

Metal Oxide Varistor (MOV) Data Sheet

Features

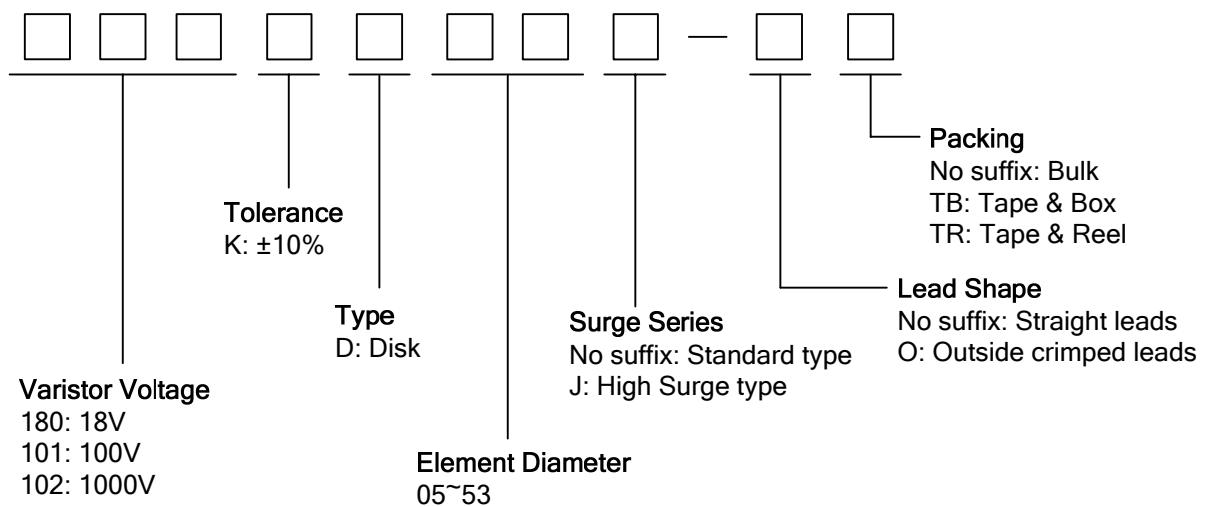
- Wide operating voltage (V_{1mA}) range from 18V to 750V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature: $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$
- Storage Temperature: $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Safety certification: UL: E327997
 CSA: 246579
 VDE: 40027827



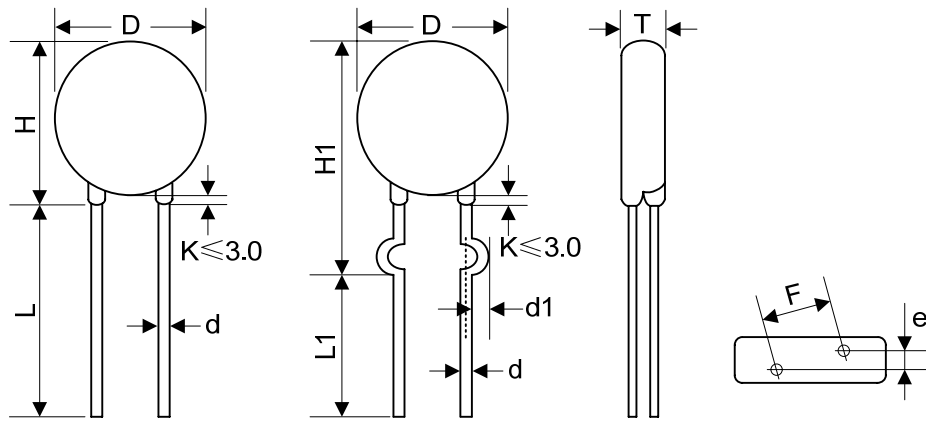
Applications

- Transistor, diode, IC, thyristor or triac semiconductor protection
- Surge protection in consumer electronics
- Surge protection in industrial electronics
- Surge protection in electronic home appliances, gas and petroleum appliances
- Relay and electromagnetic valve surge absorption

Part Number Code



Dimensions



O TYPE

| Table 1 | |
|----------|-----------|
| Unit: mm | |
| Symbol | Dimension |
| H | 5.5~10.0 |
| H1 | 8.0~13.0 |
| L(min.) | 20.0 |
| L1(min.) | 15.0 |
| D | 5.0~7.5 |
| F(±0.8) | 5.0 |
| T | Table 2 |
| e(±0.8) | Table 2 |
| d(±0.05) | 0.6 |
| d1(±0.4) | 1.2 |

| Table 2 | | | | | |
|----------|---------|-----|-------|---------|-----|
| Unit: mm | | | | | |
| Model | T | e | Model | T | e |
| 180K | 1.5~4.5 | 1.3 | 221K | 2.0~4.5 | 1.9 |
| 220K | 1.6~4.6 | 1.4 | 241K | 2.1~4.6 | 2.0 |
| 270K | 1.6~4.7 | 1.6 | 271K | 2.1~4.9 | 2.2 |
| 330K | 1.7~4.9 | 1.5 | 301K | 2.2~5.0 | 2.3 |
| 390K | 1.6~4.8 | 1.6 | 331K | 2.2~5.1 | 2.3 |
| 470K | 1.7~4.9 | 1.7 | 361K | 2.4~5.2 | 2.5 |
| 560K | 1.8~5.0 | 1.9 | 391K | 2.5~5.4 | 2.6 |
| 680K | 1.9~5.2 | 2.2 | 431K | 2.7~5.7 | 2.8 |
| 820K | 1.6~4.1 | 1.6 | 471K | 2.8~6.0 | 3.0 |
| 101K | 1.9~4.3 | 1.8 | 511K | 2.9~6.2 | 3.2 |
| 121K | 1.9~4.5 | 2.0 | 561K | 3.1~6.5 | 3.4 |
| 151K | 1.7~4.8 | 1.6 | 621K | 3.3~6.5 | 3.7 |
| 181K | 1.8~4.3 | 1.7 | 681K | 3.5~6.8 | 4.0 |
| 201K | 1.9~4.4 | 1.8 | 751K | 3.8~6.9 | 4.1 |

Electrical Characteristics

| Part Number | | Maximum Allowable Voltage | | Varistor Voltage | Maximum Clamping Voltage | | Withstanding Surge Current | | Maximum Energy (10/1000μs) | | Rated Power | Typical Capacitance (Reference) |
|-------------|------------|---------------------------|---------------------|----------------------|--------------------------|--------------------|----------------------------|------------------|----------------------------|----------------|-------------|---------------------------------|
| Standard | High Surge | V _{AC} (V) | V _{DC} (V) | V _{1mA} (V) | I _P (A) | V _C (V) | I (A) Standard | I (A) High Surge | (J) Standard | (J) High Surge | (W) | @1KHz (pf) |
| 180KD05 | 180KD05J | 11 | 14 | 18(15~21.6) | 1 | 40 | 100 | 250 | 0.4 | 0.6 | 0.01 | 1400 |
| 220KD05 | 220KD05J | 14 | 18 | 22(19.5~26) | 1 | 48 | 100 | 250 | 0.5 | 0.7 | 0.01 | 1150 |
| 270KD05 | 270KD05J | 17 | 22 | 27(24~31) | 1 | 60 | 100 | 250 | 0.6 | 0.9 | 0.01 | 930 |
| 330KD05 | 330KD05J | 20 | 26 | 33(29.5~36.5) | 1 | 73 | 100 | 250 | 0.8 | 1.1 | 0.01 | 760 |
| 390KD05 | 390KD05J | 25 | 31 | 39(35~43) | 1 | 80 | 100 | 250 | 0.9 | 1.2 | 0.01 | 640 |
| 470KD05 | 470KD05J | 30 | 38 | 47(42~52) | 1 | 104 | 100 | 250 | 1.1 | 1.5 | 0.01 | 530 |
| 560KD05 | 560KD05J | 35 | 45 | 56(50~62) | 1 | 123 | 100 | 250 | 1.3 | 1.8 | 0.01 | 450 |
| 680KD05 | 680KD05J | 40 | 56 | 68(61~75) | 1 | 145 | 100 | 250 | 1.6 | 2.2 | 0.01 | 370 |
| 820KD05 | 820KD05J | 50 | 65 | 82(74~90) | 5 | 150 | 400 | 800 | 2.5 | 4.0 | 0.1 | 300 |
| 101KD05 | 101KD05J | 60 | 85 | 100(90~110) | 5 | 177 | 400 | 800 | 3.0 | 4.1 | 0.1 | 250 |
| 121KD05 | 121KD05J | 75 | 100 | 120(108~132) | 5 | 210 | 400 | 800 | 4.0 | 4.9 | 0.1 | 210 |
| 151KD05 | 151KD05J | 95 | 125 | 150(135~165) | 5 | 260 | 400 | 800 | 4.1 | 6.5 | 0.1 | 165 |
| 181KD05 | 181KD05J | 115 | 150 | 180(162~198) | 5 | 320 | 400 | 800 | 4.9 | 7.5 | 0.1 | 140 |
| 201KD05 | 201KD05J | 130 | 170 | 200(180~220) | 5 | 355 | 400 | 800 | 6.5 | 8.5 | 0.1 | 125 |
| 221KD05 | 221KD05J | 140 | 180 | 220(198~242) | 5 | 380 | 400 | 800 | 7.5 | 9.0 | 0.1 | 110 |
| 241KD05 | 241KD05J | 150 | 200 | 240(216~264) | 5 | 415 | 400 | 800 | 8.0 | 10.5 | 0.1 | 100 |
| 271KD05 | 271KD05J | 175 | 225 | 270(243~297) | 5 | 475 | 400 | 800 | 8.5 | 11.0 | 0.1 | 95 |
| 301KD05 | 301KD05J | 190 | 250 | 300(270~330) | 5 | 520 | 400 | 800 | 9.0 | 12.0 | 0.1 | 85 |
| 331KD05 | 331KD05J | 210 | 275 | 330(297~363) | 5 | 570 | 400 | 800 | 9.5 | 13.0 | 0.1 | 75 |
| 361KD05 | 361KD05J | 230 | 300 | 360(324~396) | 5 | 620 | 400 | 800 | 10.0 | 16.0 | 0.1 | 70 |
| 391KD05 | 391KD05J | 250 | 320 | 390(351~429) | 5 | 675 | 400 | 800 | 12.0 | 17.0 | 0.1 | 65 |
| 431KD05 | 431KD05J | 275 | 350 | 430(387~473) | 5 | 745 | 400 | 800 | 13.0 | 20.0 | 0.1 | 60 |
| 471KD05 | 471KD05J | 300 | 385 | 470(423~517) | 5 | 810 | 400 | 800 | 15.0 | 21.0 | 0.1 | 55 |
| 511KD05 | 511KD05J | 320 | 415 | 510(459~561) | 5 | 845 | 400 | 800 | 16.0 | 22.5 | 0.1 | 50 |
| 561KD05 | 561KD05J | 350 | 460 | 560(504~616) | 5 | 920 | 400 | 800 | 16.0 | 24.0 | 0.1 | 45 |
| 621KD05 | 621KD05J | 385 | 505 | 620(558~682) | 5 | 1025 | 400 | 800 | 21.0 | 25.0 | 0.1 | 40 |
| 681KD05 | 681KD05J | 420 | 560 | 680(612~748) | 5 | 1120 | 400 | 800 | 21.0 | 29.0 | 0.1 | 35 |
| 751KD05 | 751KD05J | 460 | 615 | 750(675~825) | 5 | 1240 | 400 | 800 | 22.4 | 32.0 | 0.1 | 30 |

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

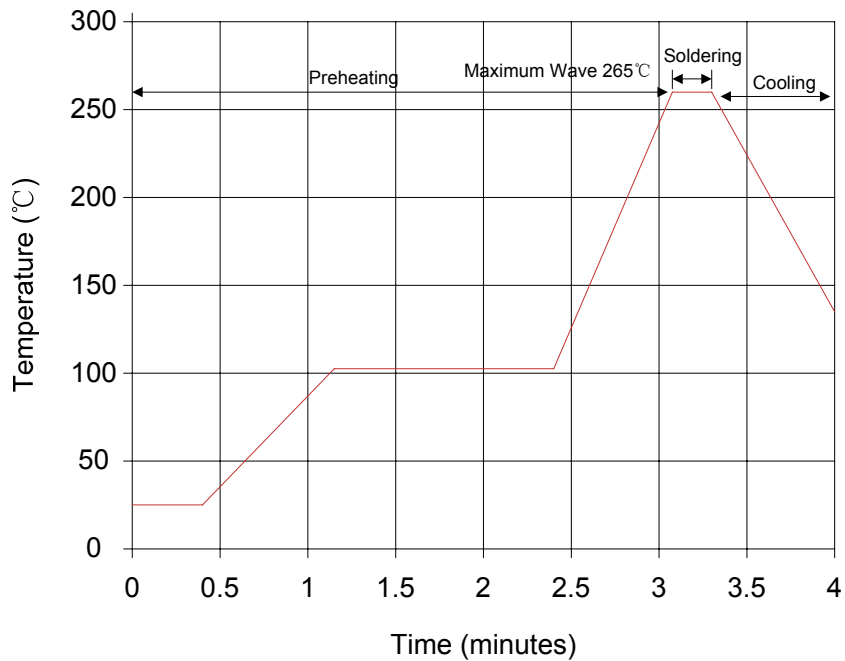
2. Leakage Current (@83% of V_{1mA}): IR≤50μA (180K~680K)
 IR≤25μA (820K~751K)

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. | | | | | | |
| 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. Applied waveform: 8/20μs</p> | To meet the Specified value | | | | | |
| 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 $ | ≤0.05%/°C | | | | | |
| | $\left \frac{V_{1mA@-40^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{65} \times 100\% (\%/^{\circ}C) \right $ | | | | | | |
| Surge Life | <p>The change of Vb shall be measured after the impulse listed below which is applied 10,000 times continuously with the interval of ten seconds at room temperature.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td rowspan="2">5Φ series</td> <td>180K to 680K</td> <td>10A (8/20μs)</td> </tr> <tr> <td>820K to 751K</td> <td>20A (8/20μs)</td> </tr> </table> | 5Φ series | 180K to 680K | 10A (8/20μs) | 820K to 751K | 20A (8/20μs) | $\frac{\Delta V_b}{V_b} \leq \pm 10\%$ |
| 5Φ series | 180K to 680K | | 10A (8/20μs) | | | | |
| | 820K to 751K | 20A (8/20μs) | | | | | |

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.) |

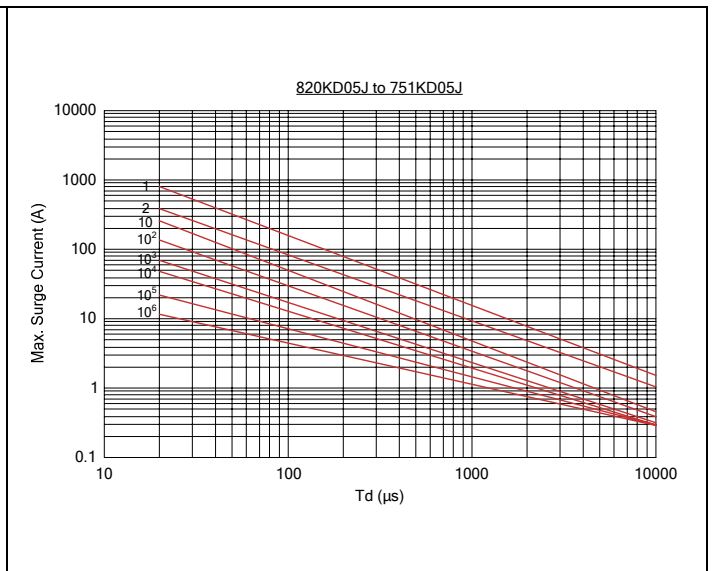
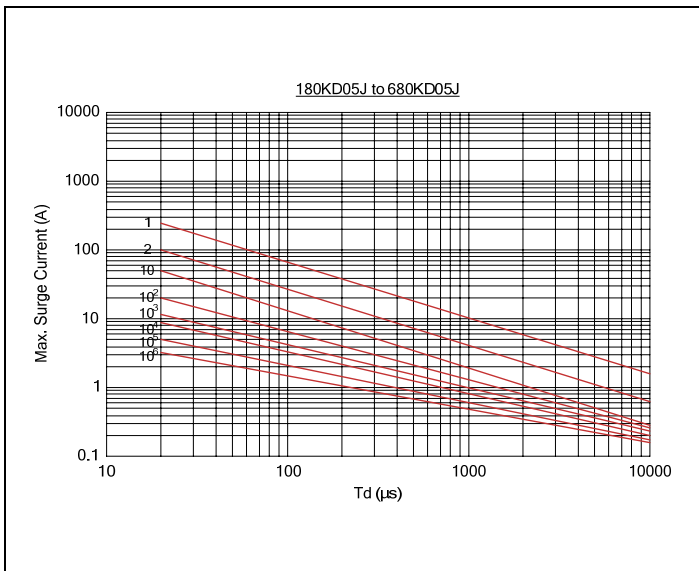
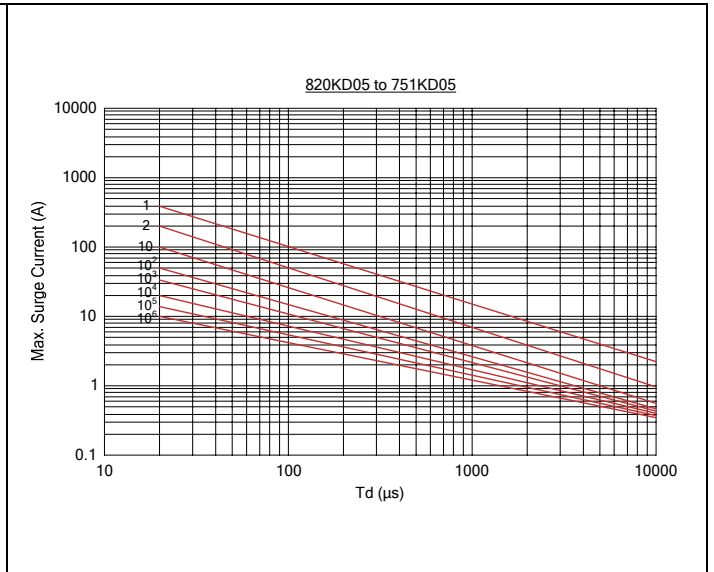
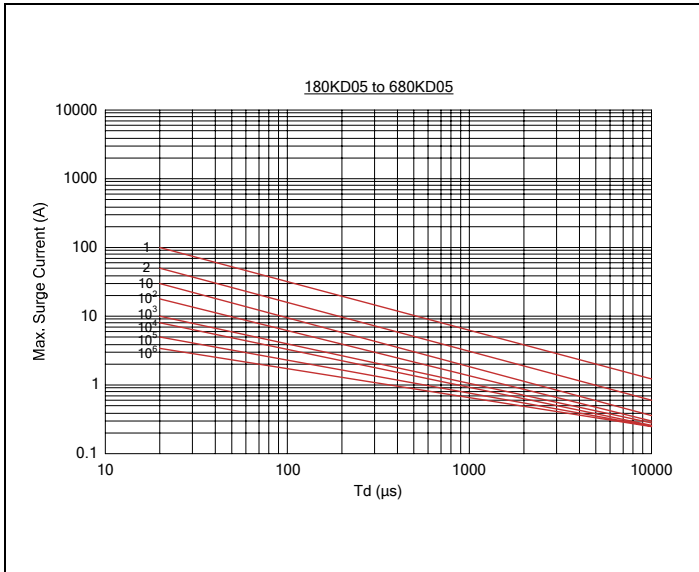
Mechanical Characteristics

| Items | Test conditions / Methods | Specifications | | | | | | | | |
|-------------------------------|--|--|------------|-----------|-----|------------|-----|--------|-----|---|
| Tensile Strength of Terminals | Gradually applying the force specified and keeping the unit fixed for 10±1 sec. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Terminal diameter (mm)</th> <th>Force (kg)</th> </tr> </thead> <tbody> <tr> <td>0.5<d≤0.8</td> <td>1.0</td> </tr> <tr> <td>0.8<d≤1.25</td> <td>2.0</td> </tr> <tr> <td>1.25<d</td> <td>4.0</td> </tr> </tbody> </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 ΔV _{1mA} /V _{1mA} ≤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. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Terminal diameter (mm)</th> <th>Force (kg)</th> </tr> </thead> <tbody> <tr> <td>0.5<d≤0.8</td> <td>0.5</td> </tr> <tr> <td>0.8<d≤1.25</td> <td>1.0</td> </tr> <tr> <td>1.25<d</td> <td>2.0</td> </tr> </tbody> </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 ΔV _{1mA} /V _{1mA} ≤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 Amplitude: 0.75mm or 98m/s ² Direction: 3 mutually perpendicular directions, 2hrs each. | No visible damage ΔV _{1mA} /V _{1mA} ≤5% | | | | | | | | |
| Solder ability | Solder Temp: 245±5°C 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 Dipping Time: 10±1 sec | No visible damage ΔV _{1mA} /V _{1mA} ≤10% | | | | | | | | |

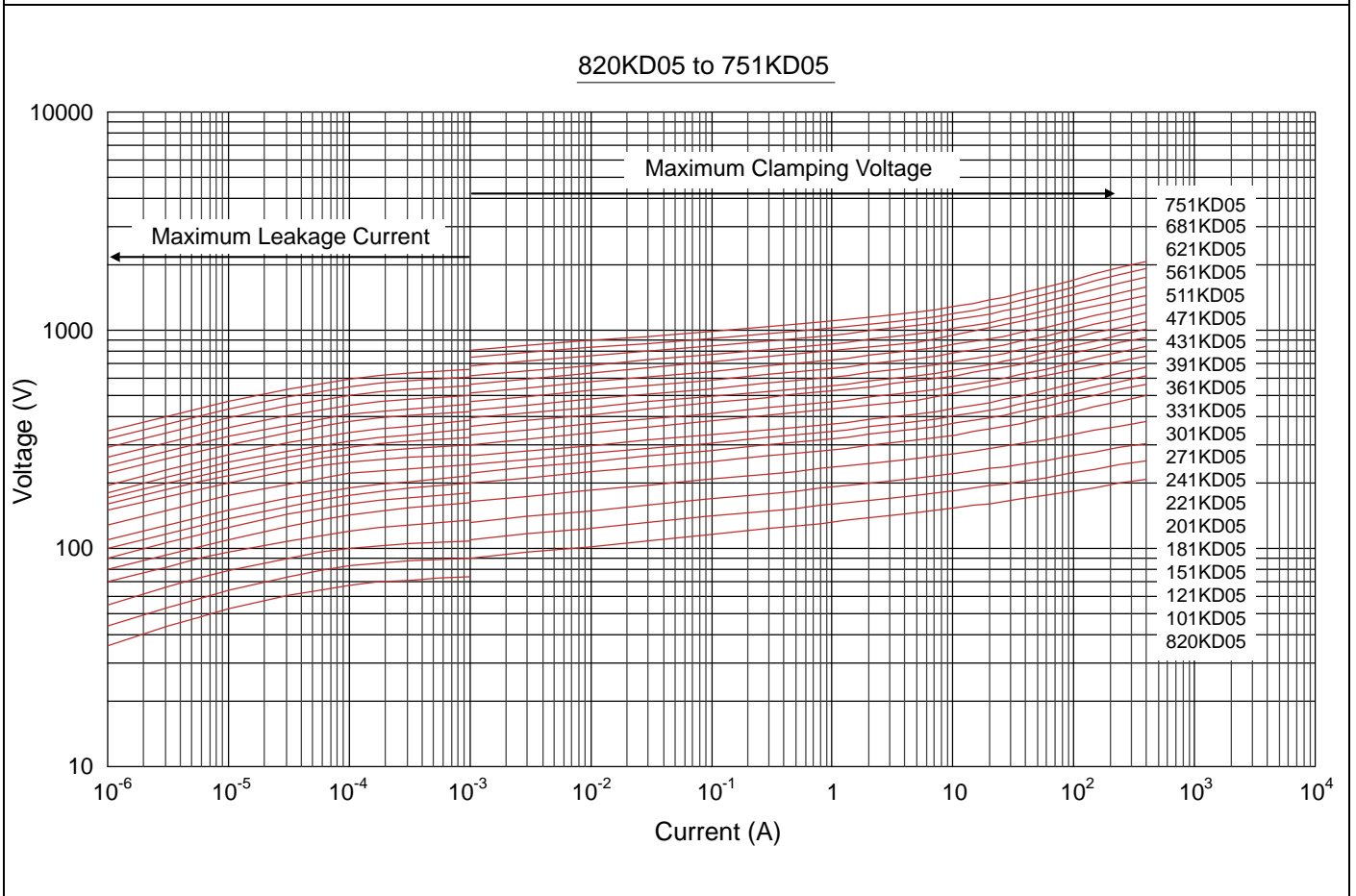
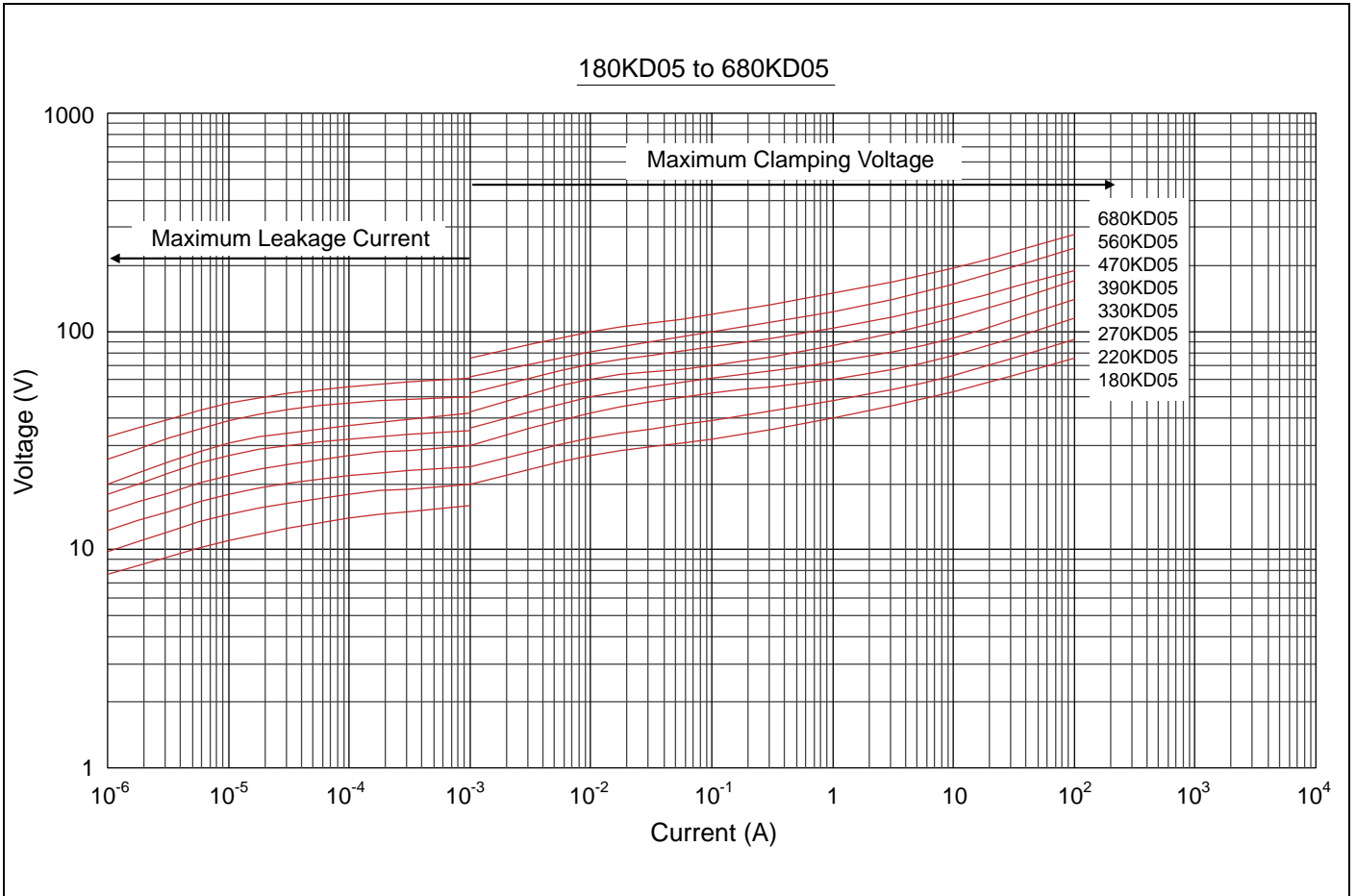
Reliability

| Items | Test conditions / Methods | Specifications | | | | | | | | | | | | | | | |
|--------------------------|--|--|------------------|------------------|---|-------|------|---|------------------|------|---|-------|------|---|------------------|------|---|
| High Temperature Storage | Ambient Temp: 125±2°C Duration: 1000hrs | ΔV _{1mA} /V _{1mA} ≤5% | | | | | | | | | | | | | | | |
| Low Temperature Storage | Ambient Temp: -40±2°C Duration: 1000hrs | ΔV _{1mA} /V _{1mA} ≤5% | | | | | | | | | | | | | | | |
| Humidity | Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs | ΔV _{1mA} /V _{1mA} ≤5% | | | | | | | | | | | | | | | |
| Temperature Cycle | The conditions shown below shall be repeated 5 cycles <table border="1" style="margin-left: auto; margin-right: auto;"> <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 ΔV _{1mA} /V _{1mA} ≤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: 85±2°C Duration: 1000hrs Load: Max. Allowable Voltage In AC eara. | ΔV _{1mA} /V _{1mA} ≤10% | | | | | | | | | | | | | | | |
| Damp Heat Load | Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs Load: Max. Allowable Voltage | No visible damage ΔV _{1mA} /V _{1mA} ≤10% | | | | | | | | | | | | | | | |
| Voltage Proof | Metal balls method, 2500Vac 1 min. | No visible damage | | | | | | | | | | | | | | | |

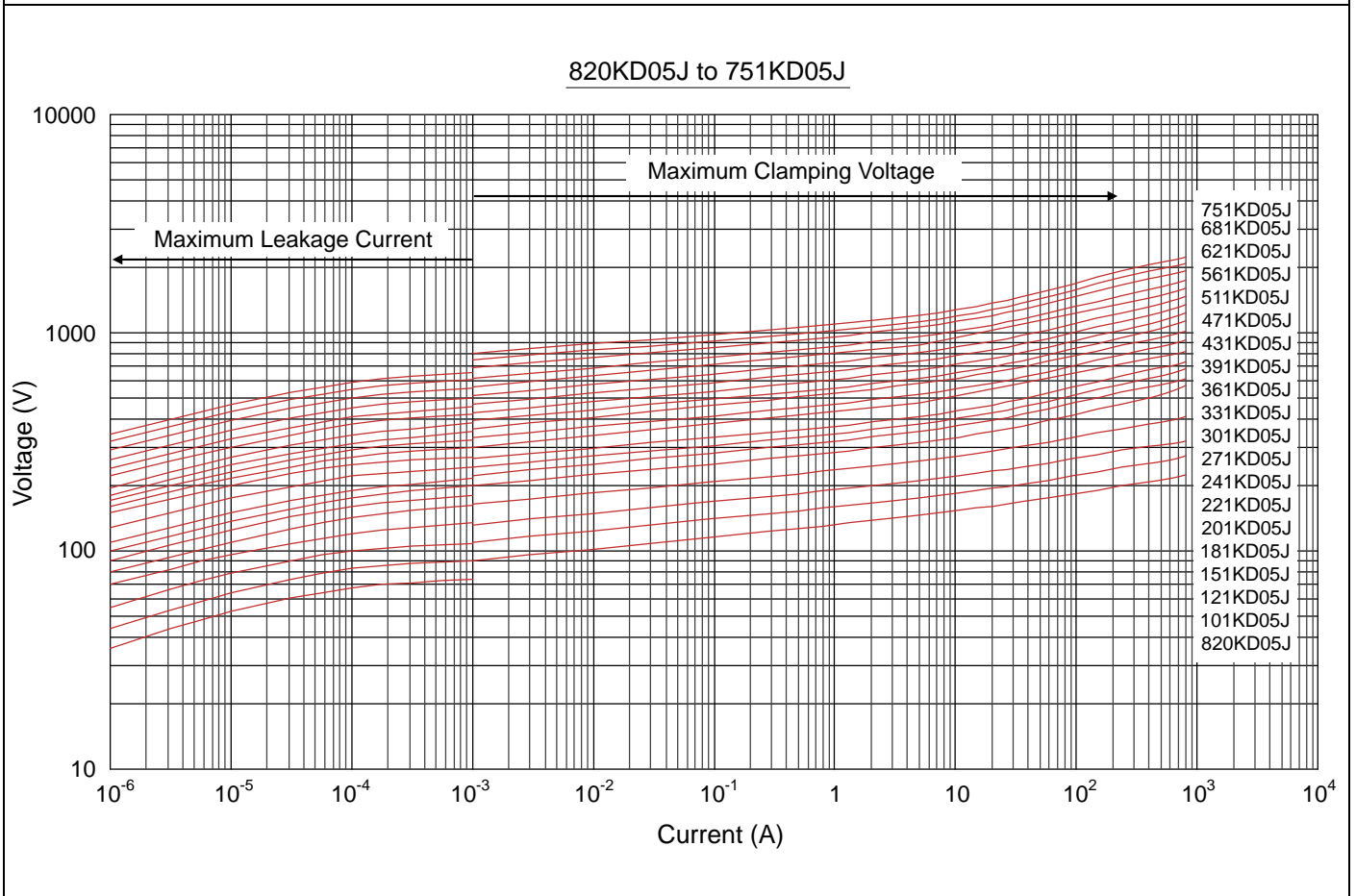
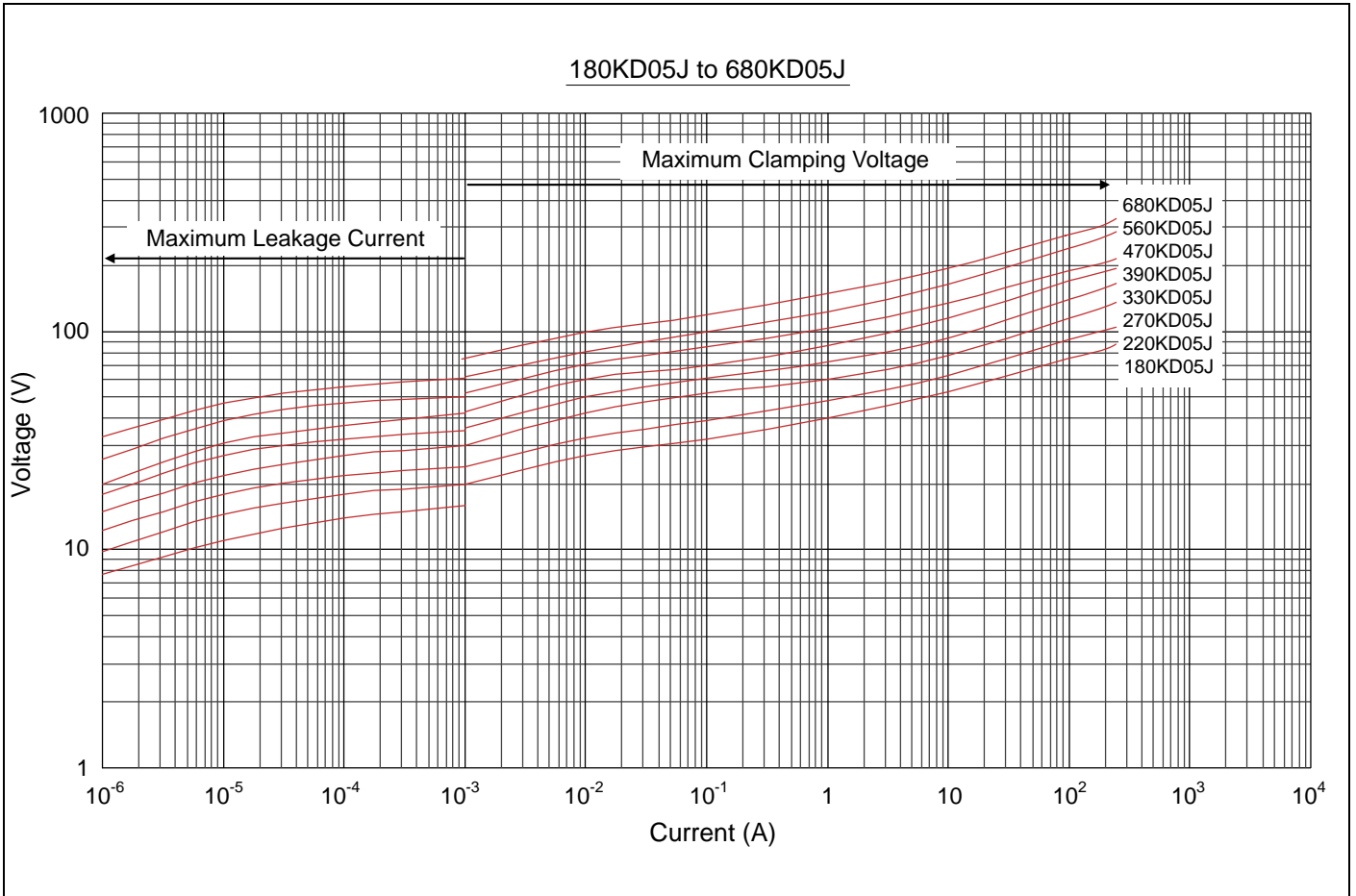
Maximum Surge Current Derating Curve



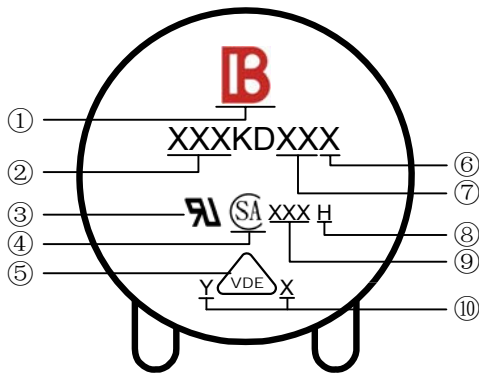
Maximum Leakage Current and Maximum Clamping Voltage Curve



Maximum Leakage Current and Maximum Clamping Voltage Curve

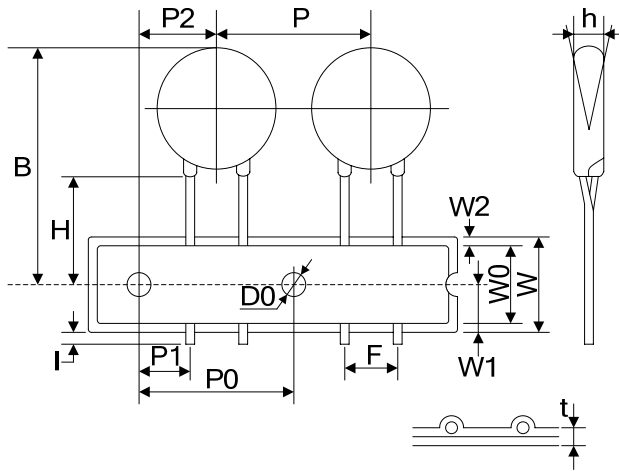


Marking Code




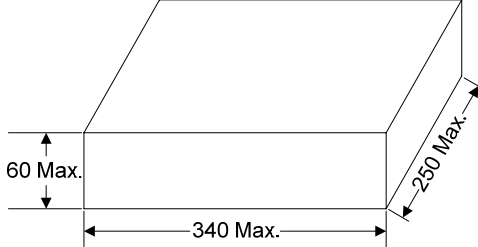
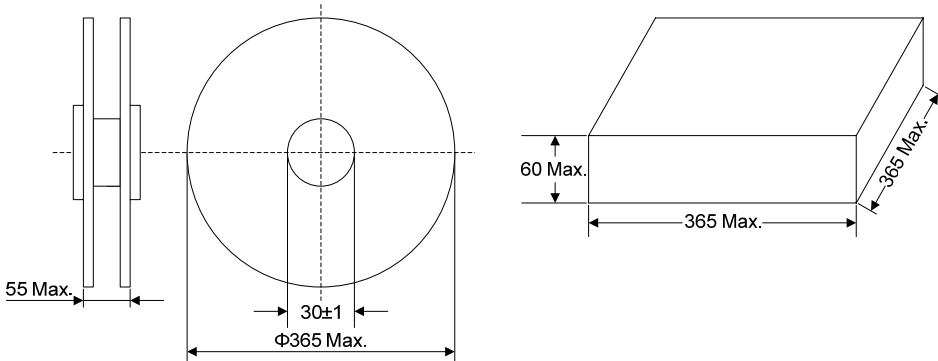
- ① Brightking Logo
- ② Varistor Voltage
- ③ UL Accreditation Logo
- ④ CSA Accreditation Logo
- ⑤ VDE Accreditation Logo
- ⑥ “J” is High Surge Code, no “J” is Standard Surge
- ⑦ Disk Size
- ⑧ “H” is Halogen Free Code, no “H” is Halogen
- ⑨ Date Code
- ⑩ Product Line Code (“Y” may be A thru Z or blank)

Taping Dimensions



| Symbol | Dimension (mm) |
|--------|----------------|
| P | 12.7±1.0 |
| P0 | 12.7±0.3 |
| P1 | 3.85±0.7 |
| P2 | 6.35±1.3 |
| F | 5.0±0.8 |
| h | 0±2 |
| W | 18.0±1.0 |
| W0 | 12.0±1.0 |
| W1 | 9.0±0.5 |
| W2 | 3.0max |
| H | 20.0±2.0 |
| I | 1.0max |
| D0 | 4.0±0.2 |
| t | 0.6±0.3 |
| B | 32max |

Quantity

| Packaging Dimensions (Unit: mm) | Quantity |
|---|-------------------------------------|
| <p>Bulk</p>  | <p>1000pcs/bag 2bags/box</p> |
| <p>Tape & Box</p>  | <p>1500pcs/box (180K~391K)</p> |
| <p>Tape & Reel</p>  | <p>2000pcs/reel (180K~391K)</p> |
| | <p>1500pcs/reel (431K~751K)</p> |

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