

## Metal Oxide Varistors (MOV) Data Sheet

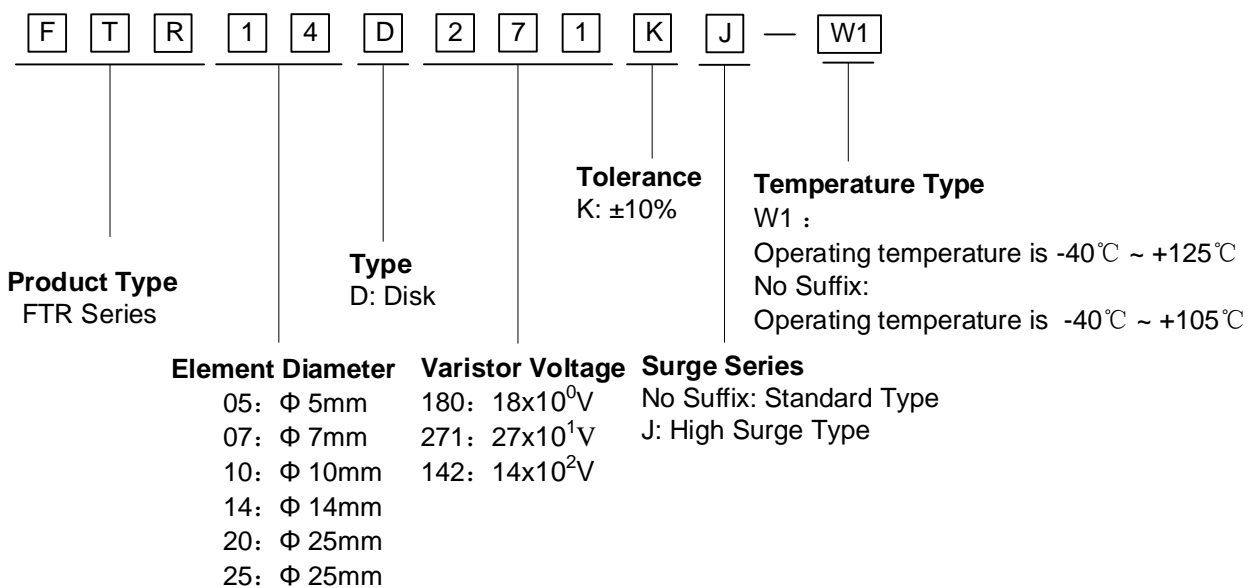
### Features

- 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 ~ +105°C & -40°C ~ +125°C
- Storage Temperature: -40°C ~ +125°C
- Agency recognition: UL 1449 4th /cUL/TUV/VDE/CQC

### Applications

- Power supply, Telecommunication, Smart meter, or PLC 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



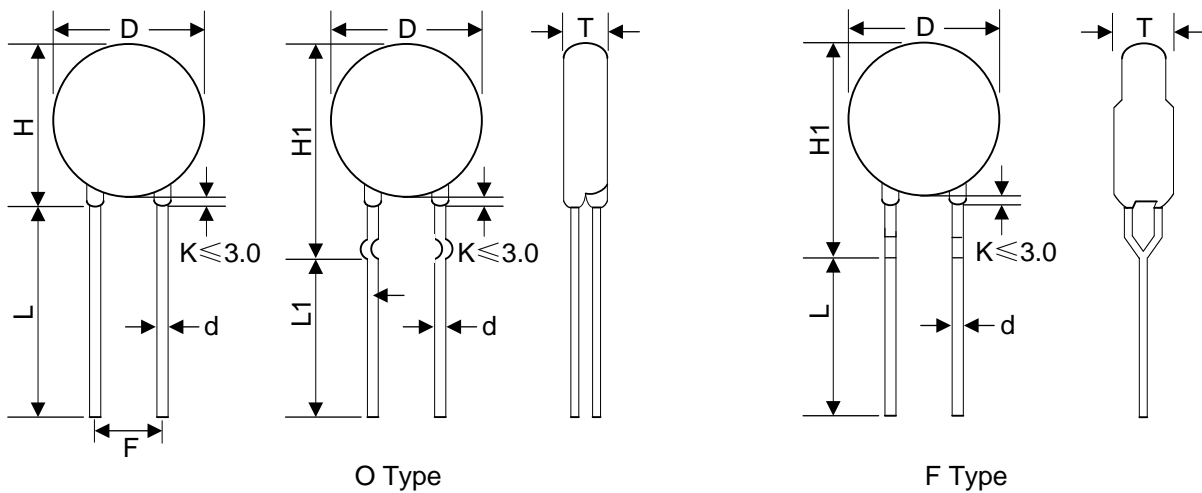
**Electrical Characteristics**

| Part Number |             | Maximum Allowable Voltage |                     | Varistor Voltage     | Maximum Clamping Voltage |                    | Withstanding Surge current |                | Maximum Energy (10/1000μs) |                | Rated Power | Dimension T <sub>max</sub> |
|-------------|-------------|---------------------------|---------------------|----------------------|--------------------------|--------------------|----------------------------|----------------|----------------------------|----------------|-------------|----------------------------|
| 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) | (A) Standard               | (A) High Surge | (J) Standard               | (J) High Surge | (W)         | (mm)                       |
| FTR14D180K  | FTR14D180KJ | 11                        | 14                  | 18(15~21.6)          | 10                       | 36                 | 1000                       | 2000           | 4                          | 7              | 0.1         | 5.0                        |
| FTR14D220K  | FTR14D220KJ | 14                        | 18                  | 22(19.5~26)          | 10                       | 43                 | 1000                       | 2000           | 5                          | 8              | 0.1         | 5.0                        |
| FTR14D270K  | FTR14D270KJ | 17                        | 22                  | 27(24~31)            | 10                       | 53                 | 1000                       | 2000           | 6                          | 10             | 0.1         | 5.0                        |
| FTR14D330K  | FTR14D330KJ | 20                        | 26                  | 33(29.5~36.5)        | 10                       | 65                 | 1000                       | 2000           | 7.5                        | 12             | 0.1         | 5.0                        |
| FTR14D390K  | FTR14D390KJ | 25                        | 31                  | 39(35~43)            | 10                       | 77                 | 1000                       | 2000           | 8.6                        | 13             | 0.1         | 5.0                        |
| FTR14D470K  | FTR14D470KJ | 30                        | 38                  | 47(42~52)            | 10                       | 93                 | 1000                       | 2000           | 10                         | 17             | 0.1         | 5.0                        |
| FTR14D560K  | FTR14D560KJ | 35                        | 45                  | 56(50~62)            | 10                       | 110                | 1000                       | 2000           | 11                         | 20             | 0.1         | 5.0                        |
| FTR14D680K  | FTR14D680KJ | 40                        | 56                  | 68(61~75)            | 10                       | 135                | 1000                       | 2000           | 14                         | 24             | 0.1         | 5.0                        |
| FTR14D820K  | FTR14D820KJ | 50                        | 65                  | 82(74~90)            | 50                       | 135                | 4500                       | 6000           | 22                         | 27             | 0.6         | 5.0                        |
| FTR14D101K  | FTR14D101KJ | 60                        | 85                  | 100(90~110)          | 50                       | 165                | 4500                       | 6000           | 28                         | 33             | 0.6         | 4.2                        |
| FTR14D121K  | FTR14D121KJ | 75                        | 100                 | 120(108~132)         | 50                       | 200                | 4500                       | 6000           | 32                         | 40             | 0.6         | 4.4                        |
| FTR14D151K  | FTR14D151KJ | 95                        | 125                 | 150(135~165)         | 50                       | 250                | 4500                       | 6000           | 40                         | 53             | 0.6         | 4.0                        |
| FTR14D181K  | FTR14D181KJ | 115                       | 150                 | 180(162~198)         | 50                       | 300                | 4500                       | 6000           | 50                         | 60             | 0.6         | 4.1                        |
| FTR14D201K  | FTR14D201KJ | 130                       | 170                 | 200(180~220)         | 50                       | 340                | 4500                       | 6000           | 57                         | 70             | 0.6         | 4.2                        |
| FTR14D221K  | FTR14D221KJ | 140                       | 180                 | 220(198~242)         | 50                       | 360                | 4500                       | 6000           | 60                         | 78             | 0.6         | 4.3                        |
| FTR14D241K  | FTR14D241KJ | 150                       | 200                 | 240(216~264)         | 50                       | 395                | 4500                       | 6000           | 63                         | 84             | 0.6         | 4.4                        |
| FTR14D271K  | FTR14D271KJ | 175                       | 225                 | 270(243~297)         | 50                       | 455                | 4500                       | 6000           | 70                         | 99             | 0.6         | 4.6                        |
| FTR14D301K  | FTR14D301KJ | 190                       | 250                 | 300(270~330)         | 50                       | 500                | 4500                       | 6000           | 77                         | 108            | 0.6         | 4.7                        |
| FTR14D331K  | FTR14D331KJ | 210                       | 275                 | 330(297~363)         | 50                       | 550                | 4500                       | 6000           | 85                         | 115            | 0.6         | 4.7                        |
| FTR14D361K  | FTR14D361KJ | 230                       | 300                 | 360(324~396)         | 50                       | 595                | 4500                       | 6000           | 93                         | 130            | 0.6         | 4.9                        |
| FTR14D391K  | FTR14D391KJ | 250                       | 320                 | 390(351~429)         | 50                       | 650                | 4500                       | 6000           | 100                        | 140            | 0.6         | 5.0                        |
| FTR14D431K  | FTR14D431KJ | 275                       | 350                 | 430(387~473)         | 50                       | 710                | 4500                       | 6000           | 115                        | 155            | 0.6         | 5.2                        |
| FTR14D471K  | FTR14D471KJ | 300                       | 385                 | 470(423~517)         | 50                       | 775                | 4500                       | 6000           | 118                        | 175            | 0.6         | 5.4                        |
| FTR14D511K  | FTR14D511KJ | 320                       | 415                 | 510(459~561)         | 50                       | 845                | 4500                       | 6000           | 121                        | 180            | 0.6         | 5.6                        |
| FTR14D561K  | FTR14D561KJ | 350                       | 460                 | 560(504~616)         | 50                       | 925                | 4500                       | 6000           | 125                        | 185            | 0.6         | 5.8                        |
| FTR14D621K  | FTR14D621KJ | 385                       | 505                 | 620(558~682)         | 50                       | 1025               | 4500                       | 6000           | 128                        | 190            | 0.6         | 6.1                        |
| FTR14D681K  | FTR14D681KJ | 420                       | 560                 | 680(612~748)         | 50                       | 1120               | 4500                       | 6000           | 130                        | 200            | 0.6         | 6.4                        |
| FTR14D751K  | FTR14D751KJ | 460                       | 615                 | 750(675~825)         | 50                       | 1240               | 4500                       | 6000           | 143                        | 210            | 0.6         | 6.5                        |
| FTR14D781K  | FTR14D781KJ | 485                       | 640                 | 780(702~858)         | 50                       | 1290               | 4500                       | 6000           | 148                        | 220            | 0.6         | 6.6                        |
| FTR14D821K  | FTR14D821KJ | 510                       | 670                 | 820(738~902)         | 50                       | 1355               | 4500                       | 6000           | 157                        | 235            | 0.6         | 6.8                        |
| FTR14D911K  | FTR14D911KJ | 550                       | 745                 | 910(819~1001)        | 50                       | 1500               | 4500                       | 6000           | 175                        | 255            | 0.6         | 7.1                        |
| FTR14D102K  | FTR14D102KJ | 625                       | 825                 | 1000(900~1100)       | 50                       | 1650               | 4500                       | 6000           | 190                        | 280            | 0.6         | 7.1                        |
| FTR14D112K  | FTR14D112KJ | 680                       | 895                 | 1100(990~1210)       | 50                       | 1815               | 4500                       | 6000           | 213                        | 310            | 0.6         | 7.6                        |
| FTR14D122K  | FTR14D122KJ | 750                       | 990                 | 1200(1080~1320)      | 50                       | 1980               | 4500                       | 6000           | 232                        | 324            | 0.6         | 8.0                        |
| FTR14D142K  | FTR14D142KJ | 880                       | 1140                | 1400(1260~1540)      | 50                       | 2310               | 4500                       | 6000           | 238                        | 327            | 0.6         | 8.6                        |

| Part Number |             | Maximum Allowable Voltage |                     | Varistor Voltage     | Maximum Clamping Voltage |                    | Withstanding Surge current |                | Maximum Energy (10/1000μs) |                | Rated Power | Dimension T <sub>max</sub> |
|-------------|-------------|---------------------------|---------------------|----------------------|--------------------------|--------------------|----------------------------|----------------|----------------------------|----------------|-------------|----------------------------|
| 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) | (A) Standard               | (A) High Surge | (J) Standard               | (J) High Surge | (W)         | (mm)                       |
| FTR14D162K  | FTR14D162KJ | 1000                      | 1280                | 1600(1440~1760)      | 50                       | 2640               | 4500                       | 6000           | 243                        | 331            | 0.6         | 9.3                        |
| FTR14D182K  | FTR14D182KJ | 1100                      | 1465                | 1800(1620~1980)      | 50                       | 2970               | 4500                       | 6000           | 250                        | 335            | 0.6         | 10.1                       |

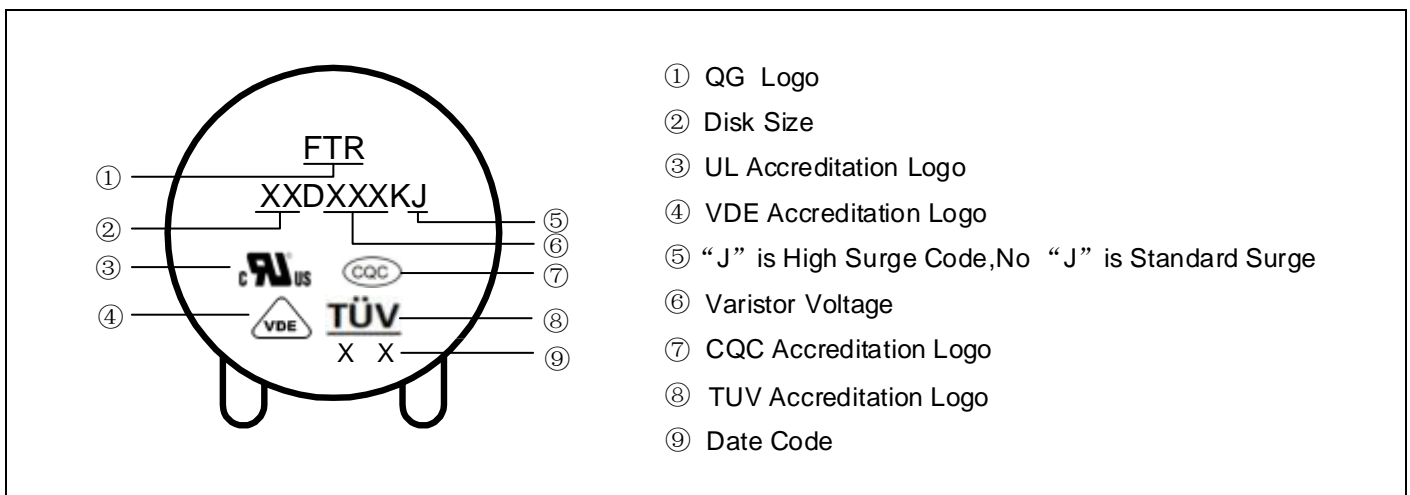
- Notes: 1. The tolerance of varistor voltage between 18V and 27V is more than 10%.  
 2. Varistor voltage  $\geq 1200V$ , structure diagram is F type.  
 3. Leakage Current (@83% of V<sub>1mA</sub>):  $IR \leq 50\mu A$  (180K~680K) ;  $IR \leq 25\mu A$  (820K~182K)

### Dimensions



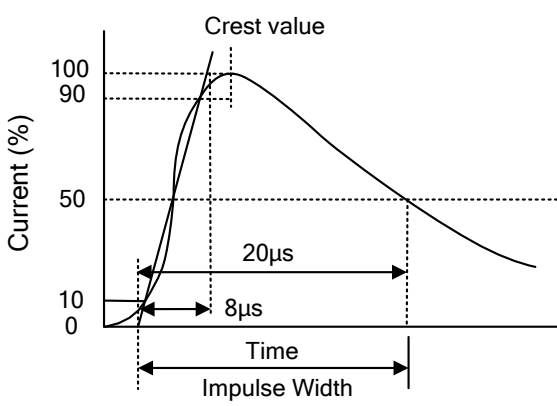
| Symbol        | H(max.) | H1(max.) | L(min.) | L1(min.) | D (max.) | F( $\pm 0.8$ ) | d( $\pm 0.05$ ) | Tmax   |
|---------------|---------|----------|---------|----------|----------|----------------|-----------------|--|
| Dimension(mm) | 19      | 21       | 20      | 15       | 16       | 7.5            | 0.8             | Please refer to the Electrical Characteristics Table |

### Marking Code



- ① QG Logo
- ② Disk Size
- ③ UL Accreditation Logo
- ④ VDE Accreditation Logo
- ⑤ "J" is High Surge Code, No "J" is Standard Surge
- ⑥ Varistor Voltage
- ⑦ CQC Accreditation Logo
- ⑧ TÜV Accreditation Logo
- ⑨ Date Code

## Electrical Ratings

| Items                              | Test Condition/Description   | Requirement                 |              |              |              |               |  |
|------------------------------------|--|-----------------------------|--------------|--------------|--------------|---------------|--|
| Varistor Voltage                   | The voltage between 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 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@85^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{60} \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="438 1892 1204 2016"> <tbody> <tr> <td rowspan="2">14Φ series</td> <td>180K to 680K</td> <td>75A (8/20μs)</td> </tr> <tr> <td>820K to 182K</td> <td>150A (8/20μs)</td> </tr> </tbody> </table> | 14Φ series                  | 180K to 680K | 75A (8/20μs) | 820K to 182K | 150A (8/20μs) | $\frac{\Delta V_b}{V_b} \leq \pm 10\%$ |
| 14Φ series                         | 180K to 680K   |                             | 75A (8/20μs) |              |              |               |  |
|                                    | 820K to 182K   | 150A (8/20μs)               |              |              |              |               |  |

## Mechanical Characteristics

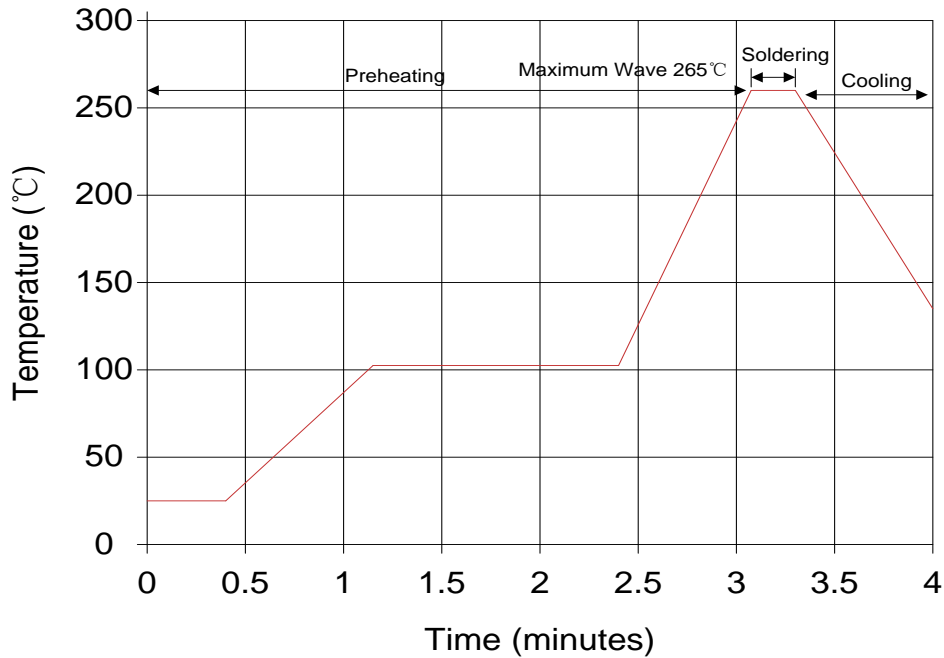
| Items                         | Test conditions / Methods  | Specifications   |           |           |     |            |     |        |     |  |
|-------------------------------|--|--|-----------|-----------|-----|------------|-----|--------|-----|--|
| Tensile Strength of Terminals | <p>Gradually applying the force specified and keeping the unit fixed for 10±1 sec.</p> <table border="1"> <tr> <td>Terminal diameter (mm)</td> <td>Force(kg)</td> </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 | <p>NO Visible damage<br/> Δ V1mA/V1mA  ≤5%</p> |
| 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 | <p>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.</p> <table border="1"> <tr> <td>Terminal diameter (mm)</td> <td>Force(kg)</td> </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 | <p>NO Visible damage<br/> Δ V1mA/V1mA  ≤5%</p> |
| 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                     | <p>Frequency range: 10~55 Hz<br/>Amplitude: 0.75mm or 98m/s<sup>2</sup><br/>Direction: 3 mutually perpendicular directions, 2hrs each.</p>   | <p>NO Visible damage<br/> Δ V1mA/V1mA  ≤5%</p>                     |           |           |     |            |     |        |     |  |
| Solder ability                | <p>Solder Temp: 245±5°C<br/>Dipping Time: 2±0.5 sec</p>  | <p>At least 95% of terminal electrode is covered by new solder</p> |           |           |     |            |     |        |     |  |
| Resistanceto Soldering Heat   | <p>Solder Temp: 260±5°C<br/>Dipping Time: 10±1 sec</p>   | <p>NO Visible damage<br/> Δ V1mA/V1mA  ≤5%</p>                     |           |           |     |            |     |        |     |  |

## Reliability

| Items                    | Test conditions / Methods   | Specifications                                |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |
|--------------------------|---|---|------------------|------------------|---|-------|------|---|------------------|------|---|-------|------|---|------------------|------|---|
| High Temperature Storage | <p>Ambient Temp: 125±2°C<br/>Duration: 1000hrs</p>  | <p> Δ V1mA/V1mA  ≤5%</p>                      |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |
| Low Temperature Storage  | <p>Ambient Temp: -40±2°C<br/>Duration: 1000hrs</p>  | <p> Δ V1mA/V1mA  ≤5%</p>                      |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |
| Humidity                 | <p>Ambient Temp: 40±2°C, 90~95% R.H.<br/>Duration: 1000hrs</p>  | <p> Δ V1mA/V1mA  ≤5%</p>                      |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |
| Temperature Cycle        | <p>The conditions shown below shall be repeated 5 cycles</p> <table border="1"> <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 | <p>No visible damage<br/> ΔV1mA/V1mA  ≤5%</p> |
| 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    | <p>Ambient Temp: 105±2°C<br/>Duration: 1000hrs<br/>Load: Max. Allowable Voltage In AC eara.</p>   | <p> ΔV1mA/V1mA  ≤5%</p>                       |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |
| Damp Heat Load           | <p>Ambient Temp: 40±2°C, 90~95% R.H.<br/>Duration: 1000hrs<br/>Load: Max. Allowable Voltage</p>   | <p>No visible damage<br/> ΔV1mA/V1mA  ≤5%</p> |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |
| Voltage Proof            | <p>Metal balls method, 2500Vac 1 min.</p>   | <p>No visible damage</p>                      |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |   |

**Soldering Recommendation**

Wave Lead Free Soldering Recommendation



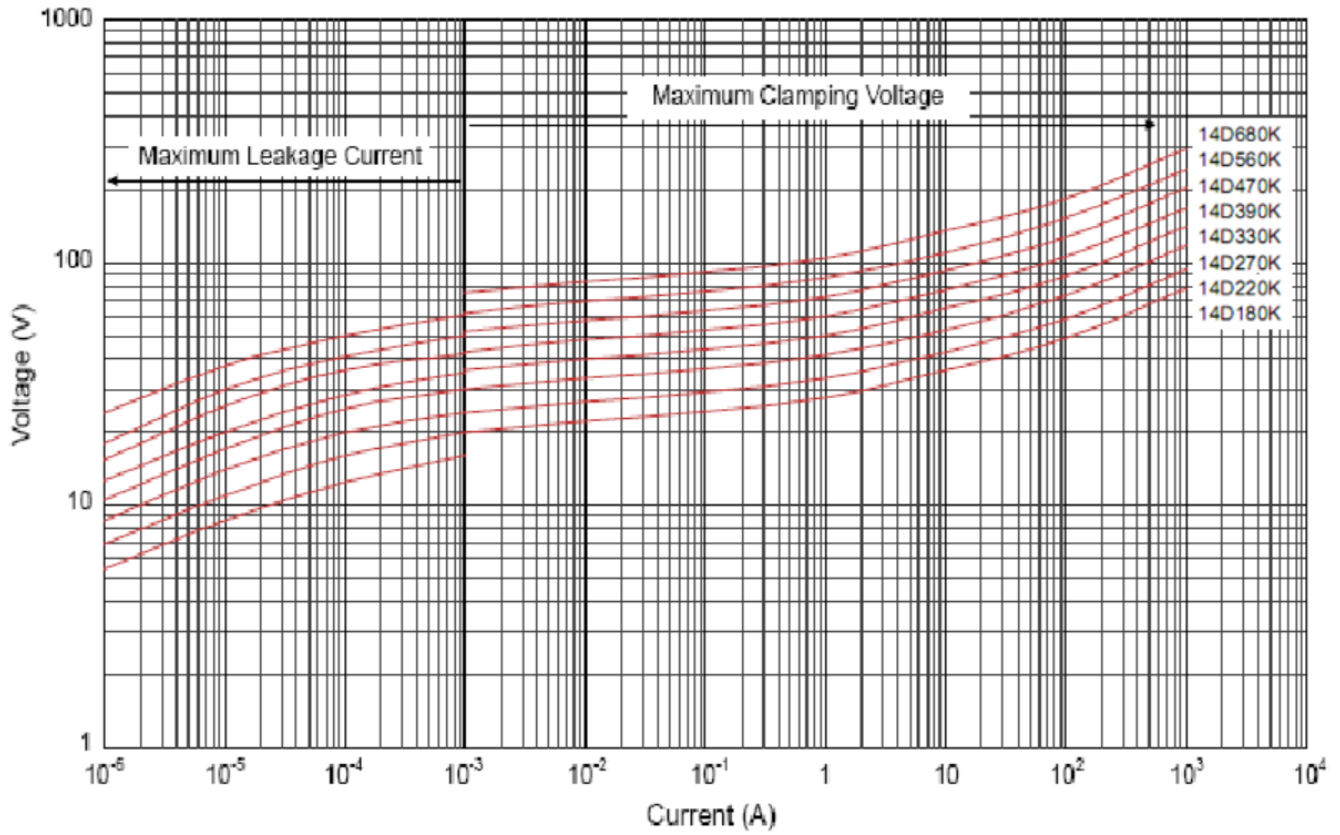
| Item             | Conditions       |
|------------------|------------------|
| Peak Temperature | 265°C            |
| Dipping Time     | 10 seconds(max.) |
| Soldering        | 1 time           |

Recommendation Reworking Conditions with Soldering Iron

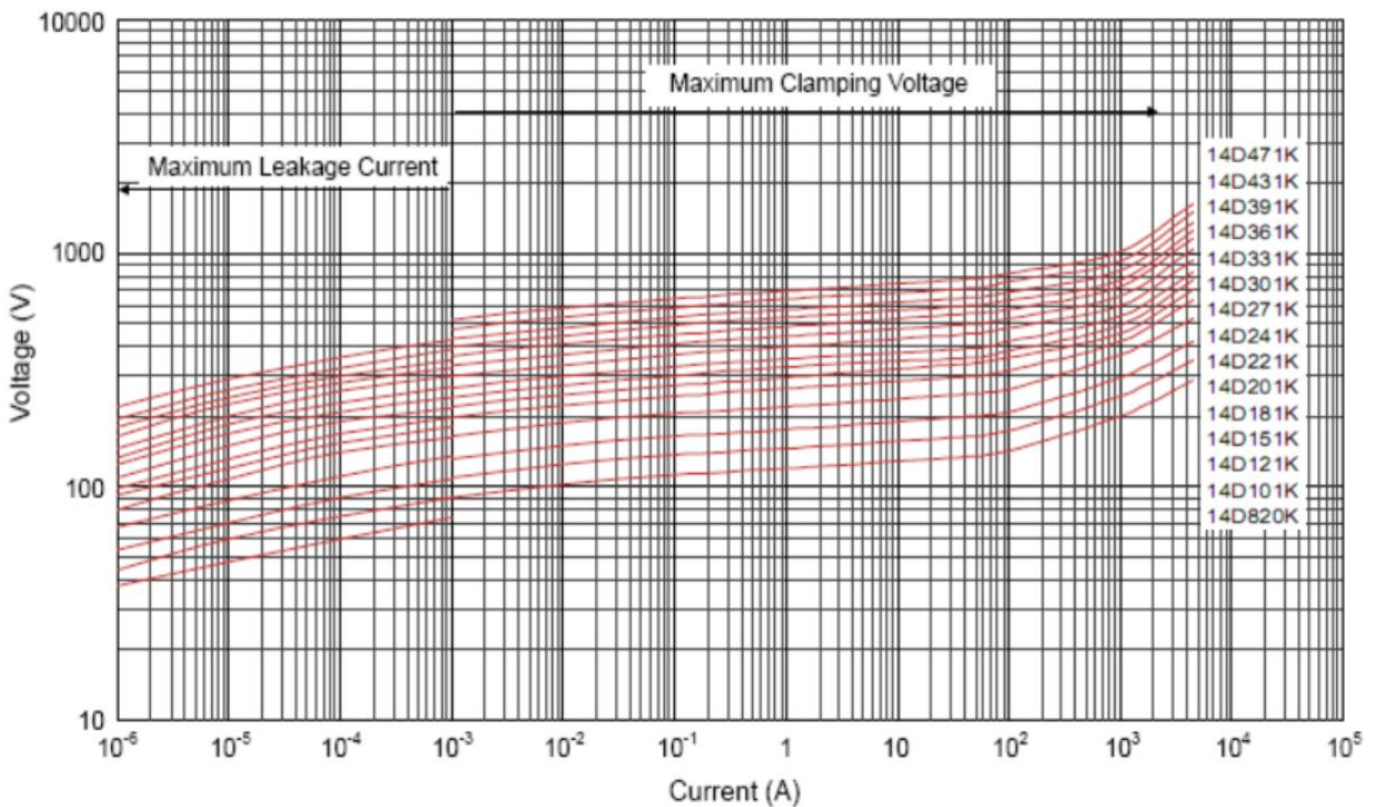
| Item                              | Conditions      |
|-----------------------------------|-----------------|
| Temperature of Soldering Iron-tip | 360°C(max.)     |
| Soldering Time                    | 3 seconds(max.) |
| Distance from Varistor            | 2mm (min.)      |

### Maximum Leakage Current and Maximum Clamping Voltage Curve

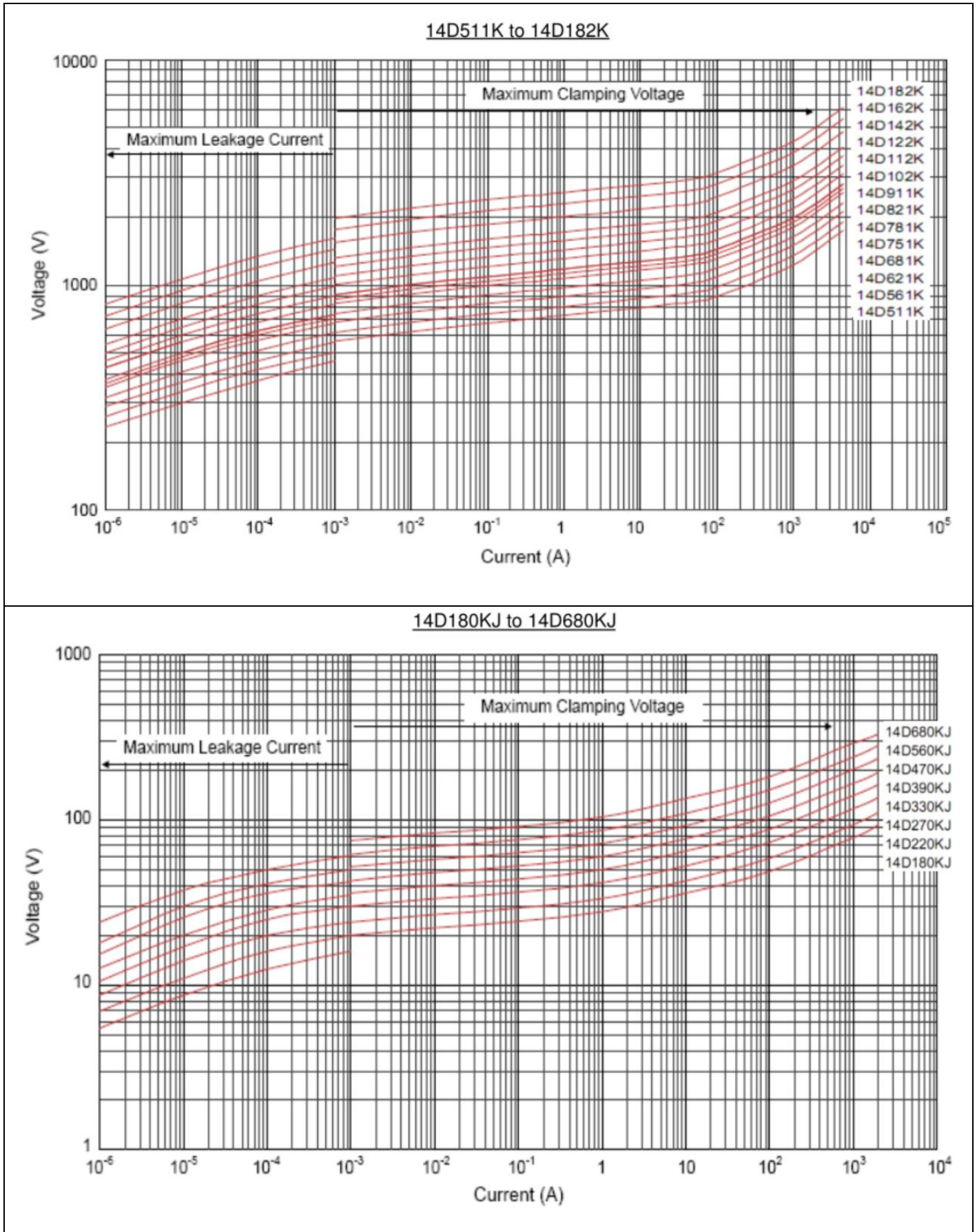
14D180K to 14D680K



14D820K to 14D471K

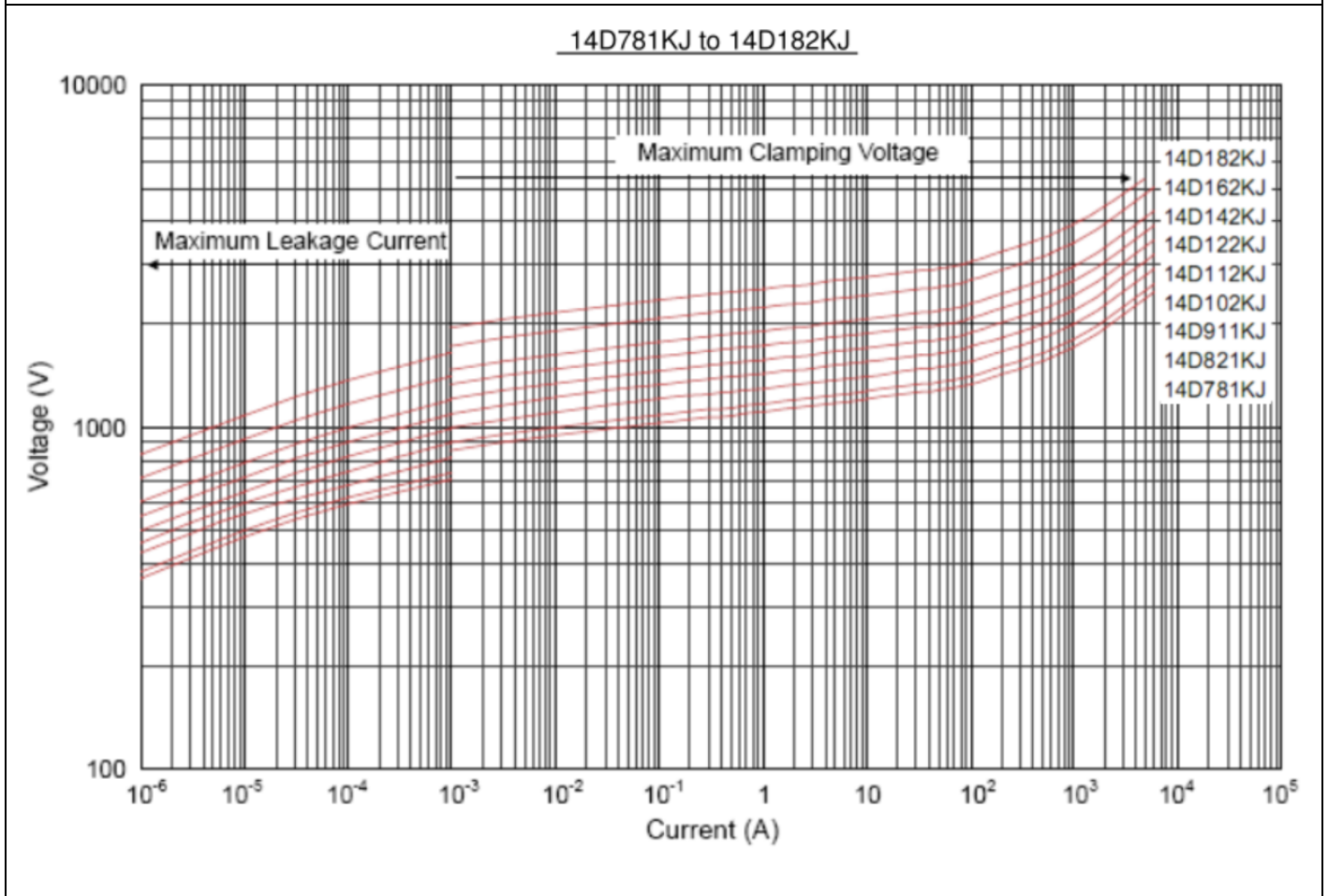
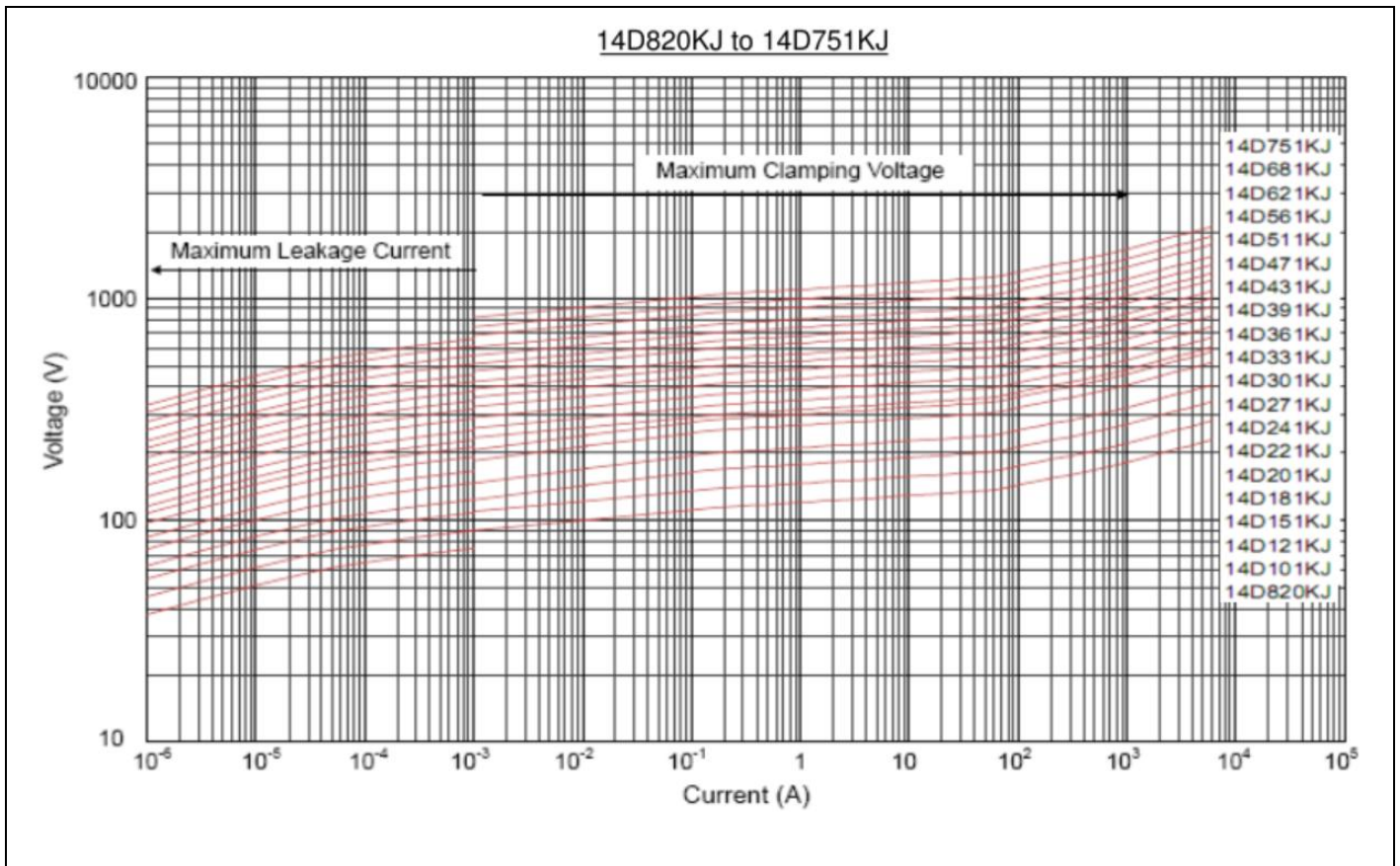


Maximum Leakage Current and Maximum Clamping Voltage Curve

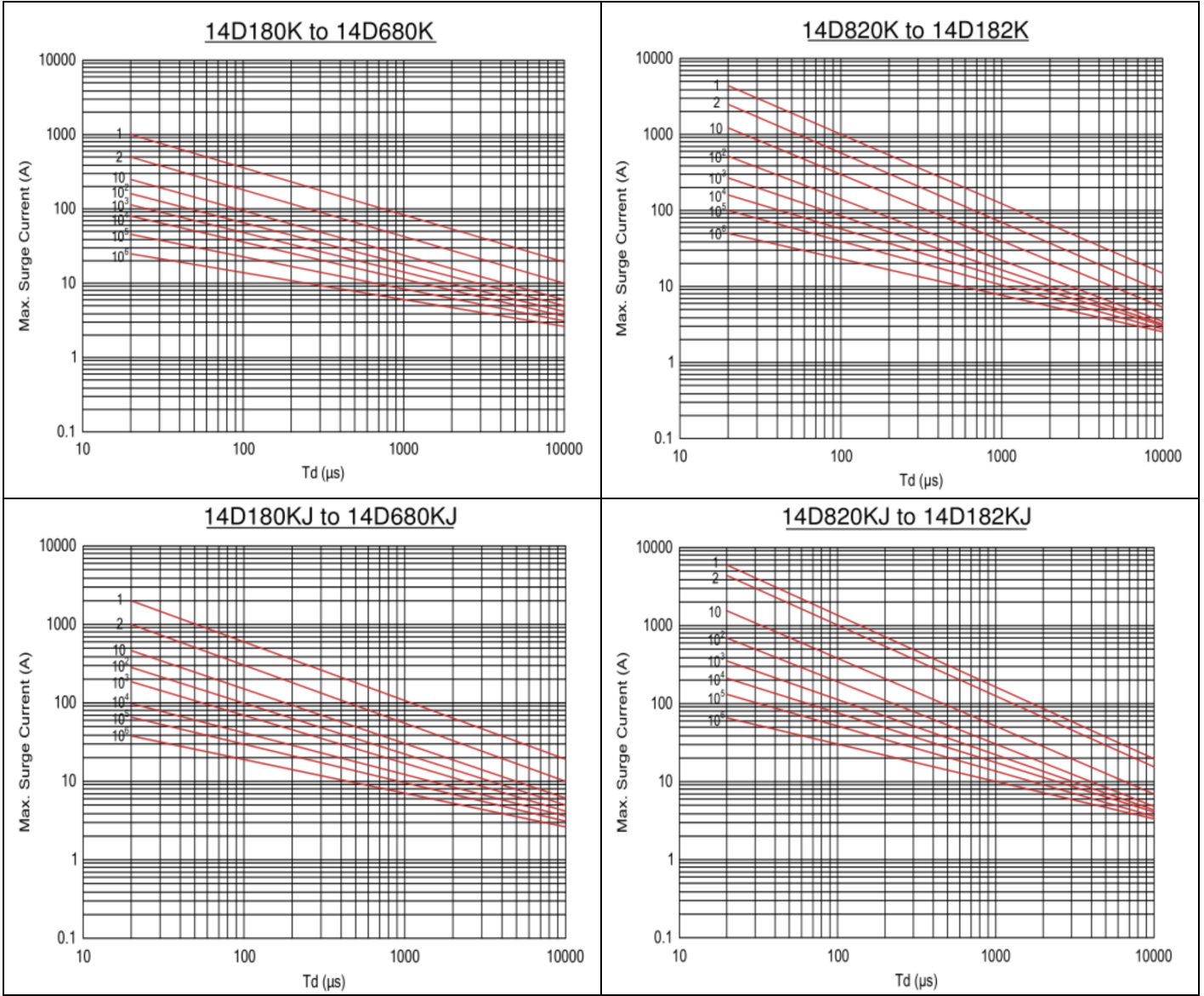




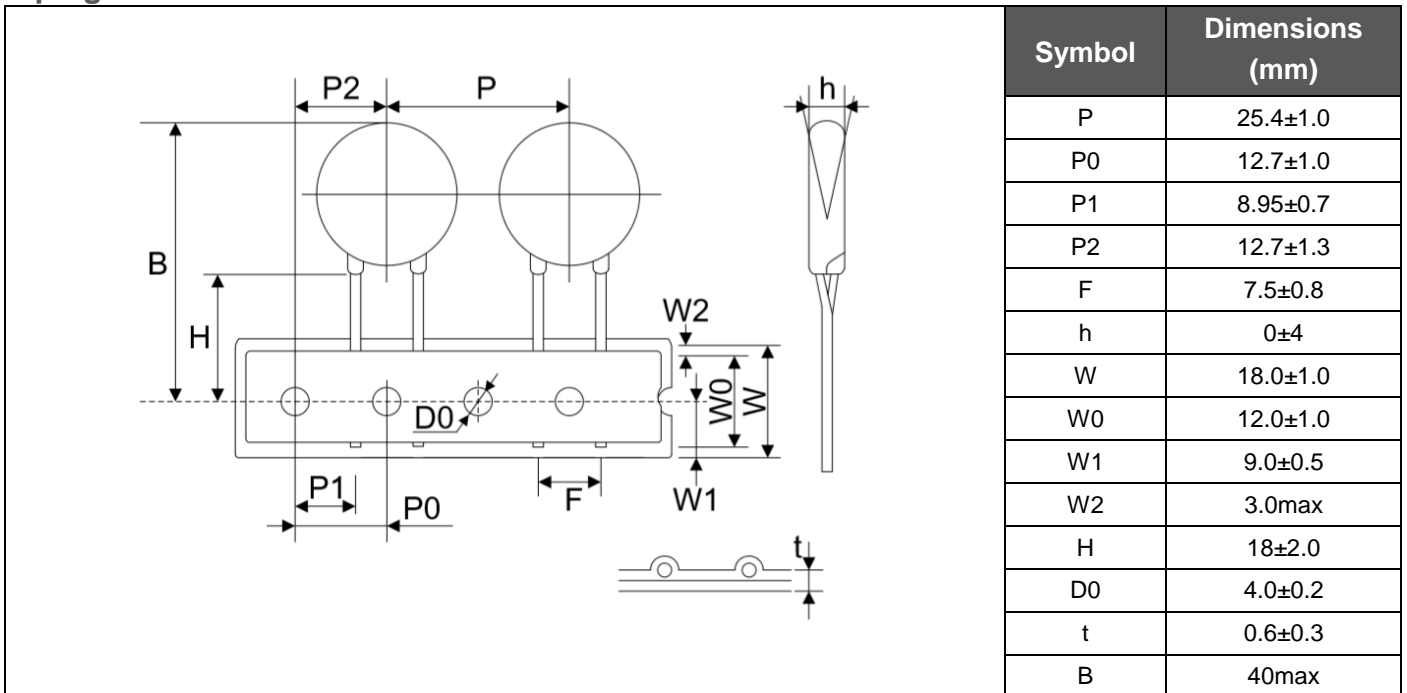
Maximum Leakage Current and Maximum Clamping Voltage Curve



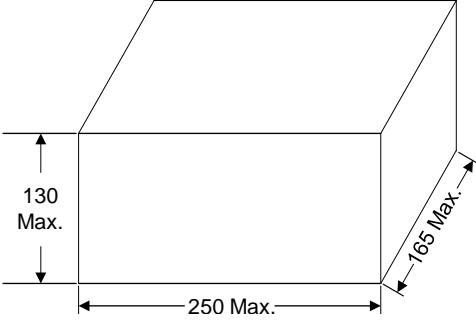


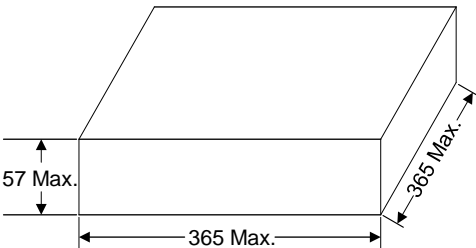
### Maximum Surge Current Derating Curve



### Taping Dimensions



### Quantity

| Packaging Dimensions (Unit: mm)   | Quantity                  |           |
|---|---------------------------|-----------|
| <p>In bulk for Terminals Untrimmed Products</p>  | 400pcs/bag<br>(180K~331K) | 4bags/box |
|   | 300pcs/bag<br>(361K~621K) |           |
|   | 250pcs/bag<br>(681k~112K) |           |
|   | 150pcs/bag<br>(122K~182K) |           |
| <p>In bulk for Terminals Trimmed Products</p>   | 400pcs/bag<br>(180K~331K) | 4bags/box |
|   | 300pcs/bag<br>(361K~621K) |           |
|   | 250pcs/bag<br>(681k~112K) |           |
|   | 150pcs/bag<br>(122K~182K) |           |
| <p>Tape &amp; Box</p>                          | 750pcs/bag<br>(180K~331K) | 6bags/box |
|   | 500pcs/bag<br>(361K~621K) |           |
|   | 400pcs/bag<br>(681k~751K) |           |
|   | 350pcs/bag<br>(781K~112K) |           |
|   | 300pcs/bag<br>(122K~182K) |           |
| <p>Tape &amp; Reel</p>                         | 750pcs/bag<br>(180K~331K) | 6bags/box |
|   | 500pcs/bag<br>(361K~621K) |           |
|   | 400pcs/bag<br>(681k~112K) |           |
|   | 300pcs/bag<br>(122K~182K) |           |

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