

## Metal Oxide Varistors (MOV) Data Sheet

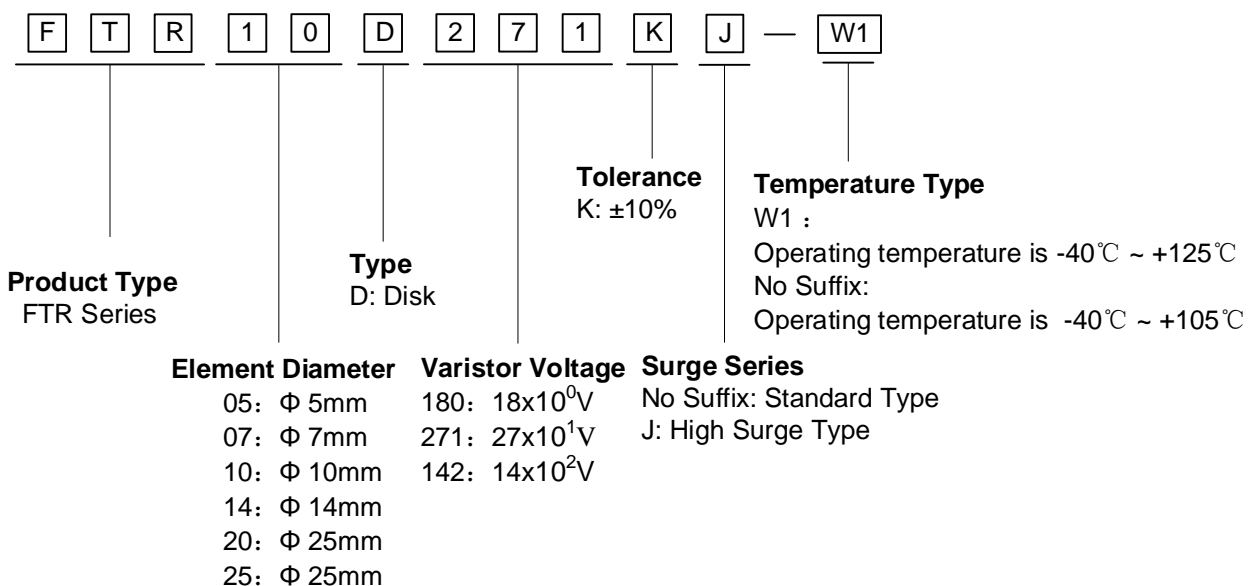
### Features

- 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



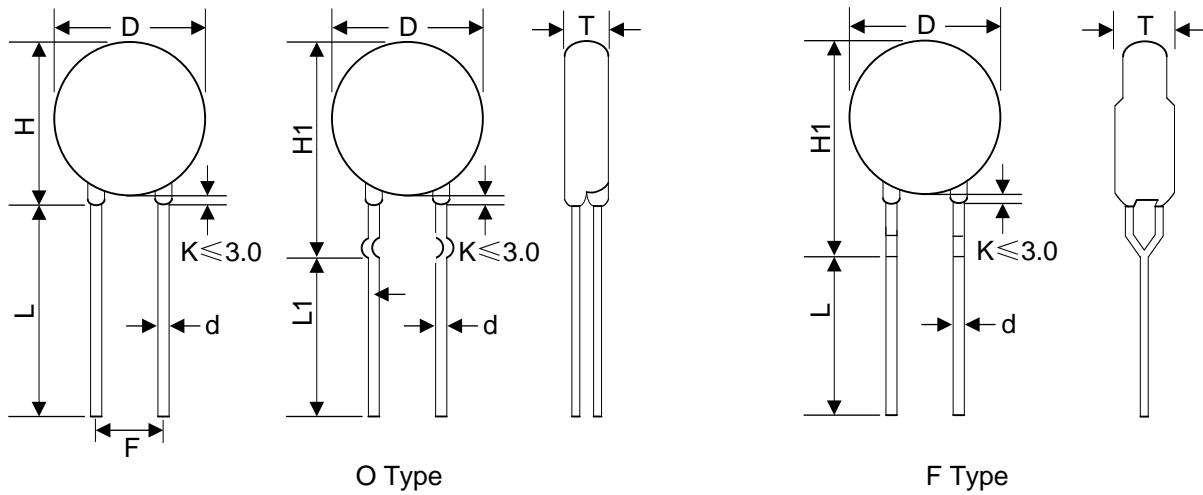
**Electrical Characteristics**

| 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)                       |
| FTR10D180K  | FTR10D180KJ | 11                        | 14                  | 18(15~21.6)          | 5                        | 36                 | 500                        | 1000           | 2.1                        | 3              | 0.05        | 5.0                        |
| FTR10D220K  | FTR10D220KJ | 14                        | 18                  | 22(19.5~26)          | 5                        | 43                 | 500                        | 1000           | 2.5                        | 5              | 0.05        | 5.0                        |
| FTR10D270K  | FTR10D270KJ | 17                        | 22                  | 27(24~31)            | 5                        | 53                 | 500                        | 1000           | 3                          | 6              | 0.05        | 5.0                        |
| FTR10D330K  | FTR10D330KJ | 20                        | 26                  | 33(29.5~36.5)        | 5                        | 65                 | 500                        | 1000           | 4                          | 7              | 0.05        | 5.0                        |
| FTR10D390K  | FTR10D390KJ | 25                        | 31                  | 39(35~43)            | 5                        | 77                 | 500                        | 1000           | 4.6                        | 9              | 0.05        | 5.0                        |
| FTR10D470K  | FTR10D470KJ | 30                        | 38                  | 47(42~52)            | 5                        | 93                 | 500                        | 1000           | 5.5                        | 11             | 0.05        | 5.0                        |
| FTR10D560K  | FTR10D560KJ | 35                        | 45                  | 56(50~62)            | 5                        | 110                | 500                        | 1000           | 7                          | 13             | 0.05        | 5.0                        |
| FTR10D680K  | FTR10D680KJ | 40                        | 56                  | 68(61~75)            | 5                        | 135                | 500                        | 1000           | 8.2                        | 15             | 0.05        | 5.0                        |
| FTR10D820K  | FTR10D820KJ | 50                        | 65                  | 82(74~90)            | 25                       | 135                | 2500                       | 3500           | 12                         | 17             | 0.4         | 5.0                        |
| FTR10D101K  | FTR10D101KJ | 60                        | 85                  | 100(90~110)          | 25                       | 165                | 2500                       | 3500           | 15                         | 18             | 0.4         | 4.2                        |
| FTR10D121K  | FTR10D121KJ | 75                        | 100                 | 120(108~132)         | 25                       | 200                | 2500                       | 3500           | 18                         | 21             | 0.4         | 4.4                        |
| FTR10D151K  | FTR10D151KJ | 95                        | 125                 | 150(135~165)         | 25                       | 250                | 2500                       | 3500           | 22                         | 25             | 0.4         | 4.0                        |
| FTR10D181K  | FTR10D181KJ | 115                       | 150                 | 180(162~198)         | 25                       | 300                | 2500                       | 3500           | 27                         | 30             | 0.4         | 4.1                        |
| FTR10D201K  | FTR10D201KJ | 130                       | 170                 | 200(180~220)         | 25                       | 340                | 2500                       | 3500           | 30                         | 35             | 0.4         | 4.2                        |
| FTR10D221K  | FTR10D221KJ | 140                       | 180                 | 220(198~242)         | 25                       | 360                | 2500                       | 3500           | 32                         | 39             | 0.4         | 4.3                        |
| FTR10D241K  | FTR10D241KJ | 150                       | 200                 | 240(216~264)         | 25                       | 395                | 2500                       | 3500           | 35                         | 42             | 0.4         | 4.4                        |
| FTR10D271K  | FTR10D271KJ | 175                       | 225                 | 270(243~297)         | 25                       | 455                | 2500                       | 3500           | 37                         | 49             | 0.4         | 4.6                        |
| FTR10D301K  | FTR10D301KJ | 190                       | 250                 | 300(270~330)         | 25                       | 500                | 2500                       | 3500           | 40                         | 54             | 0.4         | 4.7                        |
| FTR10D331K  | FTR10D331KJ | 210                       | 275                 | 330(297~363)         | 25                       | 550                | 2500                       | 3500           | 43                         | 58             | 0.4         | 4.7                        |
| FTR10D361K  | FTR10D361KJ | 230                       | 300                 | 360(324~396)         | 25                       | 595                | 2500                       | 3500           | 47                         | 65             | 0.4         | 4.9                        |
| FTR10D391K  | FTR10D391KJ | 250                       | 320                 | 390(351~429)         | 25                       | 650                | 2500                       | 3500           | 60                         | 70             | 0.4         | 5.0                        |
| FTR10D431K  | FTR10D431KJ | 275                       | 350                 | 430(387~473)         | 25                       | 710                | 2500                       | 3500           | 65                         | 80             | 0.4         | 5.2                        |
| FTR10D471K  | FTR10D471KJ | 300                       | 385                 | 470(423~517)         | 25                       | 775                | 2500                       | 3500           | 67                         | 85             | 0.4         | 5.4                        |
| FTR10D511K  | FTR10D511KJ | 320                       | 415                 | 510(459~561)         | 25                       | 845                | 2500                       | 3500           | 69                         | 90             | 0.4         | 5.6                        |
| FTR10D561K  | FTR10D561KJ | 350                       | 460                 | 560(504~616)         | 25                       | 925                | 2500                       | 3500           | 70                         | 92             | 0.4         | 5.8                        |
| FTR10D621K  | FTR10D621KJ | 385                       | 505                 | 620(558~682)         | 25                       | 1025               | 2500                       | 3500           | 72                         | 95             | 0.4         | 6.1                        |
| FTR10D681K  | FTR10D681KJ | 420                       | 560                 | 680(612~748)         | 25                       | 1120               | 2500                       | 3500           | 75                         | 98             | 0.4         | 6.4                        |
| FTR10D751K  | FTR10D751KJ | 460                       | 615                 | 750(675~825)         | 25                       | 1240               | 2500                       | 3500           | 77                         | 100            | 0.4         | 6.5                        |
| FTR10D781K  | FTR10D781KJ | 485                       | 640                 | 780(702~858)         | 25                       | 1290               | 2500                       | 3500           | 80                         | 105            | 0.4         | 6.6                        |
| FTR10D821K  | FTR10D821KJ | 510                       | 670                 | 820(738~902)         | 25                       | 1355               | 2500                       | 3500           | 85                         | 110            | 0.4         | 6.8                        |
| FTR10D911K  | FTR10D911KJ | 550                       | 745                 | 910(819~1001)        | 25                       | 1500               | 2500                       | 3500           | 93                         | 130            | 0.4         | 7.2                        |
| FTR10D102K  | FTR10D102KJ | 625                       | 825                 | 1000(900~1100)       | 25                       | 1650               | 2500                       | 3500           | 102                        | 140            | 0.4         | 7.2                        |
| FTR10D112K  | FTR10D112KJ | 680                       | 895                 | 1100(990~1210)       | 25                       | 1815               | 2500                       | 3500           | 115                        | 155            | 0.4         | 7.6                        |

Notes: 1. The tolerance of varistor voltage between 18V and 27V is more than 10%.

2. Leakage Current (@83% of V<sub>1mA</sub>): IR ≤ 50μ A (180K~680K) ; IR ≤ 25μ A (820K~112K)

## Dimensions

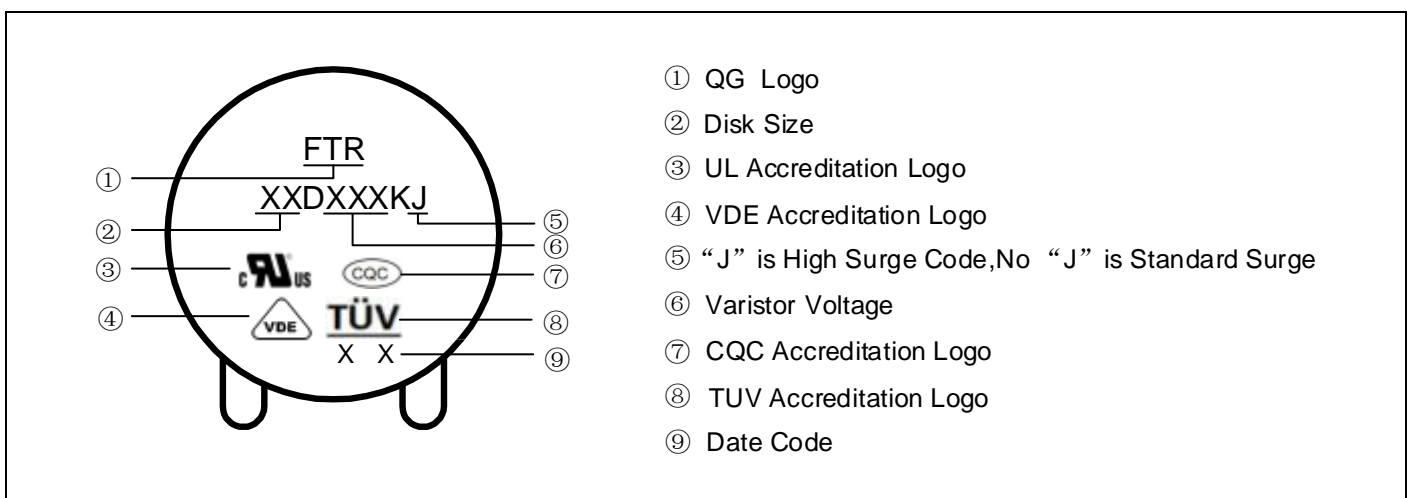


O Type

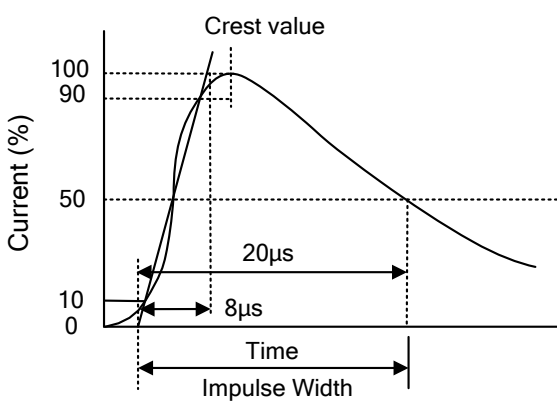
F Type

| Symbol        | H(max.) | H1(Max.) | L(min.) | L1(min.) | D (max.) | F(±0.8) | d(±0.05) | Tmax   |
|---------------|---------|----------|---------|----------|----------|---------|----------|--|
| Dimension(mm) | 14.5    | 16.5     | 20      | 15       | 12       | 7.5     | 0.8      | 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">10Φ series</td> <td>180K to 680K</td> <td>50A (8/20μs)</td> </tr> <tr> <td>820K to 112K</td> <td>100A (8/20μs)</td> </tr> </table> | 10Φ series                  | 180K to 680K | 50A (8/20μs) | 820K to 112K | 100A (8/20μs) | $\frac{\Delta V_b}{V_b} \leq \pm 10\%$ |
| 10Φ series                         | 180K to 680K  |                             | 50A (8/20μs) |              |              |               |  |
|                                    | 820K to 112K  | 100A (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>Terminal diameter (mm)      Froce(kg)<br>0.5<d≤0.8                              1.0<br>0.8<d≤1.25                              2.0<br>1.25<d                                      4.0   | NO Visible damage<br> Δ V1mA/V1mA  ≤5%                      |
| 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>Terminal diameter (mm)      Froce(kg)<br>0.5<d≤0.8                              0.5<br>0.8<d≤1.25                              1.0<br>1.25<d                                      2.0 | NO Visible damage<br> Δ V1mA/V1mA  ≤5%                      |
| Vibration                     | Frequency range: 10~55 Hz<br>Amplitude: 0.75mm or 98m/s2<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

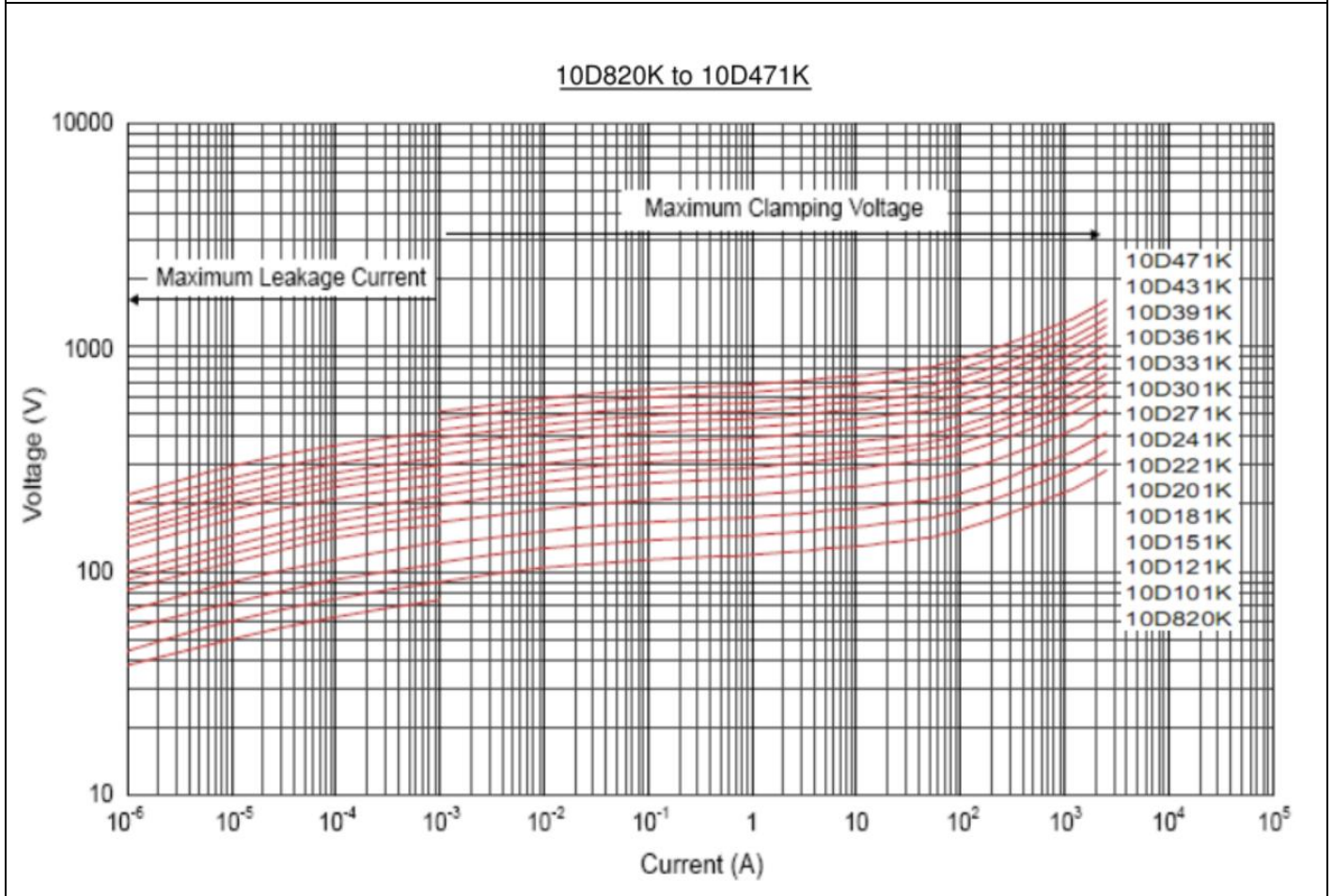
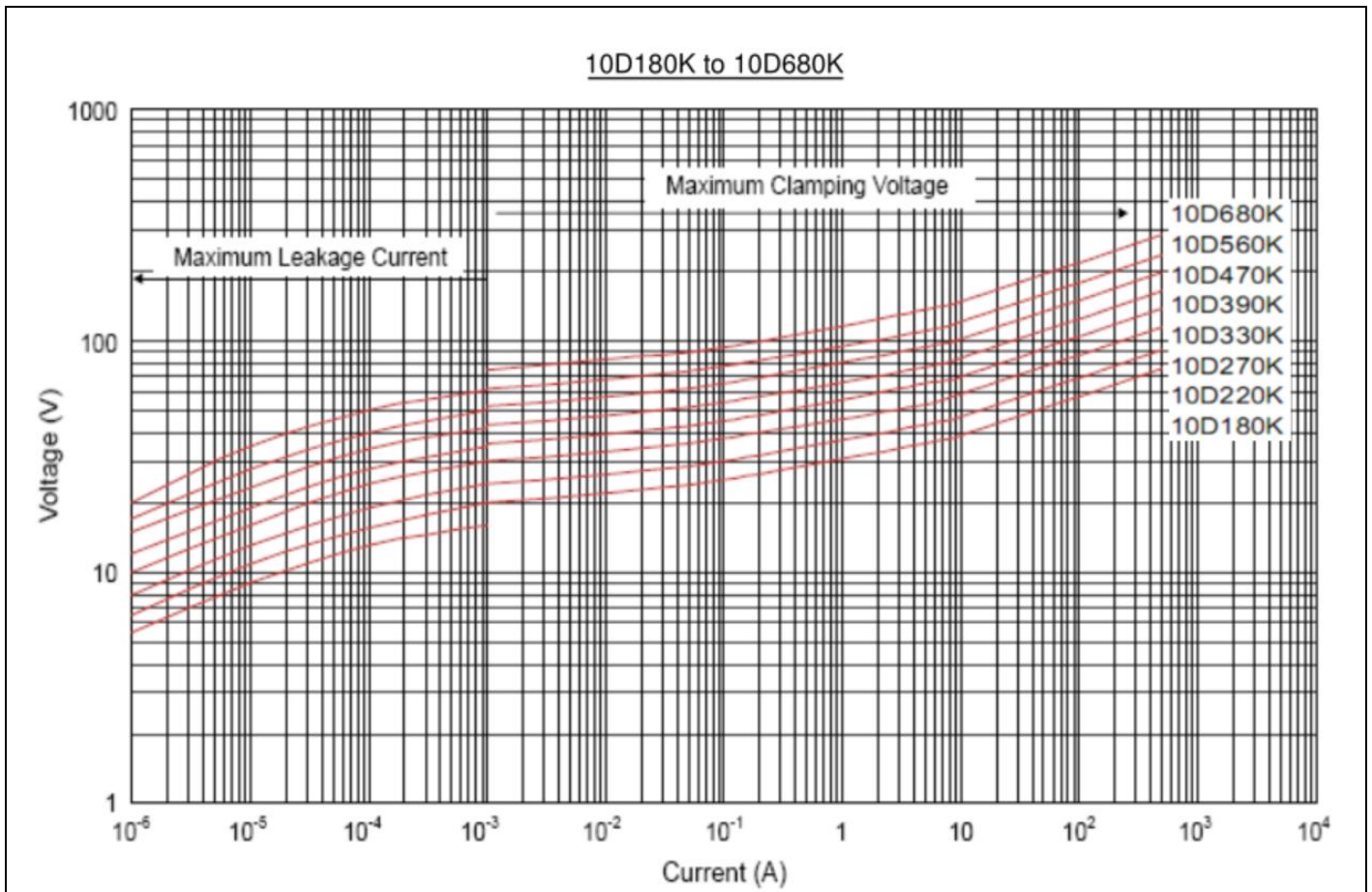


| Item             | Conditions       |
|------------------|------------------|
| Peak Temperature | 265°C            |
| Dipping Time     | 10 seconds(max.) |
| Soldering        | 1 time           |

### 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.)      |

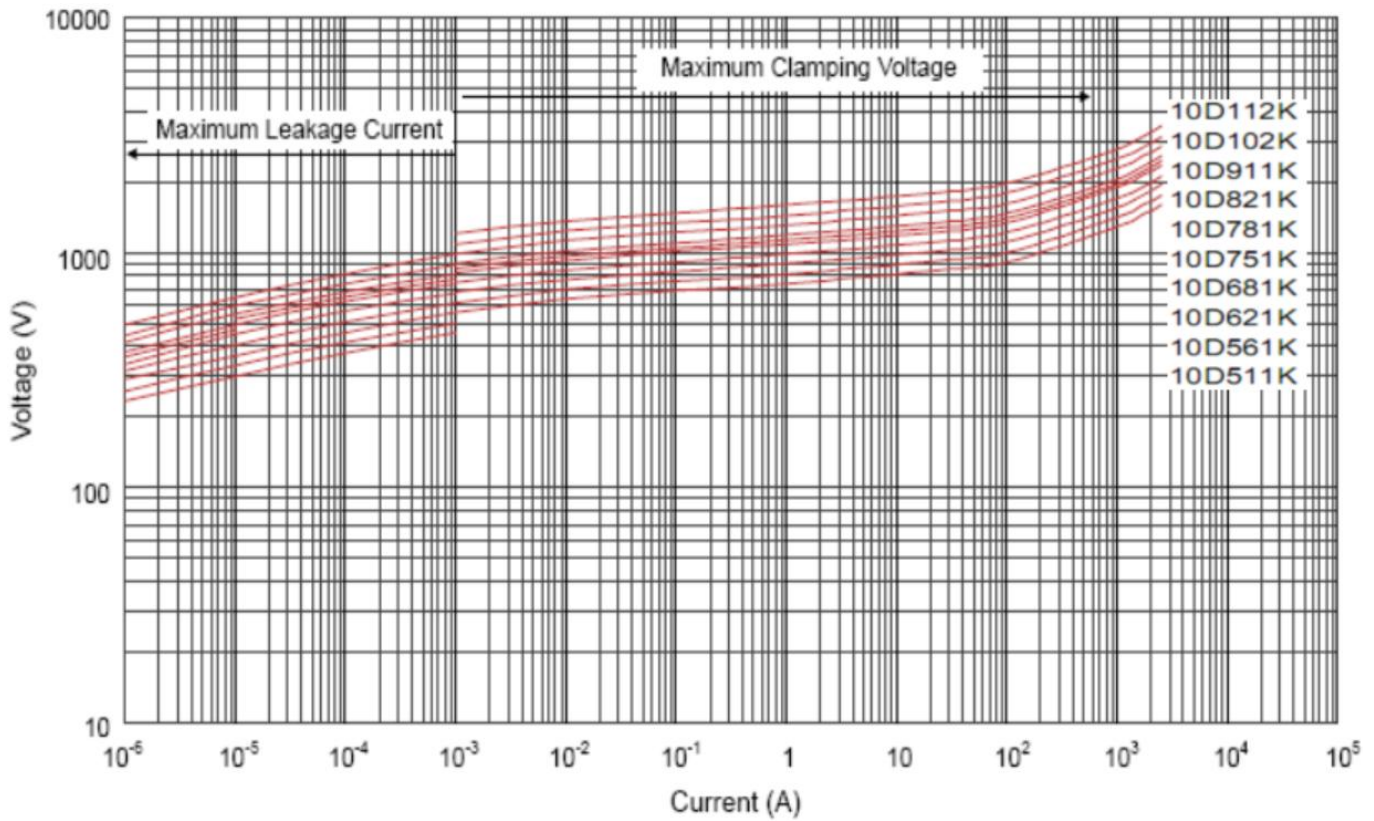
Maximum Leakage Current and Maximum Clamping Voltage Curve



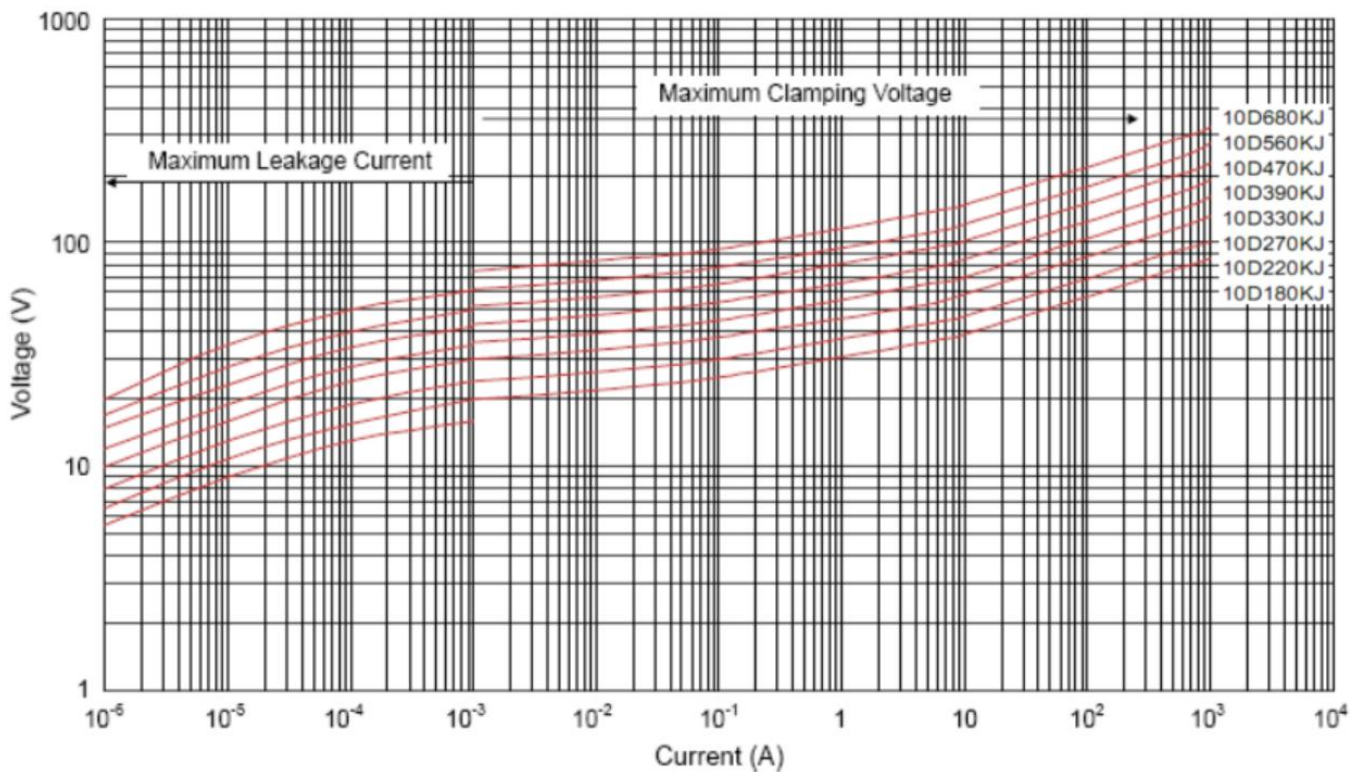


### Maximum Leakage Current and Maximum Clamping Voltage Curve

10D511K to 10D112K

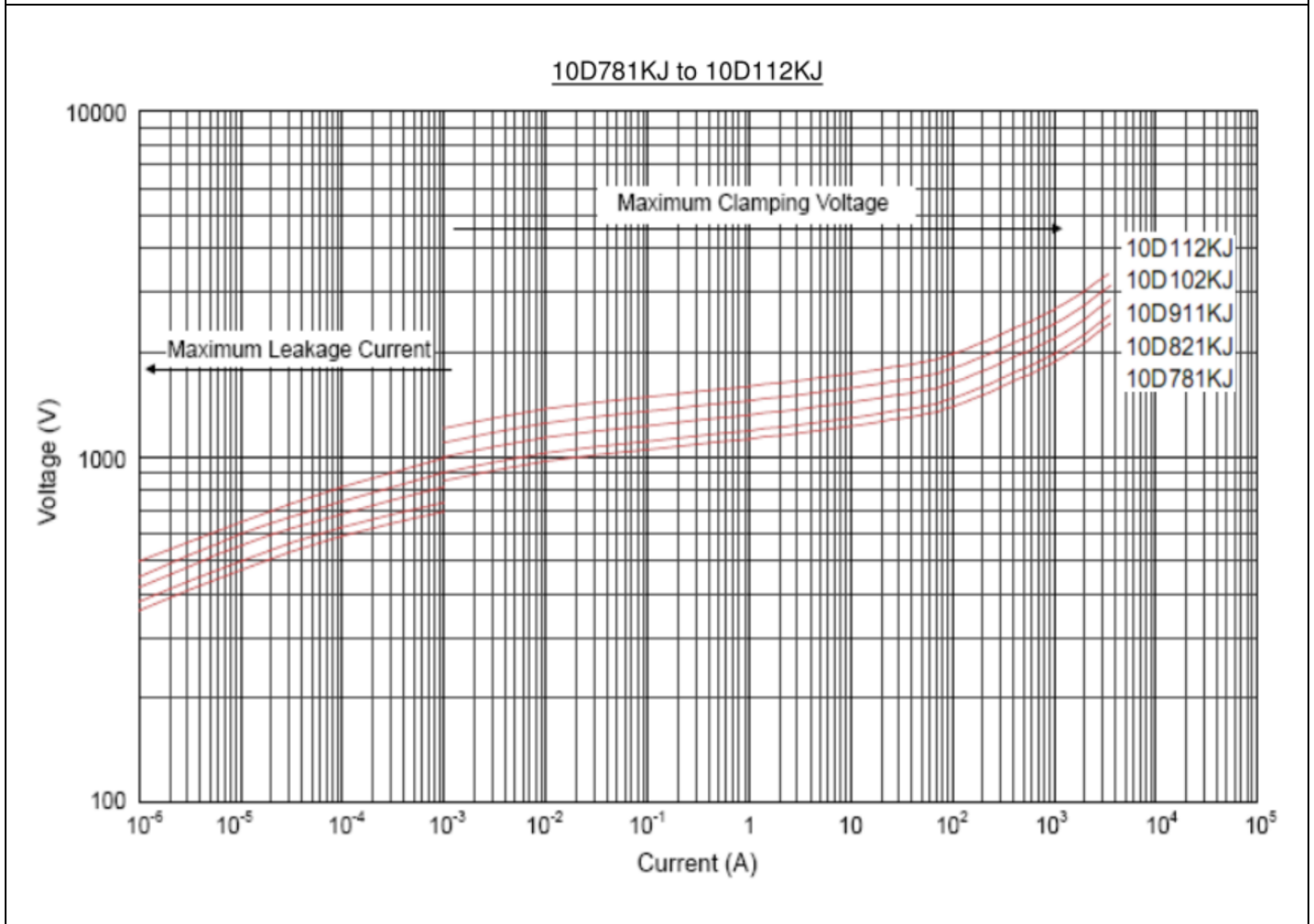
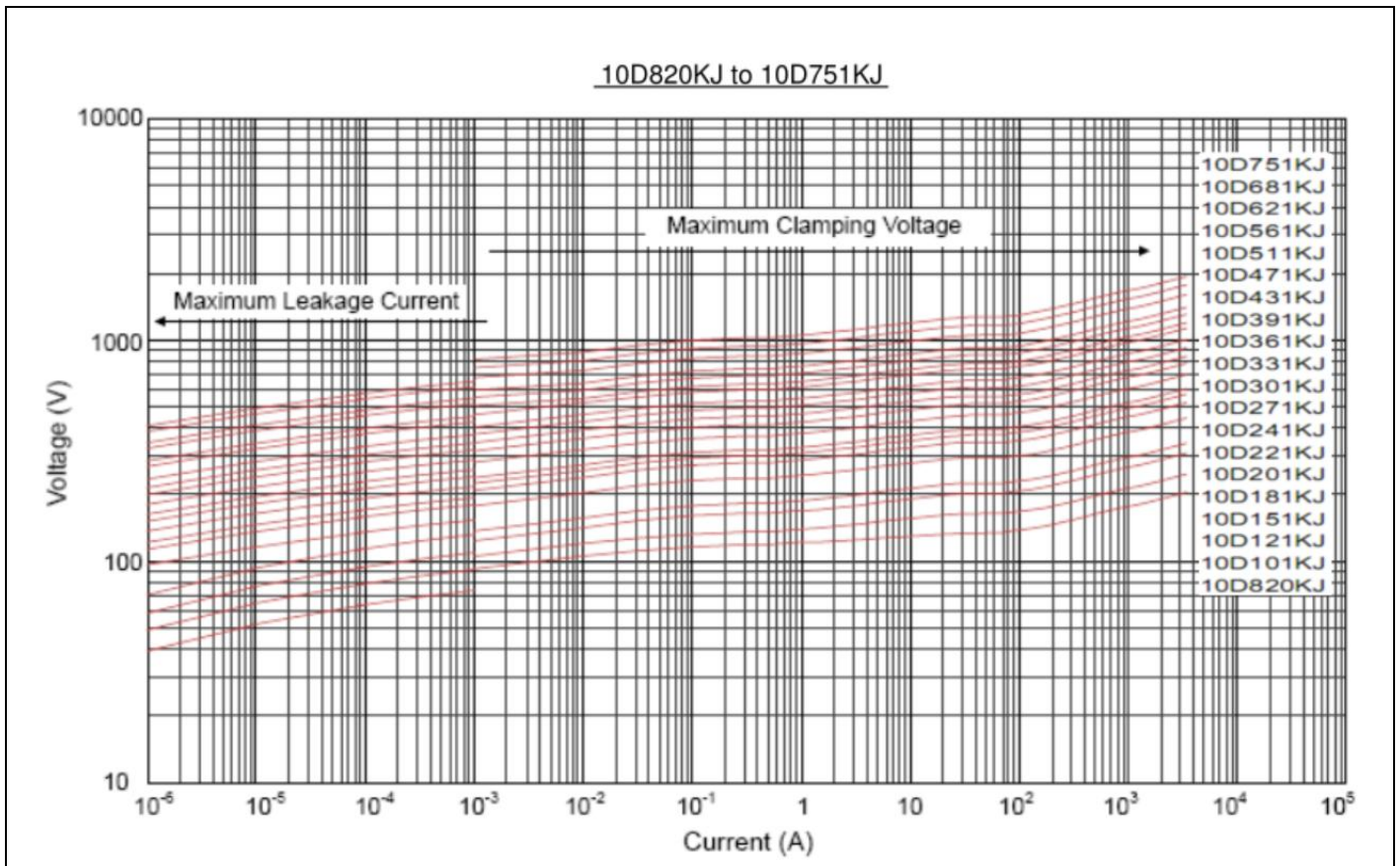


10D180KJ to 10D680KJ

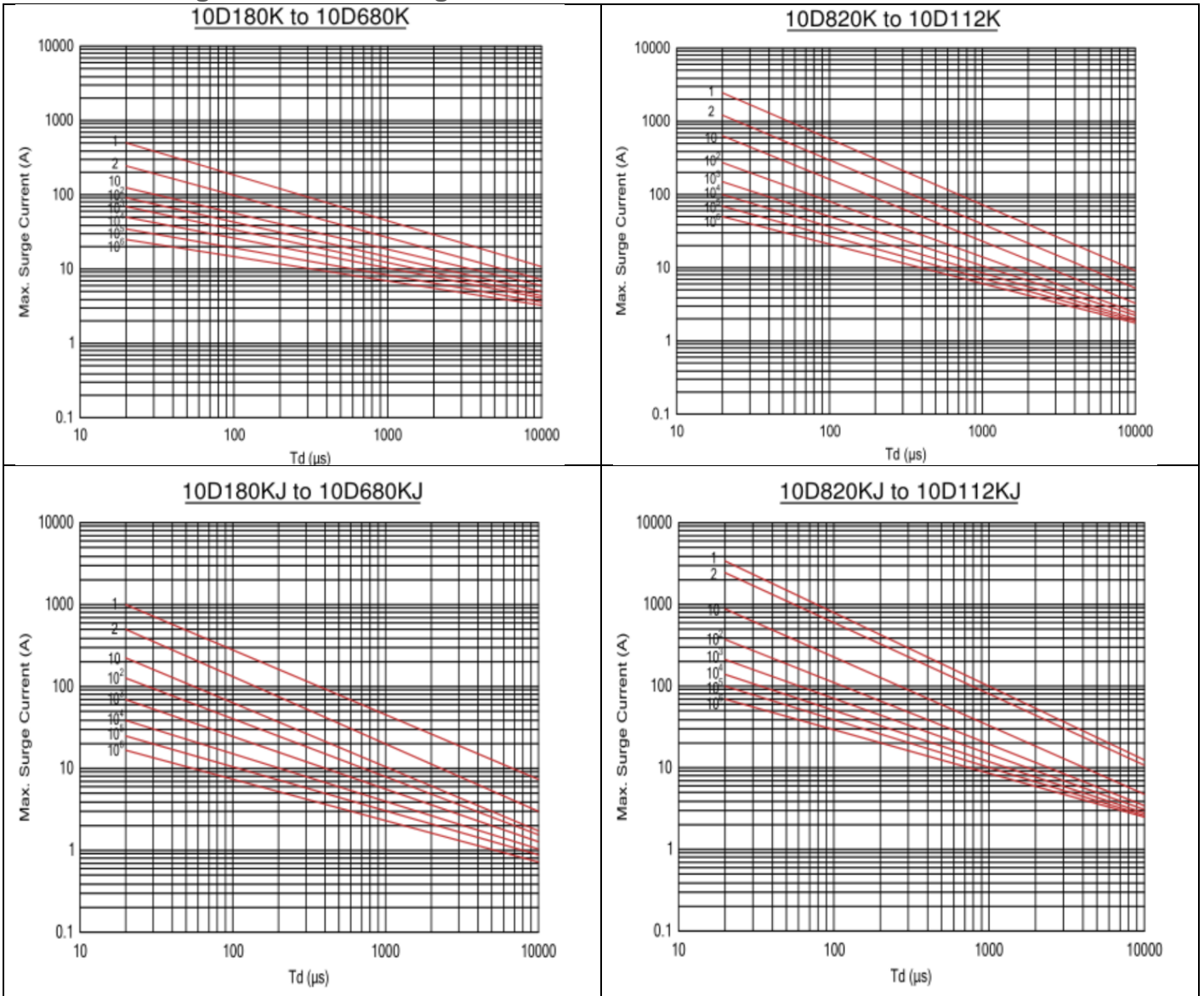




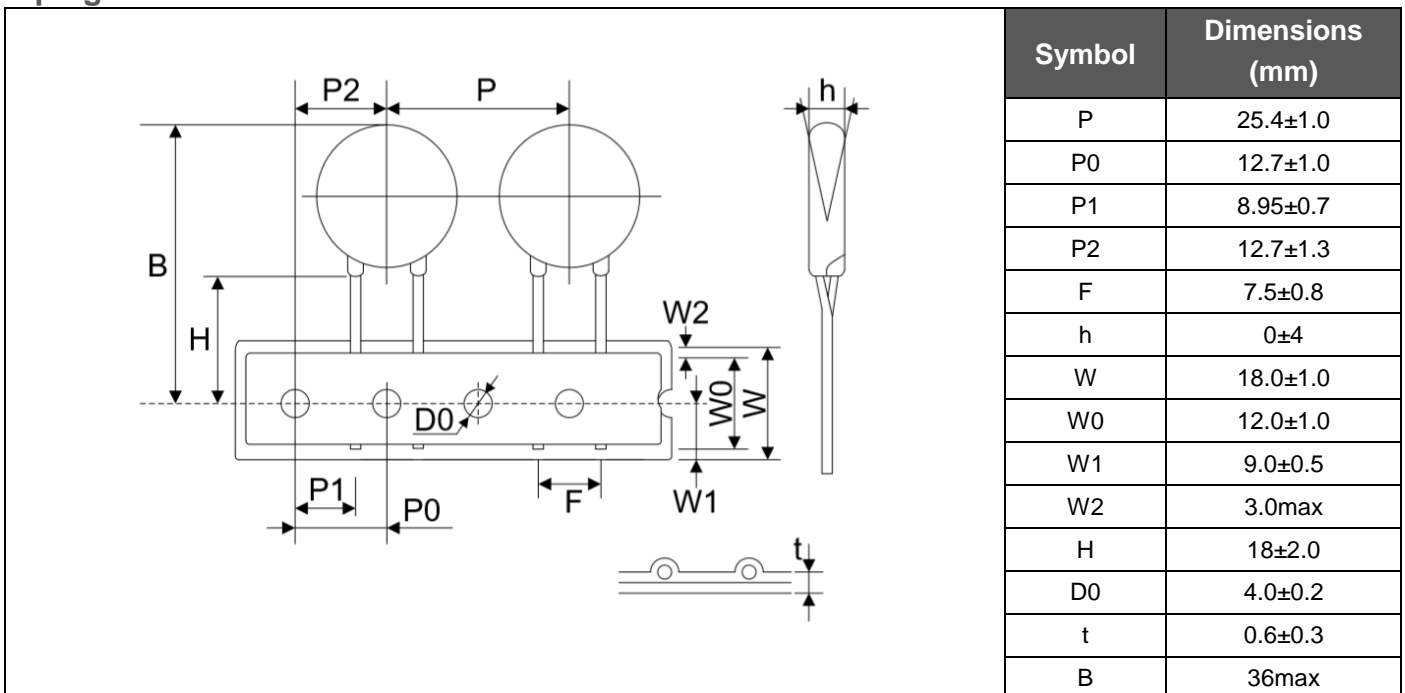
Maximum Leakage Current and Maximum Clamping Voltage Curve



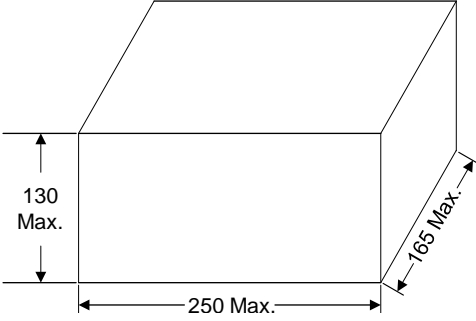


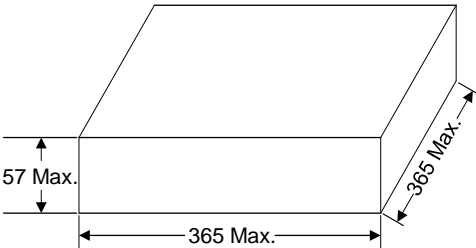
### Maximum Surge Current Derating Curve



### Taping Dimensions



### Quantity

| Packaging Dimensions (Unit: mm)   | Quantity                   |           |
|---|----------------------------|-----------|
| <p>In bulk for Terminals Untrimmed Products</p>  | 500pcs/bag<br>(180K~621K)  | 4bags/box |
|   | 400pcs/bag<br>(681k~112K)  |           |
| <p>In bulk for Terminals Trimmed Products</p>   | 500pcs/bag<br>(180K~621K)  | 4bags/box |
|   | 400pcs/bag<br>(681k~112K)  |           |
| <p>Tape &amp; Box</p>                          | 750pcs/bag<br>(180K~391K)  | 6bags/box |
|   | 500pcs/bag<br>(431K~621K)  |           |
|   | 300pcs/bag<br>(681K~112K)  |           |
| <p>Tape &amp; Reel</p>                         | 1000pcs/bag<br>(180K~391K) | 6bags/box |
|   | 750pcs/bag<br>(431K~621K)  |           |
|   | 500pcs/bag<br>(681k~751K)  |           |
|   | 400pcs/bag<br>(781k~112K)  |           |

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