

## Metal Oxide Varistors (MOV) Data Sheet

### Features

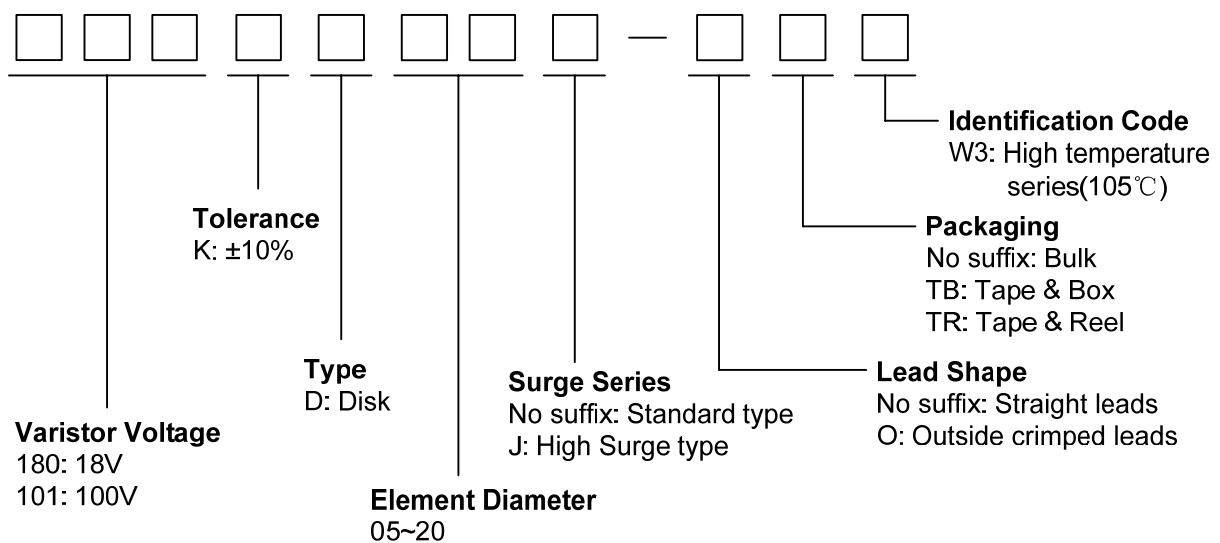
- Wide operating voltage ( $V_{1mA}$ ) range from 18V to 820V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature:  $-40^{\circ}\text{C} \sim +105^{\circ}\text{C}$
- Storage Temperature:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Safety certification: UL: E327997  
CSA: 246579  
VDE: 40027827



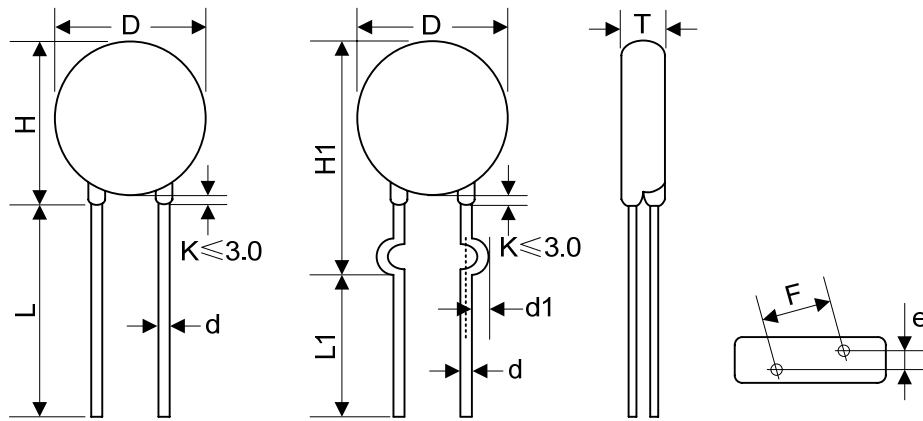
### Applications

- 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	7.5~12.0
H1	9.0~13.5
L(min.)	20.0
L1(min.)	15.0
D	7.0~9.0
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	241K	2.1~4.6	2.0
220K	1.6~4.6	1.4	271K	2.1~4.9	2.2
270K	1.6~4.7	1.6	301K	2.2~5.0	2.3
330K	1.7~4.9	1.5	331K	2.2~5.1	2.3
390K	1.6~4.8	1.6	361K	2.4~5.2	2.5
470K	1.7~4.9	1.7	391K	2.5~5.4	2.6
560K	1.8~5.0	1.9	431K	2.7~5.7	2.8
680K	1.9~5.2	2.2	471K	2.8~6.0	3.0
820K	1.6~4.1	1.6	511K	2.9~6.2	3.2
101K	1.9~4.3	1.8	561K	3.1~6.5	3.4
121K	1.9~4.5	2.0	621K	3.3~7.1	3.7
151K	1.7~4.8	1.6	681K	3.5~7.3	4.0
181K	1.8~4.3	1.7	751K	3.8~7.0	4.1
201K	1.9~4.4	1.8	781K	3.9~7.2	4.2
221K	2.0~4.5	1.9	821K	4.1~7.5	4.4

**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 <sub>AC</sub> (V)	V <sub>DC</sub> (V)	V <sub>1mA</sub> (V)	I <sub>P</sub> (A)	V <sub>C</sub> (V)	I (A) Standard	I (A) High Surge	(J) Standard	(J) High Surge	(W)	@1KHz (pf)
180KD07-W3	180KD07J-W3	11	14	15~21.6	2.5	36	250	500	0.9	2.0	0.02	2800
220KD07-W3	220KD07J-W3	14	18	19.5~26	2.5	43	250	500	1.1	2.4	0.02	2300
270KD07-W3	270KD07J-W3	17	22	24~31	2.5	53	250	500	1.4	3.0	0.02	1800
330KD07-W3	330KD07J-W3	20	26	29.5~36.5	2.5	65	250	500	1.7	3.5	0.02	1500
390KD07-W3	390KD07J-W3	25	31	35~43	2.5	77	250	500	2.1	4.0	0.02	1300
470KD07-W3	470KD07J-W3	30	38	42~52	2.5	93	250	500	2.5	5.0	0.02	1100
560KD07-W3	560KD07J-W3	35	45	50~62	2.5	110	250	500	3.1	6.0	0.02	890
680KD07-W3	680KD07J-W3	40	56	61~75	2.5	135	250	500	3.6	7.0	0.02	740
820KD07-W3	820KD07J-W3	50	65	74~90	10	135	1200	1750	5.0	10.0	0.25	600
101KD07-W3	101KD07J-W3	60	85	90~110	10	165	1200	1750	6.5	12.0	0.25	500
121KD07-W3	121KD07J-W3	75	100	108~132	10	200	1200	1750	7.8	13.0	0.25	420
151KD07-W3	151KD07J-W3	95	125	135~165	10	250	1200	1750	9.7	13.0	0.25	330
181KD07-W3	181KD07J-W3	115	150	162~198	10	300	1200	1750	11.7	16.0	0.25	280
201KD07-W3	201KD07J-W3	130	170	180~220	10	340	1200	1750	13.0	17.0	0.25	250
221KD07-W3	221KD07J-W3	140	180	198~242	10	360	1200	1750	14.0	19.0	0.25	230
241KD07-W3	241KD07J-W3	150	200	216~264	10	395	1200	1750	15.0	21.0	0.25	210
271KD07-W3	271KD07J-W3	175	225	243~297	10	455	1200	1750	18.0	24.0	0.25	185
301KD07-W3	301KD07J-W3	190	250	270~330	10	500	1200	1750	20.0	26.0	0.25	165
331KD07-W3	331KD07J-W3	210	275	297~363	10	550	1200	1750	23.0	28.0	0.25	150
361KD07-W3	361KD07J-W3	230	300	324~396	10	595	1200	1750	25.0	32.0	0.25	140
391KD07-W3	391KD07J-W3	250	320	351~429	10	650	1200	1750	25.0	35.0	0.25	130
431KD07-W3	431KD07J-W3	275	350	387~473	10	710	1200	1750	28.0	40.0	0.25	115
471KD07-W3	471KD07J-W3	300	385	423~517	10	775	1200	1750	30.0	42.0	0.25	105
511KD07-W3	511KD07J-W3	320	415	459~561	10	845	1200	1750	30.0	45.0	0.25	100
561KD07-W3	561KD07J-W3	350	460	504~616	10	925	1200	1750	30.0	49.0	0.25	90
621KD07-W3	621KD07J-W3	385	505	558~682	10	1025	1200	1750	33.0	55.0	0.25	80
681KD07-W3	681KD07J-W3	420	560	612~748	10	1120	1200	1750	33.0	60.0	0.25	75
751KD07-W3	751KD07J-W3	460	615	675~825	10	1240	1200	1750	67.2	65.0	0.25	70
781KD07-W3	781KD07J-W3	485	640	702~858	10	1290	1200	1750	67.2	65.0	0.25	70
821KD07-W3	821KD07J-W3	510	670	738~902	10	1355	1200	1750	67.2	70.0	0.25	60

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≤50μA (180K~680K)

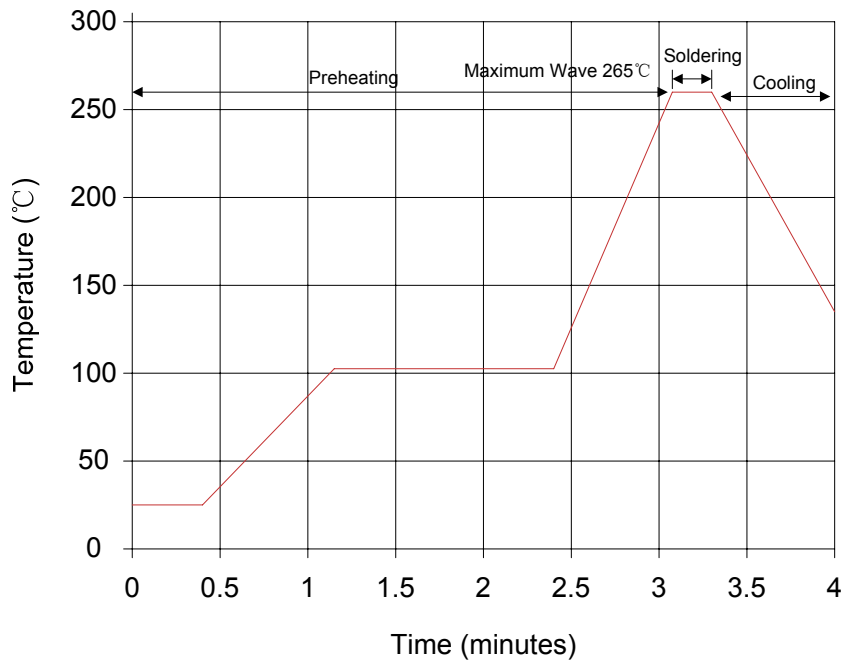
IR≤25μA (820K~821K)

**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@105^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{80} \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" style="text-align: center;">7Φ series</td> <td style="text-align: center;">180K to 680K</td> <td style="text-align: center;">25A (8/20μs)</td> </tr> <tr> <td style="text-align: center;">820K to 821K</td> <td style="text-align: center;">50A (8/20μs)</td> </tr> </table>	7Φ series	180K to 680K	25A (8/20μs)	820K to 821K	50A (8/20μs)	$\frac{\Delta V_b}{V_b} \leq \pm 10\%$
7Φ series	180K to 680K		25A (8/20μs)				
	820K to 821K	50A (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.)

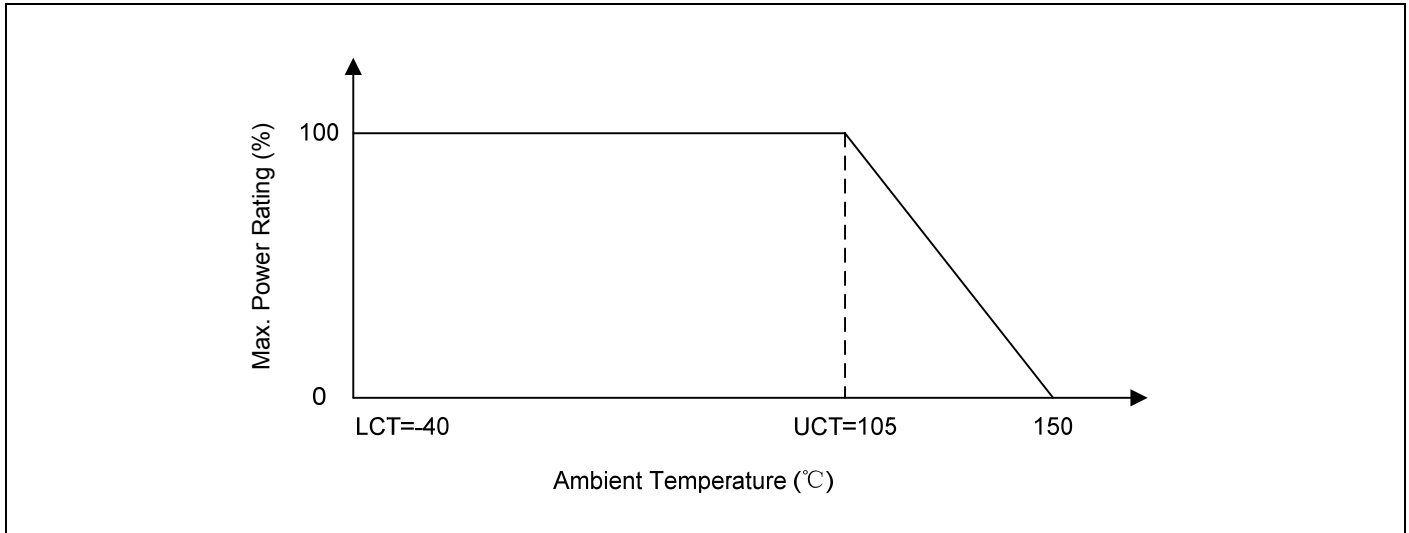
**Mechanical Characteristics**

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&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> </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 <sub>1mA</sub> /V <sub>1mA</sub>   ≤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&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> </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 <sub>1mA</sub> /V <sub>1mA</sub>   ≤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 <sup>2</sup> Direction: 3 mutually perpendicular directions, 2hrs each.	No visible damage  ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤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 <sub>1mA</sub> /V <sub>1mA</sub>   ≤10%								

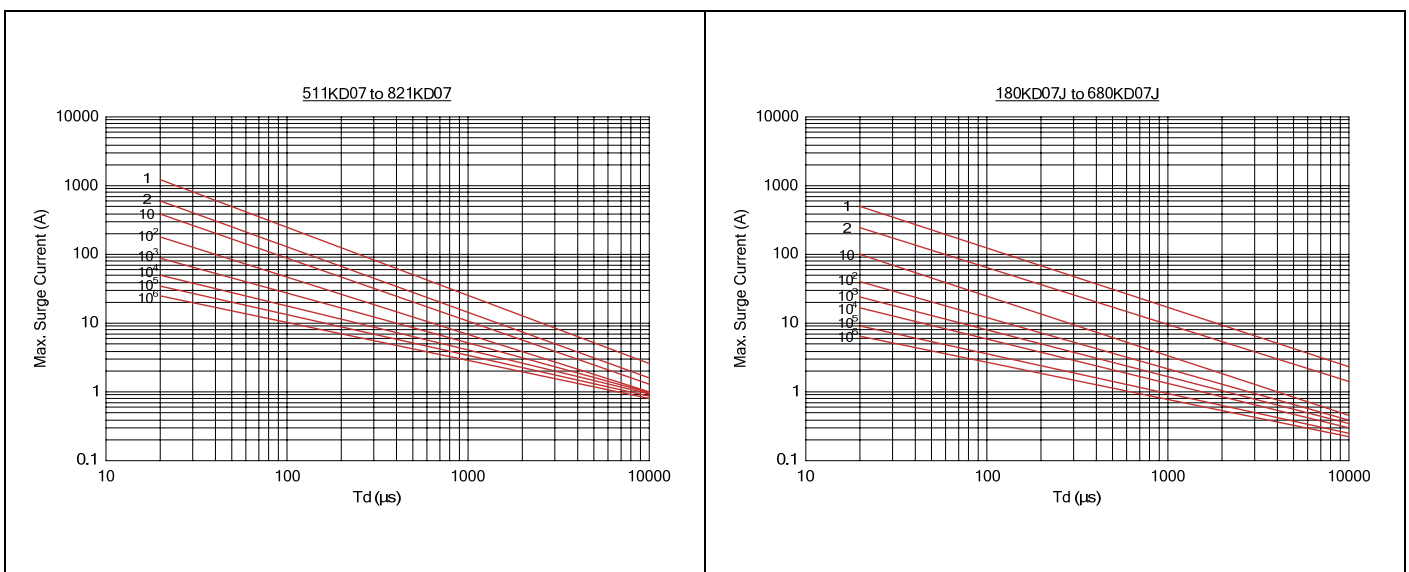
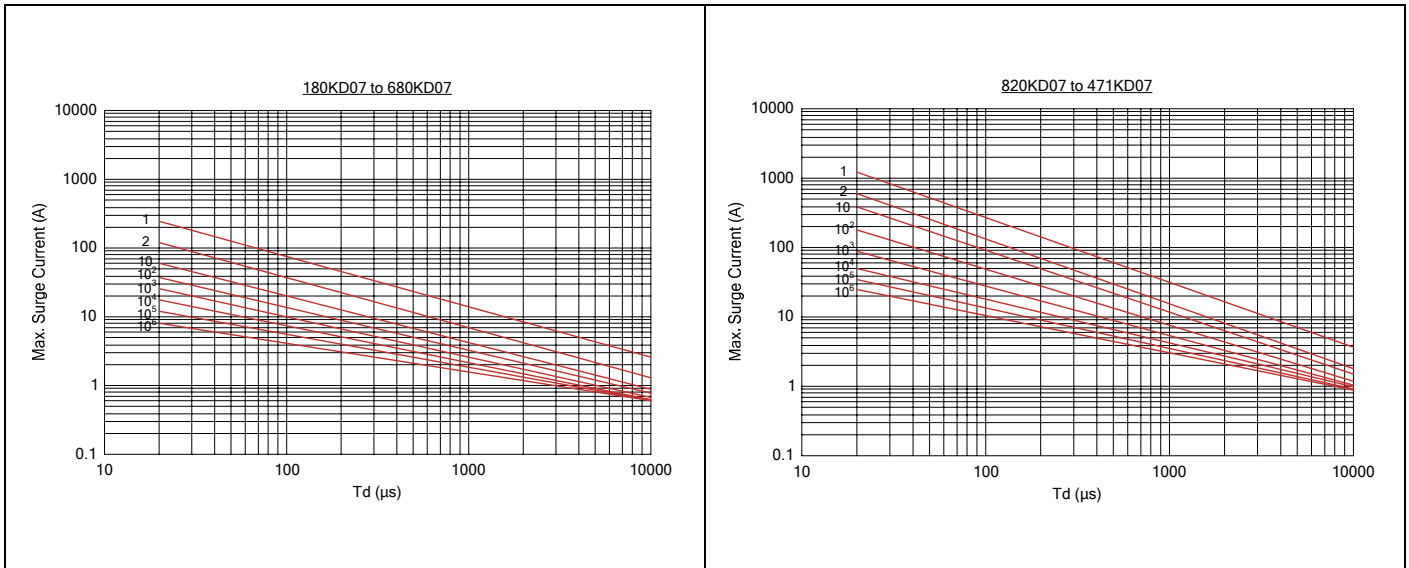
**Reliability**

Items	Test conditions / Methods	Specifications															
High Temperature Storage	Ambient Temp: 125±2°C Duration: 1000hrs	ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤5%															
Low Temperature Storage	Ambient Temp: -40±2°C Duration: 1000hrs	ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤5%															
Humidity	Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs	ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤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 <sub>1mA</sub> /V <sub>1mA</sub>   ≤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      Duration: 1000hrs Load: Max. Allowable Voltage In AC eara.	ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤10%															
Damp Heat Load	Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs      Load: Max. Allowable Voltage	No visible damage  ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤10%															
Voltage Proof	Metal balls method, 2500Vac 1 min.	No visible damage															

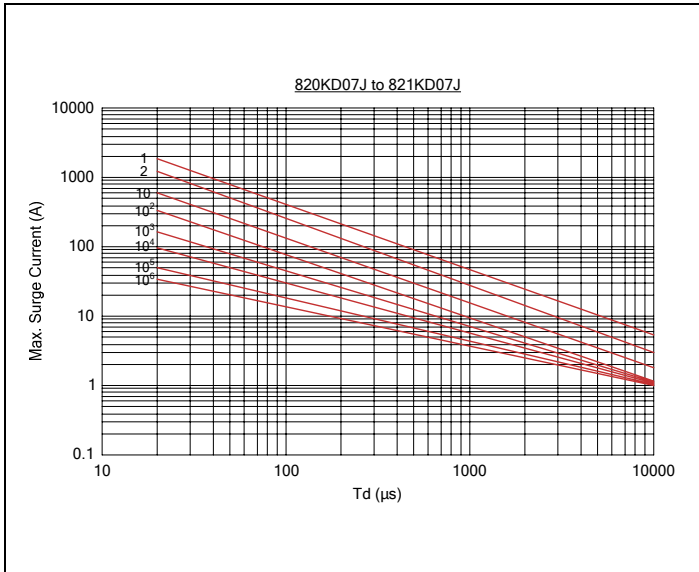
**Power Derating Curve**



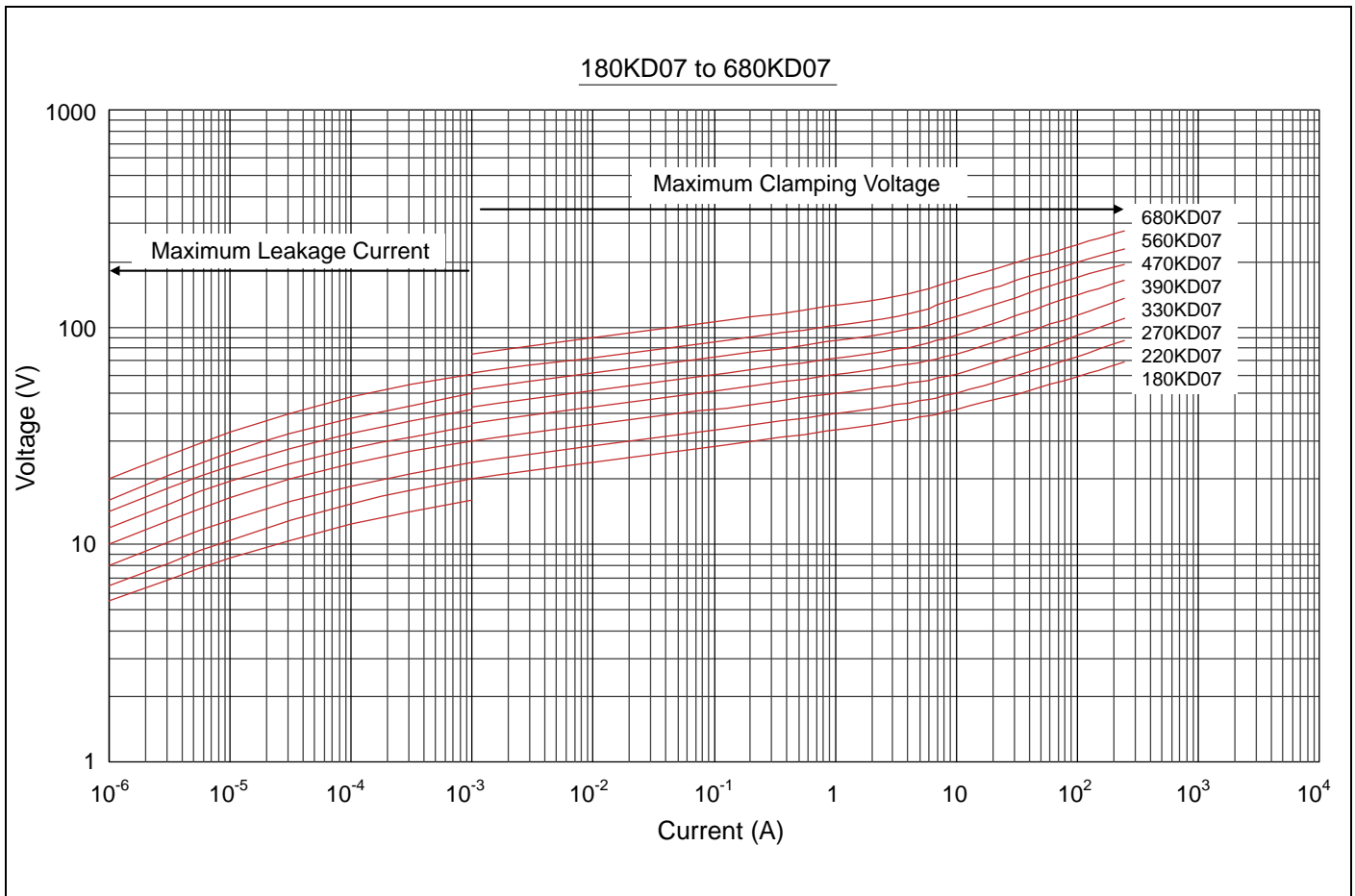
**Maximum Surge Current Derating Curve**



**Maximum Surge Current Derating Curve**

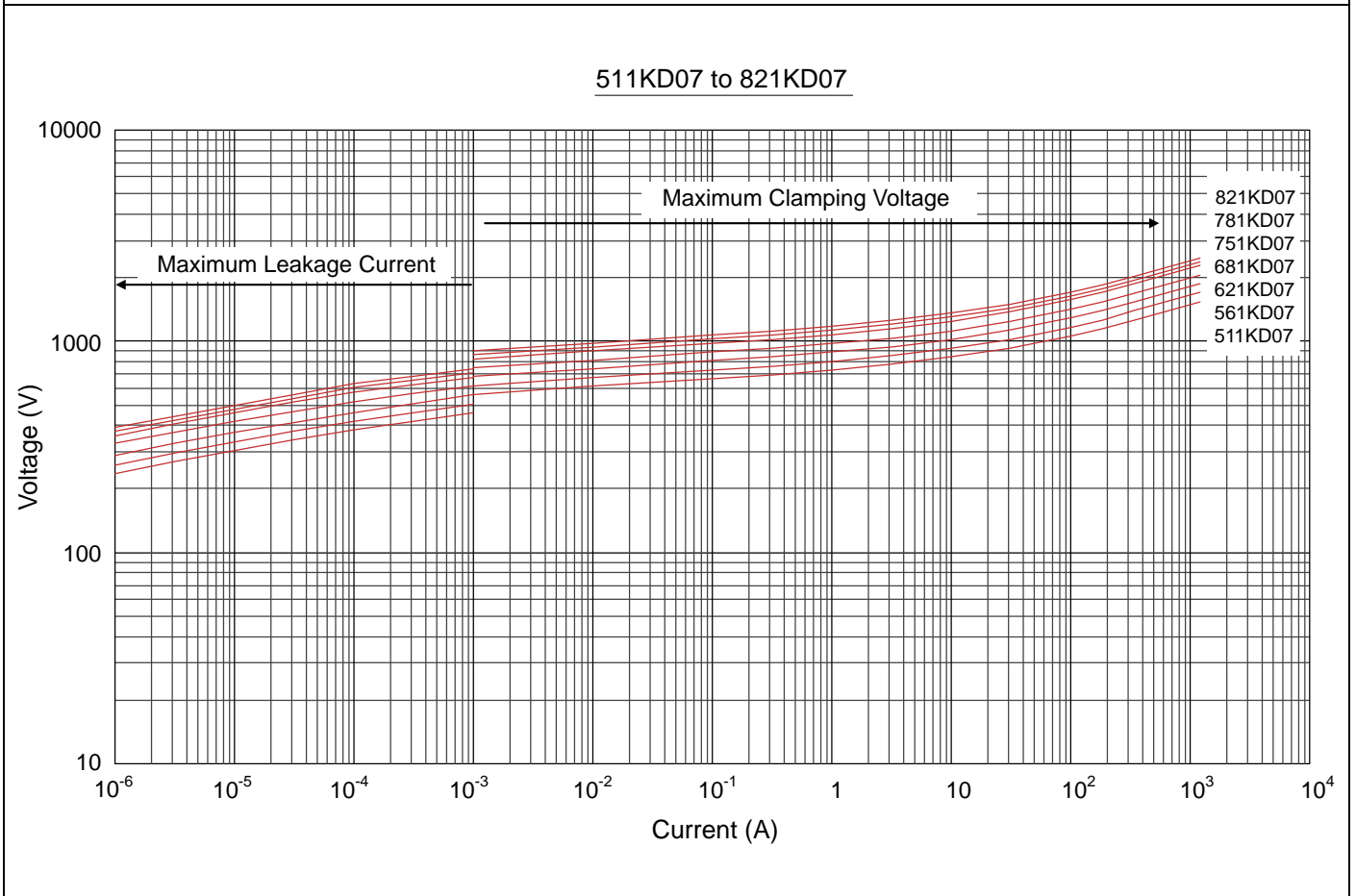
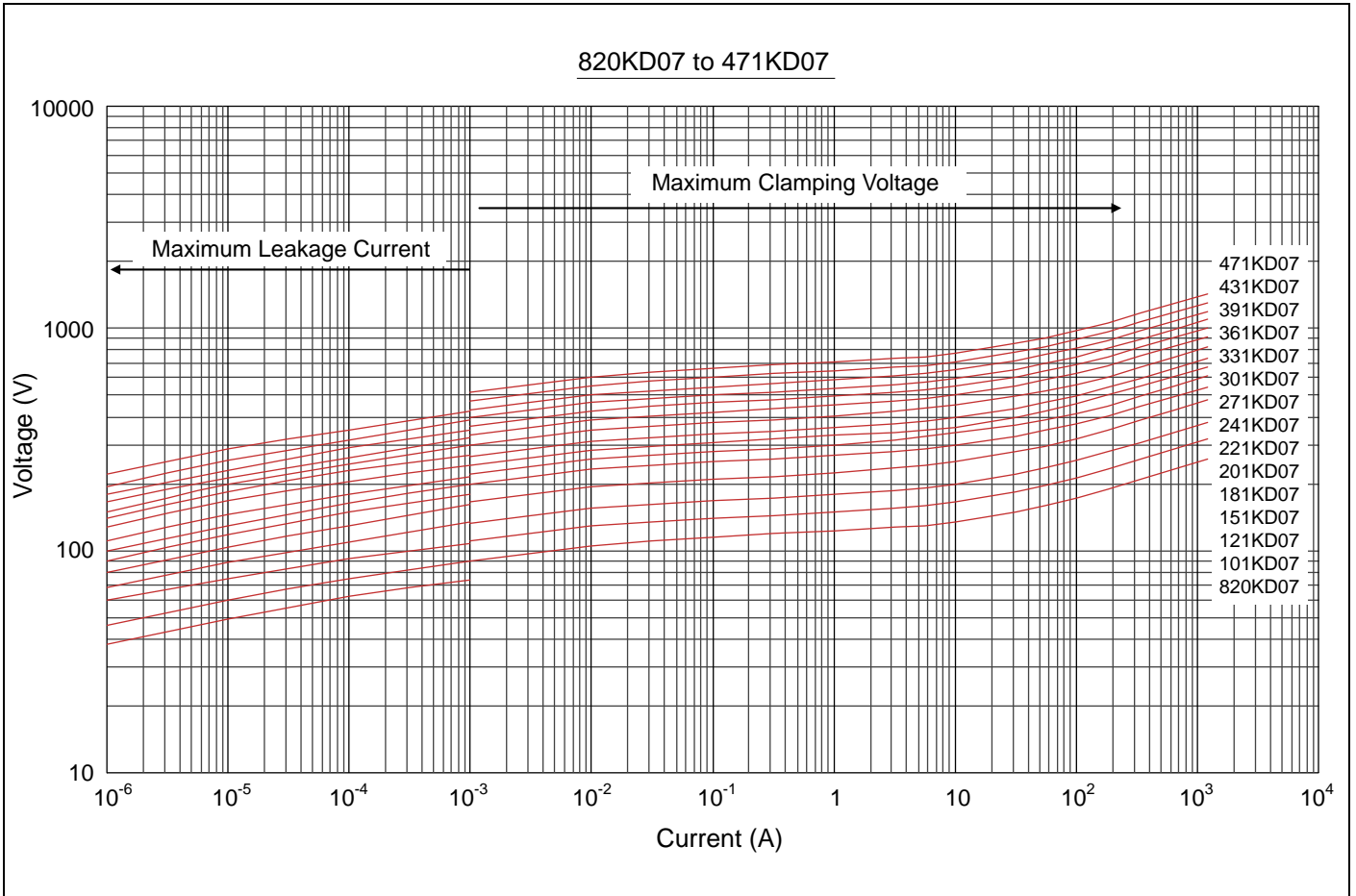


**Maximum Leakage Current and Maximum Clamping Voltage Curve**

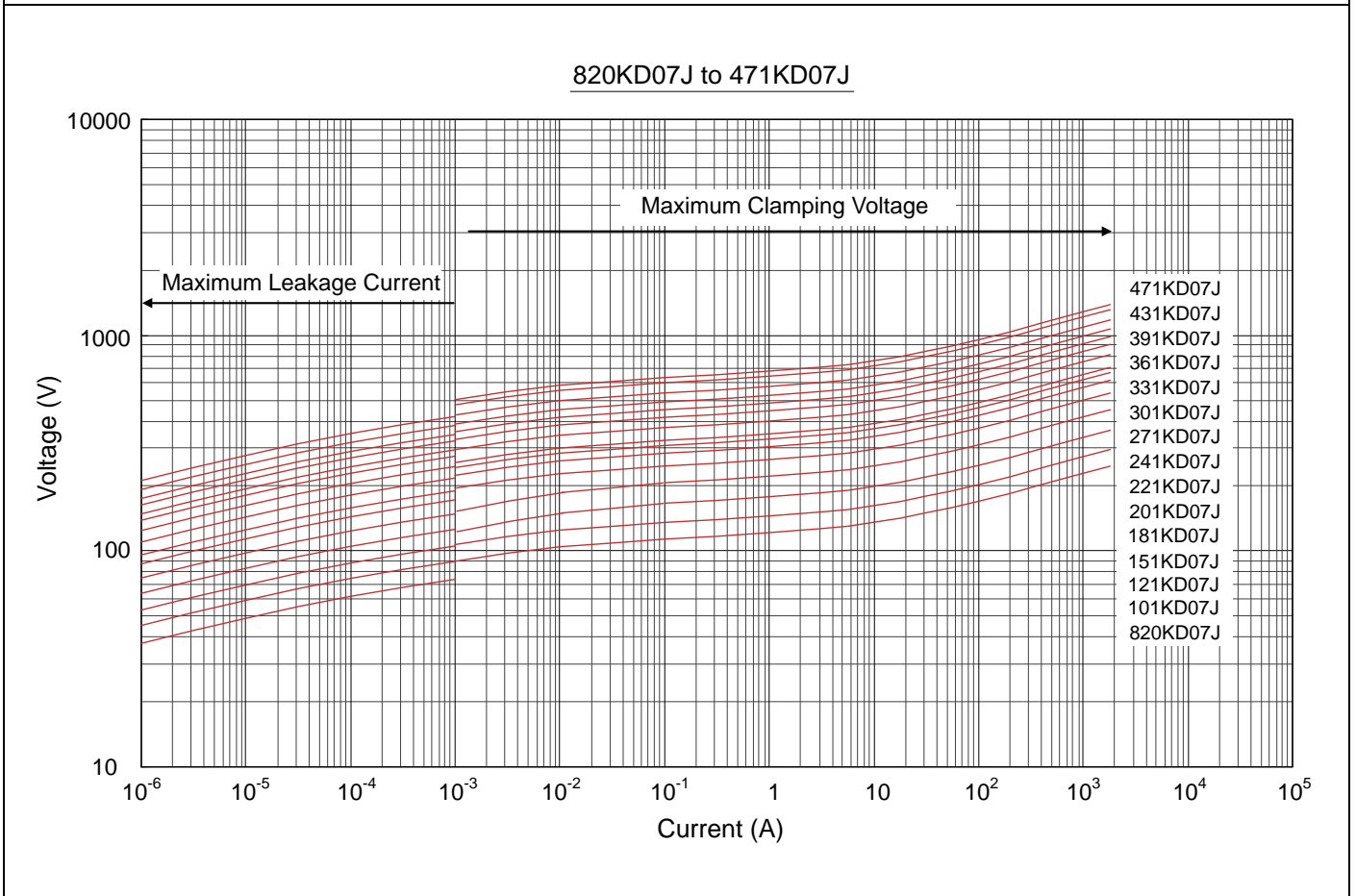
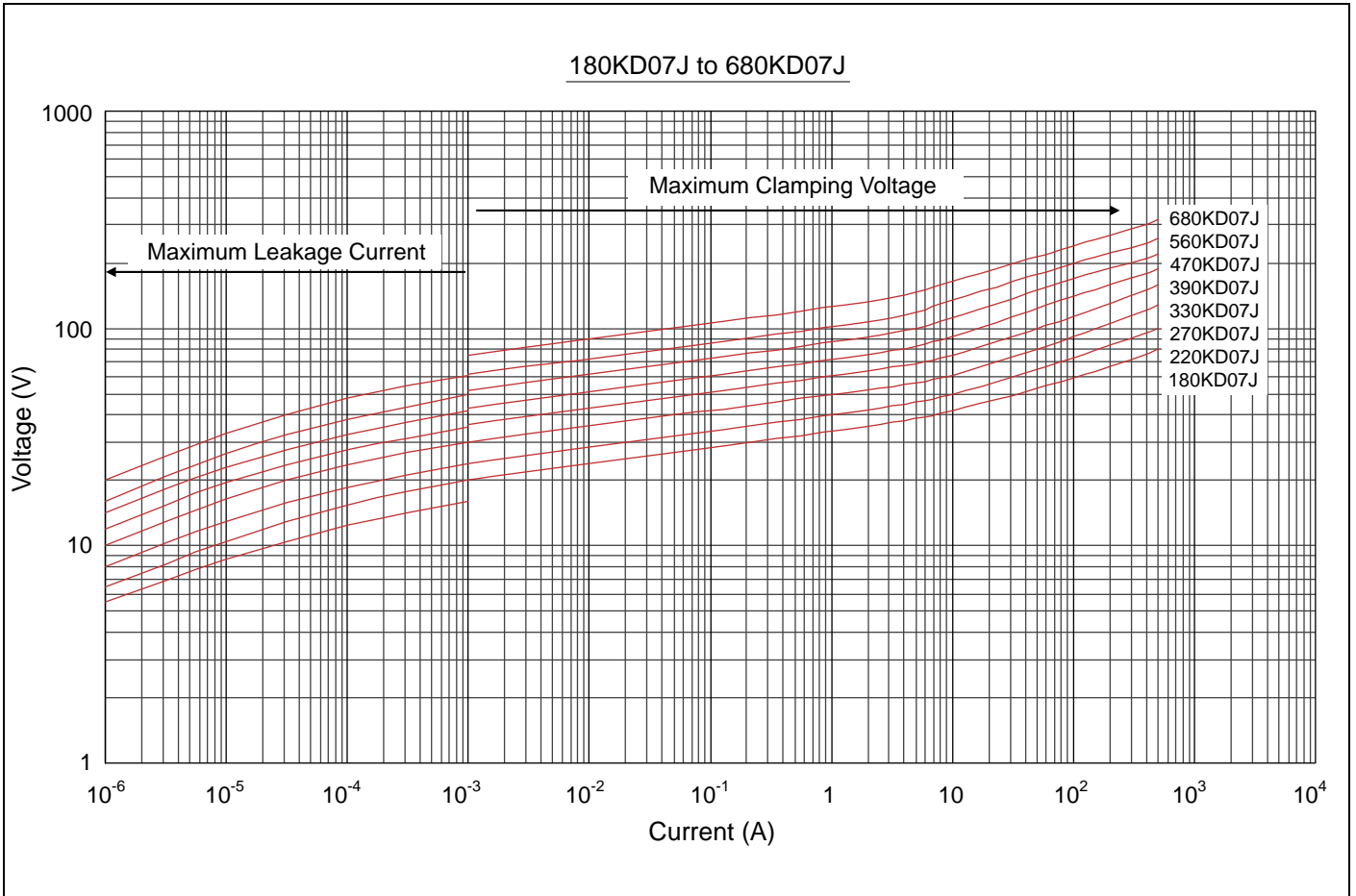




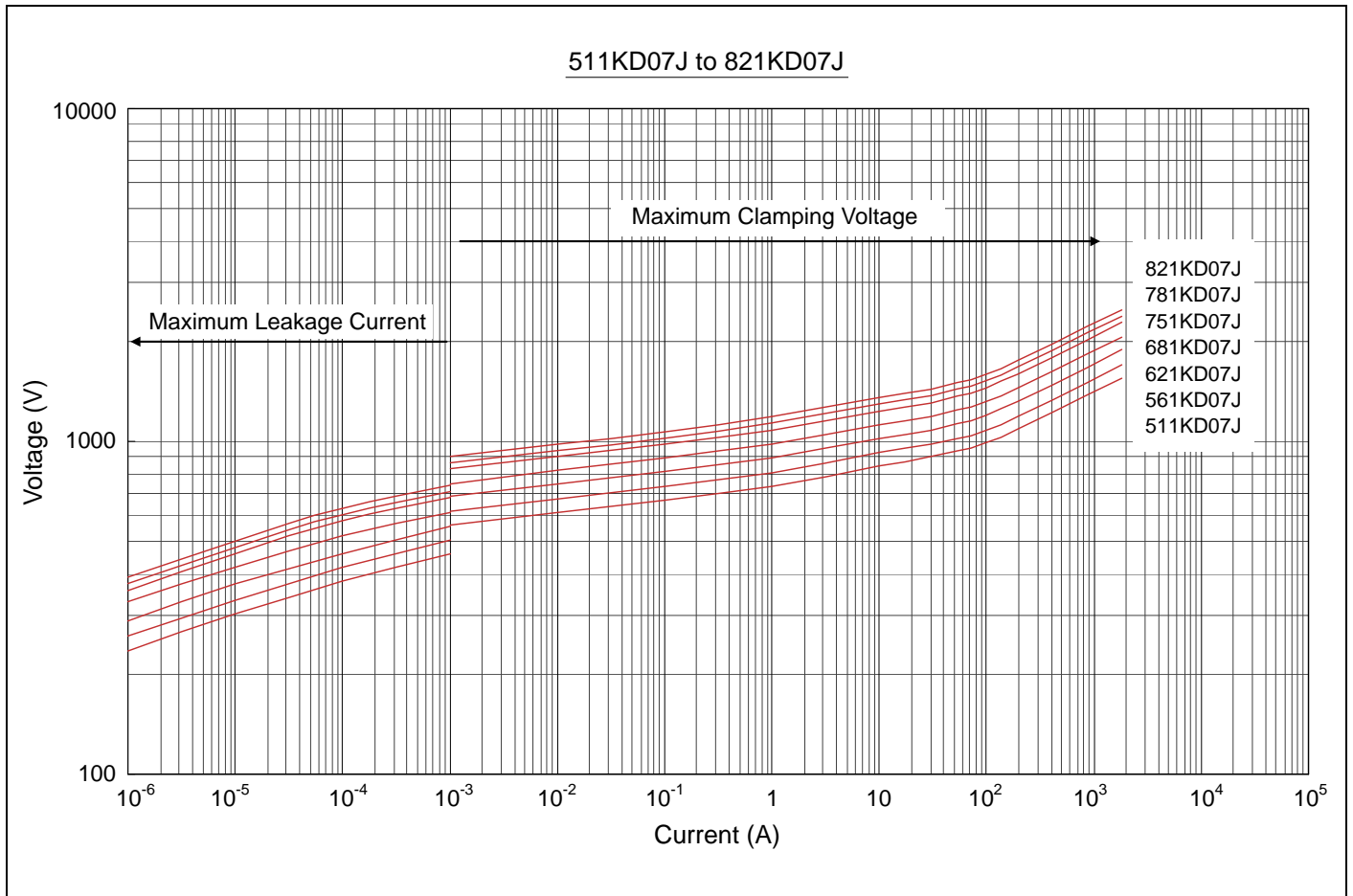
**Maximum Leakage Current and Maximum Clamping Voltage Curve**



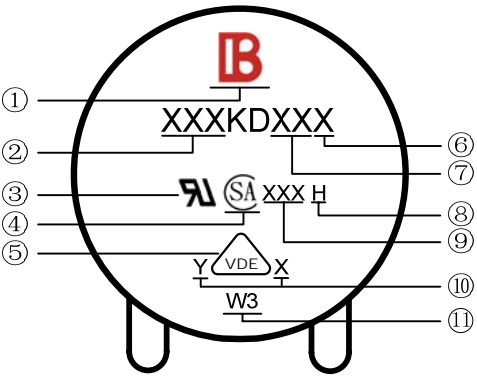
**Maximum Leakage Current and Maximum Clamping Voltage Curve**



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

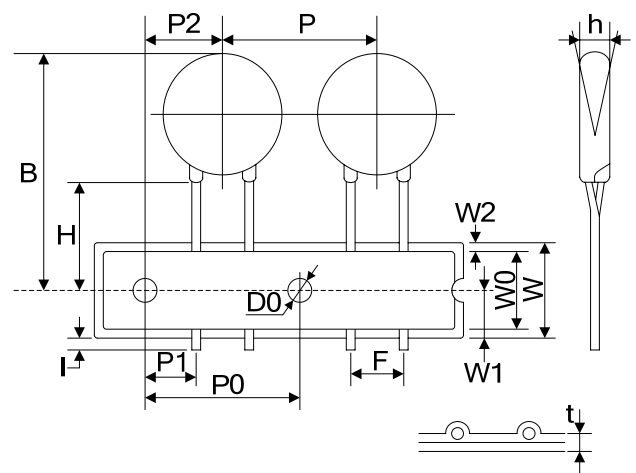


**Marking Code**




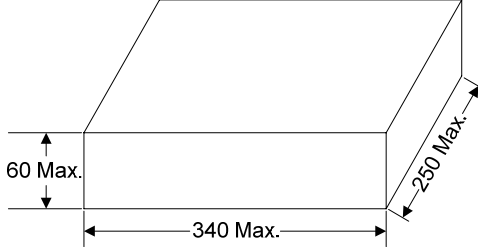
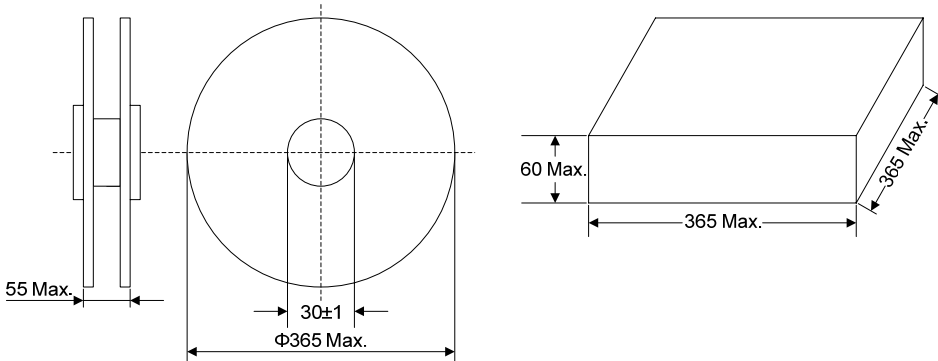
① Brightking Logo  
 ② Varistor Voltage  
 ③ UL Accreditation Logo  
 ④ CSA Accreditation Logo  
 ⑤ VDE Accreditation Logo  
 ⑥ “J” is High Surge Code, no “J” is Standard Surge  
 ⑦ Disk Size  
 ⑧ “H” is Halogen Free Code, no “H” is Halogen  
 ⑨ Date Code  
 ⑩ Product Line Code (“Y” may be A thru Z or blank)  
 ⑪ High Temperature Code (105°C)

**Taping Dimensions**



Symbol	Dimensions (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 &amp; Box</p> 	<p>1500pcs/box (180K~391K)</p>
<p>Tape &amp; Reel</p> 	<p>2000pcs/reel (180K~331K)</p>
	<p>1500pcs/reel (361K~821K)</p>