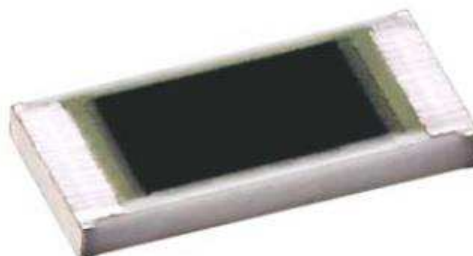
### Key Features

Suitable for  
laser fine tune

Small size and  
light weight

Highly reliable  
multilayer  
electrode  
construction

Compatible  
with all  
soldering  
process



This Ruthenium based trimmable thick film chip resistor, suitable for laser fine tuning is ideal for use in circuits where a variable resistor might otherwise be used.

### Applications

Tuner

Mobile Phone

Camcorder

Portable  
Audio

Photo Sensor

Portable  
Measuring  
Equipment

### Characteristics – Electrical

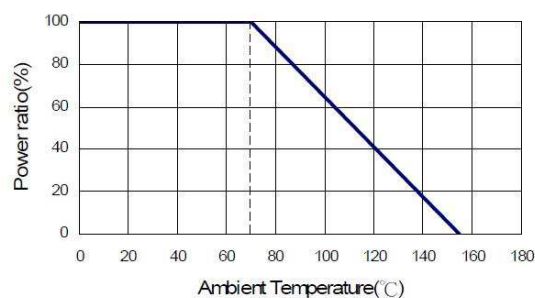
| Size | Power Rating @70°C | Max. Operating Voltage | Max. Overload Voltage | Tolerance                        | Resistance Range                      | TCR (ppm/°C)         |
|------|--------------------|------------------------|-----------------------|----------------------------------|---------------------------------------|----------------------|
| 0402 | 0.0625W            | 50V                    | 100V                  | +0 ~ -10<br>+0 ~ -20<br>+0 ~ -30 | 1Ω ~ 10MΩ                             | ±200                 |
| 0603 | 0.1W               | 50V                    | 100V                  |                                  | 1Ω ~ 9.76<br>10Ω ~ 1MΩ<br>1M02 ~ 10MΩ | ±200<br>±100<br>±200 |
| 0805 | 0.125W             | 150V                   | 300V                  |                                  |                                       |                      |
| 1206 | 0.25W              | 200V                   | 400V                  |                                  |                                       |                      |
| 1210 | 0.3W               | 200V                   | 400V                  |                                  |                                       |                      |
| 2010 | 0.75W              | 200V                   | 400V                  |                                  |                                       |                      |
| 2512 | 1W                 | 250V                   | 500V                  |                                  |                                       |                      |

Operating Temperature range -55 ~ +155°C

Operating Voltage= $V(P \cdot R)$  or Max. operating voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot V(P \cdot R)$  or Max. overload voltage listed above, whichever is lower.

### Derating



## Environmental Characteristics

| Item                                           | Requirement               | Test Methods                                                                                                                             |
|------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Coefficient of Resistance (T.C.R.) | As Spec.                  | <b>JIS-C-5201-1 4.8</b><br><b>IEC-60115-1 4.8</b><br>-55°C~+125°C,<br>25°C is the reference temperature                                  |
| Short Time Overload                            | $\pm(1.0\%+0.05\Omega)$   | <b>JIS-C-5201-1 4.13</b><br><b>IEC-60115-1 4.13</b><br>RCWV*2.5 or Max.<br>Overload Voltage<br>whichever is lower for 5 seconds          |
| Insulation Resistance                          | $\geq 10G$                | <b>JIS-C-5201-1 4.6</b><br><b>IEC-60115-1 4.6</b><br>Max. Overload Voltage<br>for 1 minute                                               |
| Endurance                                      | $\pm(2.0\%+0.10\Omega)$   | <b>JIS-C-5201-1 4.25</b><br><b>IEC-60115-1 4.25.1</b><br>70 $\pm$ 2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"              |
| Damp Heat with Load                            | $\pm(2.0\%+0.10\Omega)$   | <b>JIS-C-5201-1 4.24</b><br><b>IEC-60115-1 4.24</b><br>40 $\pm$ 2°C, 90~95% R.H.<br>RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" |
| Dry Heat                                       | $\pm(1.0\%+0.05\Omega)$   | <b>JIS-C-5201-1 4.23</b><br><b>IEC-60115-1 4.23.2</b><br>at +125/+155°C for 1000 hrs                                                     |
| Bending Strength                               | (1.0%+0.05 $\Omega$ )     | <b>JIS-C-5201-1 4.33</b><br><b>IEC-60115-1 4.33</b><br>Bending once for 5 seconds<br>2010, 2512 sizes: 2mm<br>Other sizes: 3mm           |
| Solderability                                  | 95% min. coverage         | <b>JIS-C-5201-1 4.17</b><br><b>IEC-60115-1 4.17</b><br>245 $\pm$ 5°C for 3 seconds                                                       |
| Resistance to Soldering Heat                   | $\pm(0.5\%+0.05\Omega)$   | <b>JIS-C-5201-1 4.18</b><br><b>IEC-60115-1 4.18</b><br>260 $\pm$ 5°C for 10 seconds                                                      |
| Voltage Proof                                  | No breakdown or flashover | <b>JIS-C-5201-1 4.7</b><br><b>IEC-60115-1 4.7</b><br>1.42 times Max.<br>Operating Voltage for 1 minute                                   |

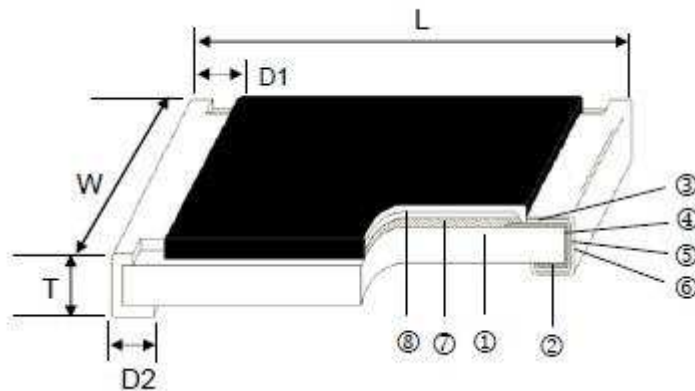
## Environmental Characteristics (cont.)

| Item                        | Requirement                                                                  | Test Methods                                                              |
|-----------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Leaching                    | Individual leaching area<br>$\leq 5\%$<br>Total leaching area<br>$\leq 10\%$ | JIS-C-5201-1 4.18<br>IEC-60068-2-58 8.2.1<br>260 $\pm$ 5°C for 30 seconds |
| Rapid Change of Temperature | $\pm(0.5\%+0.05\Omega)$                                                      | JIS-C-5201-1 4.19<br>IEC-60115-1 4.19<br>-55°C to +125/+155°C, 5 cycles   |

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

Storage Temperature: 15~28°C; Humidity < 80%RH

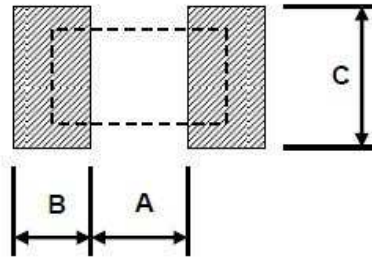
## Construction and Dimensions



|   |                   |   |                    |
|---|-------------------|---|--------------------|
| 1 | Alumina Substrate | 5 | Barrier Layer      |
| 2 | Bottom Electrode  | 6 | External Electrode |
| 3 | Top Electrode     | 7 | Resistor Layer     |
| 4 | Edge Electrode    | 8 | Primary Overcoat   |

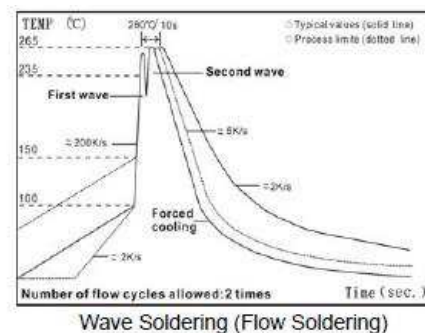
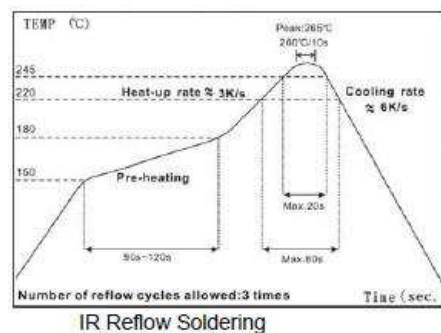
| Size | L<br>(mm)       | W<br>(mm)       | T<br>(mm)       | D1<br>(mm)      | D2<br>(mm)      | Weight<br>(g)<br>(1000pcs) |
|------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------------------|
| 0402 | 1.00 $\pm$ 0.05 | 0.50 $\pm$ 0.05 | 0.35 $\pm$ 0.05 | 0.20 $\pm$ 0.10 | 0.20 $\pm$ 0.10 | 0.620                      |
| 0603 | 1.60 $\pm$ 0.10 | 0.80 $\pm$ 0.10 | 0.45 $\pm$ 0.10 | 0.30 $\pm$ 0.20 | 0.30 $\pm$ 0.20 | 2.042                      |
| 0805 | 2.00 $\pm$ 0.10 | 1.25 $\pm$ 0.10 | 0.50 $\pm$ 0.10 | 0.35 $\pm$ 0.20 | 0.40 $\pm$ 0.20 | 4.368                      |
| 1206 | 3.10 $\pm$ 0.10 | 1.55 $\pm$ 0.10 | 0.55 $\pm$ 0.10 | 0.50 $\pm$ 0.25 | 0.50 $\pm$ 0.20 | 8.947                      |
| 1210 | 3.10 $\pm$ 0.10 | 2.60 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.50 $\pm$ 0.25 | 0.50 $\pm$ 0.20 | 15.959                     |
| 2010 | 5.00 $\pm$ 0.10 | 2.50 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.60 $\pm$ 0.25 | 0.50 $\pm$ 0.20 | 24.241                     |
| 2512 | 6.35 $\pm$ 0.10 | 3.10 $\pm$ 0.15 | 0.55 $\pm$ 0.10 | 0.60 $\pm$ 0.25 | 0.50 $\pm$ 0.20 | 39.448                     |

## Recommended Land Pattern



| Size | A<br>(mm) | B<br>(mm) | C<br>(mm) |
|------|-----------|-----------|-----------|
| 0402 | 0.50      | 0.45      | 0.60      |
| 0603 | 0.90      | 0.60      | 0.90      |
| 0805 | 1.20      | 0.70      | 1.30      |
| 1206 | 2.00      | 0.90      | 1.60      |
| 1210 | 2.00      | 0.90      | 2.80      |
| 2010 | 3.80      | 0.90      | 2.80      |
| 2512 | 3.80      | 1.60      | 3.50      |

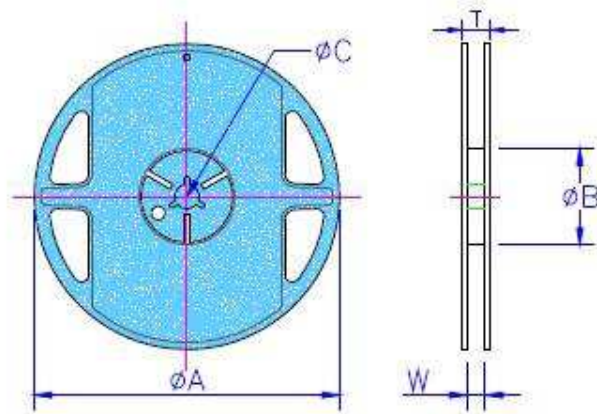
## Soldering Condition



- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

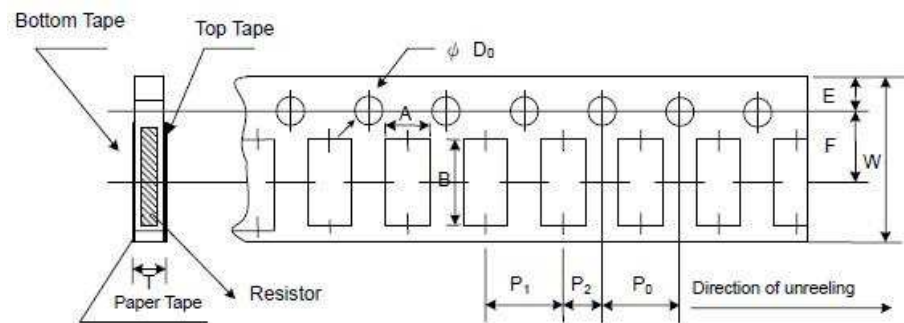
## Packaging

### Reel Specification



| Size | Tape Type | Qty Reel | Tape Width | Reel Nom. | ØA (mm)   | ØB (mm)             | ØC (mm)  | W (mm)   | T (mm)   |
|------|-----------|----------|------------|-----------|-----------|---------------------|----------|----------|----------|
| 0402 | Paper     | 10K      | 8mm        | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| 0603 | Paper     | 5K       | 8mm        | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| 0805 | Paper     | 5K       | 8mm        | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| 1206 | Paper     | 5K       | 8mm        | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| 1210 | Paper     | 5K       | 8mm        | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 9.0±0.5  | 12.5±0.5 |
| 2010 | Emboss    | 4K       | 12mm       | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 13.0±0.5 | 15.5±0.5 |
| 2512 | Plastic   | 4K       | 12mm       | 7 inch    | 178.5±1.5 | 60 <sup>+1/-0</sup> | 13.0±0.2 | 13.0±0.5 | 15.5±0.5 |

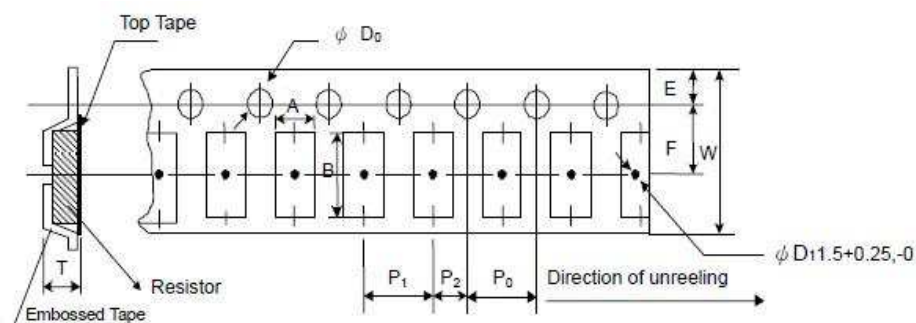
### Paper Tape Specification.



### Dimensions (mm)

| Size | A<br>±0.10 | B         | W<br>±0.20 | E<br>±0.10 | F<br>±0.05 | P <sub>0</sub><br>±0.10 | P <sub>1</sub><br>±0.05 | P <sub>2</sub><br>±0.05 | ØD <sub>0</sub><br>+0.1/-0 | T<br>±0.10 |
|------|------------|-----------|------------|------------|------------|-------------------------|-------------------------|-------------------------|----------------------------|------------|
| 0402 | 0.65       | 1.15±0.10 | 8.0        | 1.75       | 3.50       | 4.00                    | 2.00                    | 2.00                    | 1.50                       | 0.45       |
| 0603 | 1.10       | 1.90±0.10 | 8.0        | 1.75       | 3.50       | 4.00                    | 4.00                    | 2.00                    | 1.50                       | 0.70       |
| 0805 | 1.60       | 2.40±0.20 | 8.0        | 1.75       | 3.50       | 4.00                    | 4.00                    | 2.00                    | 1.50                       | 0.85       |
| 1206 | 1.90       | 3.50±0.20 | 8.0        | 1.75       | 3.50       | 4.00                    | 4.00                    | 2.00                    | 1.50                       | 0.85       |
| 1210 | 2.90       | 3.50±0.20 | 8.0        | 1.75       | 3.50       | 4.00                    | 4.00                    | 2.00                    | 1.50                       | 0.85       |

## Embossed Plastic Tape Specification



## Dimensions (mm)

| Size | A          | B          | W          | E          | F          | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | $\phi D_0$ | T       |
|------|------------|------------|------------|------------|------------|----------------|----------------|----------------|------------|---------|
| 2010 | $\pm 0.10$ | $\pm 0.10$ | $\pm 0.30$ | $\pm 0.10$ | $\pm 0.05$ | $\pm 0.10$     | $\pm 0.10$     | $\pm 0.05$     | $+0.1/-0$  | $\pm 0$ |
| 2512 | 2.8        | 5.5        | 12.0       | 1.75       | 5.5        | 4.00           | 4.00           | 2.00           | 1.50       | 1.2     |

## How To Order

| TCR         | 0805                                                 | N                                         | 1K5                                                                                                                             |
|-------------|------------------------------------------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Common Part | Size                                                 | Resistance Tolerance                      | Resistance                                                                                                                      |
| TCR         | 0402<br>0603<br>0805<br>1206<br>1210<br>2010<br>2512 | N: 0 ~ -10%<br>P: 0 ~ -20%<br>Q: 0 ~ -30% | 1R2: 1.2 $\Omega$<br>100R: 100 $\Omega$<br>3K3: 3.3K $\Omega$<br>100K: 100K $\Omega$<br>1M5: 1.5M $\Omega$<br>10M: 10M $\Omega$ |

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