

## Metal Oxide Varistor (MOV) Data Sheet

### Features

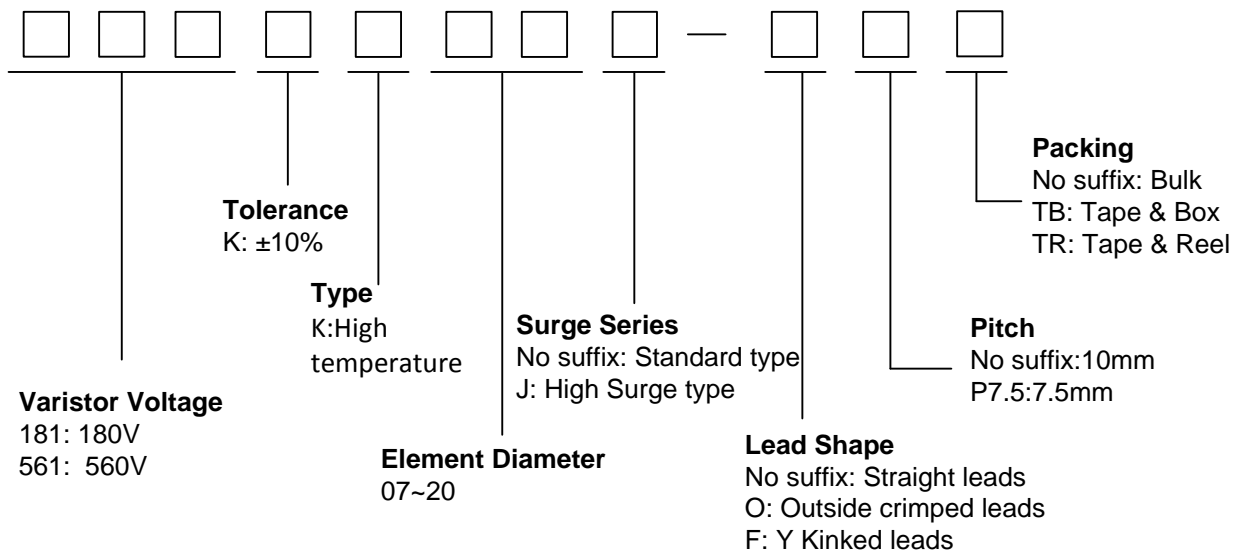
- Wide operating voltage ( $V_{1mA}$ ) range from 180V to 560V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature :  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Storage Temperature :  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Safety certification: UL: E327997



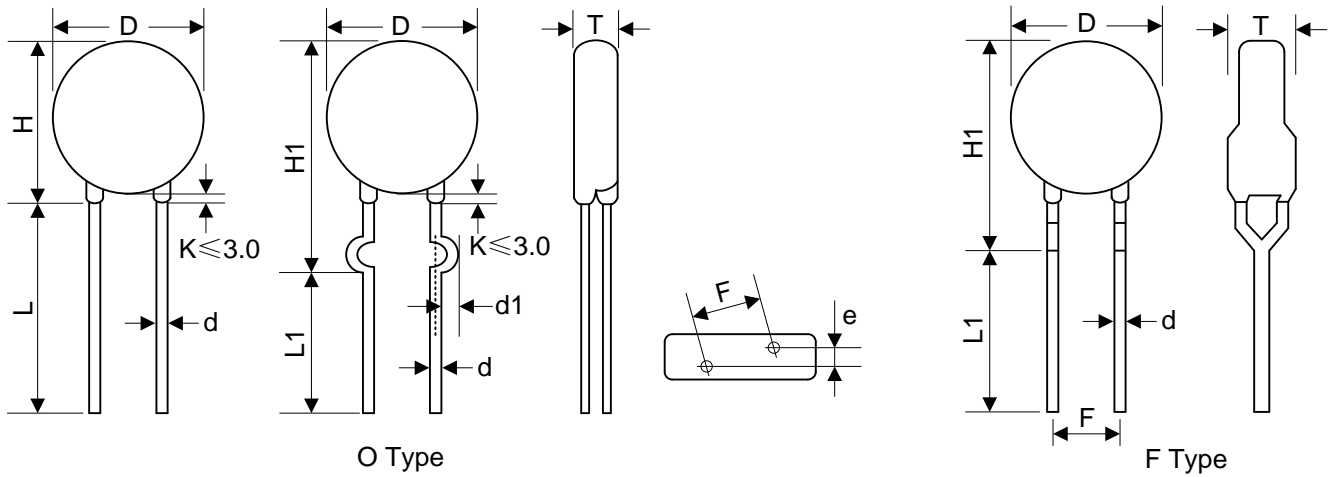
### Applications

- 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

F Type

Table 1	
Unit: mm	
Symbol	Dimension
H(max.)	26.0
H1(max.)	28.0
L(min.)	20.0
L1(min.)	15.0
D(max.)	23.0
F	7.5±0.8/10.0±1.0
T(max.)	Table 2
e(±0.8)	Table 2
d(±0.05)	0.8/1.0
d1(±0.4)	1.4/1.6

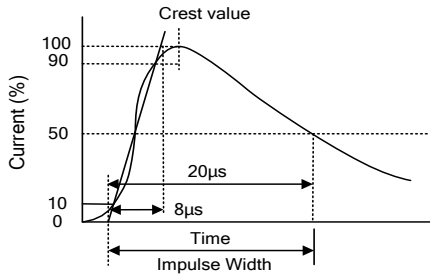
Table 2					
Unit: mm					
Model	T(max.)	e	Model	T(max.)	e
181K	4.6	2.1	471K	6.0	3.4
201K	4.7	2.2	511K	6.2	3.6
221K	4.8	2.3	561K	6.5	3.8
241K	4.9	2.4			
271K	5.0	2.6			
301K	5.0	2.7			
331K	5.2	2.7			
361K	5.4	2.9			
391K	5.5	3.0			
431K	5.7	3.2			

## 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)
181KK20	181KK20J	115	150	180(162~198)	100	300	6500	10000	85	130	1.0	2200
201KK20	201KK20J	130	170	200(180~220)	100	340	6500	10000	95	140	1.0	2000
221KK20	221KK20J	140	180	220(198~242)	100	360	6500	10000	100	155	1.0	1800
241KK20	241KK20J	150	200	240(216~264)	100	395	6500	10000	108	168	1.0	1650
271KK20	271KK20J	175	225	270(243~297)	100	455	6500	10000	127	190	1.0	1500
301KK20	301KK20J	190	250	300(270~330)	100	500	6500	10000	136	210	1.0	1300
331KK20	331KK20J	210	275	330(297~363)	100	550	6500	10000	150	228	1.0	1200
361KK20	361KK20J	230	300	360(324~396)	100	595	6500	10000	163	255	1.0	1100
391KK20	391KK20J	250	320	390(351~429)	100	650	6500	10000	180	275	1.0	1000
431KK20	431KK20J	275	350	430(387~473)	100	710	6500	10000	190	305	1.0	930
471KK20	471KK20J	300	385	470(423~517)	100	775	6500	10000	204	350	1.0	850
511KK20	511KK20J	320	415	510(459~561)	100	845	6500	10000	210	360	1.0	780
561KK20	561KK20J	350	460	560(504~616)	100	925	6500	10000	215	380	1.0	710

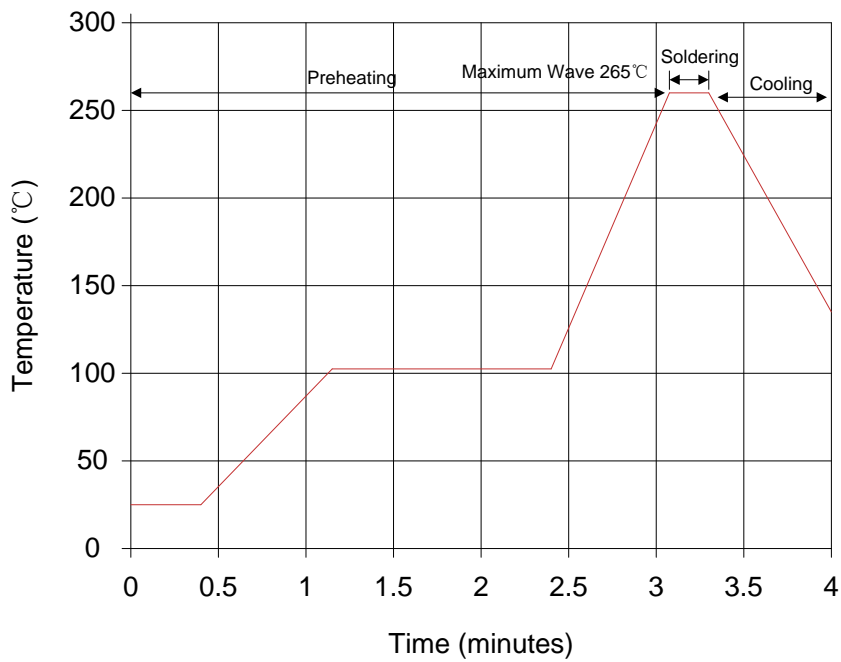
Notes: Leakage Current (@83% of V<sub>1mA</sub>) : IR≤25µA

**Electrical Ratings**

Items	Test Condition/Description	Requirement			
Varistor Voltage	The voltage between the 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 the two terminals with the specification standard impulse current.</p> <p>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@125^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{100} \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="454 1825 1184 1886"> <tr> <td>20Φ series</td> <td>181K to821K</td> <td>200A (8/20µs)</td> </tr> </table>	20Φ series	181K to821K	200A (8/20µs)	$\frac{\Delta V_b}{V_b} \leq \pm 10\%$
20Φ series	181K to821K	200A (8/20µs)			

**Soldering Recommendation**

Lead-free Wave 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.)

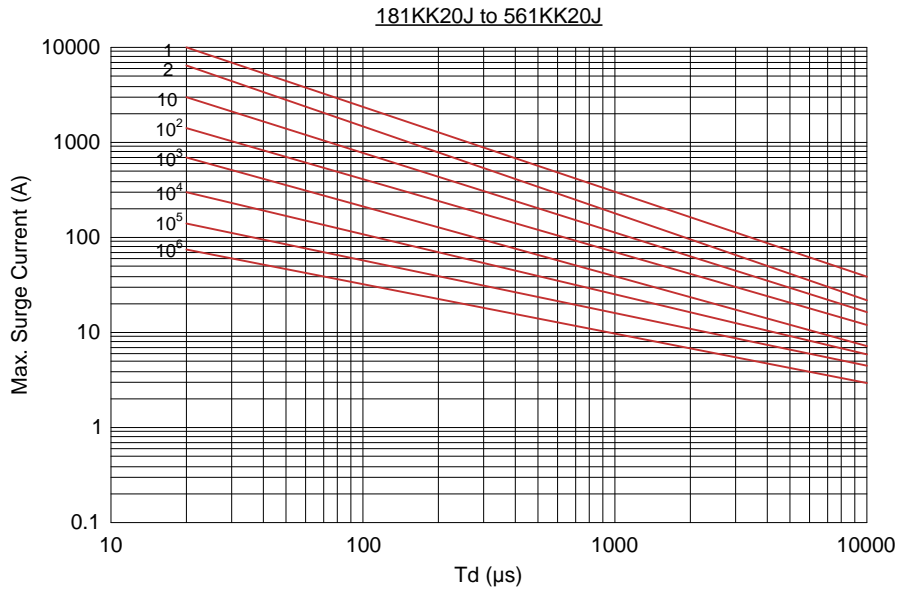
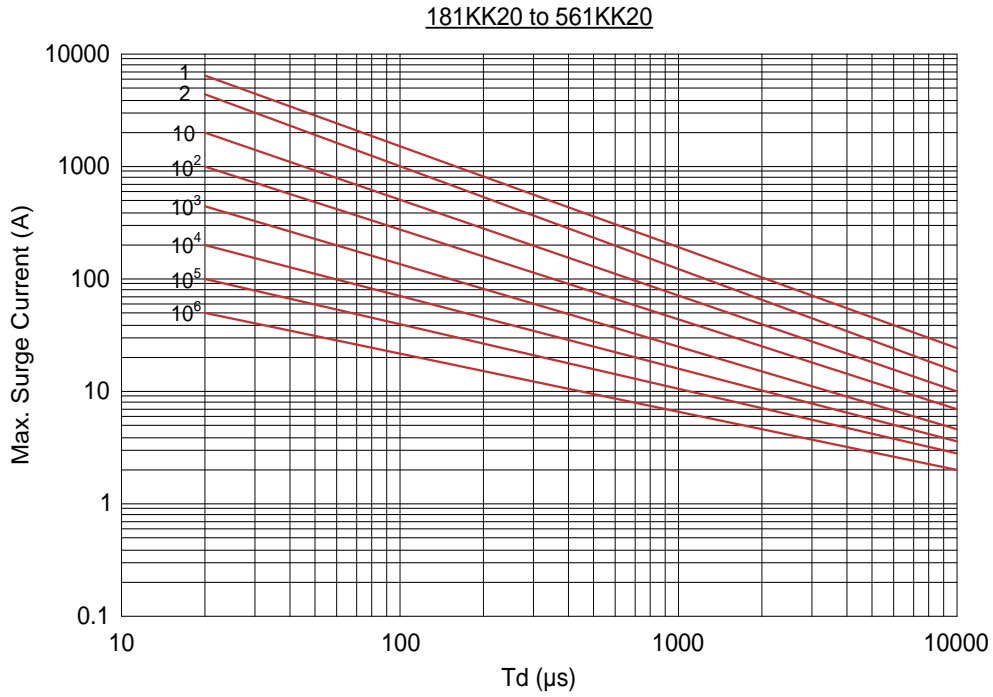
## Mechanical Characteristics

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 $ \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									
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 $ \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									
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 $ \Delta V_{1mA}/V_{1mA}  \leq 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 $ \Delta V_{1mA}/V_{1mA}  \leq 10\%$								

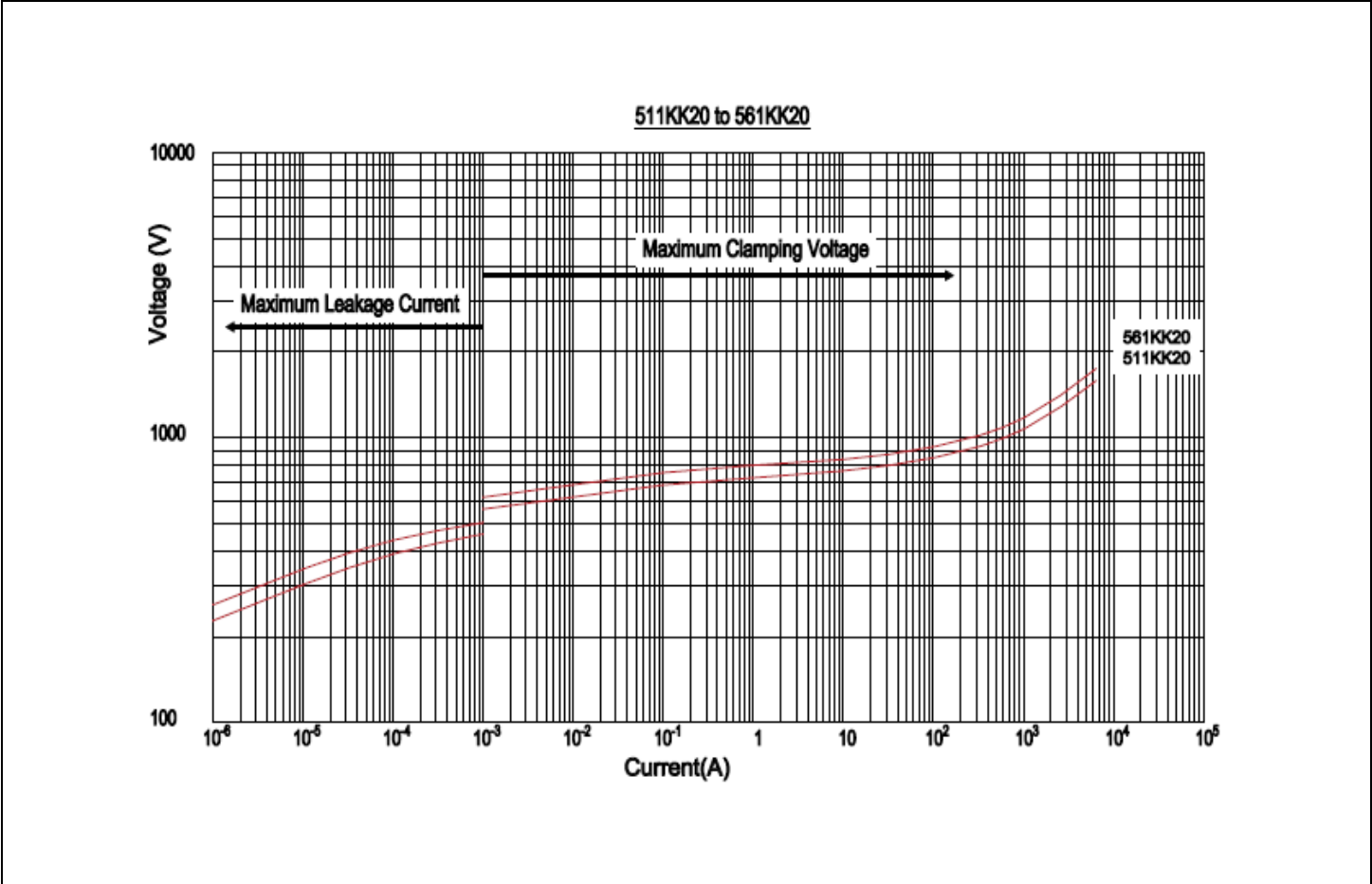
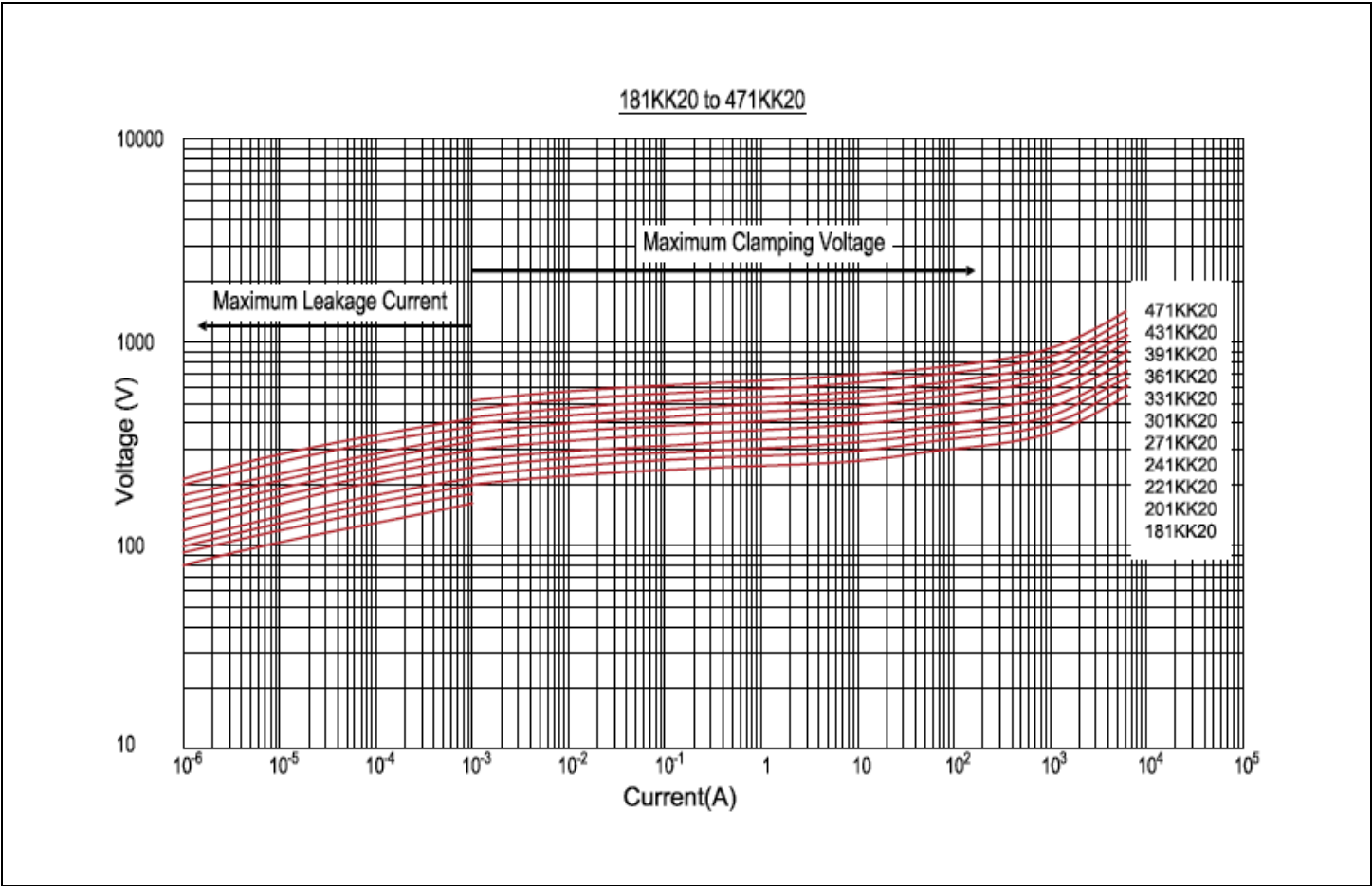
## Reliability

Items	Test conditions / Methods	Specifications															
High Temperature Storage	Ambient Temp: 125±2°C Duration: 1000hrs	$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$															
Low Temperature Storage	Ambient Temp: -40±2°C Duration: 1000hrs	$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$															
Humidity	Ambient Temp: 40±2°C, 90~95%R.H. Duration: 1000hrs	$ \Delta V_{1mA}/V_{1mA}  \leq 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 $ \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															
4	Room temperature	15±3															
High Temperature Load	Ambient Temp: 125±2°C Duration: 1000hrs Load: Max. Allowable Voltage In AC eara.	$ \Delta V_{1mA}/V_{1mA}  \leq 10\%$															
Damp HeatLoad	Ambient Temp: 40±2°C, 90~95%R.H. Duration: 1000hrs Load: Max. Allowable Voltage	No visible damage $ \Delta V_{1mA}/V_{1mA}  \leq 10\%$															
Voltage Proof	Metal balls method, 2500Vac 1 min.	No visible damage															

### Maximum Surge Current Derating Curve

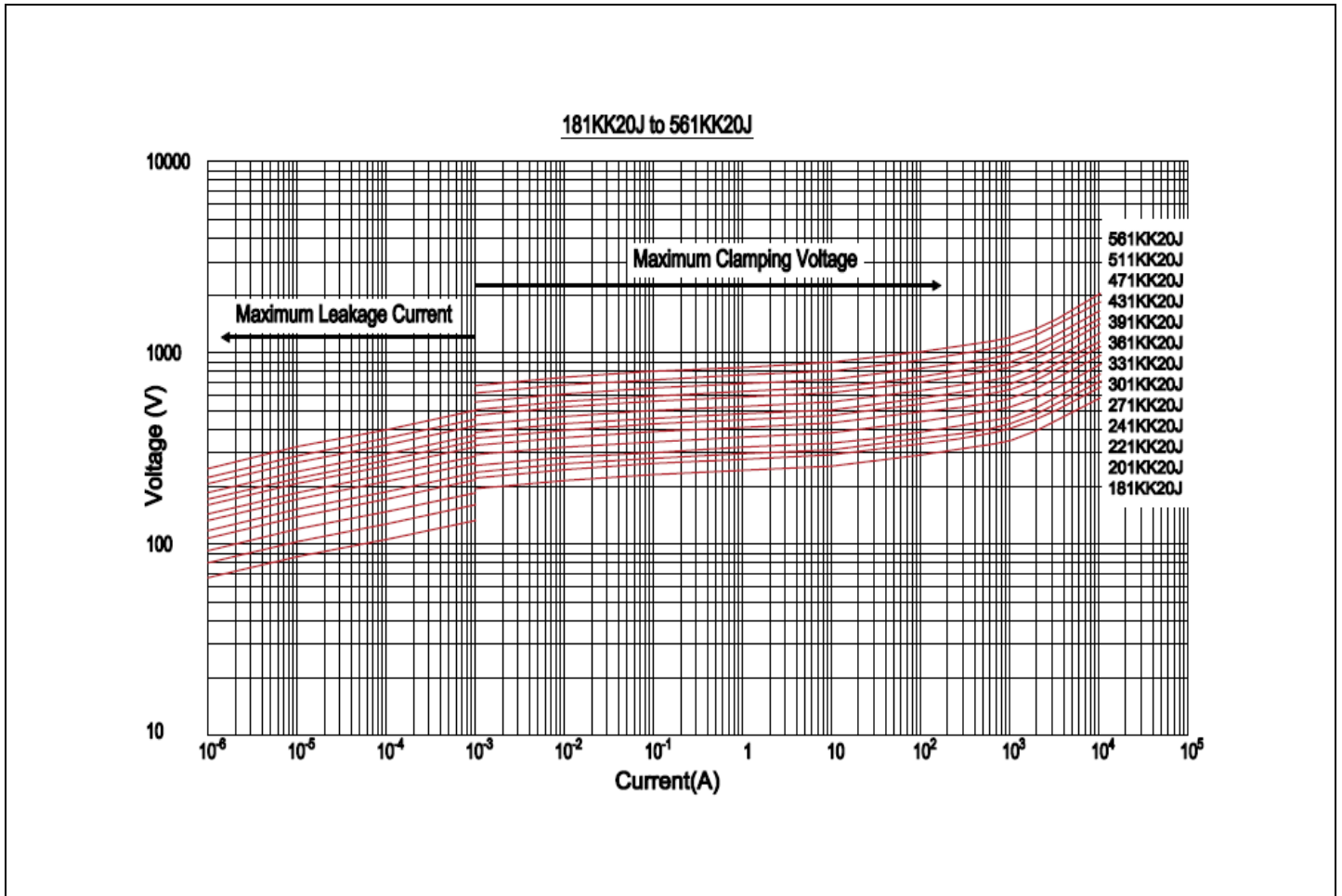


**Maximum Leakage Current and Maximum Clamping Voltage Curve**

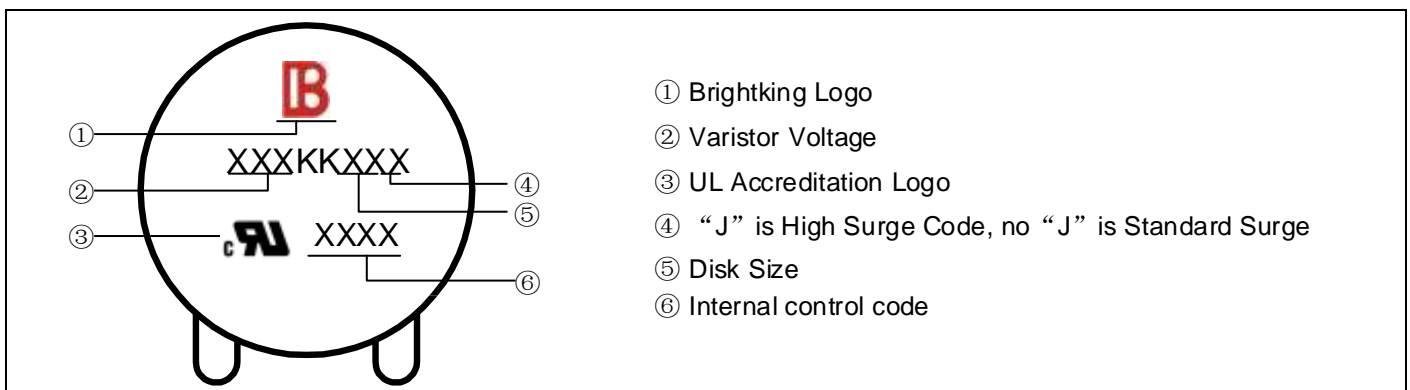




**Maximum Leakage Current and Maximum Clamping Voltage Curve**



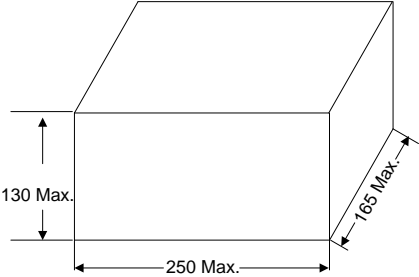
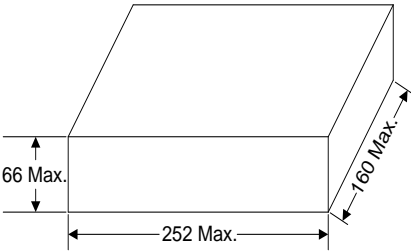
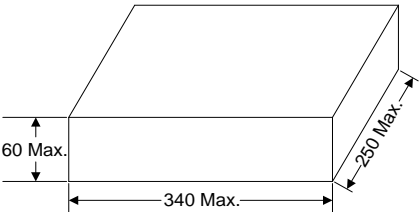
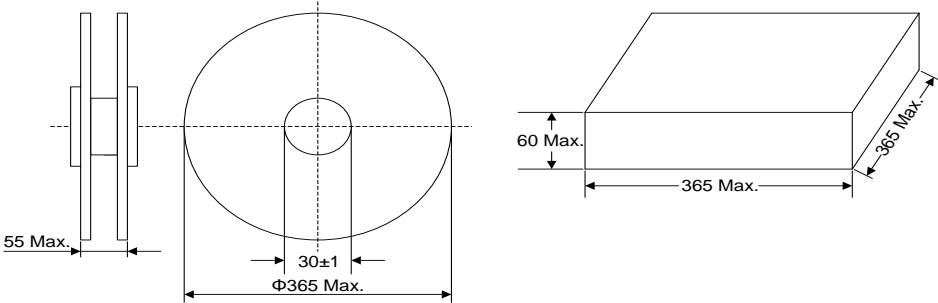
**Marking Code**



**Taping Dimensions**

	Symbol	Dimensions (mm)
	P	25.4±1.0
	P0	12.7±1.0
	P1	8.95/7.7±0.7
	P2	12.7±1.3
	F	7.5±0.8/10.0±1.0
	h	0±4
	W	18.0±1.0
	W0	12.0±1.0
	W1	9.0±0.5
	W2	3.0max
	H	20.0±2.0
	I	2.0max
	D0	4.0±0.2
	t	0.6±0.3
	B	45max

**Quantity**

Packaging Dimensions (Unit: mm)	Quantity
<p>In bulk for Terminals Untrimmed Products</p> 	<p>250pcs/bag 4bags/box (181K~301K)</p>
<p>In bulk for Terminals Trimmed Products</p> 	<p>200pcs/bag 4bags/box (331K~561K)</p>
<p>Tape &amp; Box</p> 	<p>250pcs/bag 2bags/box (181K~301K)</p> <p>200pcs/bag 2bags/box (331K~561K)</p>
<p>Tape &amp; Reel</p> 	<p>400pcs/box (181K~301K)</p> <p>300pcs/box (331K~561K)</p>