

## Metal Oxide Varistor (MOV) Data Sheet

### Features

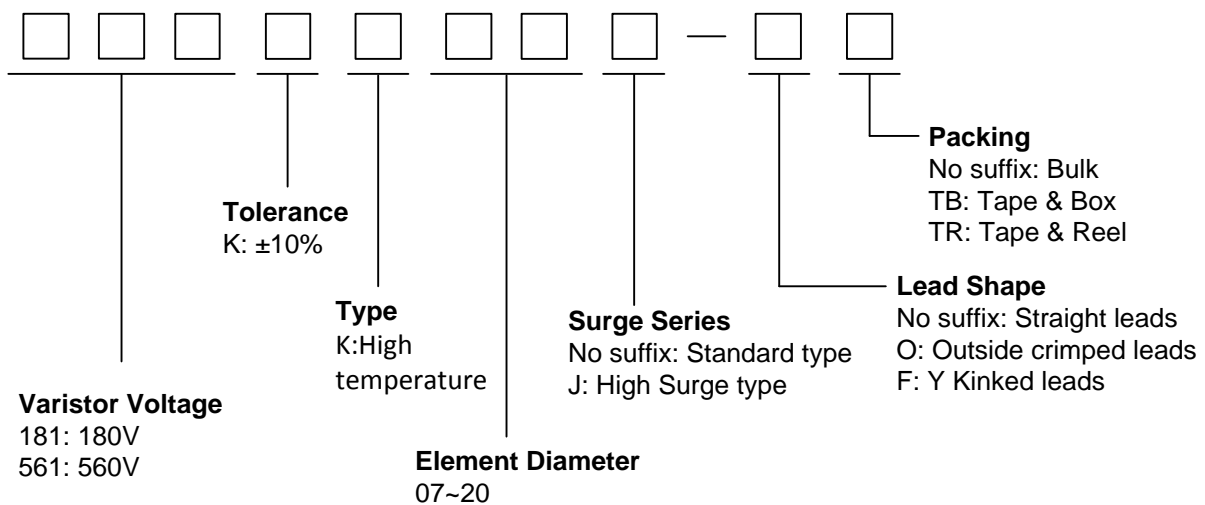
- Wide operating voltage (V1mA) range from 180V to 560V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature : -40°C ~ +125°C
- Storage Temperature : -40°C ~ +125°C
- Safety certification: UL: E327997



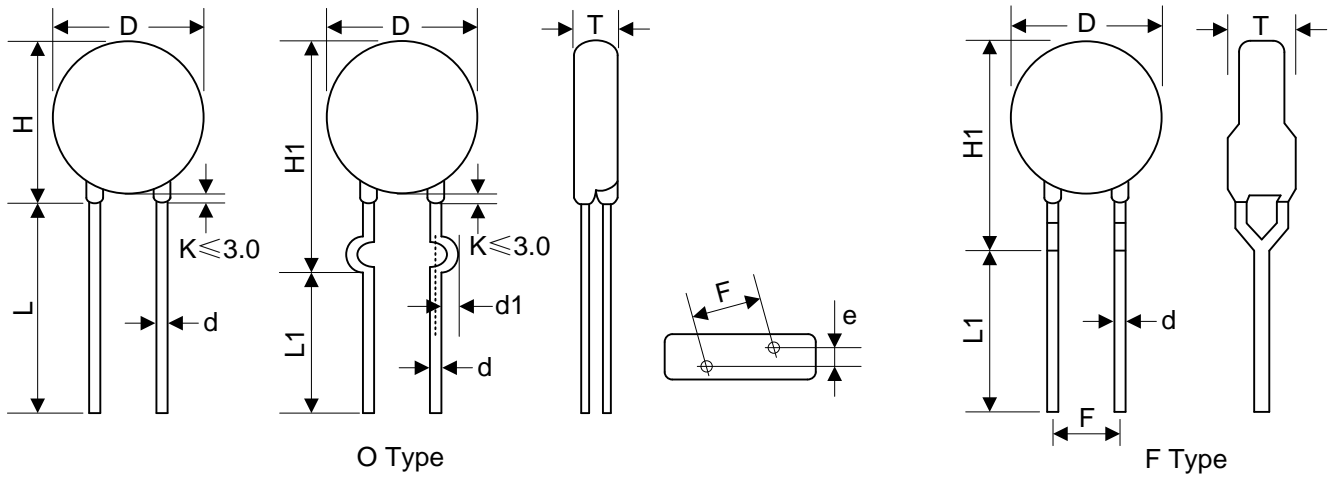
### Applications

- Transistor, diode, IC, thyristor or triac semiconductor protection
- Surge protection in consumer electronics
- Surge protection in industrial electronics
- Surge protection in electronic home appliances, gas and petroleum appliances
- Relay and electromagnetic valve surge absorption

### Part Number Code



**Dimensions**



O Type

F Type

| Table 1  |           |
|----------|-----------|
| Unit: mm |           |
| Symbol   | Dimension |
| H(max.)  | 20.0      |
| H1(max.) | 21.0      |
| L(min.)  | 20.0      |
| L1(min.) | 15.0      |
| D(max.)  | 16.5      |
| F(±0.8)  | 7.5       |
| T(max.)  | Table 2   |
| e(±0.8)  | Table 2   |
| d(±0.05) | 0.8       |
| d1(±0.4) | 1.4       |

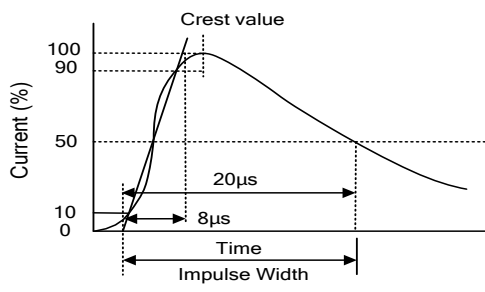
| Table 2  |         |     |       |         |     |
|----------|---------|-----|-------|---------|-----|
| Unit: mm |         |     |       |         |     |
| Model    | T(max.) | e   | Model | T(max.) | e   |
| 181K     | 4.2     | 1.9 | 471K  | 5.8     | 3.2 |
| 201K     | 4.3     | 2.0 | 511K  | 6.1     | 3.4 |
| 221K     | 4.4     | 2.1 | 561K  | 6.4     | 3.6 |
| 241K     | 4.5     | 2.2 |       |         |     |
| 271K     | 4.6     | 2.4 |       |         |     |
| 301K     | 4.6     | 2.5 |       |         |     |
| 331K     | 5.0     | 2.5 |       |         |     |
| 361K     | 5.2     | 2.7 |       |         |     |
| 391K     | 5.4     | 2.8 |       |         |     |
| 431K     | 5.6     | 3.0 |       |         |     |

**Electrical Characteristics**

| Part Number |            | Maximum Allowable Voltage |                     | Varistor Voltage     | Maximum Clamping Voltage |                    | Withstanding Surge Current |                  | Maximum Energy (10/1000µs) |                | Rated Power | Typical Capacitance (Reference) |
|-------------|------------|---------------------------|---------------------|----------------------|--------------------------|--------------------|----------------------------|------------------|----------------------------|----------------|-------------|---------------------------------|
| Standard    | High Surge | V <sub>AC</sub> (V)       | V <sub>DC</sub> (V) | V <sub>1mA</sub> (V) | I <sub>P</sub> (A)       | V <sub>C</sub> (V) | I (A) Standard             | I (A) High Surge | (J) Standard               | (J) High Surge | (W)         | @1KHz (pf)                      |
| 181KK14     | 181KK14J   | 115                       | 150                 | 180(162~198)         | 50                       | 300                | 4500                       | 6000             | 50.0                       | 60.0           | 0.6         | 1100                            |
| 201KK14     | 201KK14J   | 130                       | 170                 | 200(180~220)         | 50                       | 340                | 4500                       | 6000             | 57.0                       | 70.0           | 0.6         | 1000                            |
| 221KK14     | 221KK14J   | 140                       | 180                 | 220(198~242)         | 50                       | 360                | 4500                       | 6000             | 60.0                       | 78.0           | 0.6         | 900                             |
| 241KK14     | 241KK14J   | 150                       | 200                 | 240(216~264)         | 50                       | 395                | 4500                       | 6000             | 63.0                       | 84.0           | 0.6         | 830                             |
| 271KK14     | 271KK14J   | 175                       | 225                 | 270(243~297)         | 50                       | 455                | 4500                       | 6000             | 70.0                       | 99.0           | 0.6         | 740                             |
| 301KK14     | 301KK14J   | 190                       | 250                 | 300(270~330)         | 50                       | 500                | 4500                       | 6000             | 77.0                       | 108            | 0.6         | 670                             |
| 331KK14     | 331KK14J   | 210                       | 275                 | 330(297~363)         | 50                       | 550                | 4500                       | 6000             | 85.0                       | 115            | 0.6         | 610                             |
| 361KK14     | 361KK14J   | 230                       | 300                 | 360(324~396)         | 50                       | 595                | 4500                       | 6000             | 93.0                       | 130            | 0.6         | 560                             |
| 391KK14     | 391KK14J   | 250                       | 320                 | 390(351~429)         | 50                       | 650                | 4500                       | 6000             | 100                        | 140            | 0.6         | 510                             |
| 431KK14     | 431KK14J   | 275                       | 350                 | 430(387~473)         | 50                       | 710                | 4500                       | 6000             | 115                        | 155            | 0.6         | 460                             |
| 471KK14     | 471KK14J   | 300                       | 385                 | 470(423~517)         | 50                       | 775                | 4500                       | 6000             | 118                        | 175            | 0.6         | 430                             |
| 511KK14     | 511KK14J   | 320                       | 415                 | 510(459~561)         | 50                       | 845                | 4500                       | 6000             | 121                        | 180            | 0.6         | 390                             |
| 561KK14     | 561KK14J   | 350                       | 460                 | 560(504~616)         | 50                       | 925                | 4500                       | 6000             | 125                        | 185            | 0.6         | 360                             |

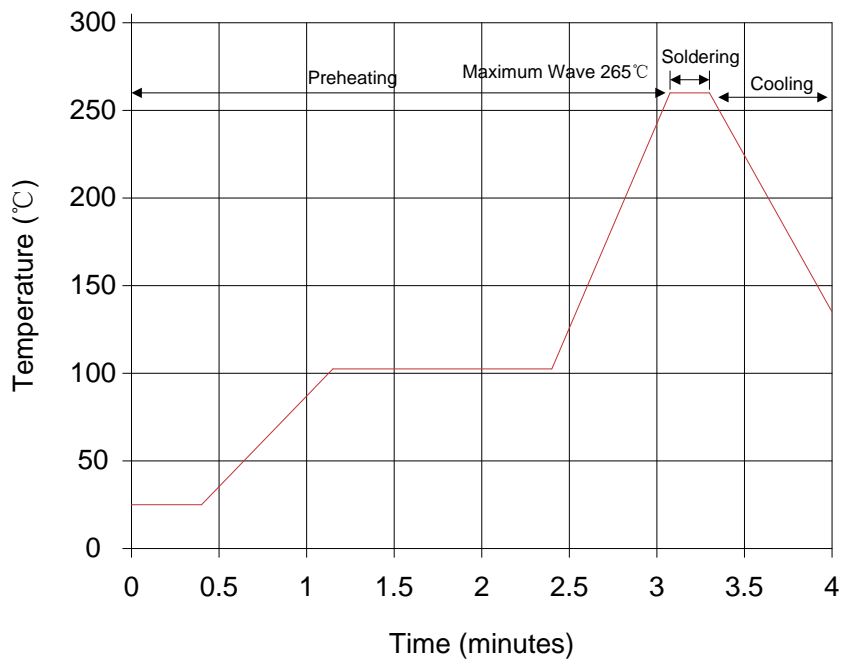
Notes: Leakage Current (@83% of V<sub>1mA</sub>) : IR≤25µA

**Electrical Ratings**

| Items                              | Test Condition/Description   | Requirement   |                             |               |  |
|------------------------------------|--|---------------|-----------------------------|---------------|--|
| Varistor Voltage                   | The voltage between the two terminals with the specified measuring current 1mA.DC applied is called Vb.  |               |                             |               |  |
| Maximum Allowable Voltage          | The recommended maximum sine wave voltage (RMS) or the Maximum DC voltage can be applied continuously.   |               |                             |               |  |
| Maximum Clamping Voltage           | <p>The maximum voltage between the two terminals with the specification standard impulse current.</p> <p>Applied waveform: 8/20µs</p>   |               | To meet the Specified value |               |  |
| Rated Wattage                      | The maximum average power that can be applied within the specified ambient temperature.  |               |                             |               |  |
| Energy                             | The maximum energy within the varistor voltage change of ±10% when one impulse of 10/1000µs or 2ms is applied.   |               |                             |               |  |
| Withstanding Surge Current         | The maximum current within the varistor voltage change of ±10% with the standard impulse current (8/20µs) applied one time.  |               |                             |               |  |
| Varistor Voltage Temp. Coefficient | $\left  \frac{V_{1mA@125^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{100} \times 100\%(\%/^{\circ}C) \right $ $\left  \frac{V_{1mA@-40^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{65} \times 100\%(\%/^{\circ}C) \right $                                   | ≤0.05%/°C     |                             |               |  |
| Surge Life                         | <p>The change of Vb shall be measured after the impulse listed below which is applied 10,000 times continuously with the interval of ten seconds at room temperature.</p> <table border="1" data-bbox="446 1848 1189 1915"> <tr> <td>14Φ series</td> <td>181K to 821K</td> <td>150A (8/20µs)</td> </tr> </table> | 14Φ series    | 181K to 821K                | 150A (8/20µs) | $\frac{\Delta V_b}{V_b} \leq \pm 10\%$ |
| 14Φ series                         | 181K to 821K   | 150A (8/20µs) |                             |               |  |

**Soldering Recommendation**

Lead-free Wave Soldering Recommendation



| Item             | Conditions        |
|------------------|-------------------|
| Peak Temperature | 265°C             |
| Dipping Time     | 10 seconds (max.) |
| Soldering        | 1 time            |

Recommendation Reworking Conditions with Soldering Iron

| Item                              | Conditions      |
|-----------------------------------|-----------------|
| Temperature of Soldering Iron-tip | 360°C(max.)     |
| Soldering Time                    | 3 seconds(max.) |
| Distance from Varistor            | 2mm (min.)      |

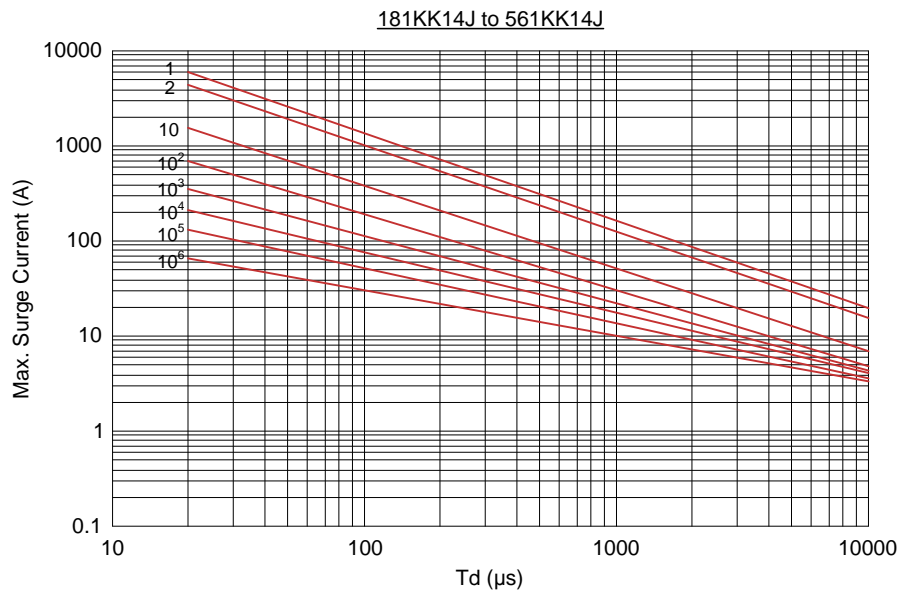
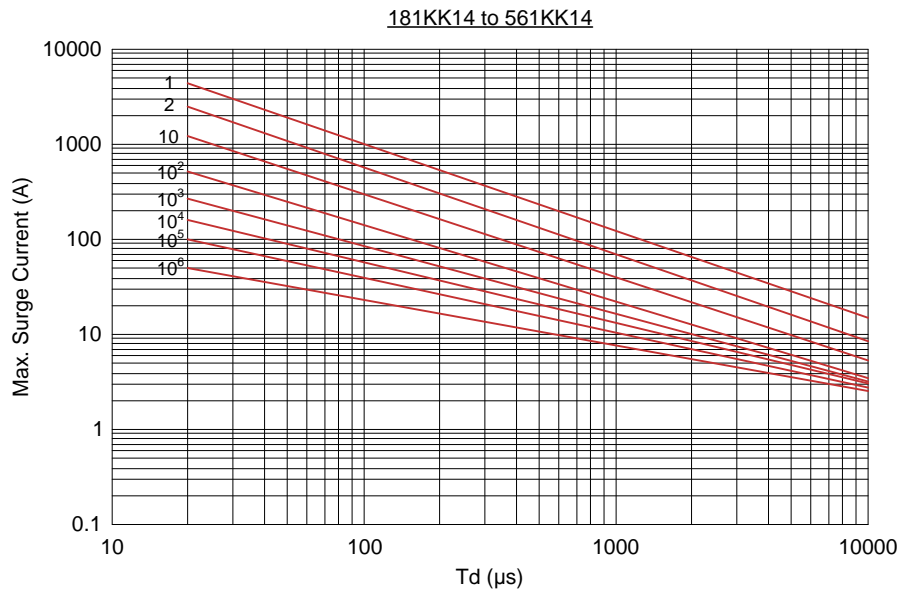
## Mechanical Characteristics

| Items                         | Test conditions / Methods  | Specifications  |            |               |     |                |     |          |     |  |
|-------------------------------|--|---|------------|---------------|-----|----------------|-----|----------|-----|--|
| Tensile Strength of Terminals | Gradually applying the force specified and keeping the unit fixed for 10±1 sec.<br><table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Terminal diameter (mm)</th> <th>Force (kg)</th> </tr> </thead> <tbody> <tr> <td>0.5 &lt; d ≤ 0.8</td> <td>1.0</td> </tr> <tr> <td>0.8 &lt; d ≤ 1.25</td> <td>2.0</td> </tr> <tr> <td>1.25 &lt; d</td> <td>4.0</td> </tr> </tbody> </table>   | Terminal diameter (mm)  | Force (kg) | 0.5 < d ≤ 0.8 | 1.0 | 0.8 < d ≤ 1.25 | 2.0 | 1.25 < d | 4.0 | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5% |
| Terminal diameter (mm)        | Force (kg)   |   |            |               |     |                |     |          |     |  |
| 0.5 < d ≤ 0.8                 | 1.0  |   |            |               |     |                |     |          |     |  |
| 0.8 < d ≤ 1.25                | 2.0  |   |            |               |     |                |     |          |     |  |
| 1.25 < d                      | 4.0  |   |            |               |     |                |     |          |     |  |
| Bending Strength of Terminals | Hold specimen and apply the force specified below to each lead. Bend the specimen to 90°, then return to the original position. Repeat the procedure in the opposite direction.<br><table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Terminal diameter (mm)</th> <th>Force (kg)</th> </tr> </thead> <tbody> <tr> <td>0.5 &lt; d ≤ 0.8</td> <td>0.5</td> </tr> <tr> <td>0.8 &lt; d ≤ 1.25</td> <td>1.0</td> </tr> <tr> <td>1.25 &lt; d</td> <td>2.0</td> </tr> </tbody> </table> | Terminal diameter (mm)  | Force (kg) | 0.5 < d ≤ 0.8 | 0.5 | 0.8 < d ≤ 1.25 | 1.0 | 1.25 < d | 2.0 | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5% |
| Terminal diameter (mm)        | Force (kg)   |   |            |               |     |                |     |          |     |  |
| 0.5 < d ≤ 0.8                 | 0.5  |   |            |               |     |                |     |          |     |  |
| 0.8 < d ≤ 1.25                | 1.0  |   |            |               |     |                |     |          |     |  |
| 1.25 < d                      | 2.0  |   |            |               |     |                |     |          |     |  |
| Vibration                     | Frequency range: 10~55 Hz<br>Amplitude: 0.75mm or 98m/s <sup>2</sup><br>Direction: 3 mutually perpendicular directions, 2hrs each.   | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5%  |            |               |     |                |     |          |     |  |
| Solder ability                | Solder Temp: 245±5°C<br>Dipping Time: 2±0.5 sec  | At least 95% of terminal electrode is covered by new solder       |            |               |     |                |     |          |     |  |
| Resistance to Soldering Heat  | Solder Temp: 260±5°C<br>Dipping Time: 10±1 sec   | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 10% |            |               |     |                |     |          |     |  |

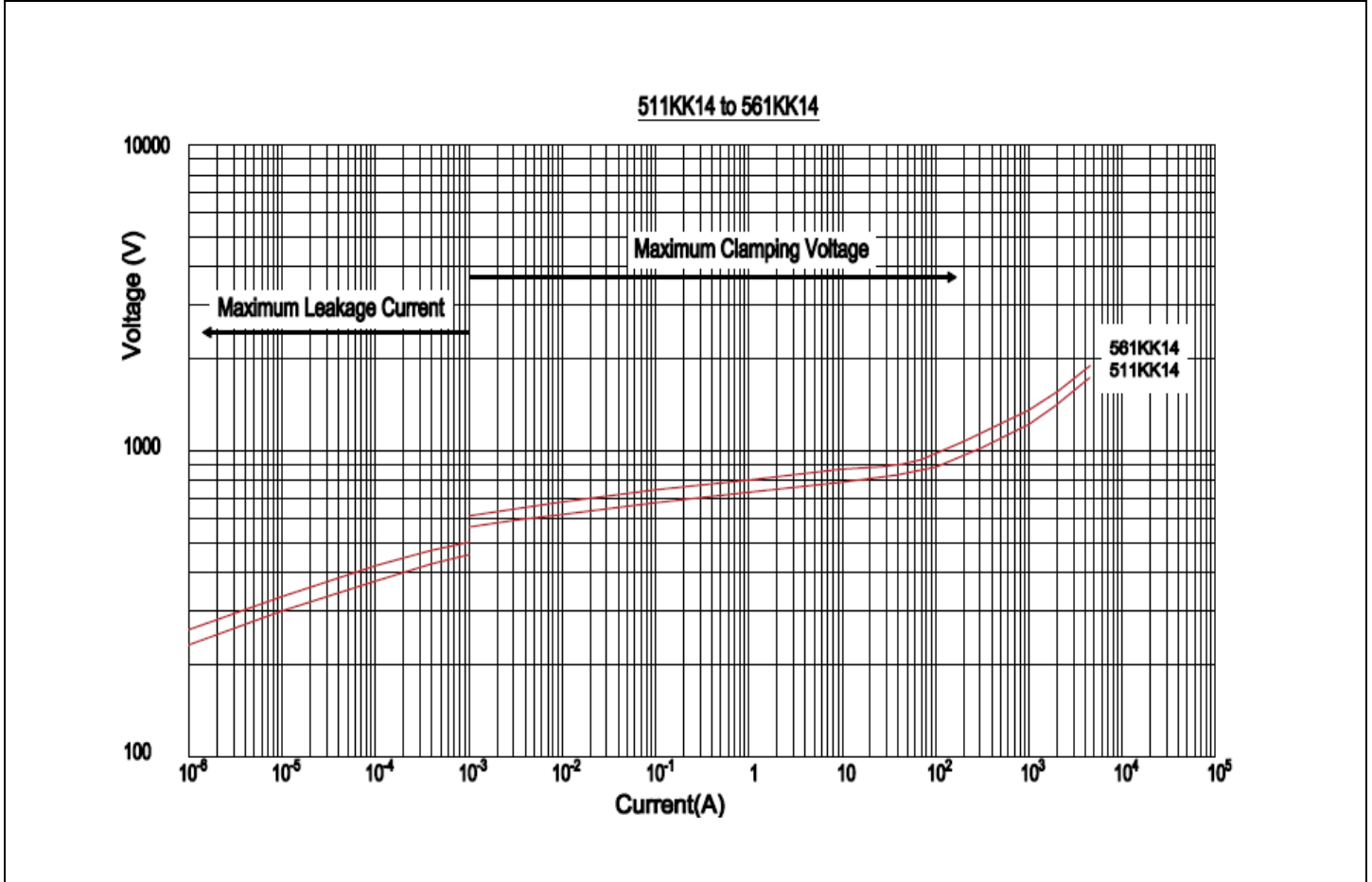
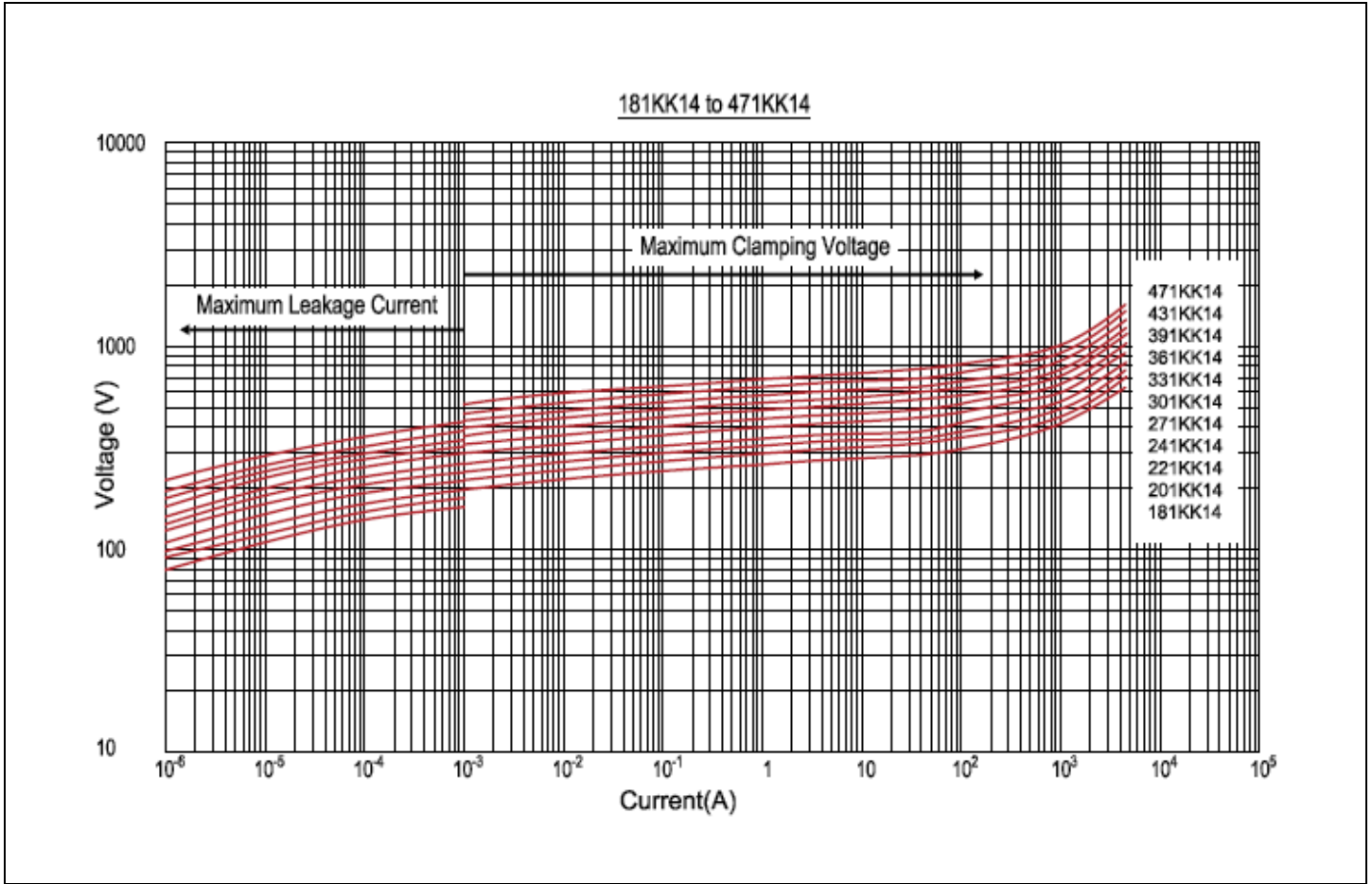
## Reliability

| Items                    | Test conditions / Methods  | Specifications  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
|--------------------------|--|---|------------------|------------------|---|-------|------|---|------------------|------|---|-------|------|---|------------------|------|--|
| High Temperature Storage | Ambient Temp: 125±2°C<br>Duration: 1000hrs   | ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5%                        |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Low Temperature Storage  | Ambient Temp: -40±2°C<br>Duration: 1000hrs   | ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5%                        |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Humidity                 | Ambient Temp: 40±2°C, 90~95%R.H.<br>Duration: 1000hrs  | ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5%                        |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Temperature Cycle        | The conditions shown below shall be repeated 5 cycles<br><table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40±3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>15±3</td> </tr> <tr> <td>3</td> <td>125±3</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>15±3</td> </tr> </tbody> </table> | Step  | Temperature (°C) | Period (minutes) | 1 | -40±3 | 30±3 | 2 | Room temperature | 15±3 | 3 | 125±3 | 30±3 | 4 | Room temperature | 15±3 | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 5% |
| Step                     | Temperature (°C)   | Period (minutes)  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 1                        | -40±3  | 30±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 2                        | Room temperature   | 15±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 3                        | 125±3  | 30±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 4                        | Room temperature   | 15±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| High Temperature Load    | Ambient Temp: 125±2°C      Duration: 1000hrs<br>Load: Max. Allowable Voltage In AC eara.   | ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 10%                       |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Damp HeatLoad            | Ambient Temp: 40±2°C, 90~95%R.H.<br>Duration: 1000hrs      Load: Max. Allowable Voltage  | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤ 10% |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Voltage Proof            | Metal balls method, 2500Vac 1 min.   | No visible damage   |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |

### Maximum Surge Current Derating Curve

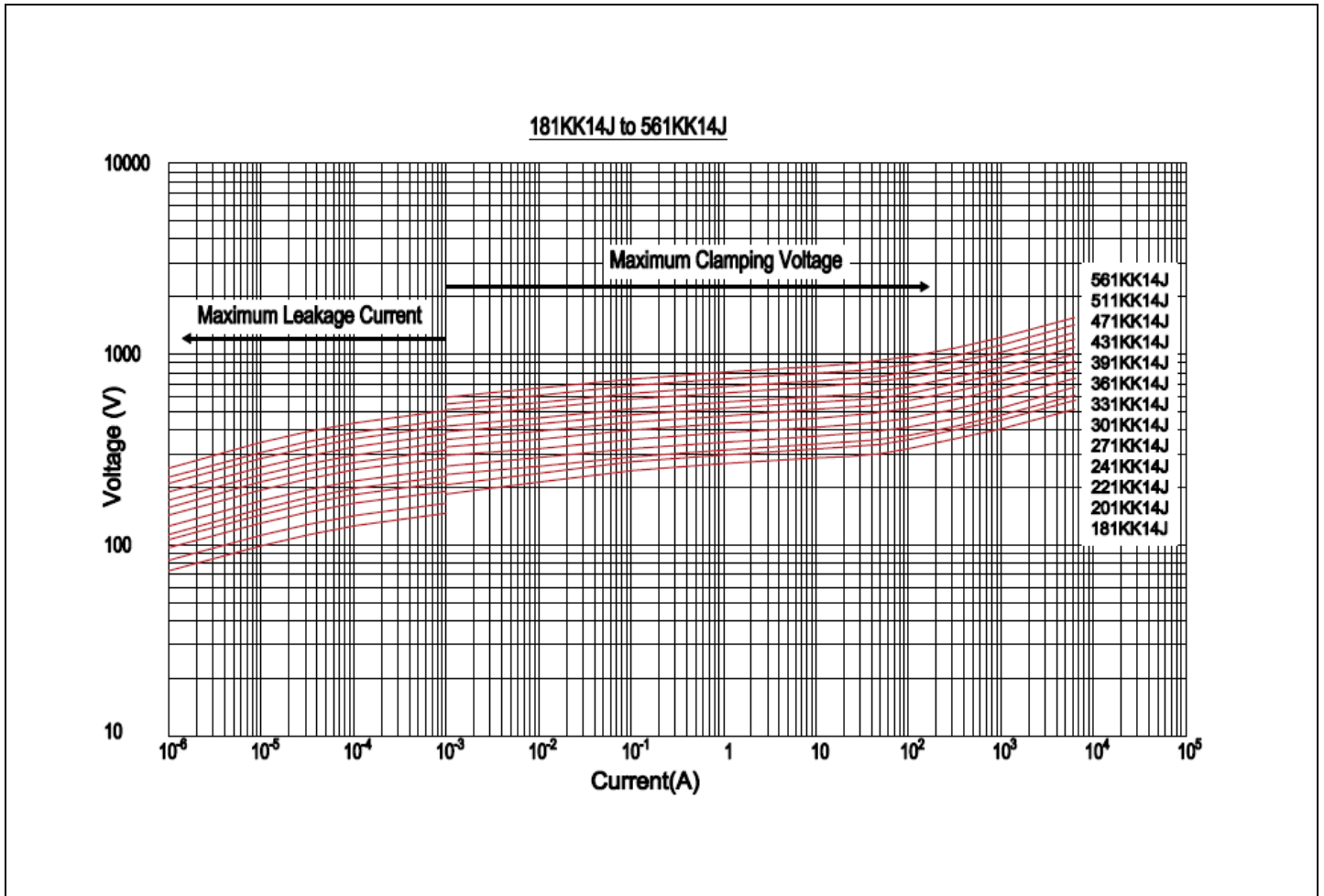


**Maximum Leakage Current and Maximum Clamping Voltage Curve**

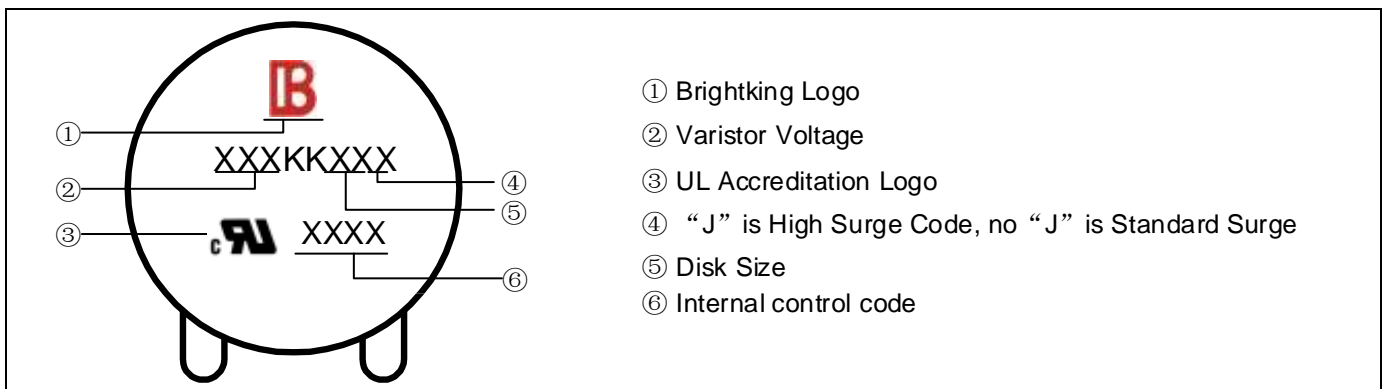




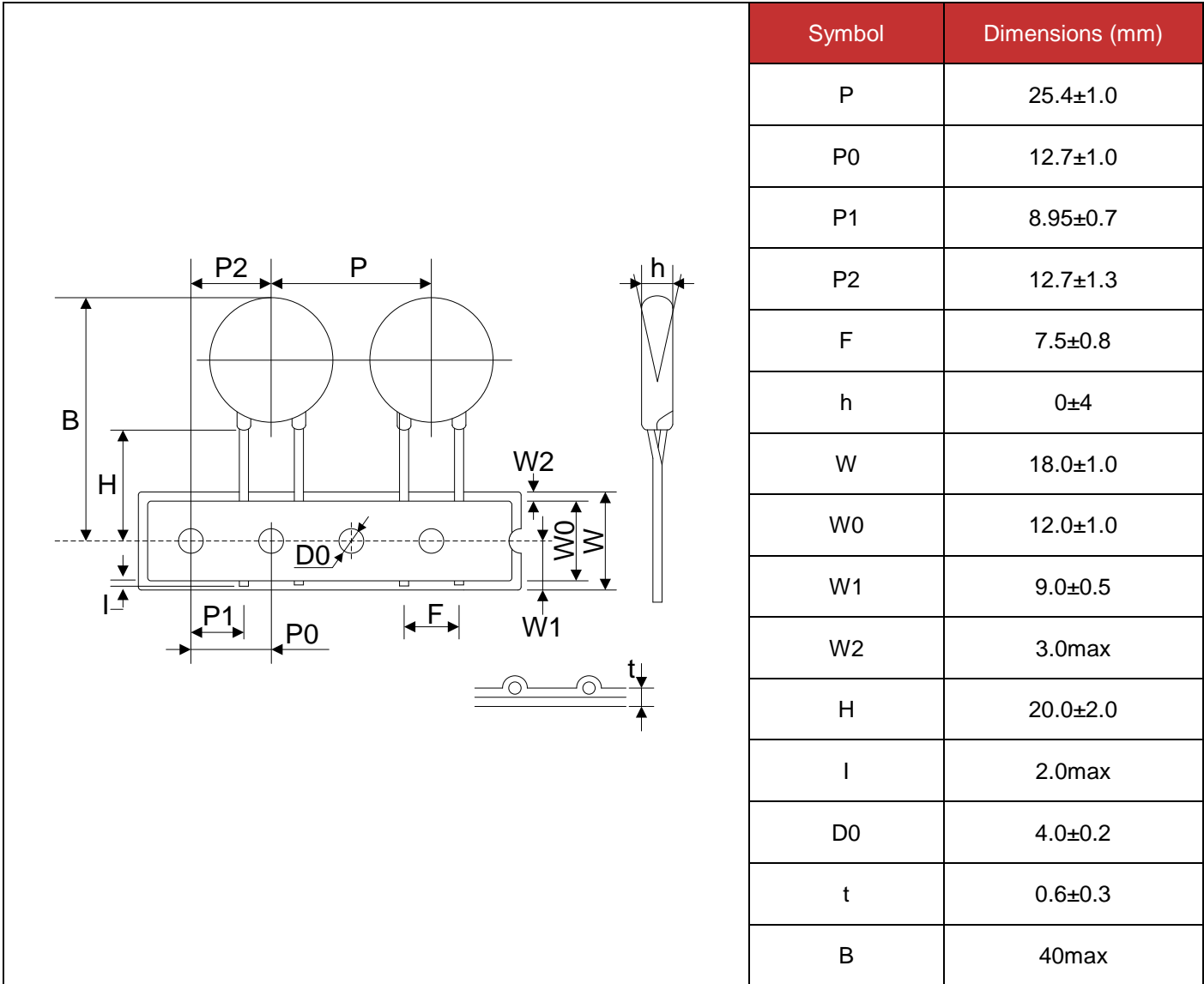
## Maximum Leakage Current and Maximum Clamping Voltage Curve



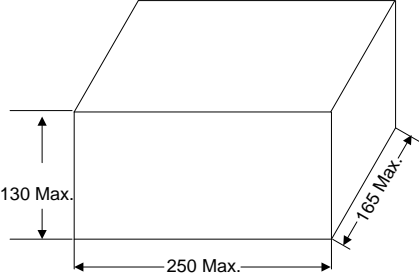
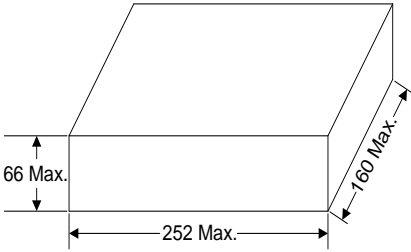
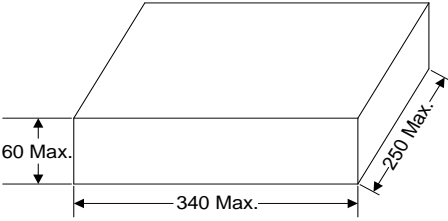
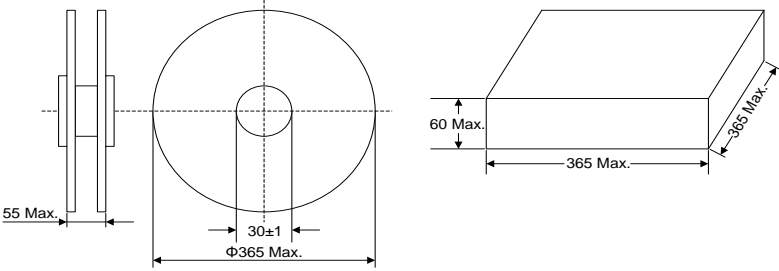
## Marking Code



**Taping Dimensions**



**Quantity**

| Packaging Dimensions (Unit: mm)   | Quantity  |
|---|---|
| <p>In bulk for Terminals Untrimmed Products</p>  | <p>400pcs/bag<br/>4bags/box<br/>(181K~331K)</p>   |
| <p>In bulk for Terminals Trimmed Products</p>   | <p>400pcs/bag<br/>4bags/box<br/>(181K~331K)</p> <p>300pcs/bag<br/>4bags/box<br/>(361K~561K)</p>       |
| <p>Tape &amp; Box</p>                          | <p>750pcs/box<br/>(181K~241K)</p> <p>600pcs/box<br/>(271K~331K)</p> <p>500pcs/box<br/>(361K~561K)</p> |
| <p>Tape &amp; Reel</p>                        | <p>1000pcs/reel<br/>(181K~331K)</p> <p>750pcs/reel<br/>(361K~561K)</p>                                |

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