

## Metal Oxide Varistors (MOV) Data Sheet

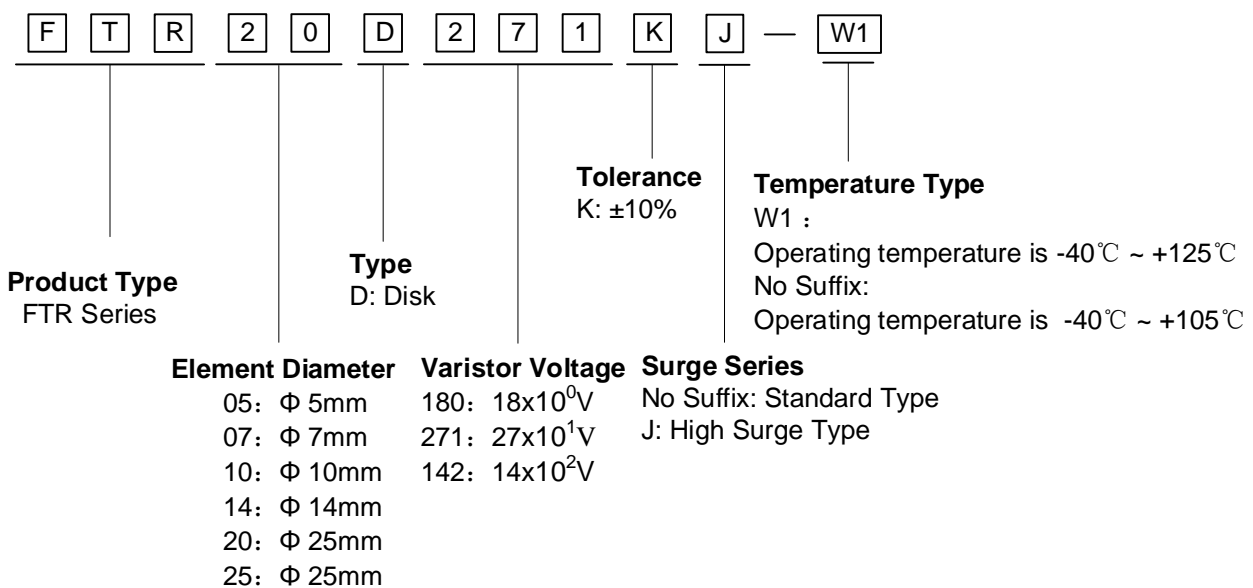
### Features

- 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/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



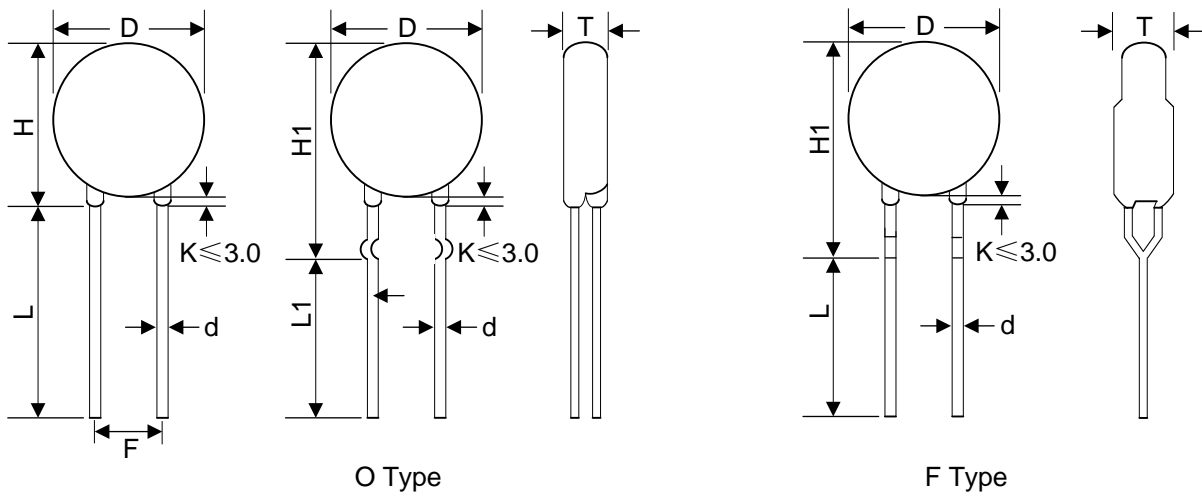
**Electrical Characteristics**

| 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)                       |
| FTR20D180K  | FTR20D180KJ | 11                        | 14                  | 18(15~21.6)          | 20                       | 36                 | 2000                       | 3000           | 11                         | 13             | 0.2         | 5.0                        |
| FTR20D220K  | FTR20D220KJ | 14                        | 18                  | 22(19.5~26)          | 20                       | 43                 | 2000                       | 3000           | 14                         | 16             | 0.2         | 5.0                        |
| FTR20D270K  | FTR20D270KJ | 17                        | 22                  | 27(24~31)            | 20                       | 53                 | 2000                       | 3000           | 16                         | 19             | 0.2         | 5.0                        |
| FTR20D330K  | FTR20D330KJ | 20                        | 26                  | 33(29.5~36.5)        | 20                       | 65                 | 2000                       | 3000           | 23                         | 24             | 0.2         | 5.0                        |
| FTR20D390K  | FTR20D390KJ | 25                        | 31                  | 39(35~43)            | 20                       | 77                 | 2000                       | 3000           | 26                         | 28             | 0.2         | 5.0                        |
| FTR20D470K  | FTR20D470KJ | 30                        | 38                  | 47(42~52)            | 20                       | 93                 | 2000                       | 3000           | 30                         | 34             | 0.2         | 5.0                        |
| FTR20D560K  | FTR20D560KJ | 35                        | 45                  | 56(50~62)            | 20                       | 110                | 2000                       | 3000           | 38                         | 44             | 0.2         | 5.0                        |
| FTR20D680K  | FTR20D680KJ | 40                        | 56                  | 68(61~75)            | 20                       | 135                | 2000                       | 3000           | 41                         | 49             | 0.2         | 5.0                        |
| FTR20D820K  | FTR20D820KJ | 50                        | 65                  | 82(74~90)            | 100                      | 135                | 6500                       | 10000          | 45                         | 56             | 1.0         | 5.0                        |
| FTR20D101K  | FTR20D101KJ | 60                        | 85                  | 100(90~110)          | 100                      | 165                | 6500                       | 10000          | 50                         | 70             | 1.0         | 4.6                        |
| FTR20D121K  | FTR20D121KJ | 75                        | 100                 | 120(108~132)         | 100                      | 200                | 6500                       | 10000          | 55                         | 85             | 1.0         | 4.8                        |
| FTR20D151K  | FTR20D151KJ | 95                        | 125                 | 150(135~165)         | 100                      | 250                | 6500                       | 10000          | 70                         | 106            | 1.0         | 4.4                        |
| FTR20D181K  | FTR20D181KJ | 115                       | 150                 | 180(162~198)         | 100                      | 300                | 6500                       | 10000          | 85                         | 130            | 1.0         | 4.5                        |
| FTR20D201K  | FTR20D201KJ | 130                       | 170                 | 200(180~220)         | 100                      | 340                | 6500                       | 10000          | 95                         | 140            | 1.0         | 4.6                        |
| FTR20D221K  | FTR20D221KJ | 140                       | 180                 | 220(198~242)         | 100                      | 360                | 6500                       | 10000          | 100                        | 155            | 1.0         | 4.7                        |
| FTR20D241K  | FTR20D241KJ | 150                       | 200                 | 240(216~264)         | 100                      | 395                | 6500                       | 10000          | 108                        | 168            | 1.0         | 4.8                        |
| FTR20D271K  | FTR20D271KJ | 175                       | 225                 | 270(243~297)         | 100                      | 455                | 6500                       | 10000          | 127                        | 190            | 1.0         | 5.0                        |
| FTR20D301K  | FTR20D301KJ | 190                       | 250                 | 300(270~330)         | 100                      | 500                | 6500                       | 10000          | 136                        | 210            | 1.0         | 5.0                        |
| FTR20D331K  | FTR20D331KJ | 210                       | 275                 | 330(297~363)         | 100                      | 550                | 6500                       | 10000          | 150                        | 228            | 1.0         | 5.1                        |
| FTR20D361K  | FTR20D361KJ | 230                       | 300                 | 360(324~396)         | 100                      | 595                | 6500                       | 10000          | 163                        | 255            | 1.0         | 5.3                        |
| FTR20D391K  | FTR20D391KJ | 250                       | 320                 | 390(351~429)         | 100                      | 650                | 6500                       | 10000          | 180                        | 275            | 1.0         | 5.4                        |
| FTR20D431K  | FTR20D431KJ | 275                       | 350                 | 430(387~473)         | 100                      | 710                | 6500                       | 10000          | 190                        | 305            | 1.0         | 5.6                        |
| FTR20D471K  | FTR20D471KJ | 300                       | 385                 | 470(423~517)         | 100                      | 775                | 6500                       | 10000          | 204                        | 350            | 1.0         | 5.8                        |
| FTR20D511K  | FTR20D511KJ | 320                       | 415                 | 510(459~561)         | 100                      | 845                | 6500                       | 10000          | 210                        | 360            | 1.0         | 6.0                        |
| FTR20D561K  | FTR20D561KJ | 350                       | 460                 | 560(504~616)         | 100                      | 925                | 6500                       | 10000          | 215                        | 380            | 1.0         | 6.4                        |
| FTR20D621K  | FTR20D621KJ | 385                       | 505                 | 620(558~682)         | 100                      | 1025               | 6500                       | 10000          | 224                        | 390            | 1.0         | 6.7                        |
| FTR20D681K  | FTR20D681KJ | 420                       | 560                 | 680(612~748)         | 100                      | 1120               | 6500                       | 10000          | 230                        | 400            | 1.0         | 7.0                        |
| FTR20D751K  | FTR20D751KJ | 460                       | 615                 | 750(675~825)         | 100                      | 1240               | 6500                       | 10000          | 255                        | 420            | 1.0         | 7.1                        |
| FTR20D781K  | FTR20D781KJ | 485                       | 640                 | 780(702~858)         | 100                      | 1290               | 6500                       | 10000          | 265                        | 440            | 1.0         | 7.2                        |
| FTR20D821K  | FTR20D821KJ | 510                       | 670                 | 820(738~902)         | 100                      | 1355               | 6500                       | 10000          | 282                        | 460            | 1.0         | 7.4                        |
| FTR20D911K  | FTR20D911KJ | 550                       | 745                 | 910(819~1001)        | 100                      | 1500               | 6500                       | 10000          | 310                        | 510            | 1.0         | 7.8                        |
| FTR20D102K  | FTR20D102KJ | 625                       | 825                 | 1000(900~1100)       | 100                      | 1650               | 6500                       | 10000          | 342                        | 565            | 1.0         | 7.8                        |
| FTR20D112K  | FTR20D112KJ | 680                       | 895                 | 1100(990~1210)       | 100                      | 1815               | 6500                       | 10000          | 383                        | 620            | 1.0         | 8.2                        |
| FTR20D122K  | FTR20D122KJ | 750                       | 990                 | 1200(1080~1320)      | 100                      | 1980               | 6500                       | 10000          | 408                        | 660            | 1.0         | 8.6                        |
| FTR20D142K  | FTR20D142KJ | 880                       | 1140                | 1400(1260~1540)      | 100                      | 2310               | 6500                       | 10000          | 532                        | 784            | 1.0         | 9.1                        |

| 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)                       |
| FTR20D162K  | FTR20D162KJ | 1000                      | 1280                | 1600(1440~1760)      | 100                      | 2640               | 6500                       | 10000          | 606                        | 896            | 1.0         | 10.2                       |
| FTR20D182K  | FTR20D182KJ | 1100                      | 1465                | 1800(1620~1980)      | 100                      | 2970               | 6500                       | 10000          | 625                        | 990            | 1.0         | 10.8                       |

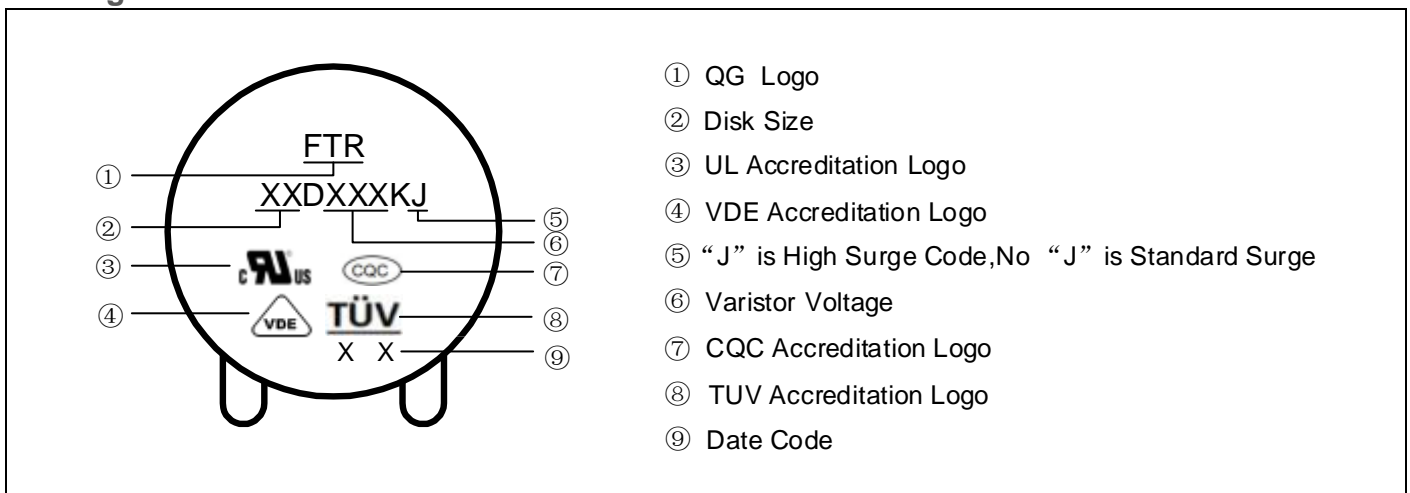
- Notes: 1. The tolerance of varistor voltage between 18V and 27V is more than 10%.  
 2. Varistor voltage ≥ 1200V, structure diagram is F type.  
 3. Leakage Current (@83% of V<sub>1mA</sub>): IR ≤ 50μ A (180K~680K) ; IR ≤ 25μ A (820K~182K)

### Dimensions

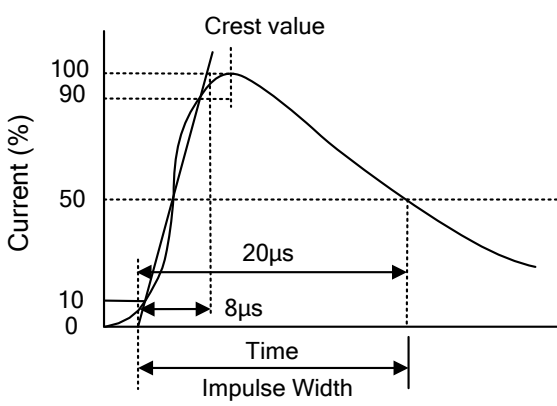


| Symbol        | H(max.) | H1(Max.) | L(min.) | L1(min.) | D (max.) | F(±0.8) | d(±0.05) | Tmax   |
|---------------|---------|----------|---------|----------|----------|---------|----------|--|
| Dimension(mm) | 25.5    | 28       | 20      | 15       | 22.5     | 10      | 1        | Please refer to the Electrical Characteristics Table |

### Marking 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"> <tr> <td rowspan="2">20Φ series</td> <td>180K to 680K</td> <td>100A (8/20μs)</td> </tr> <tr> <td>820K to 182K</td> <td>200A (8/20μs)</td> </tr> </table> | 20Φ series                  | 180K to 680K  | 100A (8/20μs) | 820K to 182K | 200A (8/20μs) | $\frac{\Delta V_b}{V_b} \leq \pm 10\%$ |
| 20Φ series                         | 180K to 680K   |                             | 100A (8/20μs) |               |              |               |  |
|                                    | 820K to 182K   | 200A (8/20μs)               |               |               |              |               |  |

**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"> <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 | NO Visible damage<br> Δ V1mA/V1mA  ≤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"> <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 | NO Visible damage<br> Δ V1mA/V1mA  ≤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> Δ V1mA/V1mA  ≤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 |           |           |     |            |     |        |     |  |
| Resistanceto Soldering Heat   | Solder Temp: 260±5°C<br>Dipping Time: 10±1 sec   | NO Visible damage<br> Δ V1mA/V1mA  ≤5%                      |           |           |     |            |     |        |     |  |

**Reliability**

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

### Soldering Recommendation

#### Wave Lead Free Soldering Recommendation

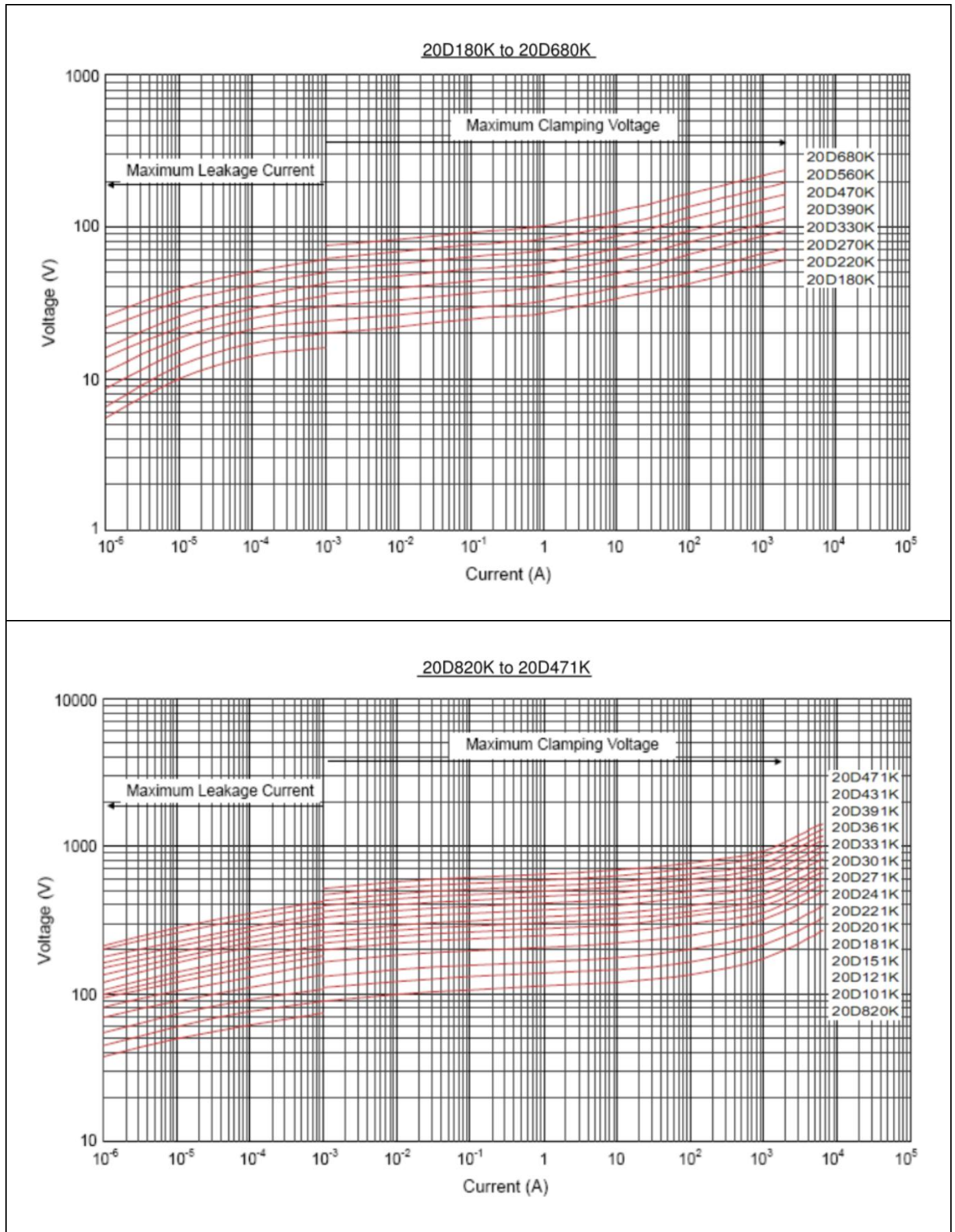


| Item             | Conditions       |
|------------------|------------------|
| Peak Temperature | 265°C            |
| Dipping Time     | 10 seconds(max.) |
| Soldering        | 1 time           |

#### Recommendation Reworking Conditions with Soldering Iron

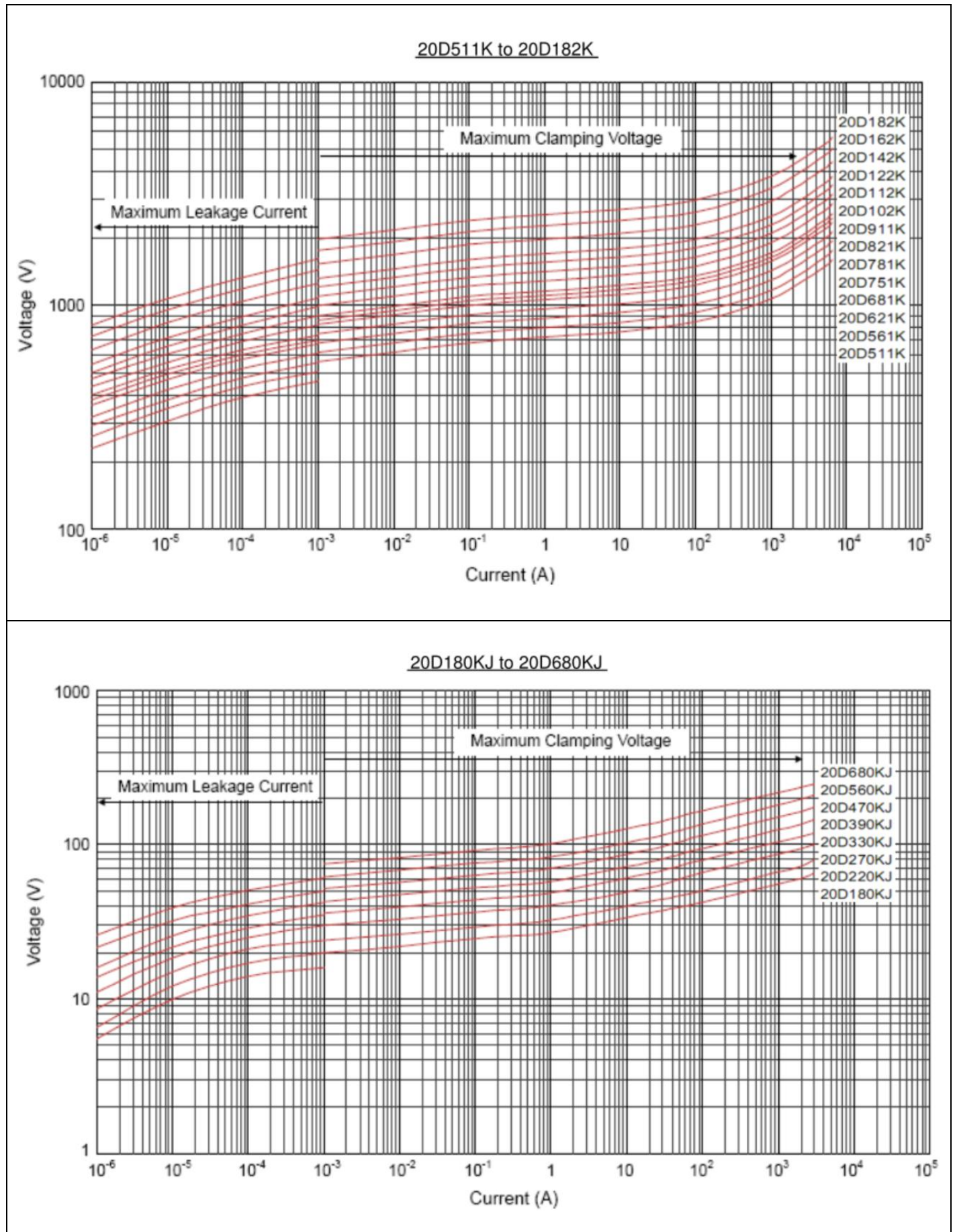
| Item                              | Conditions      |
|-----------------------------------|-----------------|
| Temperature of Soldering Iron-tip | 360°C(max.)     |
| Soldering Time                    | 3 seconds(max.) |
| Distance from Varistor            | 2mm (min.)      |

Maximum Leakage Current and Maximum Clamping Voltage Curve





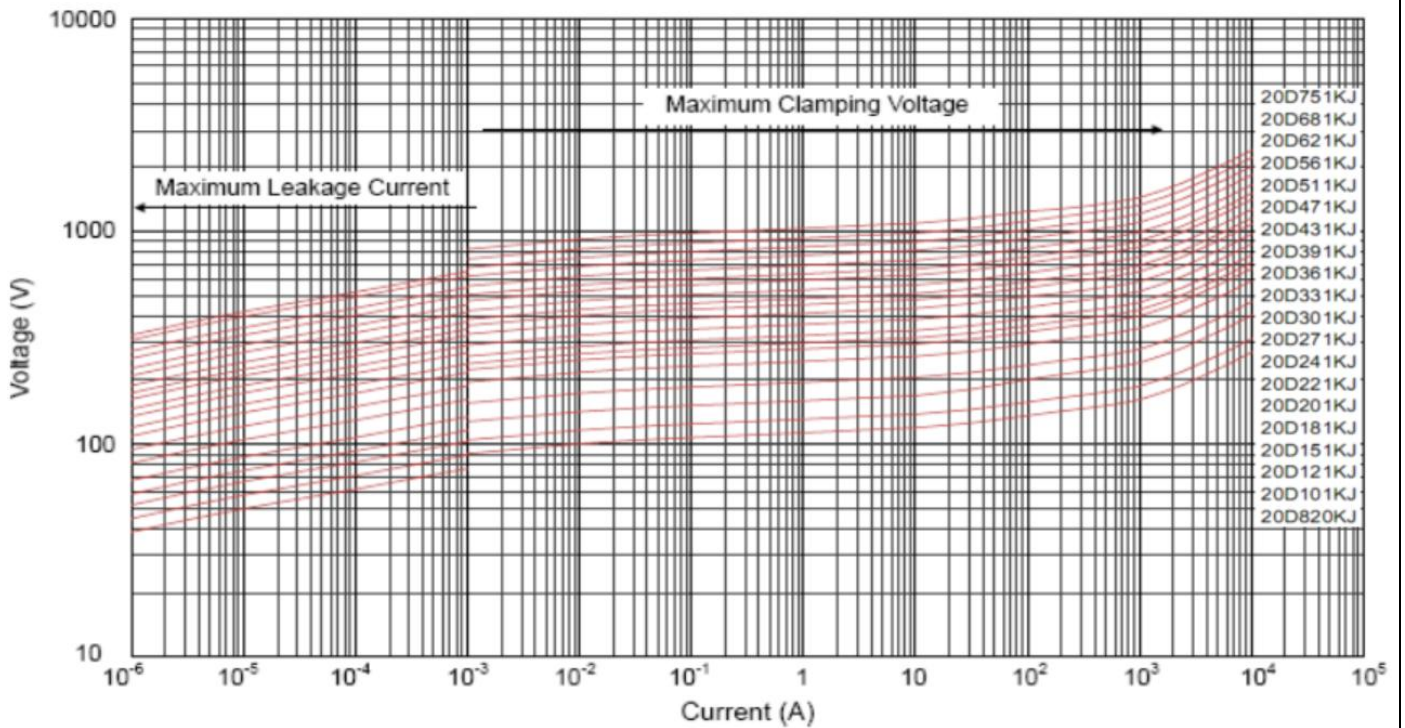
Maximum Leakage Current and Maximum Clamping Voltage Curve



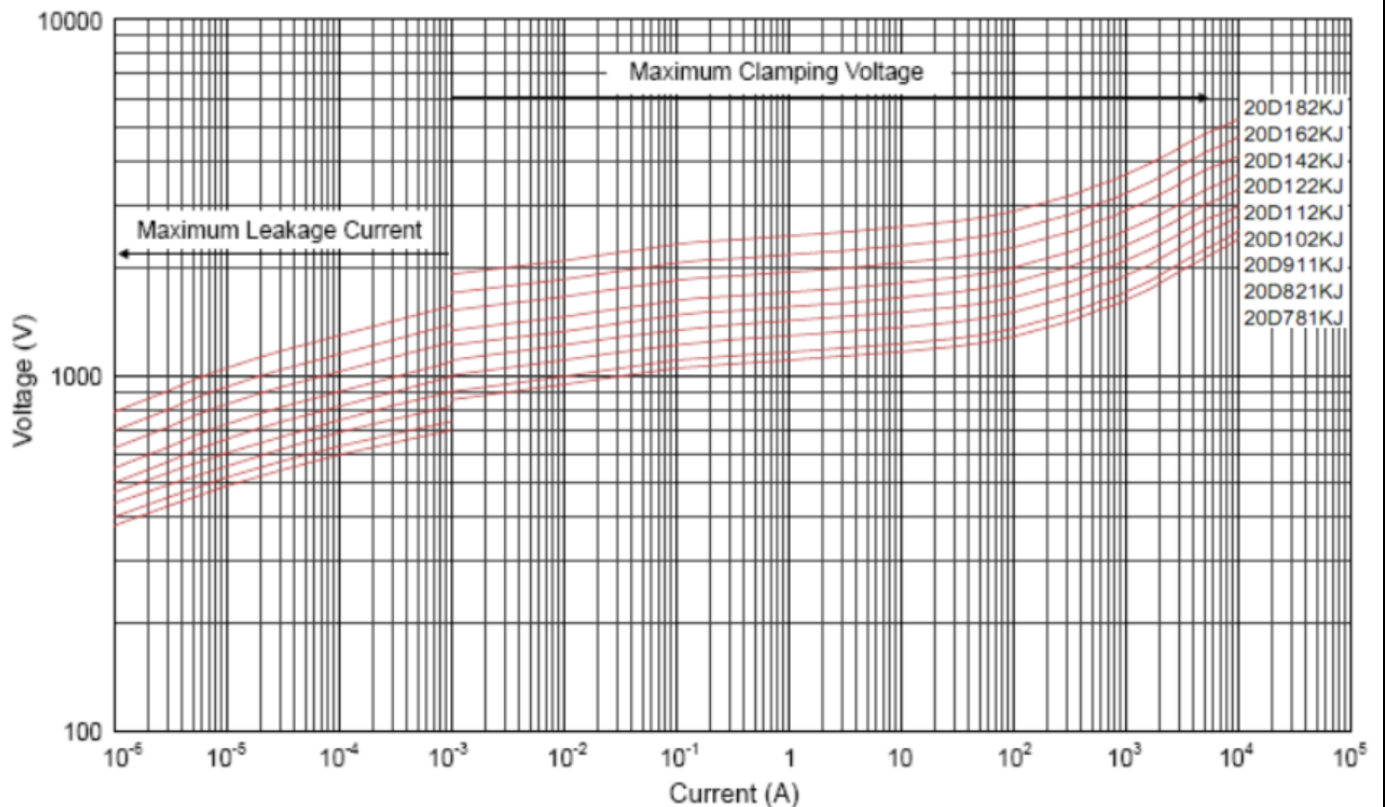


Maximum Leakage Current and Maximum Clamping Voltage Curve

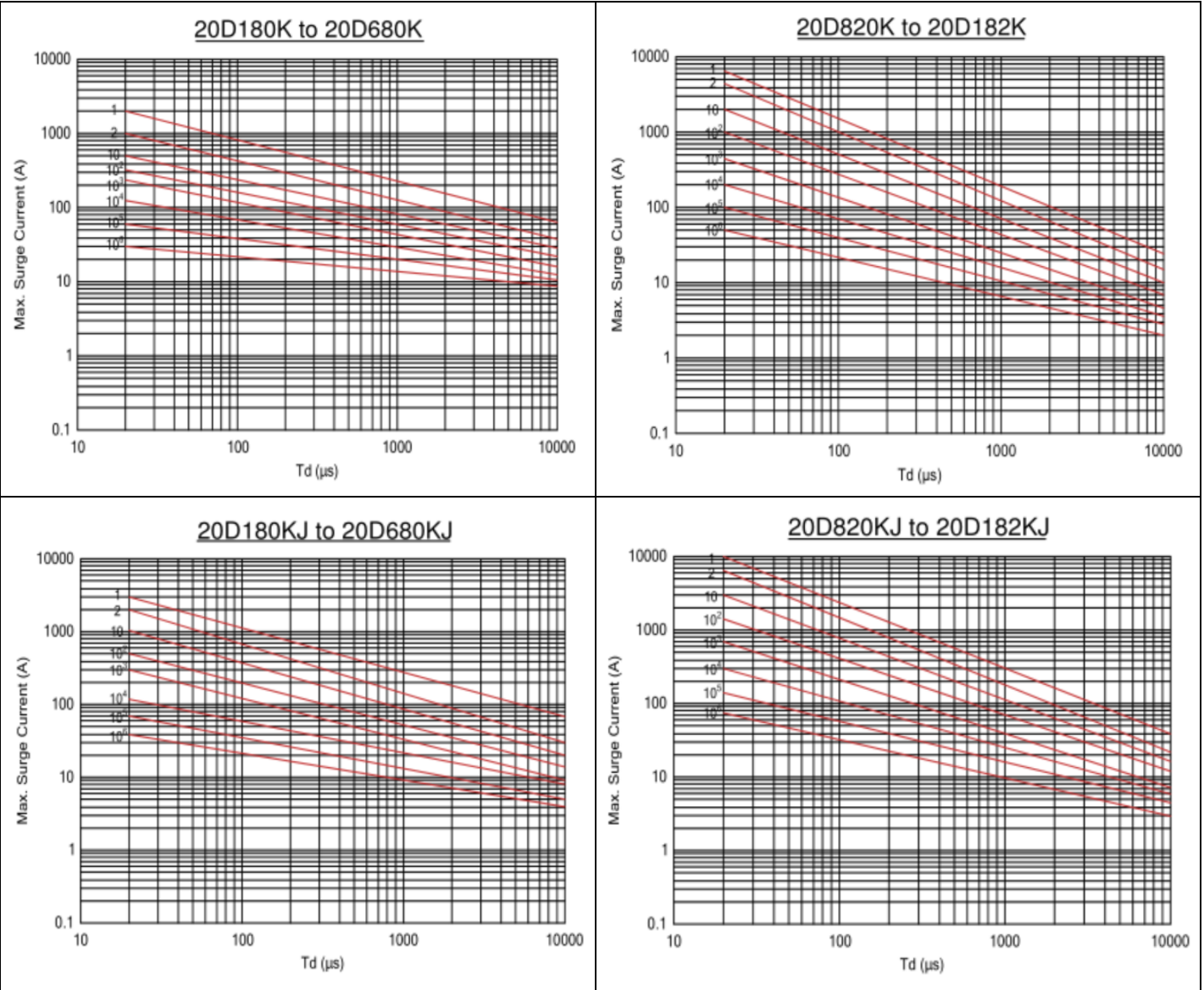
20D820KJ to 20D751KJ



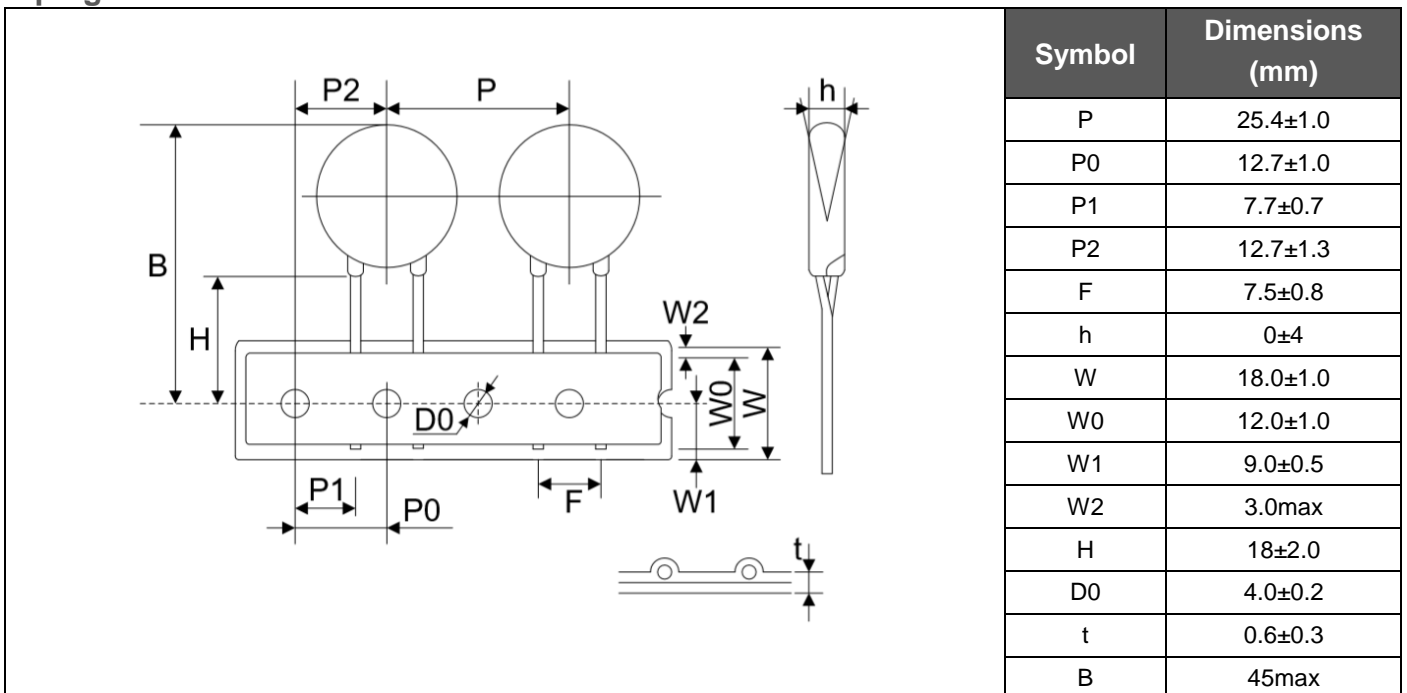
20D781KJ to 20D182KJ



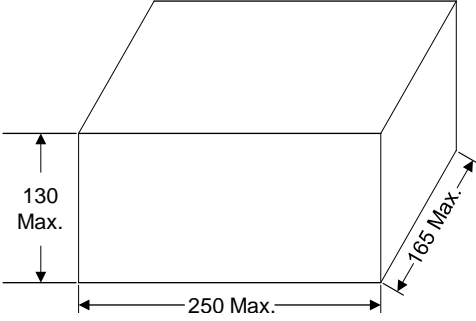


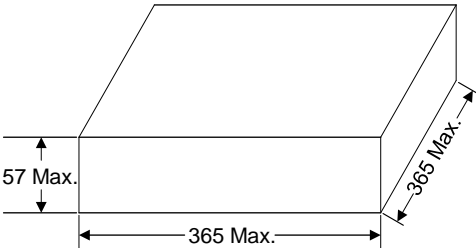
### Maximum Surge Current Derating Curve



### Taping Dimensions



### Quantity

| Packaging Dimensions (Unit: mm)   | Quantity                  |           |
|---|---------------------------|-----------|
| <p>In bulk for Terminals Untrimmed Products</p>  | 250pcs/bag<br>(180K~301K) | 4bags/box |
|   | 200pcs/bag<br>(331K~561K) |           |
|   | 150pcs/bag<br>(621k~112K) |           |
|   | 100pcs/bag<br>(122K~182K) |           |
| <p>In bulk for Terminals Trimmed Products</p>   | 250pcs/bag<br>(180K~301K) | 2bags/box |
|   | 200pcs/bag<br>(331K~561K) |           |
|   | 150pcs/bag<br>(621k~112K) |           |
|   | 100pcs/bag<br>(122K~182K) |           |
| <p>Tape &amp; Box</p>                          | 400pcs/bag<br>(180K~301K) | 6bags/box |
|   | 300pcs/bag<br>(331K~561K) |           |
| <p>Tape &amp; Reel</p>                         | 400pcs/bag<br>(180K~301K) | 6bags/box |
|   | 300pcs/bag<br>(331K~561K) |           |

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[C07DK221U](#) [TND10V-471KB00AAA0](#) [B72205S301K211](#) [B72207S141K111](#) [B72210S271K111](#) [B72214S350K551](#) [B72220P3351K101](#)  
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