

## ■ Precision Product Thin Film Chip Resistor — TP Series



Top view



Bottom view

### ■ Applications

- Computer & relative products
- Communication devices
- Measuring instrument
- Converters
- Printing equipment

### ■ Features

- Excellent long-term stability
- The variance of reliability test is reduced to  $\pm 0.1\%$
- Low TCR down to  $\pm 5 \text{ ppm}/^\circ\text{C}$
- Tight tolerance down to  $\pm 0.01\%$
- Halogen free and lead free
- RoHS compliant

### ■ Parts Number Explanation

#### ■ Example:

| TP  | 1206   | B   | 10K0  | P  | 05                                   | 10  | Z                |
|---|--|---|---|--|--------------------------------------|---|------------------|
| Product Type  | Size (Inch)  | Tolerance   | Resistance  | Package  | Quantity (PCS)                       | TCR (ppm/°C)  | Optional         |
| TP Series Precision Product Thin Film Chip Resistor | 0402<br>0603<br>0805<br>1206<br>1210<br>2010<br>2512 | T : $\pm 0.01\%$<br>A : $\pm 0.05\%$<br>B : $\pm 0.1\%$<br>C : $\pm 0.25\%$<br>D : $\pm 0.5\%$<br>F : $\pm 1.0\%$ | 4 digits<br>EX.<br>22R0 = 22 $\Omega$<br>100R = 100 $\Omega$<br>2K20 = 2.2 K $\Omega$<br>22K0 = 22 K $\Omega$<br>100K = 100 K $\Omega$<br>1M00 = 1 M $\Omega$ | P : Paper Taping (0603~1210)<br>Q : Paper Taping (0402)<br>E : Embossed Taping | 04 : 4000<br>05 : 5000<br>10 : 10000 | 05 : $\pm 5$<br>10 : $\pm 10$<br>15 : $\pm 15$<br>25 : $\pm 25$ | Z : Default Code |



**TP Series Precision Product Thin Film  
Chip Resistor Product Specifications**

|                      |               |
|----------------------|---------------|
| <b>Document No.</b>  | S-10-12-61-02 |
| <b>Released Date</b> | 2021/05/19    |
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**Standard Electrical Specifications**

| 項目 Item<br>型別 Type | 額定功率<br>Rated Power<br>at 70°C | 最大<br>工作電壓<br>Max<br>Working<br>Voltage | 最大<br>過負載電壓<br>Max<br>Overload<br>Voltage | 溫度係數<br>T.C.R.<br>(PPM/°C) | 阻值範圍<br>Resistance Range |                    |               |             |            |            |  |
|--------------------|--------------------------------|---|---|----------------------------|--------------------------|--------------------|---------------|-------------|------------|------------|--|
|                    |                                |   |   |                            | T<br>±0.01%              | A<br>±0.05%        | B<br>±0.1%    | C<br>±0.25% | D<br>±0.5% | F<br>±1.0% |  |
| TP0402             | 0.063W                         | 50V                                     | 100V                                      | ±5                         | 49.9 Ω ~<br>12 KΩ        | 20 Ω ~ 12 KΩ       |               |             |            |            |  |
|                    |                                |   |   | ±10, ±15                   |                          | 10 Ω ~ 68 KΩ       |               |             |            |            |  |
|                    |                                |   |   | ±25                        |                          | 4.7 Ω ~ 220 KΩ     |               |             |            |            |  |
| TP0603             | 0.1W                           | 75V                                     | 150V                                      | ±5                         | 49.9 Ω ~<br>30 KΩ        | 20 Ω ~ 30 KΩ       |               |             |            |            |  |
|                    |                                |   |   | ±10, ±15                   |                          | 10 Ω ~ 332 KΩ      |               |             |            |            |  |
|                    |                                |   |   | ±25                        |                          | 4.7 Ω ~ 680 KΩ     |               |             |            |            |  |
| TP0805             | 0.125W                         | 150V                                    | 300V                                      | ±5                         | 49.9 Ω ~<br>50 KΩ        | 20 Ω ~ 50 KΩ       |               |             |            |            |  |
|                    |                                |   |   | ±10, ±15                   |                          | 10 Ω ~ 680 KΩ      |               |             |            |            |  |
|                    |                                |   |   | ±25                        |                          | 4.7 Ω ~ 1 MΩ       |               |             |            |            |  |
| TP1206             | 0.25W                          | 200V                                    | 400V                                      | ±5                         | 49.9 Ω ~<br>100 KΩ       | 20 Ω ~ 100 KΩ      |               |             |            |            |  |
|                    |                                |   |   | ±10, ±15                   |                          | 10 Ω ~ 1 MΩ        |               |             |            |            |  |
|                    |                                |   |   | ±25                        |                          | 4.7 Ω ~ 1.5 MΩ     |               |             |            |            |  |
| TP1210             | 0.25W                          |   |   | 400V                       | ±5                       | 49.9 Ω ~<br>100 KΩ | 20 Ω ~ 100 KΩ |             |            |            |  |
|                    |                                |   |   |                            | ±10, ±15                 |                    | 10 Ω ~ 100 KΩ |             |            |            |  |
|                    |                                |   |   |                            | ±25                      |                    | 4.7 Ω ~ 1 MΩ  |             |            |            |  |
| TP2010             | 0.5W                           |   |   | 400V                       | ±5                       | 49.9 Ω ~<br>100 KΩ | 20 Ω ~ 100 KΩ |             |            |            |  |
|                    |                                |   |   |                            | ±10, ±15                 |                    | 10 Ω ~ 100 KΩ |             |            |            |  |
|                    |                                |   |   |                            | ±25                      |                    | 4.7 Ω ~ 1 MΩ  |             |            |            |  |
| TP2512             | 0.75W                          | 400V                                    | ±5  | 49.9 Ω ~<br>100 KΩ         | 20 Ω ~ 100 KΩ            |                    |               |             |            |            |  |
|                    |                                |   | ±10, ±15                                  |                            | 10 Ω ~ 100 KΩ            |                    |               |             |            |            |  |
|                    |                                |   | ±25                                       |                            | 4.7 Ω ~ 1 MΩ             |                    |               |             |            |            |  |

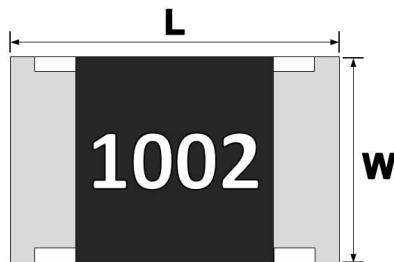
- Operating Temperature Range : -55°C ~ +155°C.
- For non-standard parts, please contact our sales department.

■ **Construction**



|   |                     |   |                        |   |                      |
|---|---------------------|---|------------------------|---|----------------------|
| ① | Alumina Substrate   | ④ | Bottom Inner Electrode | ⑦ | Side Inner Electrode |
| ② | Resistive Layer     | ⑤ | Protective Overcoat    | ⑧ | Nickel Barrier       |
| ③ | Top Inner Electrode | ⑥ | Marking                | ⑨ | Solder coating (Sn)  |

■ **Dimensions**



Unit : mm

| TYPE   | L           | W           | H           | l <sub>1</sub> | l <sub>2</sub> |
|--------|-------------|-------------|-------------|----------------|----------------|
| TP0402 | 1.00 ± 0.10 | 0.50 ± 0.05 | 0.30 ± 0.05 | 0.20 ± 0.10    | 0.20 ± 0.10    |
| TP0603 | 1.60 ± 0.15 | 0.80 ± 0.10 | 0.45 ± 0.10 | 0.30 ± 0.20    | 0.30 ± 0.20    |
| TP0805 | 2.00 ± 0.15 | 1.25 ± 0.15 | 0.55 ± 0.10 | 0.35 ± 0.20    | 0.40 ± 0.20    |
| TP1206 | 3.10 ± 0.15 | 1.60 ± 0.15 | 0.55 ± 0.10 | 0.45 ± 0.20    | 0.50 ± 0.20    |
| TP1210 | 3.10 ± 0.15 | 2.50 ± 0.15 | 0.55 ± 0.10 | 0.45 ± 0.20    | 0.50 ± 0.20    |
| TP2010 | 5.00 ± 0.15 | 2.50 ± 0.15 | 0.55 ± 0.10 | 0.60 ± 0.20    | 0.60 ± 0.20    |
| TP2512 | 6.30 ± 0.15 | 3.20 ± 0.15 | 0.55 ± 0.10 | 0.60 ± 0.20    | 0.60 ± 0.20    |



## ■ Performance Characteristics

### ■ Power Derating Curve

The Operating Temperature Range:  $-55^{\circ}\text{C} \sim +155^{\circ}\text{C}$ .

Power rating is in the case based on continuous full-load at ambient temperature of  $70^{\circ}\text{C}$ . For operation at ambient temperature in excess of  $70^{\circ}\text{C}$ , the load should be derated in accordance with figure of derating Curve.



### ■ Rated Voltage

Resistance Range:  $\geq 1\Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or a RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined formula as following:

$$V = \sqrt{P \times R}$$

V = Rated voltage (V)

P = Rated power (W)

R = Nominal resistance ( $\Omega$ )



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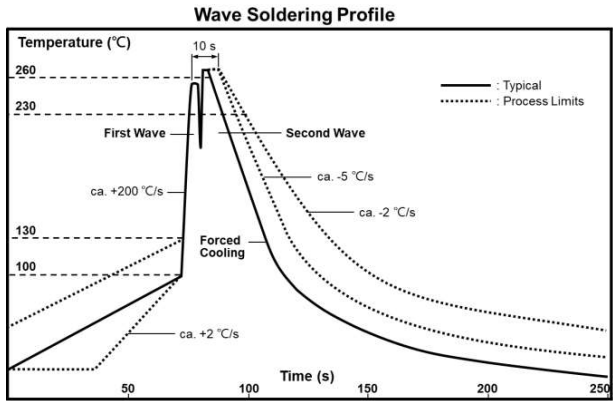
**■ Reliability Tests and Requirements**

| Test Item                                     | Test Method                               | Procedure   | Requirements                                |
|---|---|---|---|
| Temperature Coefficient of Resistance (T.C.R) | JIS-C-5201-1 4.8<br>IEC-60115-1 4.8       | At 25 / -55°C and 25°C / +125°C, 25°C is the reference temperature  | Refer to Standard Electrical Specifications |
| Short Time Overload                           | JIS-C-5201-1 4.13<br>IEC-60115-1 4.13     | 2.5 times RCWW or Max. Overload voltage whichever is less for 5 seconds.  | ±(0.1%+0.05Ω)<br>No Visual damage           |
| Insulation Resistance                         | JJIS-C-5201-1 4.6<br>IEC-60115-1 4.6      | Apply 100VDC for 1 minute.  | ≥10GΩ                                       |
| Solderability                                 | JIS-C-5201-1 4.17<br>IEC-60115-1 4.17     | 245±5°C for 3 seconds.  | >95% Coverage<br>No Visual damage           |
| Resistance to Soldering Heat                  | JIS-C-5201-1 4.18<br>IEC-60115-1 4.18     | 260±5°C for 10 seconds.   | ±(0.1%+0.05Ω)<br>No Visual damage           |
| Leaching                                      | JIS-C-5201-1 4.18<br>IEC-60068-2-58 8.2.1 | 260±5°C for 30 seconds.   | >95% Coverage<br>No Visual damage           |
| Rapid Change of Temperature                   | JIS-C-5201-1 4.19<br>IEC-60115-1 4.19     | -55°C to +155°C, 300 cycles   | ±(0.2%+0.05Ω)<br>No Visual damage           |
| High Temperature Exposure                     | JIS-C5201-1 4.25<br>IEC 60068-2-2         | At 155±5°C for 1000 hours.  | ±(0.2%+0.05Ω)                               |
| Resistance to Solvent                         | JIS-C-5201-1 4.29                         | The tested resistor be immersed into isopropyl alcohol of 20~25°C for 60 secs.<br>Then the resistor is left in the room for 48 hrs. | ±(0.1%+0.05Ω)<br>No Visual damage           |
| Damp Heat with Load                           | JIS-C-5201-1 4.24<br>IEC-60115-1 4.24     | 40±2°C, 90~95% R.H. RCWW or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"                  | ±(0.1%+0.05Ω)                               |
| Biased Humidity                               | MIL-STD-202<br>Method 103                 | 1,000 hours; 85°C / 85% RH, 10% of operating power. Measurement at 24±4 hours after test conclusion.                                | ±(0.1%+0.05Ω)                               |
| Load Life (Endurance)                         | JIS-C-5201-1 4.25<br>IEC-60115-1 4.25.1   | 70±2°C, RCWW or Max. working voltage whichever is less for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" .                            | ±(0.1%+0.05Ω)                               |
| Bending Strength                              | JIS-C-5201-1 4.33<br>IEC-60115-1 4.33     | Bending once for 5 seconds<br>D : 0402、0603、0805 = 5mm<br>1206、1210 = 3mm<br>2010、2512 = 2mm  | ±(0.1%+0.05Ω)<br>No Visual damage           |

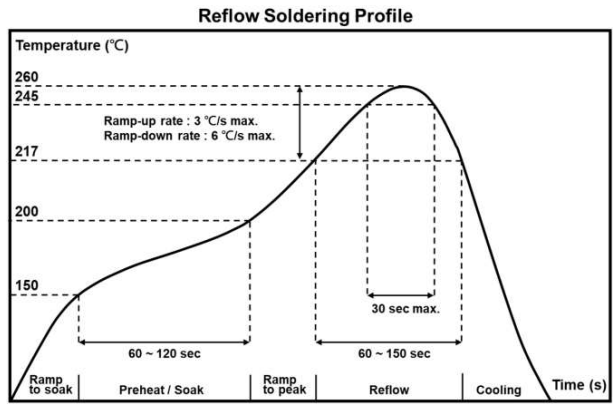
● We can also provide AEC-Q200 test reports if required by customers.

**Recommended Customer Soldering Parameters**

**Wave solder Temperature condition**



**Solder reflow Temperature condition**



**Rework temperature ( hot air equipment ) : 350°C, 3~5seconds**

**Recommended reflow methods**

IR, vapor phase oven, hot air oven

If reflow temperatures exceed the recommended profile, devices may not meet the performance requirements.

**Recommend Land Pattern Design**



Unit: mm

| Type<br>Item | 0402 | 0603 | 0805 | 1206 | 1210 | 2010 | 2512 |
|--------------|------|------|------|------|------|------|------|
| A            | 0.50 | 0.80 | 1.30 | 2.20 | 2.00 | 3.80 | 4.90 |
| B            | 1.60 | 2.40 | 2.90 | 4.20 | 4.40 | 6.60 | 8.10 |
| C            | 0.70 | 1.00 | 1.40 | 1.70 | 2.70 | 2.70 | 3.40 |

## ■ Marking



0402: no marking



0603: 3 digits code



0805~2512: 4 digits code

### ■ No marking on 0402 type

### ■ 3 digits code for 0603 type

#### ● Standard E96 Values and 0603 Resistance Codes

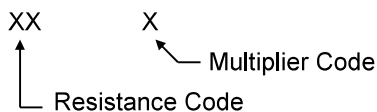
|                |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| <b>R-Value</b> | 100 | 102 | 105 | 107 | 110 | 113 | 115 | 118 | 121 | 124 | 127 | 130 | 133 | 137 | 140 | 143 | 147 | 150 | 154 | 158 | 162 | 165 | 169 | 174 |
| <b>Code</b>    | 01  | 02  | 03  | 04  | 05  | 06  | 07  | 08  | 09  | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  | 24  |
| <b>R-Value</b> | 178 | 182 | 187 | 191 | 196 | 200 | 205 | 210 | 215 | 221 | 226 | 232 | 237 | 243 | 249 | 255 | 261 | 267 | 274 | 280 | 287 | 294 | 301 | 309 |
| <b>Code</b>    | 25  | 26  | 27  | 28  | 29  | 30  | 31  | 32  | 33  | 34  | 35  | 36  | 37  | 38  | 39  | 40  | 41  | 42  | 43  | 44  | 45  | 46  | 47  | 48  |
| <b>R-Value</b> | 316 | 324 | 332 | 340 | 348 | 357 | 365 | 374 | 383 | 392 | 402 | 412 | 422 | 432 | 442 | 453 | 464 | 475 | 487 | 499 | 511 | 523 | 536 | 549 |
| <b>Code</b>    | 49  | 50  | 51  | 52  | 53  | 54  | 55  | 56  | 57  | 58  | 59  | 60  | 61  | 62  | 63  | 64  | 65  | 66  | 67  | 68  | 69  | 70  | 71  | 72  |
| <b>R-Value</b> | 562 | 576 | 590 | 604 | 619 | 634 | 649 | 665 | 681 | 698 | 715 | 732 | 750 | 768 | 787 | 806 | 825 | 845 | 866 | 887 | 909 | 931 | 953 | 976 |
| <b>Code</b>    | 73  | 74  | 75  | 76  | 77  | 78  | 79  | 80  | 81  | 82  | 83  | 84  | 85  | 86  | 87  | 88  | 89  | 90  | 91  | 92  | 93  | 94  | 95  | 96  |

#### ● E96 Multiplier Code

| Code       | A               | B               | C               | D               | E               | F               | G               | H               | X                | Y                | Z                |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|
| Multiplier | 10 <sup>0</sup> | 10 <sup>1</sup> | 10 <sup>2</sup> | 10 <sup>3</sup> | 10 <sup>4</sup> | 10 <sup>5</sup> | 10 <sup>6</sup> | 10 <sup>7</sup> | 10 <sup>-1</sup> | 10 <sup>-2</sup> | 10 <sup>-3</sup> |

1. 0603 3 digits coding formula for E96 values as following:

CODING FORMULA



$$\text{Example: } 10.2\text{K}\Omega = \underline{102} \times \underline{10^2}\Omega = \mathbf{02C}$$

$$33.2\Omega = \underline{332} \times \underline{10^{-1}}\Omega = \mathbf{51X}$$

| E24 | 10 | 11 | 12 | 13 | 15 | 16 | 18 | 20 | 22 | 24 | 27 | 30 | 33 | 36 | 39 | 43 | 47 | 51 | 56 | 62 | 68 | 75 | 82 | 91 |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

2. 0603 3 digits for E24 values

Examples:

|                      |     |      |       |      |
|----------------------|-----|------|-------|------|
| <b>Resistance</b>    | 33Ω | 470Ω | 5.6KΩ | 62KΩ |
| <b>3 digits code</b> | 330 | 471  | 562   | 623  |

("R"= decimal point)

3. 0603 E192 values have no marking code.

#### 4 digits code for 0805 ~ 2512 type

First 3 digits are the significant figures, the 4th digit is the multiplier. "R"= decimal point.

Examples:

|                      |       |      |       |      |        |      |
|----------------------|-------|------|-------|------|--------|------|
| <b>Resistance</b>    | 49.9Ω | 100Ω | 1.1KΩ | 10KΩ | 33.2KΩ | 1 MΩ |
| <b>4 digits code</b> | 49R9  | 1000 | 1101  | 1002 | 3322   | 1004 |

■ **Packaging Information**

■ **Reel Dimensions**



Unit: mm

| TYPE                | SIZE | A        | φB      | φC       | φD     | W        | φM      |
|---------------------|------|----------|---------|----------|--------|----------|---------|
| 0402                | 7"   | 10K/Reel | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0   | 178±2.0 |
| 0603/0805/1206/1210 | 7"   | 5K/Reel  | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 60±1.0   | 178±2.0 |
| 2010/2512           | 7"   | 4K/Reel  | 2.0±0.5 | 13.5±1.0 | 21±1.0 | 16.0±2.0 | 178±2.0 |

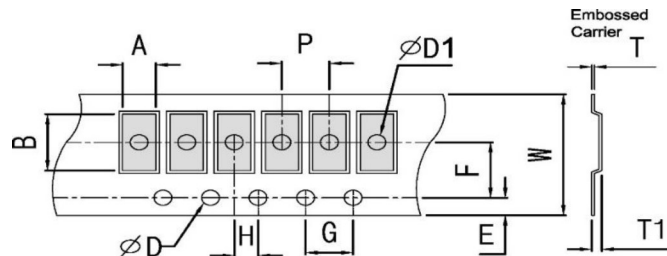
■ **Paper Tape Dimensions**



Unit: mm

| Type | A         | B         | W        | E         | F        | G        | H        | T         | φD                                  | P        |
|------|-----------|-----------|----------|-----------|----------|----------|----------|-----------|-------------------------------------|----------|
| 0402 | 0.70±0.10 | 1.20±0.10 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.45±0.10 | 1.50 <sup>+0.10</sup> <sub>-0</sub> | 2.0±0.10 |
| 0603 | 1.05±0.20 | 1.80±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.60±0.10 |                                     | 4.0±0.10 |
| 0805 | 1.55±0.20 | 2.30±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.75±0.10 |                                     |          |
| 1206 | 1.90±0.20 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.75±0.10 |                                     |          |
| 1210 | 2.85±0.20 | 3.50±0.20 | 8.0±0.20 | 1.75±0.10 | 3.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.75±0.10 |                                     |          |

■ **Plastic Embossed Tape Dimensions**

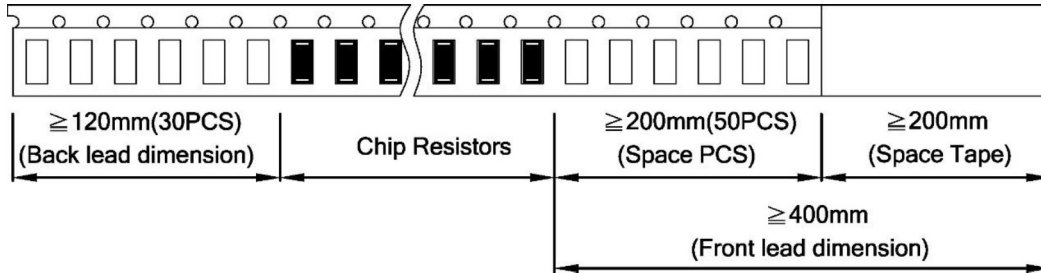


Unit: mm

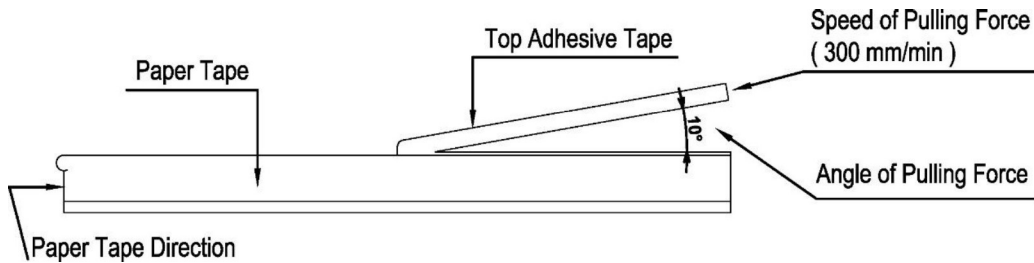
| Type | A         | B         | W       | E         | F        | G        | H        | T         | φD                                  | φD1       | T1        | P        |
|------|-----------|-----------|---------|-----------|----------|----------|----------|-----------|-------------------------------------|-----------|-----------|----------|
| 2010 | 2.80±0.20 | 5.60±0.20 | 12±0.10 | 1.75±0.10 | 5.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.23±0.10 | 1.50 <sup>+0.10</sup> <sub>-0</sub> | 1.50±0.10 | 0.85±0.15 | 4.0±0.10 |
| 2512 | 3.40±0.20 | 6.70±0.20 | 12±0.10 | 1.75±0.10 | 5.5±0.05 | 4.0±0.10 | 2.0±0.05 | 0.23±0.10 |                                     | 1.50±0.10 | 0.85±0.15 |          |



■ **Front & Back Lead Dimensions**

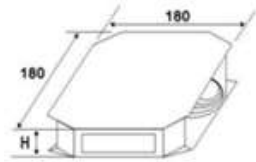


■ **Top Adhesive Peel Off Strength : 10~70g**

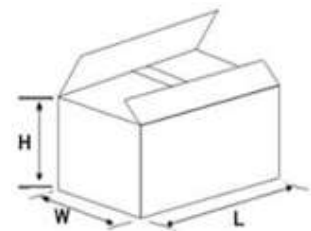


■ **Package**

| Inner Box Size |            |
|----------------|------------|
| Reel           | Size H(mm) |
| 1              | 13         |
| 2              | 24         |
| 3              | 36         |
| 5              | 60         |
| 10             | 113        |



| External Box Size |             |            |             |
|-------------------|-------------|------------|-------------|
| Contain (Kpcs)    | Length (mm) | Width (mm) | Height (mm) |
| 25K               | 180         | 180        | 60          |
| 50K               | 180         | 180        | 110         |
| 150K              | 430         | 200        | 200         |
| 300K              | 400         | 400        | 200         |



■ **Storage Data :**

Storage time at the environment temp: 25±5°C & humidity: 60±20% is valid for one year from the date of delivery.

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[CRCW06036K80FKEE](#) [M55342K03B499DRS6](#) [M55342K06B14E0RS6](#) [M55342K06B1E78RS3](#) [M55342K06B6E19RWL](#)  
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[RC1005J181CS](#) [RC1005J202CS](#) [RC1005J391CS](#) [RC1005J560CS](#) [RC1005J683CS](#)