

# DATA SHEET

## METAL OXIDE VARISTORS POWER SUPPLY

14K series

RoHS compliant & Halogen free



Product specification— October 06, 2020 V.1



## Metal Oxide Varistor (MOV) Data Sheet

### Features

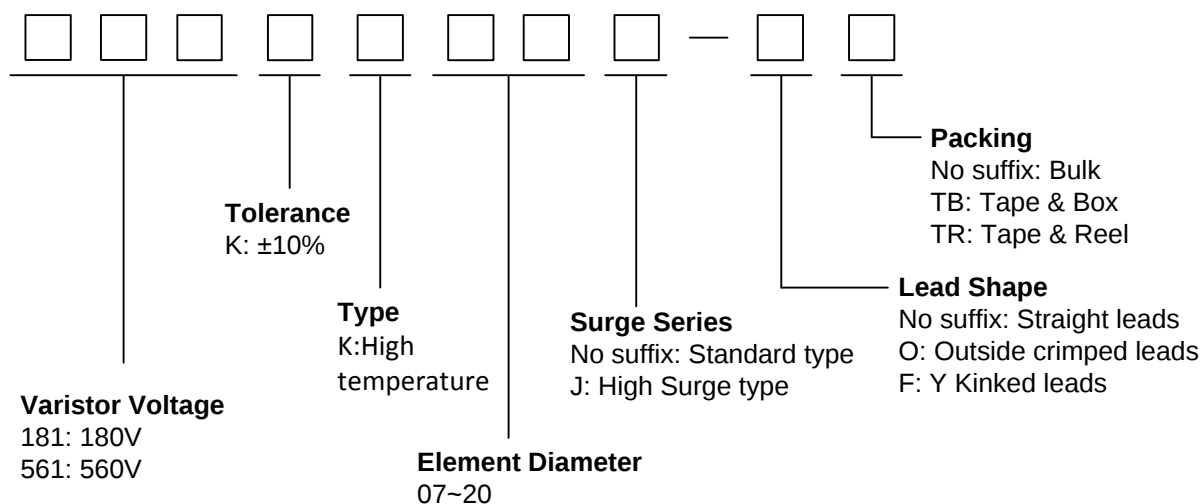
- Wide operating voltage (V1mA) range from 180V to 560V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature: -40°C ~ +125°C
- Storage Temperature: -40°C ~ +125°C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



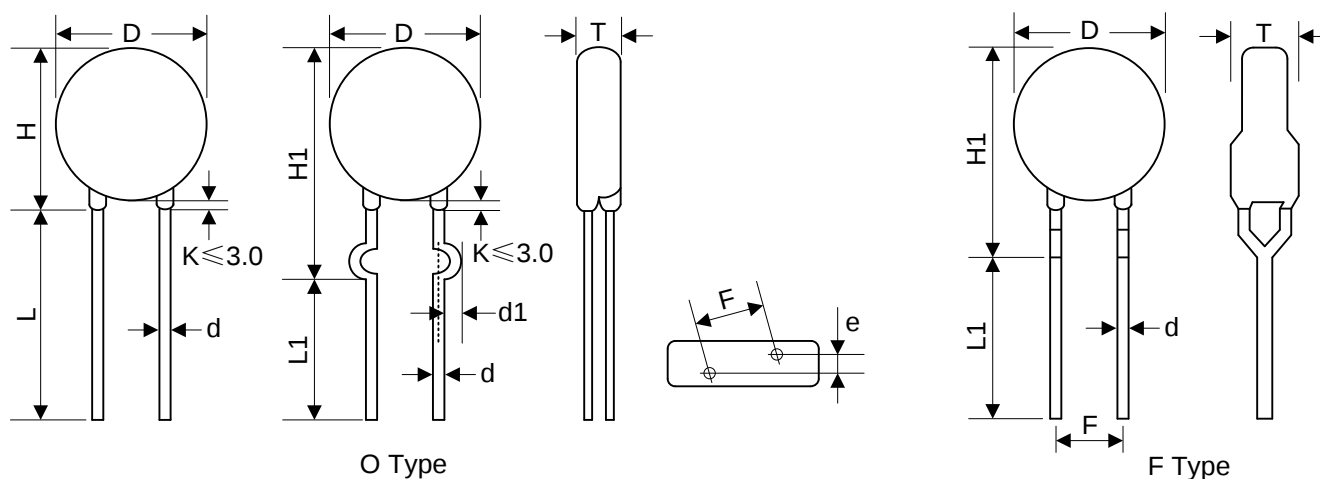
### Applications

- 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

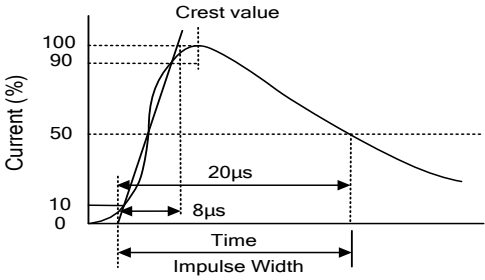
| Model | T(max.) | e   | Model | T(max.) | e   |
|-------|---------|-----|-------|---------|-----|
| 181K  | 4.2     | 1.9 | 471K  | 5.8     | 3.2 |
| 201K  | 4.3     | 2.0 | 511K  | 6.1     | 3.4 |
| 221K  | 4.4     | 2.1 | 561K  | 6.4     | 3.6 |
| 241K  | 4.5     | 2.2 |       |         |     |
| 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                             |

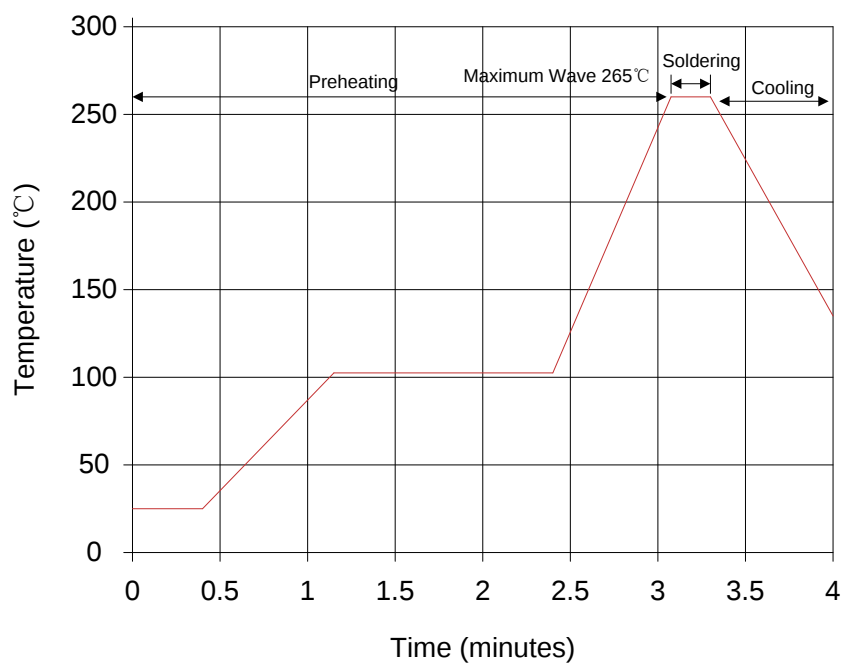
Notes: Leakage Current (@83% of V<sub>1mA</sub>): IR≤25μA

## 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.                                                                                                                                                                                                       | To meet the Specified value |              |               |                                        |
| 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.<br/>Applied waveform: 8/20μs</p>                                                                                          |                             |              |               |                                        |
| 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 $                                                                                                                                                                       | ≤0.05%/°C                   |              |               |                                        |
|                                    | $\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 $                                                                                                                                                                        |                             |              |               |                                        |
| 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"> <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.)       |

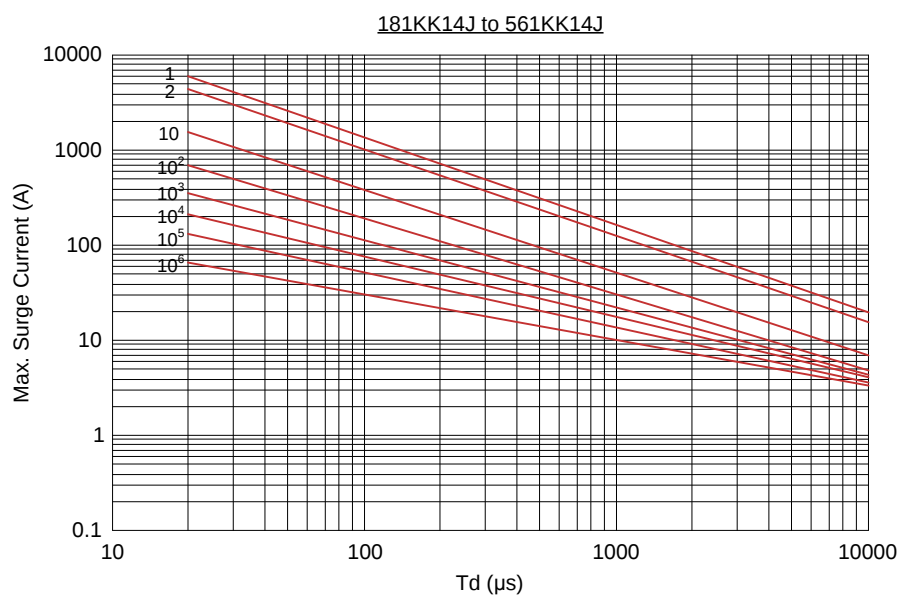
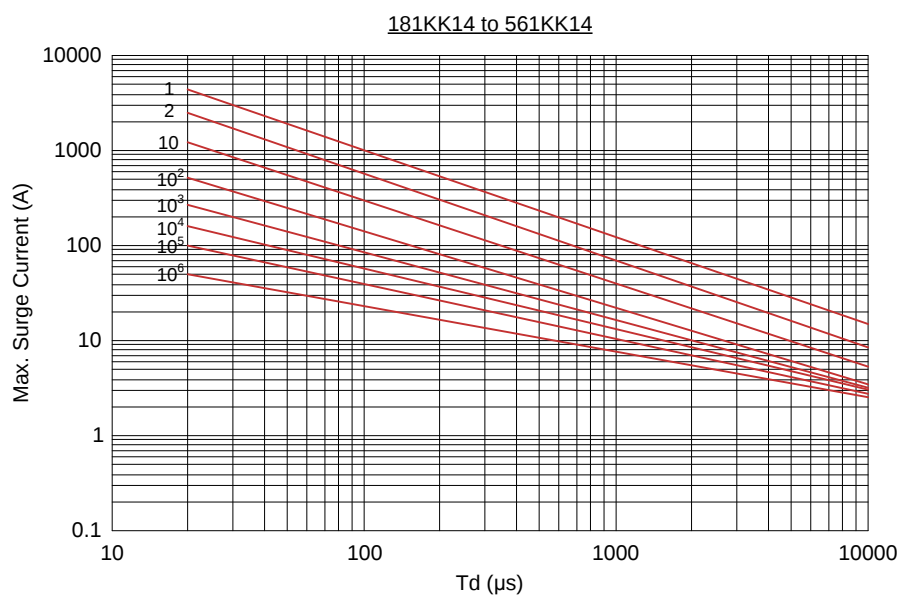
## Mechanical Characteristics

| Items                         | Test conditions / Methods                                                                                                                                                                                                                                                                                                                                                                         | Specifications                                                  |            |           |     |            |     |        |     |                                                                |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|------------|-----------|-----|------------|-----|--------|-----|----------------------------------------------------------------|
| Tensile Strength of Terminals | <div>Gradually applying the force specified and keeping the unit fixed for 10±1 sec.</div> <table><tr><th>Terminal diameter (mm)</th><th>Force (kg)</th></tr><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></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 | <div>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.</div> <table><tr><th>Terminal diameter (mm)</th><th>Force (kg)</th></tr><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></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℃<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℃<br>Dipping Time: 10±1 sec                                                                                                                                                                                                                                                                                                                                                     | No visible damage<br> ΔV <sub>1mA</sub> /V <sub>1mA</sub>  ≤10% |            |           |     |            |     |        |     |                                                                |

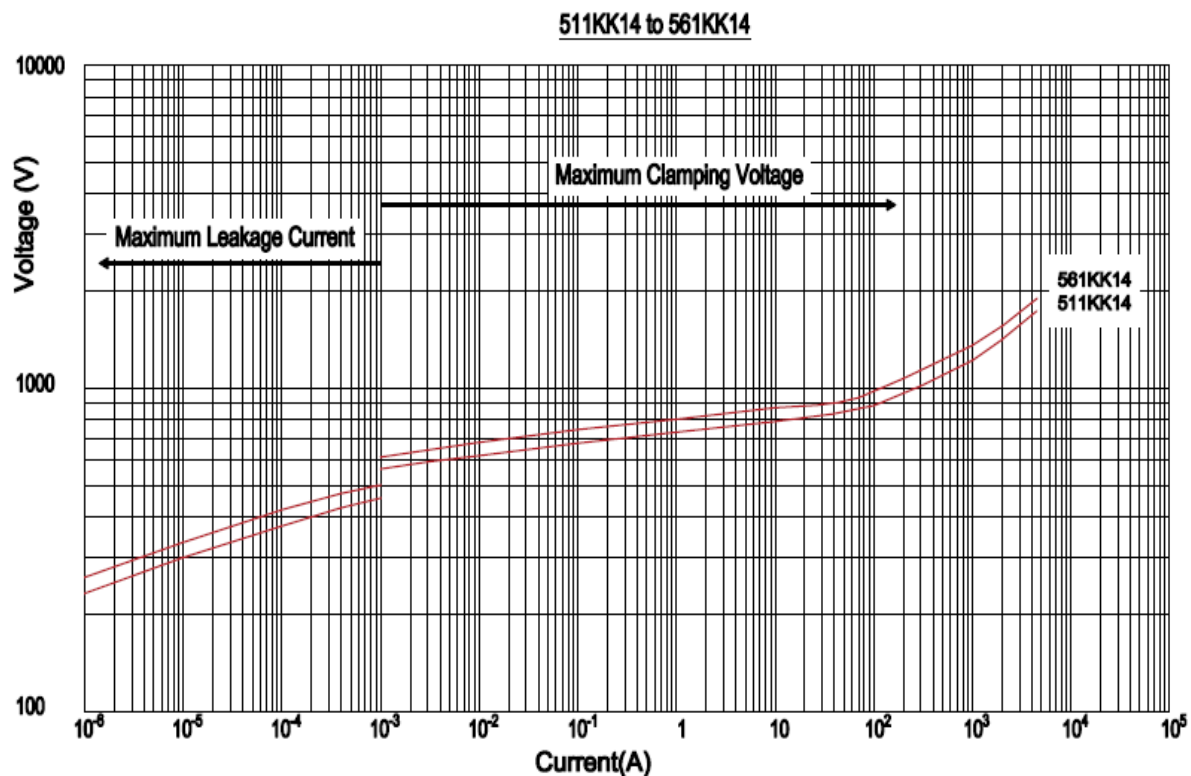
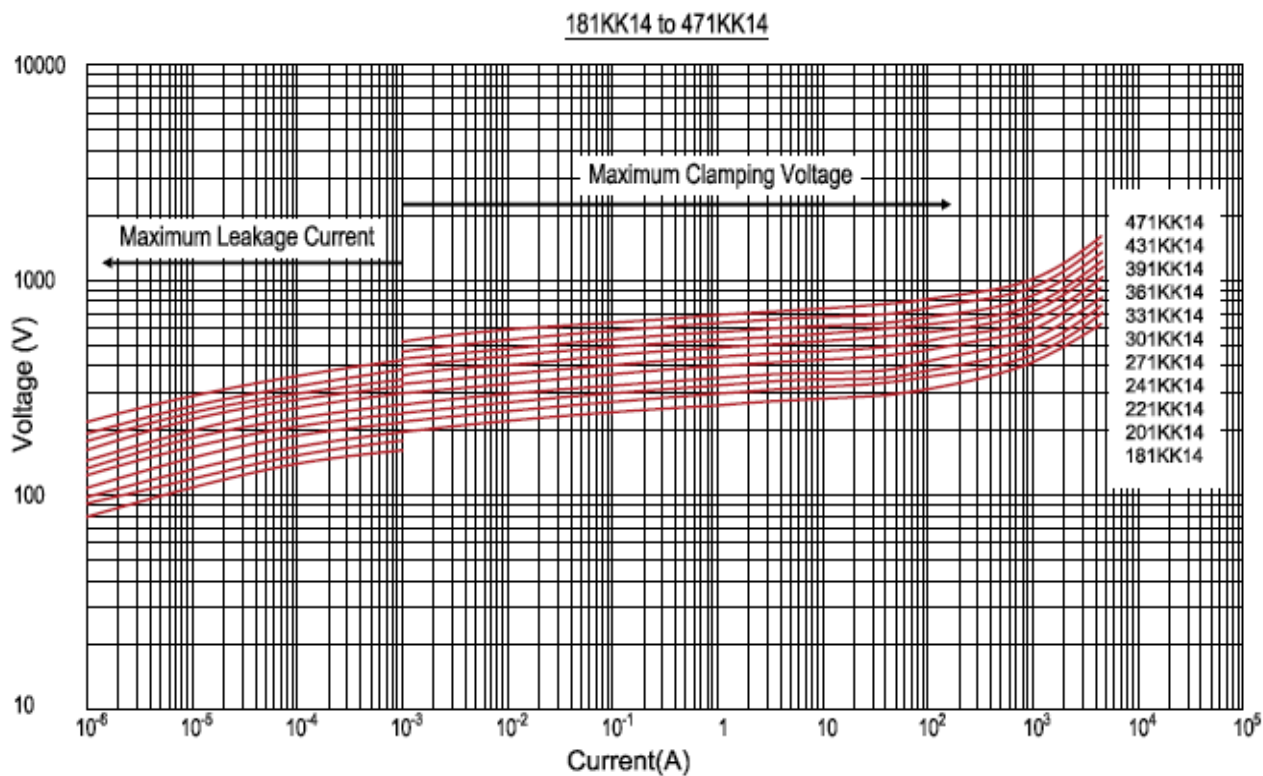
## Reliability

| 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> <tr> <th>Step</th><th>Temperature (°C)</th><th>Period (minutes)</th></tr> <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> </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                                                |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |                                                                 |

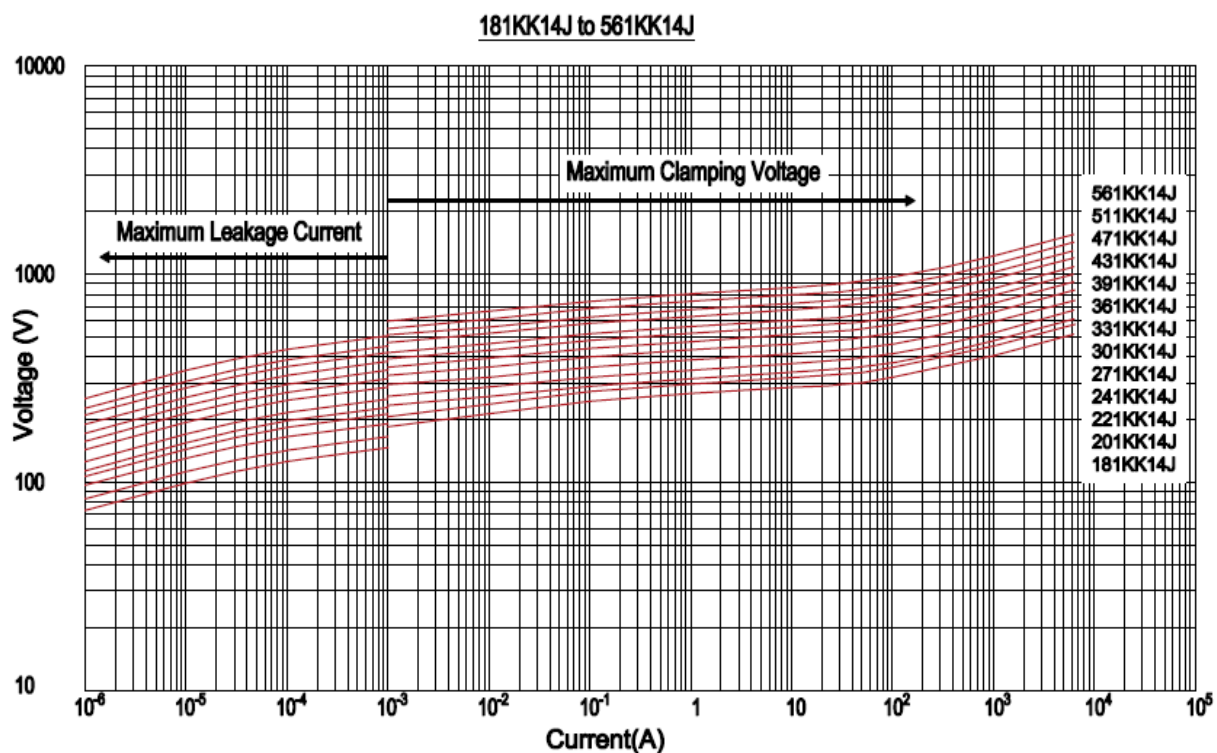
## Maximum Surge Current Derating Curve



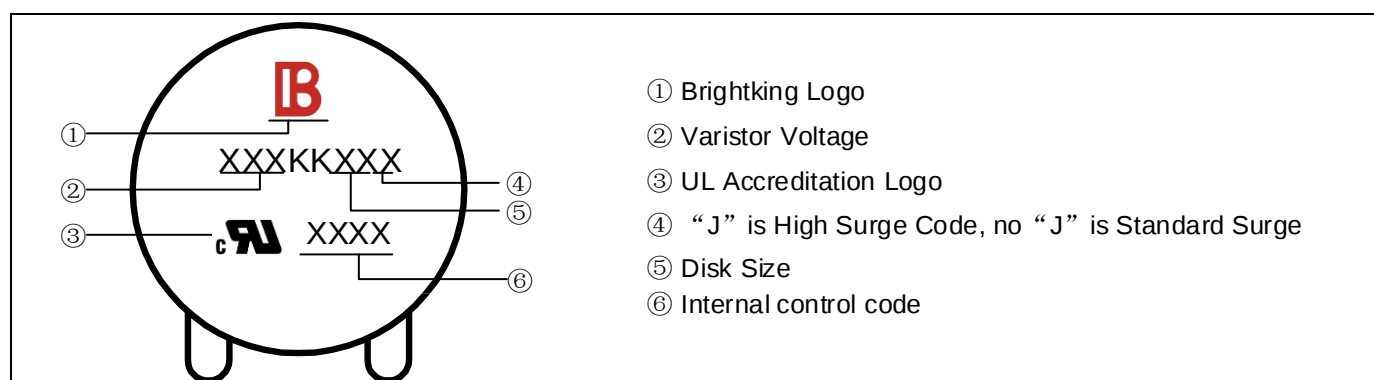
## Maximum Leakage Current and Maximum Clamping Voltage Curve



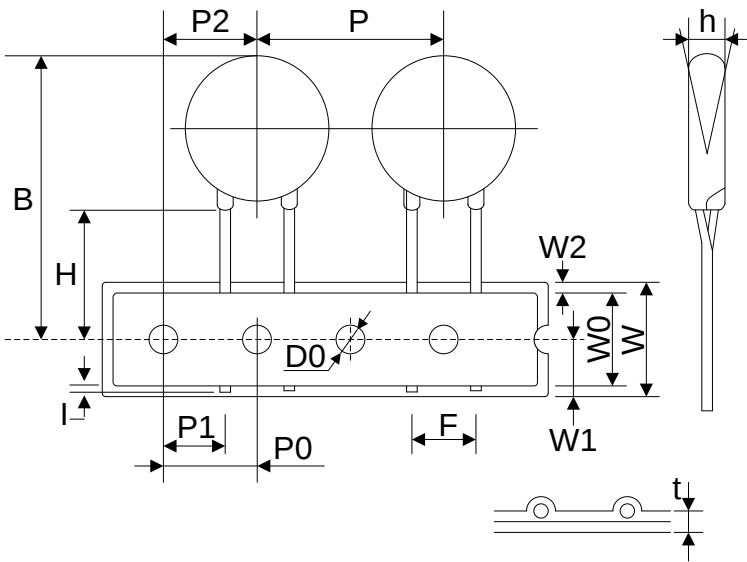
## Maximum Leakage Current and Maximum Clamping Voltage Curve



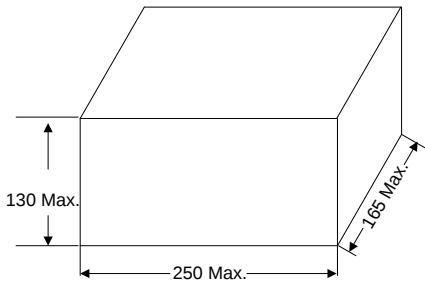
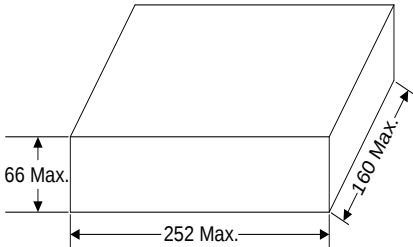
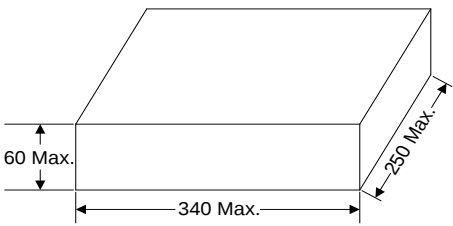
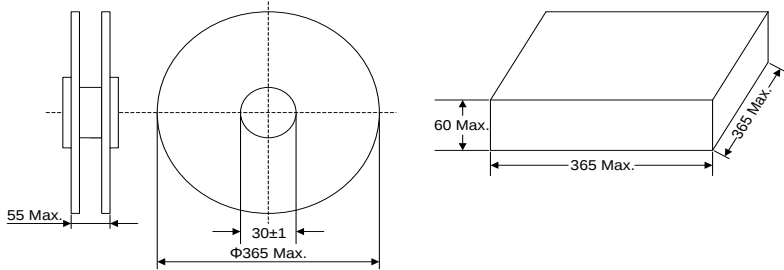
## Marking Code



Taping Dimensions

|  | Symbol | Dimensions (mm) |
|------------------------------------------------------------------------------------|--------|-----------------|
|                                                                                    | P      | 25.4±1.0        |
|                                                                                    | P0     | 12.7±1.0        |
|                                                                                    | P1     | 8.95±0.7        |
|                                                                                    | P2     | 12.7±1.3        |
|                                                                                    | F      | 7.5±0.8         |
|                                                                                    | h      | 0±4             |
|                                                                                    | W      | 18.0±1.0        |
|                                                                                    | W0     | 12.0±1.0        |
|                                                                                    | W1     | 9.0±0.5         |
|                                                                                    | W2     | 3.0max          |
|                                                                                    | H      | 20.0±2.0        |
|                                                                                    | I      | 2.0max          |
|                                                                                    | D0     | 4.0±0.2         |
|                                                                                    | t      | 0.6±0.3         |
|                                                                                    | B      | 40max           |

## Quantity

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