

## 10D Series Data Sheet

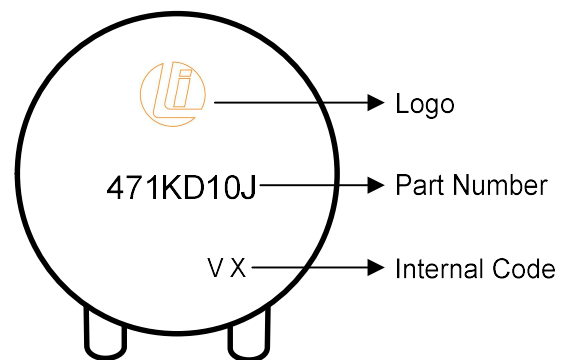
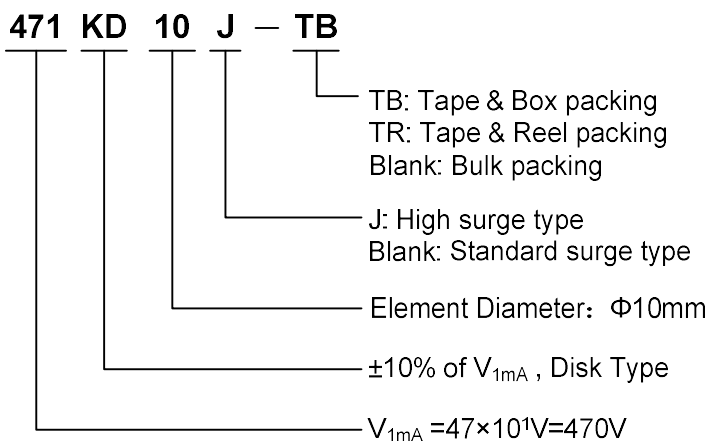
### Features

- Wide operating voltage ( $V_{1mA}$ ) range from 18V to 1100V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level1, per J-STD-020
- Operating temperature:  $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$
- Storage Temperature:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$

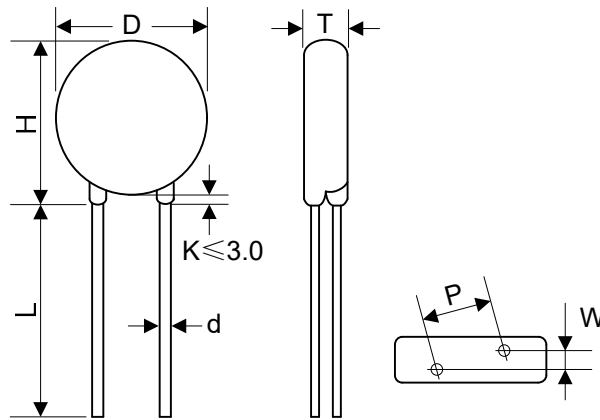
### Applications

- Transistor, diode, IC, SCR or SCR 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 and Marking Code



Dimensions



Straight leads

| Item           | D         | H         | L     | d        | P       | T                            | W |
|----------------|-----------|-----------|-------|----------|---------|------------------------------|---|
| Dimension (mm) | 10.0~12.5 | 10.5~16.0 | ≥20.0 | 0.8±0.05 | 7.5±0.8 | Refer to the following table |   |

| Model | T       | W       | Model | T       | W       | Model | T       | W       |
|-------|---------|---------|-------|---------|---------|-------|---------|---------|
| 180K  | 2.0~4.6 | 1.5±0.8 | 151K  | 2.2~5.4 | 1.8±0.8 | 471K  | 3.3~6.7 | 3.2±0.8 |
| 220K  | 2.1~4.7 | 1.6±0.8 | 181K  | 2.3~4.8 | 1.9±0.8 | 511K  | 3.4~6.8 | 3.4±0.8 |
| 270K  | 2.1~4.8 | 1.8±0.8 | 201K  | 2.4~5.0 | 2.0±0.8 | 561K  | 3.6~7.0 | 3.6±0.8 |
| 330K  | 2.2~5.0 | 1.7±0.8 | 221K  | 2.5~5.1 | 2.1±0.8 | 621K  | 3.8~7.3 | 3.9±0.8 |
| 390K  | 2.1~5.3 | 1.8±0.8 | 241K  | 2.6~5.2 | 2.2±0.8 | 681K  | 4.0~7.6 | 4.2±0.8 |
| 470K  | 2.2~5.4 | 1.9±0.8 | 271K  | 2.6~5.4 | 2.4±0.8 | 751K  | 4.3~8.0 | 4.3±0.8 |
| 560K  | 2.3~5.5 | 2.1±0.8 | 301K  | 2.7~5.5 | 2.5±0.8 | 781K  | 4.4~8.1 | 4.4±0.8 |
| 680K  | 2.4~5.6 | 2.4±0.8 | 331K  | 2.7~5.8 | 2.5±0.8 | 821K  | 4.6~8.3 | 4.6±0.8 |
| 820K  | 2.1~4.7 | 1.8±0.8 | 361K  | 2.9~6.0 | 2.7±0.8 | 911K  | 4.8~8.8 | 5.0±0.8 |
| 101K  | 2.4~4.9 | 2.0±0.8 | 391K  | 3.0~6.2 | 2.8±0.8 | 102K  | 5.4~9.3 | 5.0±0.8 |
| 121K  | 2.4~5.1 | 2.2±0.8 | 431K  | 3.2~6.5 | 3.0±0.8 | 112K  | 5.8~9.9 | 5.4±0.8 |

### Electrical Characteristics

| Model    | Varistor Voltage | Maximum Allowable Voltage |              | Maximum Clamping Voltage |           | Surge Current | Maximum Energy (10/1000 $\mu$ s) | Maximum Leakage Current @83% of $V_{1mA}$ | Rated Power | Typical Capacitance (Reference) |
|----------|------------------|---------------------------|--------------|--------------------------|-----------|---------------|----------------------------------|---|-------------|---------------------------------|
|          | $V_{1mA}$ (V)    | $V_{AC}$ (V)              | $V_{DC}$ (V) | $I_P$ (A)                | $V_C$ (V) | I (A)         | E (J)                            | $I_R$ ( $\mu$ A)                          | P (W)       | @1KHz (pF)                      |
| 180KD10  | 18(15~21.6)      | 11                        | 14           | 5                        | 36        | 500           | 2.1                              | 50  | 0.05        | 5600                            |
| 180KD10J | 18(15~21.6)      | 11                        | 14           | 5                        | 36        | 1000          | 3                                | 50  | 0.05        | 5600                            |
| 220KD10  | 22(19.5~26)      | 14                        | 18           | 5                        | 43        | 500           | 2.5                              | 50  | 0.05        | 4500                            |
| 220KD10J | 22(19.5~26)      | 14                        | 18           | 5                        | 43        | 1000          | 5                                | 50  | 0.05        | 4500                            |
| 270KD10  | 27(24~31)        | 17                        | 22           | 5                        | 53        | 500           | 3                                | 50  | 0.05        | 3700                            |
| 270KD10J | 27(24~31)        | 17                        | 22           | 5                        | 53        | 1000          | 6                                | 50  | 0.05        | 3700                            |
| 330KD10  | 33(29.5~36.5)    | 20                        | 26           | 5                        | 65        | 500           | 4                                | 50  | 0.05        | 3000                            |
| 330KD10J | 33(29.5~36.5)    | 20                        | 26           | 5                        | 65        | 1000          | 7                                | 50  | 0.05        | 3000                            |
| 390KD10  | 39(35~43)        | 25                        | 31           | 5                        | 77        | 500           | 4.6                              | 50  | 0.05        | 2400                            |
| 390KD10J | 39(35~43)        | 25                        | 31           | 5                        | 77        | 1000          | 9                                | 50  | 0.05        | 2400                            |
| 470KD10  | 47(42~52)        | 30                        | 38           | 5                        | 93        | 500           | 5.5                              | 50  | 0.05        | 2100                            |
| 470KD10J | 47(42~52)        | 30                        | 38           | 5                        | 93        | 1000          | 11                               | 50  | 0.05        | 2100                            |
| 560KD10  | 56(50~62)        | 35                        | 45           | 5                        | 110       | 500           | 7                                | 50  | 0.05        | 1800                            |
| 560KD10J | 56(50~62)        | 35                        | 45           | 5                        | 110       | 1000          | 13                               | 50  | 0.05        | 1800                            |
| 680KD10  | 68(61~75)        | 40                        | 56           | 5                        | 135       | 500           | 8.2                              | 50  | 0.05        | 1500                            |
| 680KD10J | 68(61~75)        | 40                        | 56           | 5                        | 135       | 1000          | 15                               | 50  | 0.05        | 1500                            |
| 820KD10  | 82(74~90)        | 50                        | 65           | 25                       | 135       | 2500          | 12                               | 25  | 0.4         | 1200                            |
| 820KD10J | 82(74~90)        | 50                        | 65           | 25                       | 135       | 3500          | 17                               | 25  | 0.4         | 1200                            |
| 101KD10  | 100(90~110)      | 60                        | 85           | 25                       | 165       | 2500          | 15                               | 25  | 0.4         | 1000                            |
| 101KD10J | 100(90~110)      | 60                        | 85           | 25                       | 165       | 3500          | 18                               | 25  | 0.4         | 1000                            |
| 121KD10  | 120(108~132)     | 75                        | 100          | 25                       | 200       | 2500          | 18                               | 25  | 0.4         | 830                             |
| 121KD10J | 120(108~132)     | 75                        | 100          | 25                       | 200       | 3500          | 21                               | 25  | 0.4         | 830                             |
| 151KD10  | 150(135~165)     | 95                        | 125          | 25                       | 250       | 2500          | 22                               | 25  | 0.4         | 670                             |
| 151KD10J | 150(135~165)     | 95                        | 125          | 25                       | 250       | 3500          | 25                               | 25  | 0.4         | 670                             |
| 181KD10  | 180(162~198)     | 115                       | 150          | 25                       | 300       | 2500          | 27                               | 25  | 0.4         | 560                             |
| 181KD10J | 180(162~198)     | 115                       | 150          | 25                       | 300       | 3500          | 30                               | 25  | 0.4         | 560                             |
| 201KD10  | 200(180~220)     | 130                       | 170          | 25                       | 340       | 2500          | 30                               | 25  | 0.4         | 500                             |
| 201KD10J | 200(180~220)     | 130                       | 170          | 25                       | 340       | 3500          | 35                               | 25  | 0.4         | 500                             |
| 221KD10  | 220(198~242)     | 140                       | 180          | 25                       | 360       | 2500          | 32                               | 25  | 0.4         | 450                             |
| 221KD10J | 220(198~242)     | 140                       | 180          | 25                       | 360       | 3500          | 39                               | 25  | 0.4         | 450                             |
| 241KD10  | 240(216~264)     | 150                       | 200          | 25                       | 395       | 2500          | 35                               | 25  | 0.4         | 420                             |
| 241KD10J | 240(216~264)     | 150                       | 200          | 25                       | 395       | 3500          | 42                               | 25  | 0.4         | 420                             |
| 271KD10  | 270(243~297)     | 175                       | 225          | 25                       | 455       | 2500          | 37                               | 25  | 0.4         | 370                             |

### Electrical Characteristics

| Model    | Varistor Voltage | Maximum Allowable Voltage |              | Maximum Clamping Voltage |           | Surge Current | Maximum Energy (10/1000 $\mu$ s) | Maximum Leakage Current @83% of $V_{1mA}$ | Rated Power | Typical Capacitance (Reference) |
|----------|------------------|---------------------------|--------------|--------------------------|-----------|---------------|----------------------------------|---|-------------|---------------------------------|
|          | $V_{1mA}$ (V)    | $V_{AC}$ (V)              | $V_{DC}$ (V) | $I_P$ (A)                | $V_C$ (V) | I (A)         | E (J)                            | $I_R$ ( $\mu$ A)                          | P (W)       | @1KHz (pF)                      |
| 271KD10J | 270(243~297)     | 175                       | 225          | 25                       | 455       | 3500          | 49                               | 25  | 0.4         | 370                             |
| 301KD10  | 300(270~330)     | 190                       | 250          | 25                       | 500       | 2500          | 40                               | 25  | 0.4         | 330                             |
| 301KD10J | 300(270~330)     | 190                       | 250          | 25                       | 500       | 3500          | 54                               | 25  | 0.4         | 330                             |
| 331KD10  | 330(297~363)     | 210                       | 275          | 25                       | 550       | 2500          | 43                               | 25  | 0.4         | 300                             |
| 331KD10J | 330(297~363)     | 210                       | 275          | 25                       | 550       | 3500          | 58                               | 25  | 0.4         | 300                             |
| 361KD10  | 360(324~396)     | 230                       | 300          | 25                       | 595       | 2500          | 47                               | 25  | 0.4         | 280                             |
| 361KD10J | 360(324~396)     | 230                       | 300          | 25                       | 595       | 3500          | 65                               | 25  | 0.4         | 280                             |
| 391KD10  | 390(351~429)     | 250                       | 320          | 25                       | 650       | 2500          | 60                               | 25  | 0.4         | 260                             |
| 391KD10J | 390(351~429)     | 250                       | 320          | 25                       | 650       | 3500          | 70                               | 25  | 0.4         | 260                             |
| 431KD10  | 430(387~473)     | 275                       | 350          | 25                       | 710       | 2500          | 65                               | 25  | 0.4         | 230                             |
| 431KD10J | 430(387~473)     | 275                       | 350          | 25                       | 710       | 3500          | 80                               | 25  | 0.4         | 230                             |
| 471KD10  | 470(423~517)     | 300                       | 385          | 25                       | 775       | 2500          | 67                               | 25  | 0.4         | 210                             |
| 471KD10J | 470(423~517)     | 300                       | 385          | 25                       | 775       | 3500          | 85                               | 25  | 0.4         | 210                             |
| 511KD10  | 510(459~561)     | 320                       | 415          | 25                       | 845       | 2500          | 69                               | 25  | 0.4         | 200                             |
| 511KD10J | 510(459~561)     | 320                       | 415          | 25                       | 845       | 3500          | 90                               | 25  | 0.4         | 200                             |
| 561KD10  | 560(504~616)     | 350                       | 460          | 25                       | 925       | 2500          | 70                               | 25  | 0.4         | 180                             |
| 561KD10J | 560(504~616)     | 350                       | 460          | 25                       | 925       | 3500          | 92                               | 25  | 0.4         | 180                             |
| 621KD10  | 620(558~682)     | 385                       | 505          | 25                       | 1025      | 2500          | 72                               | 25  | 0.4         | 160                             |
| 621KD10J | 620(558~682)     | 385                       | 505          | 25                       | 1025      | 3500          | 95                               | 25  | 0.4         | 160                             |
| 681KD10  | 680(612~748)     | 420                       | 560          | 25                       | 1120      | 2500          | 75                               | 25  | 0.4         | 150                             |
| 681KD10J | 680(612~748)     | 420                       | 560          | 25                       | 1120      | 3500          | 98                               | 25  | 0.4         | 150                             |
| 751KD10  | 750(675~825)     | 460                       | 615          | 25                       | 1240      | 2500          | 77                               | 25  | 0.4         | 130                             |
| 751KD10J | 750(675~825)     | 460                       | 615          | 25                       | 1240      | 3500          | 100                              | 25  | 0.4         | 130                             |
| 781KD10  | 780(702~858)     | 485                       | 640          | 25                       | 1290      | 2500          | 80                               | 25  | 0.4         | 125                             |
| 781KD10J | 780(702~858)     | 485                       | 640          | 25                       | 1290      | 3500          | 105                              | 25  | 0.4         | 125                             |
| 821KD10  | 820(738~902)     | 510                       | 670          | 25                       | 1355      | 2500          | 85                               | 25  | 0.4         | 120                             |
| 821KD10J | 820(738~902)     | 510                       | 670          | 25                       | 1355      | 3500          | 110                              | 25  | 0.4         | 120                             |
| 911KD10  | 910(819~1001)    | 550                       | 745          | 25                       | 1500      | 2500          | 93                               | 25  | 0.4         | 110                             |
| 911KD10J | 910(819~1001)    | 550                       | 745          | 25                       | 1500      | 3500          | 130                              | 25  | 0.4         | 110                             |
| 102KD10  | 1000(900~1100)   | 625                       | 825          | 25                       | 1650      | 2500          | 102                              | 25  | 0.4         | 100                             |
| 102KD10J | 1000(900~1100)   | 625                       | 825          | 25                       | 1650      | 3500          | 140                              | 25  | 0.4         | 100                             |
| 112KD10  | 1100(990~1210)   | 680                       | 895          | 25                       | 1815      | 2500          | 115                              | 25  | 0.4         | 90                              |
| 112KD10J | 1100(990~1210)   | 680                       | 895          | 25                       | 1815      | 3500          | 155                              | 25  | 0.4         | 90                              |

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           | The maximum voltage between two terminals with the specification standard impulse current.<br>Applied waveform: 8/20μs   |              |  |               |
| Surge Current                      | The maximum current within the varistor voltage change of ±10% with the standard impulse current (8/20μs) applied one time.  |              |  |               |
| Energy                             | The maximum energy within the varistor voltage change of ±10% when one impulse of 10/1000μs is applied.  |              |  |               |
| Leakage Current                    | The current through the varistor when 0.83V <sub>1mA</sub> is applied to both end.   |              |  |               |
| Rated Power                        | The maximum average power that can be applied within the specified ambient temperature.  |              |  |               |
| 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 $   |              | ≤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                         | The change of V <sub>1mA</sub> shall be measured after the impulse listed below which is applied 10,000 times continuously with the interval of ten seconds at room temperature. |              | ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤10% |               |
|                                    | 10D series   | 180K to 680K |  | 50A (8/20μs)  |
|                                    |  | 820K to 112K |  | 100A (8/20μs) |

Mechanical Characteristics and Reliability

| Items                         | Test conditions / Methods   |                  | Specifications  |  |
|-------------------------------|---|------------------|---|--|
| Tensile Strength of Terminals | Gradually applying the force specified and keeping the unit fixed for 10±1 sec.   |                  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$    |  |
|                               | Terminal diameter (mm)  | Force (kg)       |   |  |
|                               | 0.5<d≤0.8   | 1.0              |   |  |
|                               | 0.8<d≤1.25  | 2.0              |   |  |
| 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. |                  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$    |  |
|                               | Terminal diameter (mm)  | Force (kg)       |   |  |
|                               | 0.5<d≤0.8   | 0.5              |   |  |
|                               | 0.8<d≤1.25  | 1.0              |   |  |
| 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>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$    |  |
|                               | Solder Temp: 245±5°C<br>Dipping Time: 2±0.5 sec   |                  |   |  |
| Solder ability                | Solder Temp: 245±5°C<br>Dipping Time: 2±0.5 sec   |                  | At least 95% of terminal electrode is covered by new solder |  |
| Resistance to Soldering Heat  | Solder Temp: 260±5°C<br>Dipping Time: 10±1 sec  |                  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 10\%$   |  |
| High Temperature Storage      | Ambient Temp: 125±2°C<br>Duration: 1000hrs  |                  | $ \Delta V_{1mA}/V_{1mA}  \leq 5\%$                         |  |
| Low Temperature Storage       | Ambient Temp: -40±2°C<br>Duration: 1000hrs  |                  | $ \Delta V_{1mA}/V_{1mA}  \leq 5\%$                         |  |
| Humidity                      | Ambient Temp: 40±2°C, 90~95% R.H.<br>Duration: 1000hrs  |                  | $ \Delta V_{1mA}/V_{1mA}  \leq 5\%$                         |  |
| Temperature Cycle             | The conditions shown below shall be repeated 5 cycles   |                  |   | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ |
|                               | Step  | Temperature (°C) | Period (minutes)  |  |
|                               | 1   | -40±3            | 30±3  |  |
|                               | 2   | Room temperature | 15±3  |  |
|                               | 3   | 125±3            | 30±3  |  |
| High Temperature Load         | Ambient Temp: 85±2°C      Duration: 1000hrs<br>Load: Max. Allowable Voltage In AC eara.   |                  | $ \Delta V_{1mA}/V_{1mA}  \leq 10\%$                        |  |
|                               | Ambient Temp: 40±2°C, 90~95% R.H.<br>Duration: 1000hrs      Load: Max. Allowable Voltage  |                  |   |  |
| Damp Heat Load                | Ambient Temp: 40±2°C, 90~95% R.H.<br>Duration: 1000hrs      Load: Max. Allowable Voltage  |                  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 10\%$   |  |
| Voltage Proof                 | Metal balls method, 2500Vac 1 min.  |                  | No visible damage   |  |

**Soldering Recommendation**

**Wave Lead Free Soldering Recommendation**



Peak Temperature: 265°C  
 Dipping Time: 10 seconds (max.)  
 Soldering: 1 time

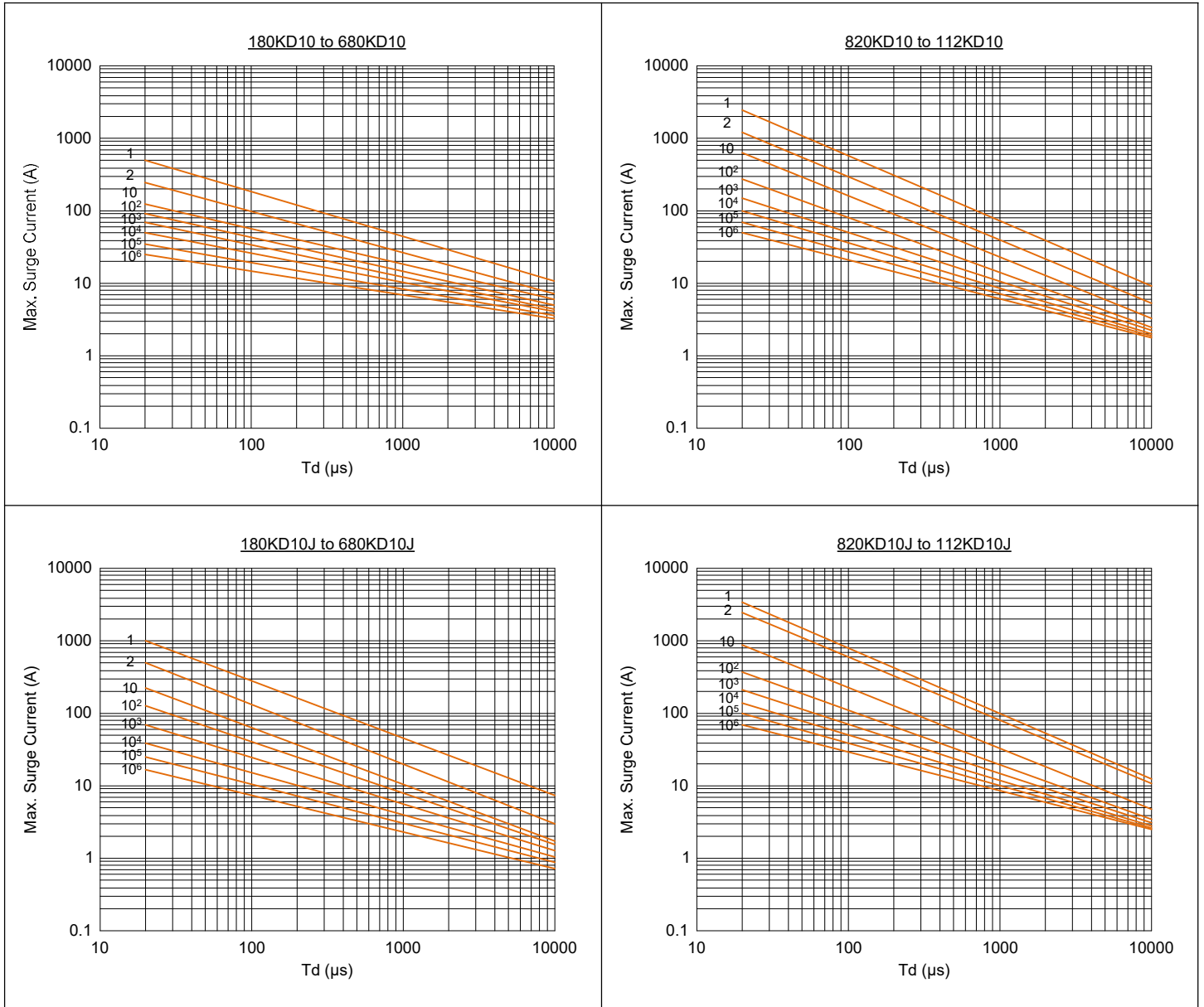
**Recommendation Reworking Conditions with Soldering Iron**

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

**Power Derating Curve**

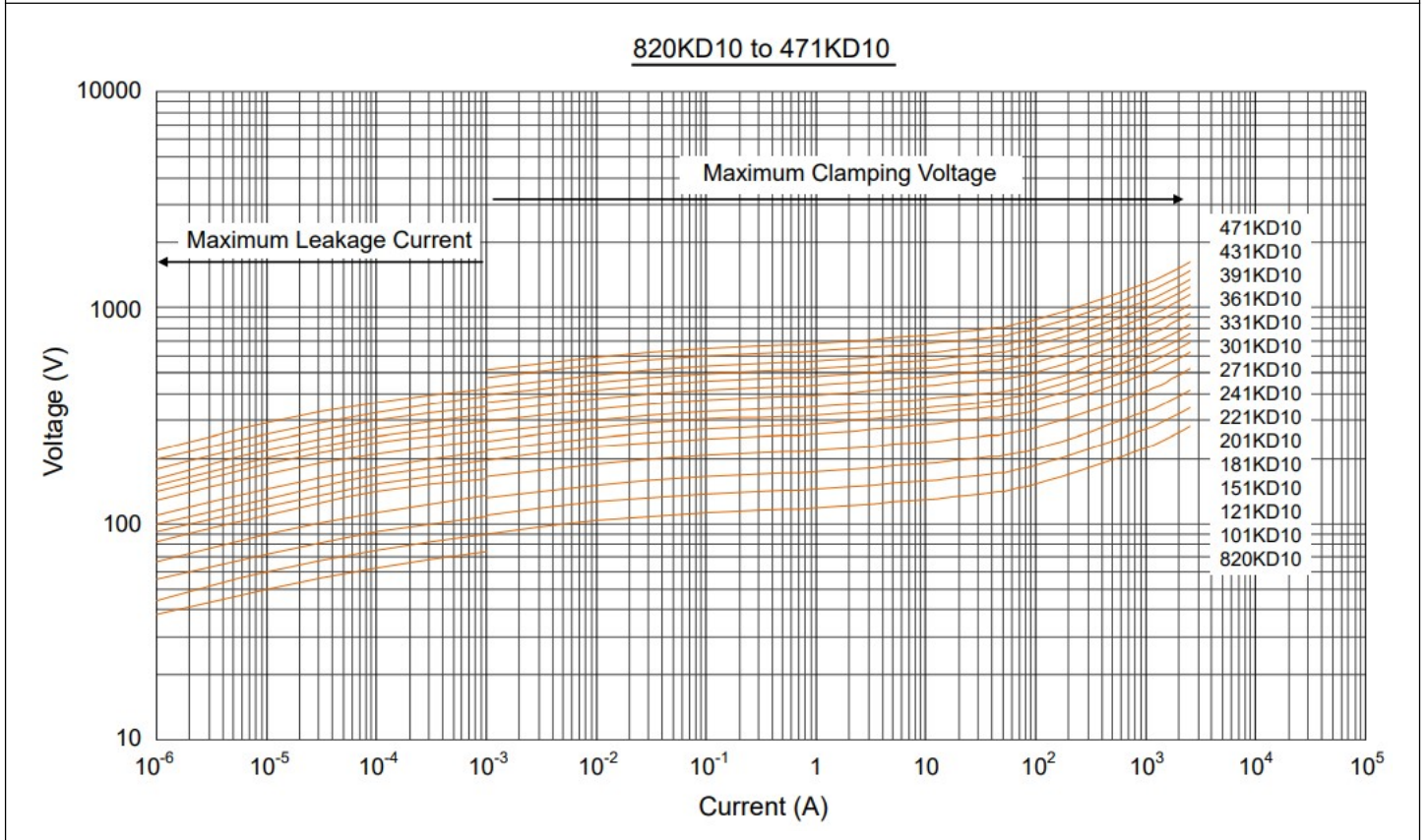
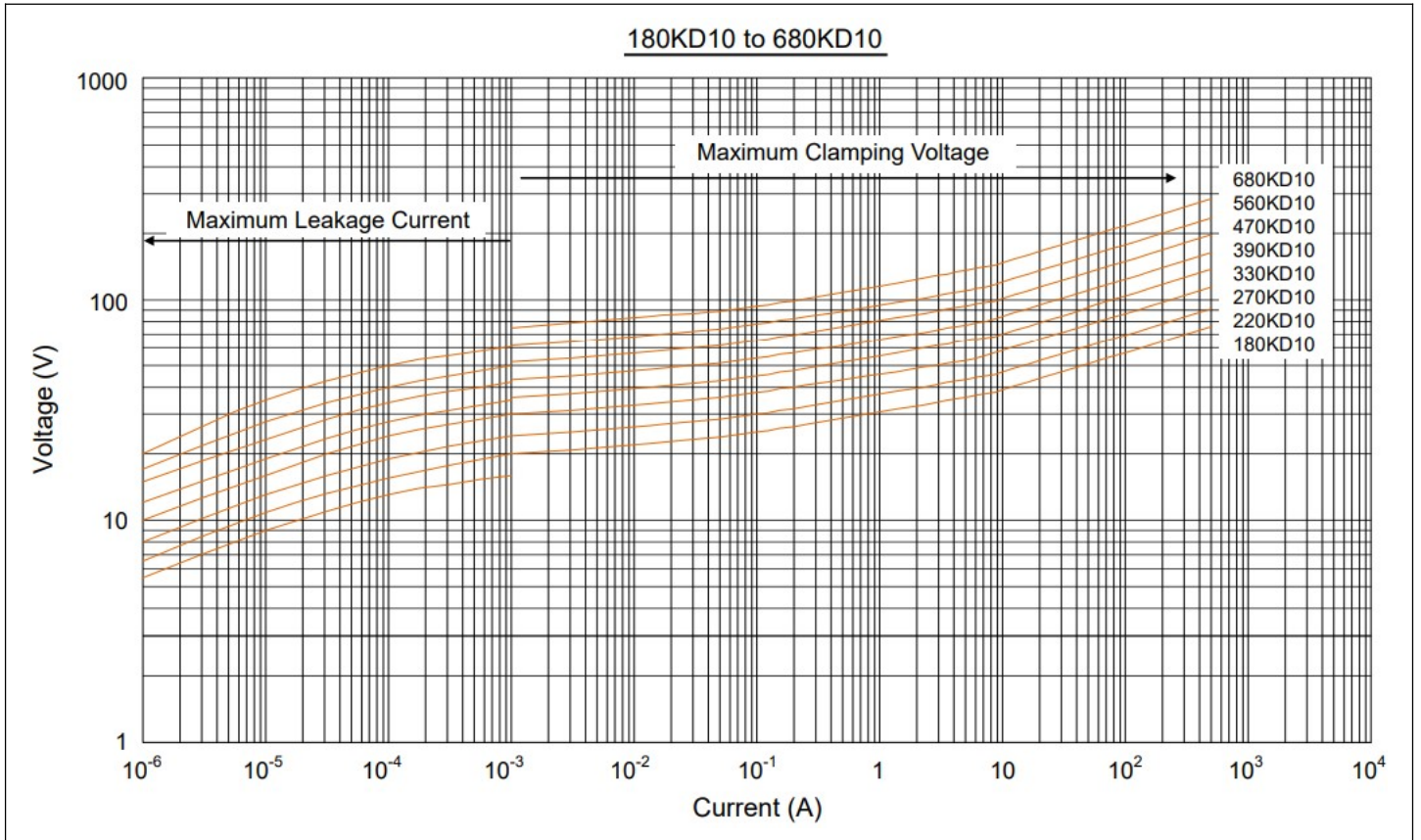


**Maximum Surge Current Derating Curve**

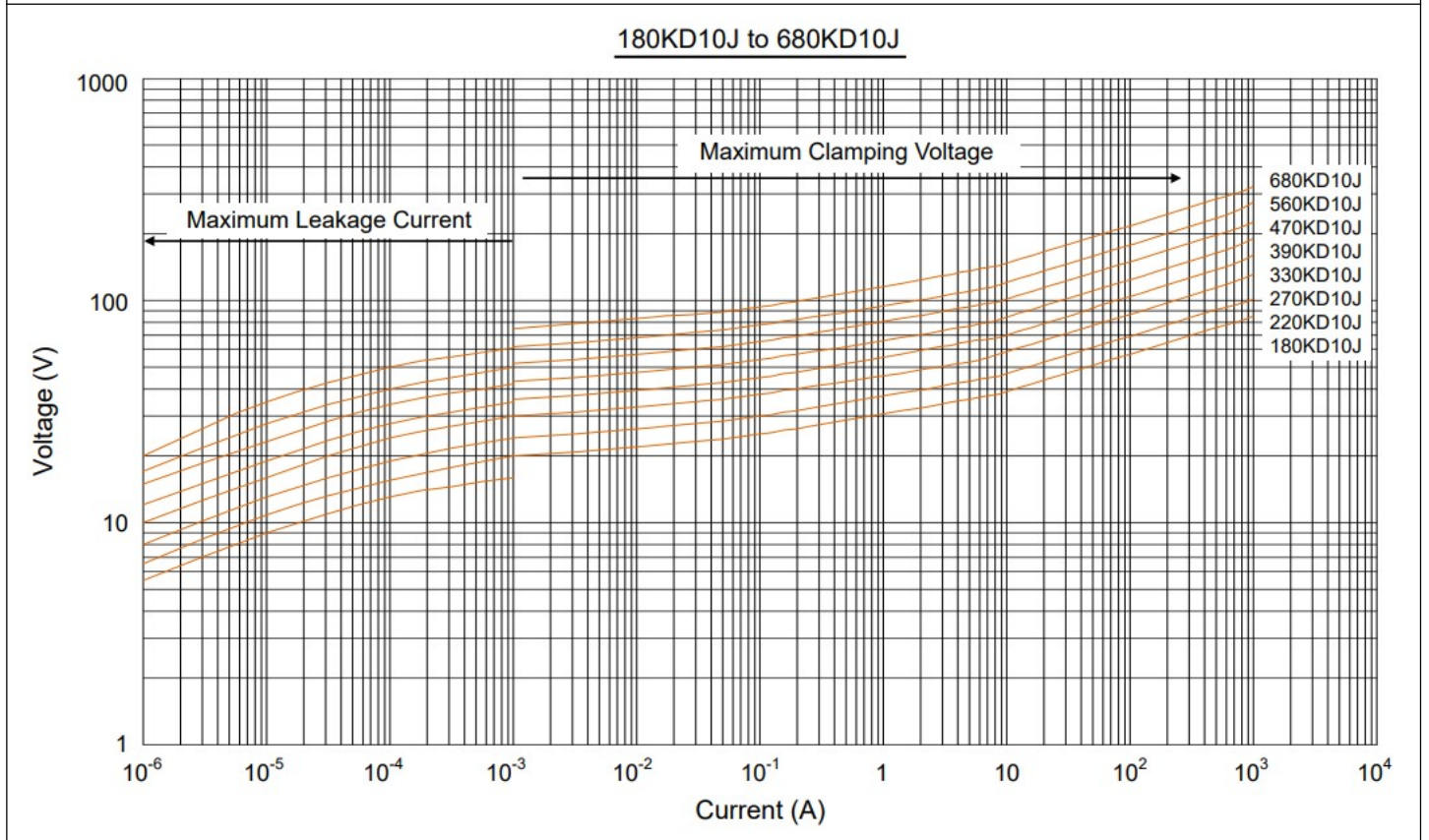
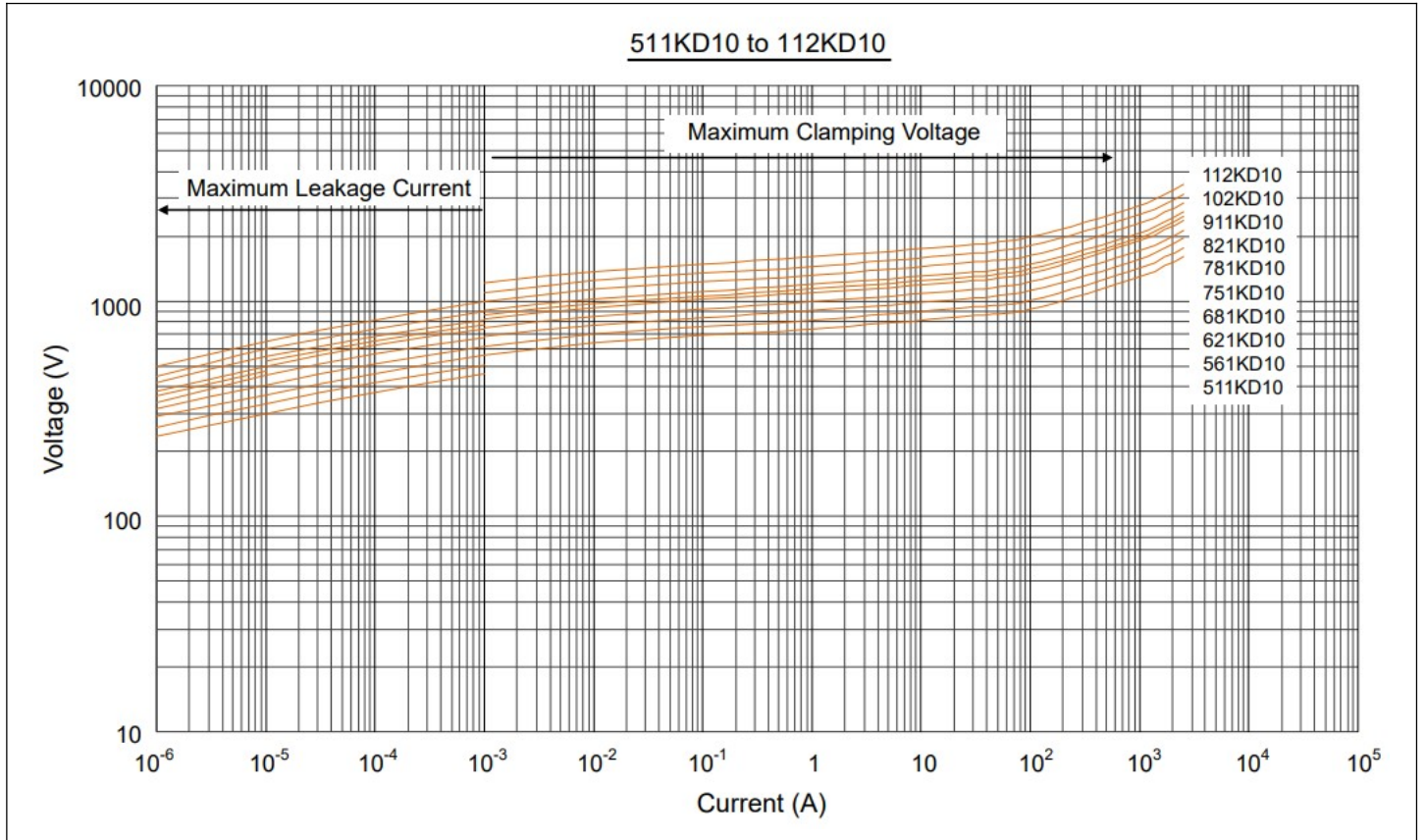




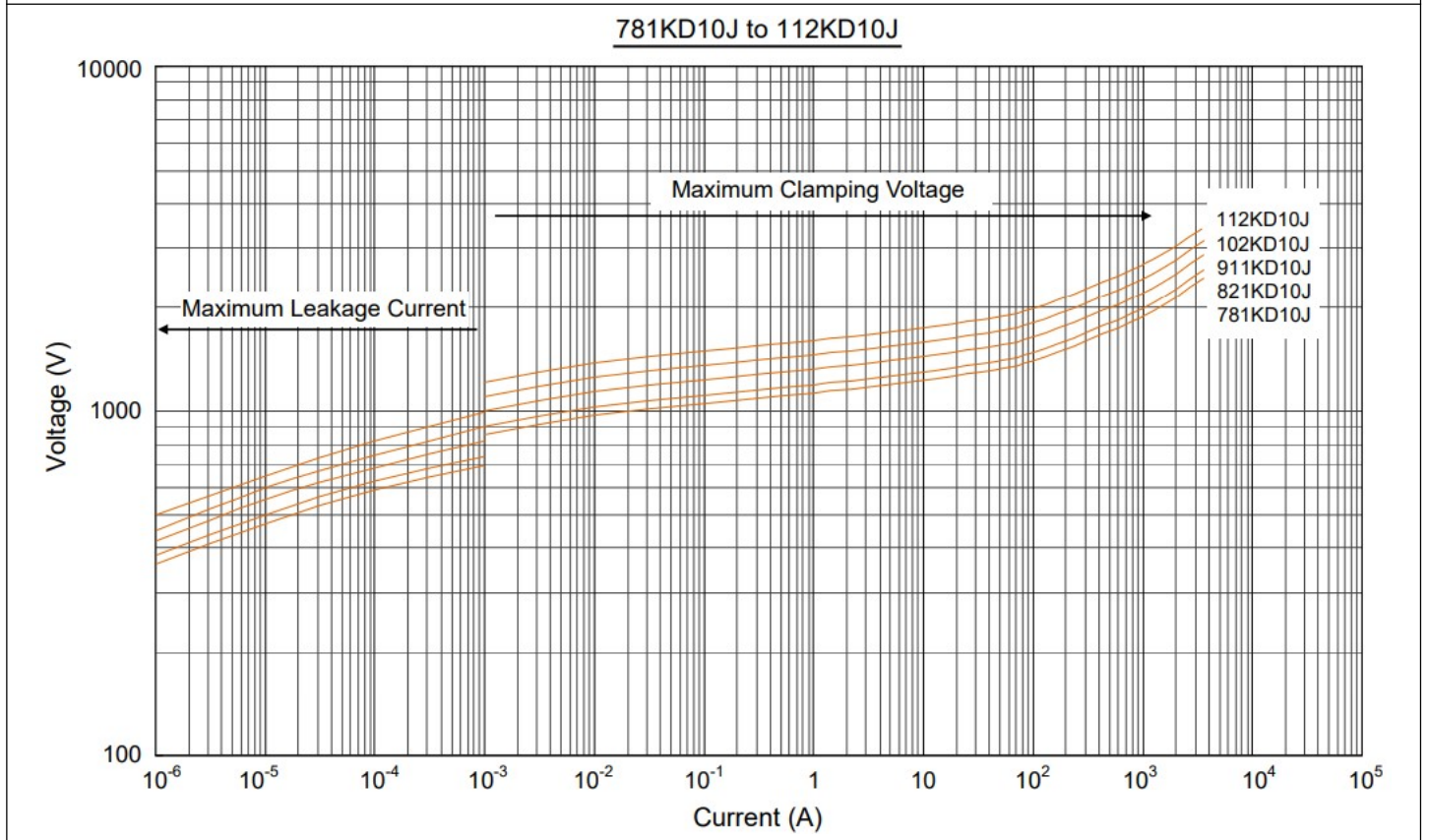
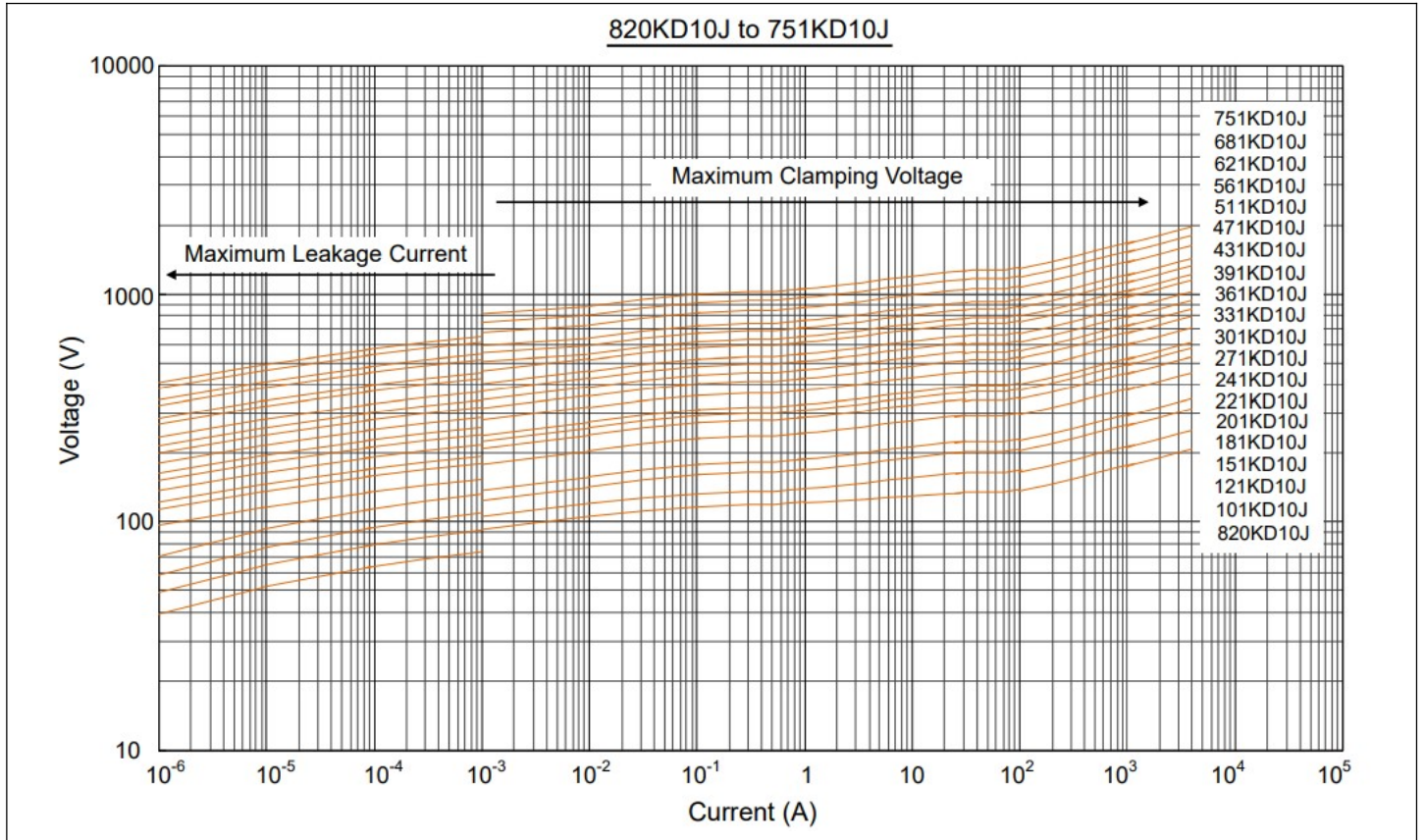
**Maximum Leakage Current and Maximum Clamping Voltage Curve**



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



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

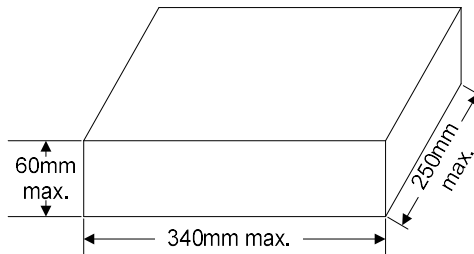


Taping Packaging

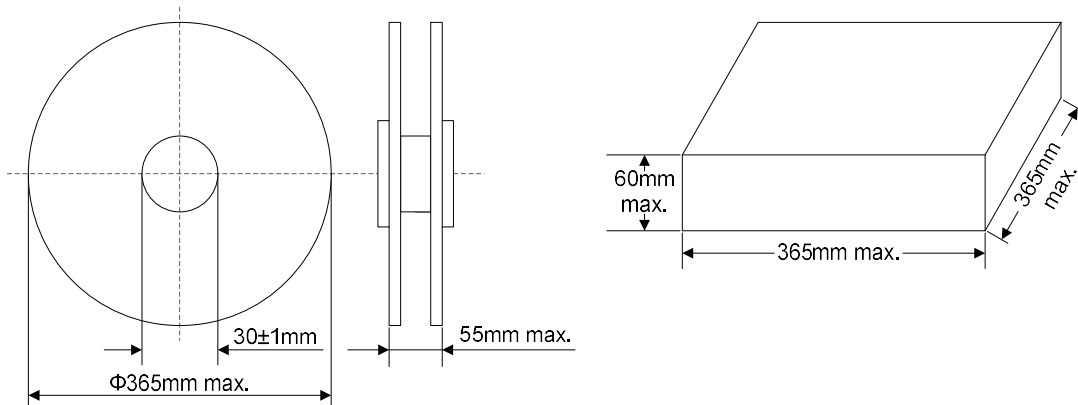


|                |         |          |          |          |          |          |          |         |
|----------------|---------|----------|----------|----------|----------|----------|----------|---------|
| Item           | P       | P0       | P1       | P2       | P3       | W        | W0       | W1      |
| Dimensions(mm) | 7.5±0.8 | 12.7±1.0 | 8.95±0.7 | 12.7±1.3 | 25.4±1.0 | 18.0±1.0 | 12.0±1.0 | 3.0max. |
| Item           | W2      | H        | H0       | D0       | L        | h        | t        |         |
| Dimensions(mm) | 9.0±0.5 | 20.0±2.0 | 36max.   | 4.0±0.2  | 1.0max.  | 0±2      | 0.6±0.3  |         |

Tape & Box



Tape & Reel



**Quantity**

| Packaging   | Model     | Quantity     |            |
|-------------|-----------|--------------|------------|
| Bulk        | 180K~621K | 500pcs/bag   | 2 bags/box |
|             | 681K~112K | 400pcs/bag   | 2 bags/box |
| Tape & Box  | 180K~391K | 750pcs/box   | /          |
|             | 431K~621K | 500pcs/box   | /          |
|             | 681K~751K | 300pcs/box   | /          |
| Tape & Reel | 180K~391K | 1000pcs/reel | 1 reel/box |
|             | 431K~621K | 750pcs/reel  | 1 reel/box |
|             | 681K~751K | 500pcs/reel  | 1 reel/box |

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