

Metal Oxide Varistors (MOV) Data Sheet

Features

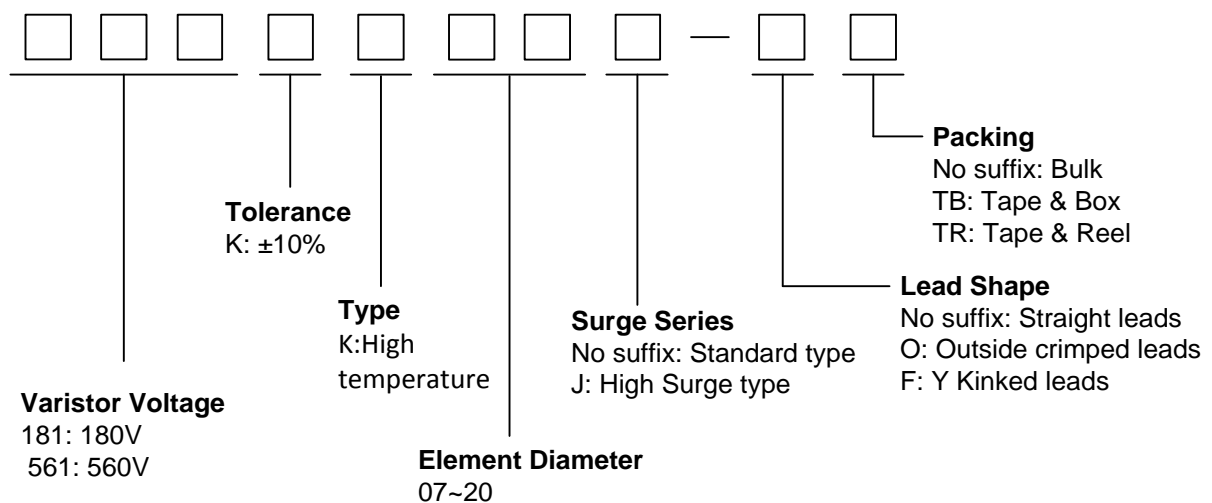
- Wide operating voltage (V1mA) range from 180V to 560V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature : -40°C ~ +125°C
- Storage Temperature : -40°C ~ +125°C
- Safety certification: UL: E327997



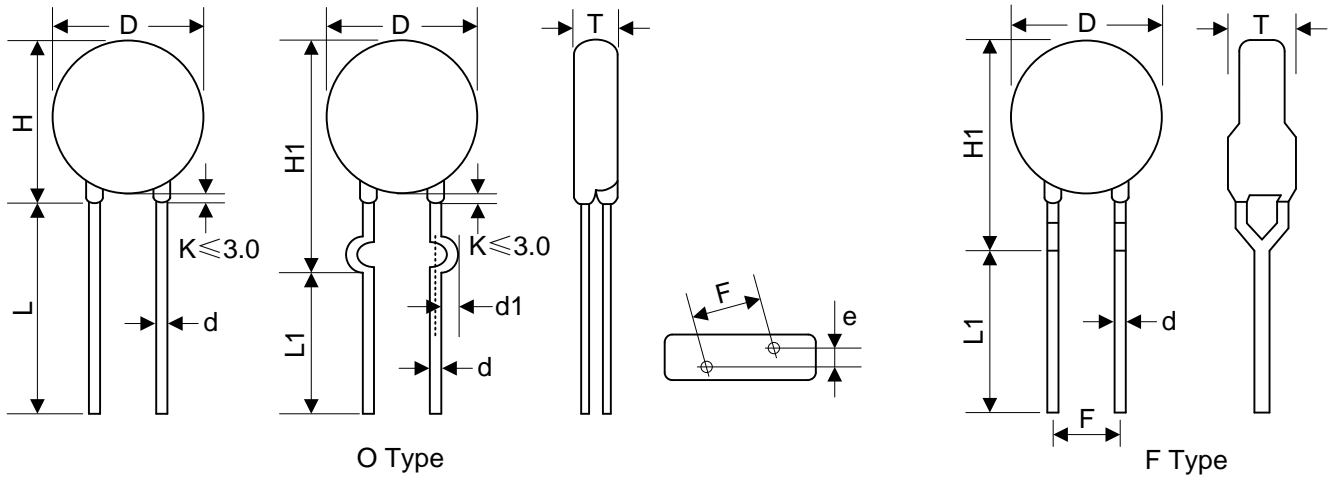
Applications

- 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.)	16.0
H1(max.)	17.5
L(min.)	20.0
L1(min.)	15.0
D(max.)	12.5
F(±0.8)	7.5
T(max.)	Table 2
e(±0.8)	Table 2
d(±0.05)	0.8
d1(±0.4)	1.4

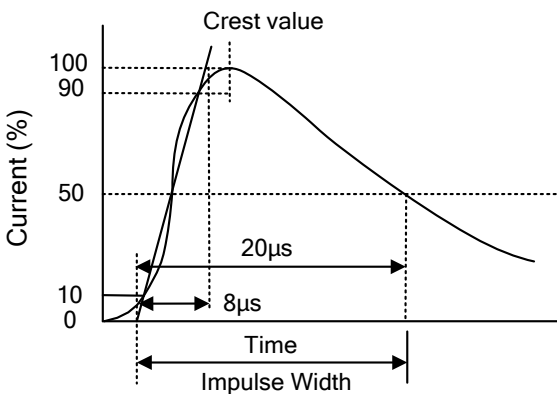
Table 2					
Unit: mm					
Model	T(max.)	e	Model	T(max.)	e
181K	4.8	1.9	471K	6.7	3.2
201K	5.0	2.0	511K	6.8	3.4
221K	5.1	2.1	561K	7.0	3.6
241K	5.2	2.2			
271K	5.4	2.4			
301K	5.5	2.5			
331K	5.8	2.5			
361K	6.0	2.7			
391K	6.2	2.8			
431K	6.5	3.0			

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)
181KK10	181KK10J	115	150	180(162~198)	25	300	2500	3500	27.0	30.0	0.4	560
201KK10	201KK10J	130	170	200(180~220)	25	340	2500	3500	30.0	35.0	0.4	500
221KK10	221KK10J	140	180	220(198~242)	25	360	2500	3500	32.0	39.0	0.4	450
241KK10	241KK10J	150	200	240(216~264)	25	395	2500	3500	35.0	42.0	0.4	420
271KK10	271KK10J	175	225	270(243~297)	25	455	2500	3500	37.0	49.0	0.4	370
301KK10	301KK10J	190	250	300(270~330)	25	500	2500	3500	40.0	54.0	0.4	330
331KK10	331KK10J	210	275	330(297~363)	25	550	2500	3500	43.0	58.0	0.4	300
361KK10	361KK10J	230	300	360(324~396)	25	595	2500	3500	47.0	65.0	0.4	280
391KK10	391KK10J	250	320	390(351~429)	25	650	2500	3500	60.0	70.0	0.4	260
431KK10	431KK10J	275	350	430(387~473)	25	710	2500	3500	65.0	80.0	0.4	230
471KK10	471KK10J	300	385	470(423~517)	25	775	2500	3500	67.0	85.0	0.4	210
511KK10	511KK10J	320	415	510(459~561)	25	845	2500	3500	69.0	90.0	0.4	200
561KK10	561KK10J	350	460	560(504~616)	25	925	2500	3500	70.0	92.0	0.4	180

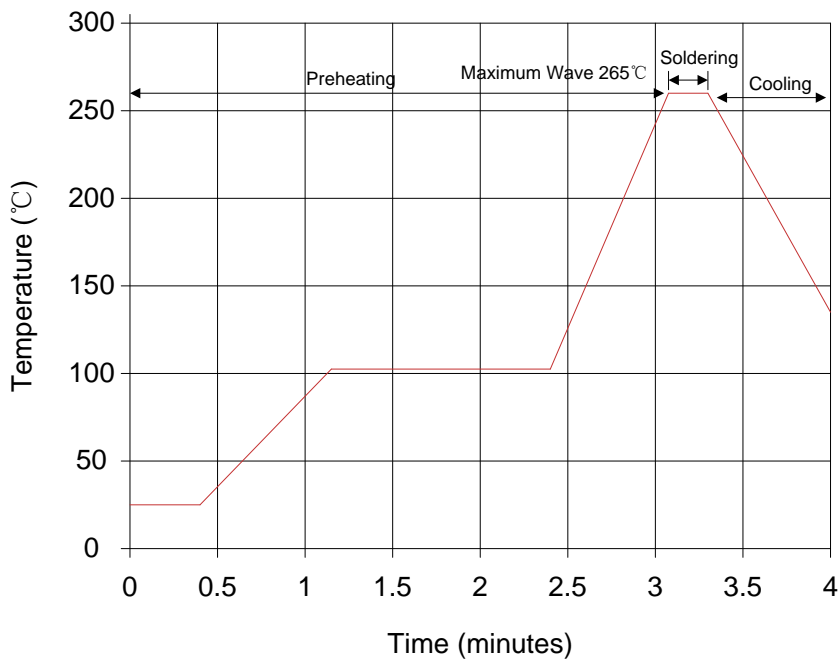
Notes: 1. Leakage Current (@83% of V_{1mA}) : IR≤25μA

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.				
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> 	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@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="438 1892 1204 1960"> <tr> <td>10Φ series</td> <td>181K to 821K</td> <td>100A (8/20μs)</td> </tr> </table>	10Φ series	181K to 821K	100A (8/20μs)	$\frac{\Delta V_b}{V_b} \leq \pm 10\%$
10Φ series	181K to 821K	100A (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.)

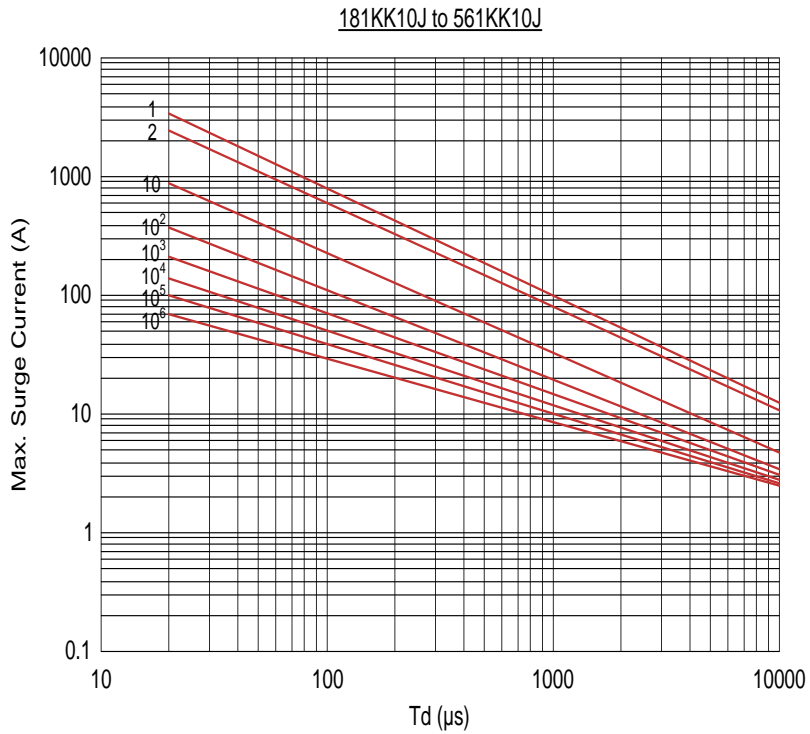
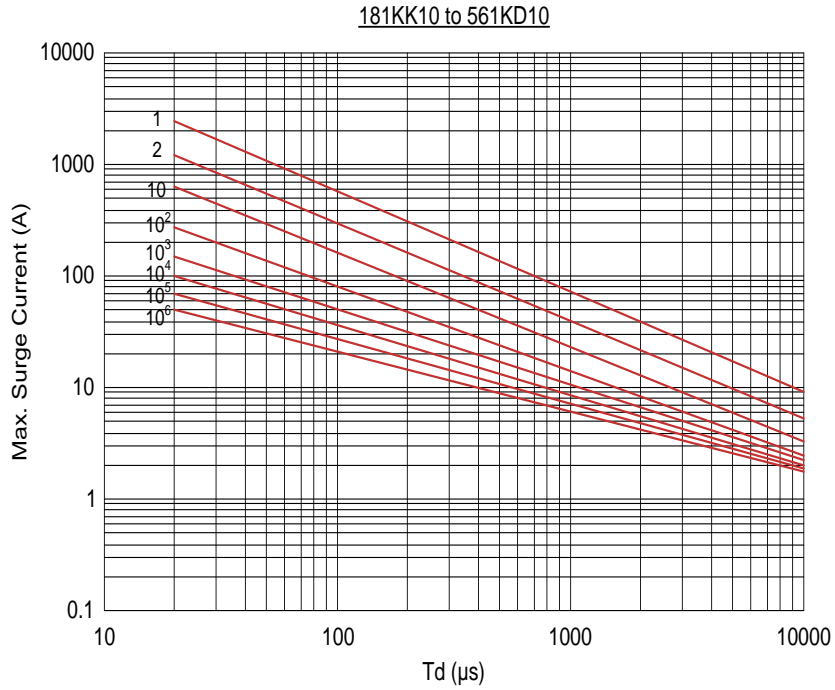
Mechanical Characteristics

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<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%								

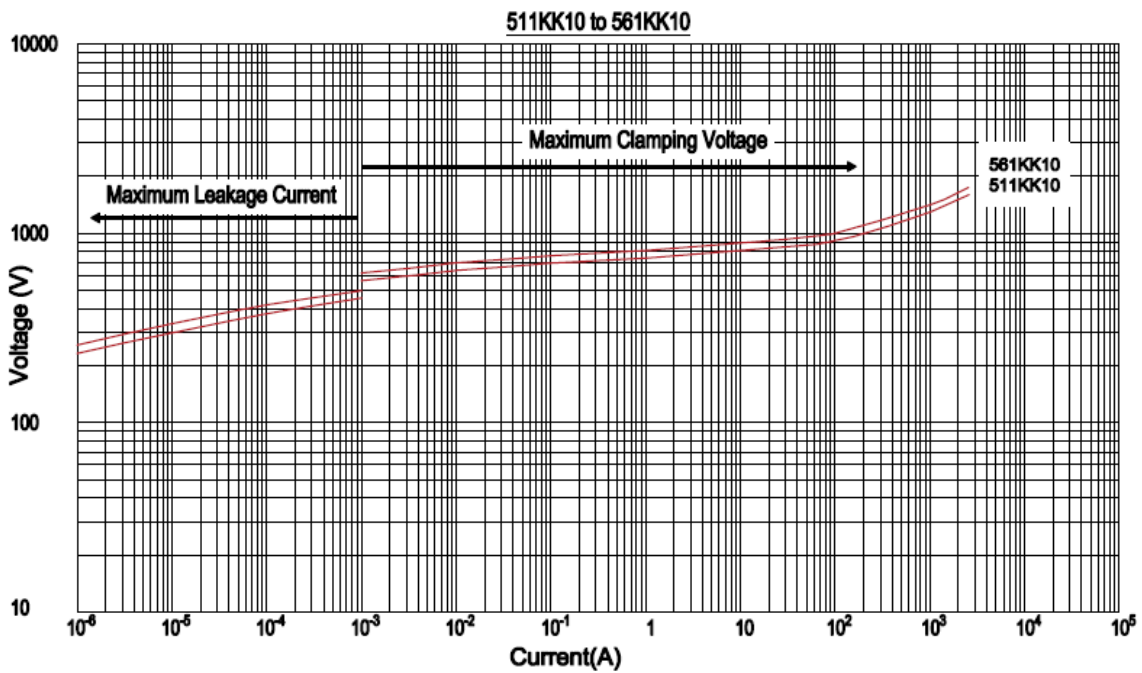
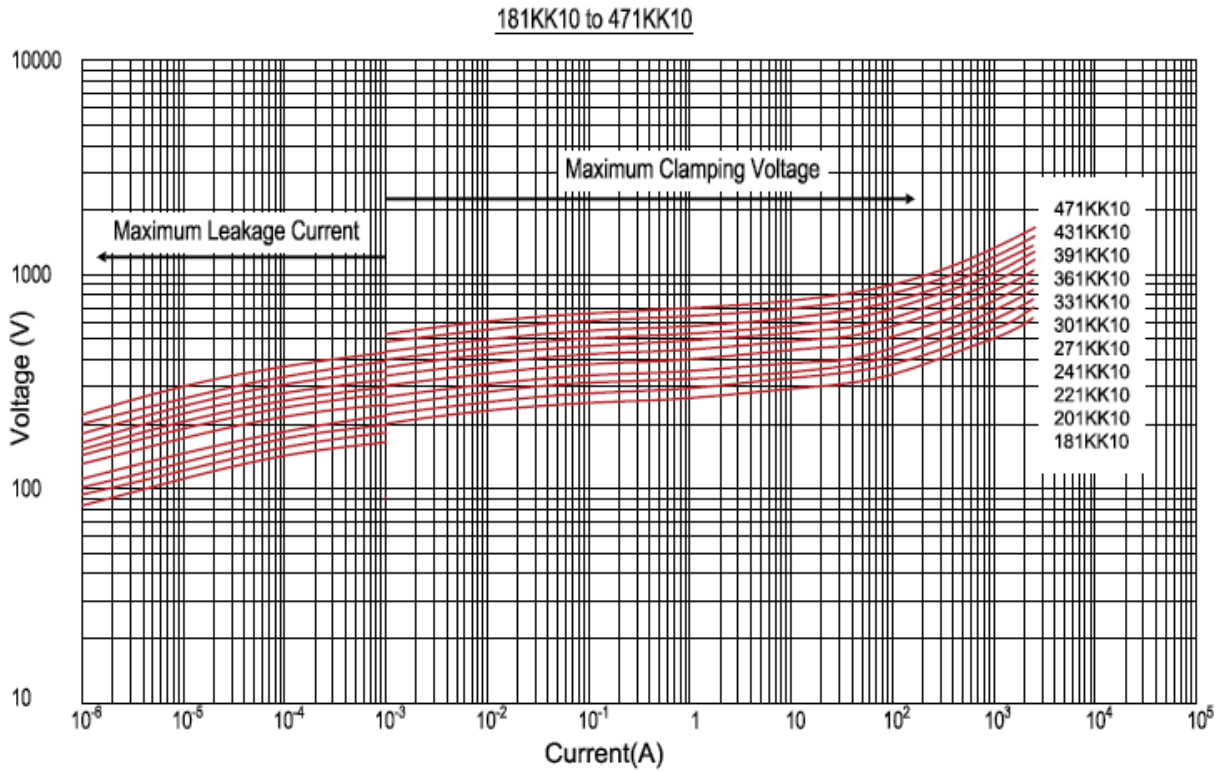
Reliability

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: 125±2°C Duration: 1000hrs Load: Max. Allowable Voltage In AC eara.	ΔV _{1mA} /V _{1mA} ≤10%															
Damp HeatLoad	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															

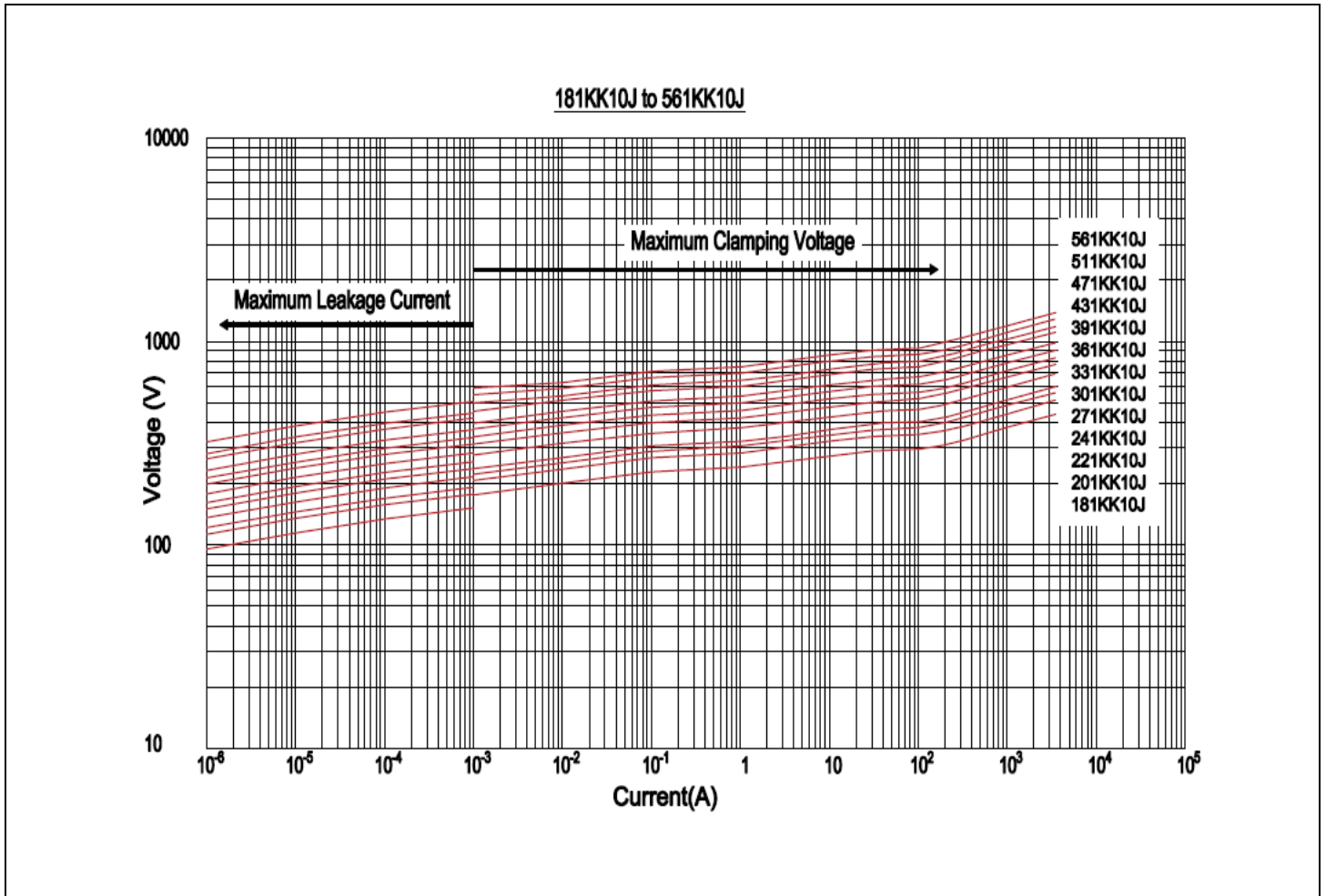
Maximum Surge Current Derating Curve



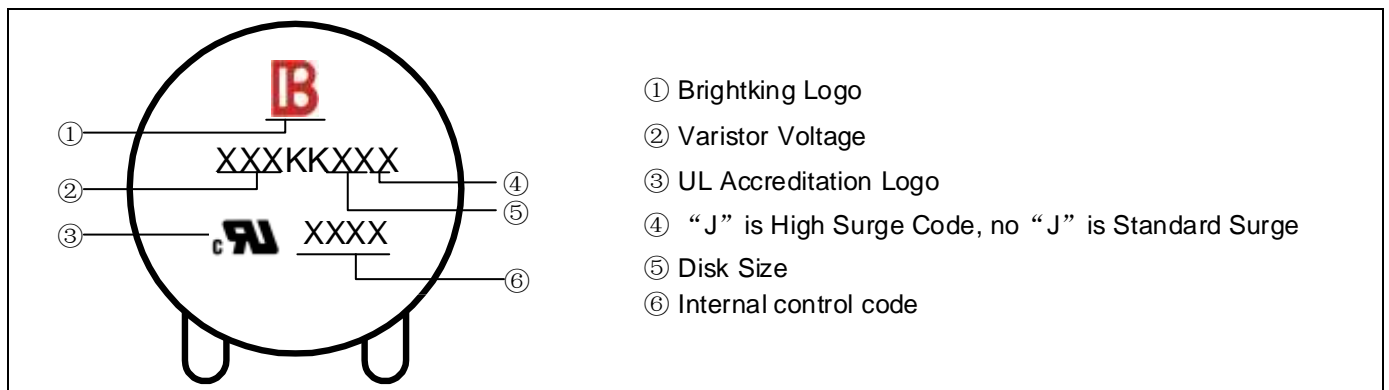
Maximum Leakage Current and Maximum Clamping Voltage Curve



Maximum Leakage Current and Maximum Clamping Voltage Curve



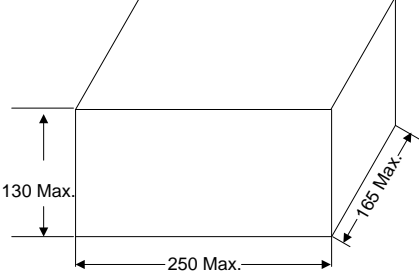
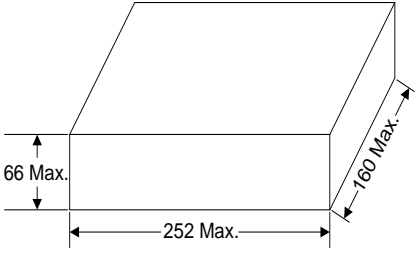
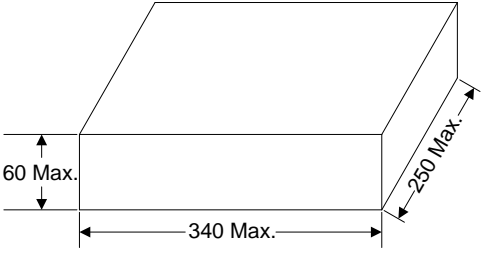
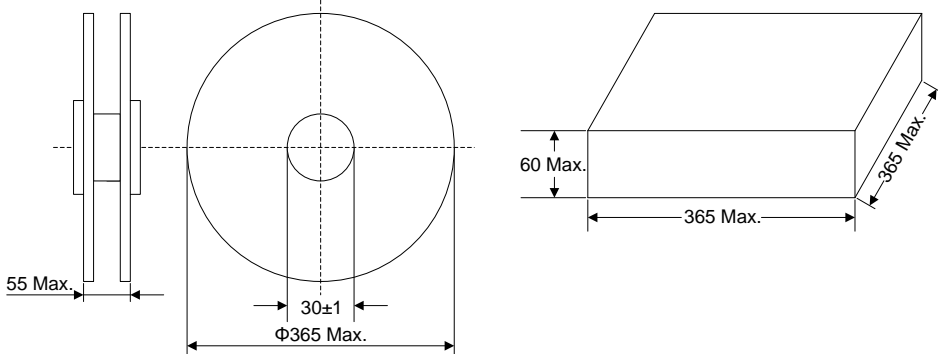
Marking Code



Taping Dimensions

	Symbol	Dimension (mm)
	P	25.4±1.0
	P0	12.7±1.0
	P1	8.95±0.7
	P2	12.7±1.3
	F	7.5±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
	l	2.0max
	D0	4.0±0.2
t	0.6±0.3	
B	36max	

Quantity

Packaging Dimensions (Unit: mm)	Quantity
<p>In bulk for Terminals Untrimmed Products</p> 	<p>500pcs/bag 4bags/box (181K~561K)</p>
<p>In bulk for Terminals Trimmed Products</p> 	<p>500pcs/bag 4bags/box (181K~561K)</p>
<p>Tape & Box</p> 	<p>750pcs/box (181K~241K)</p>
	<p>600pcs/box (271K~391K)</p>
	<p>500pcs/box (431K~561K)</p>
<p>Tape & Reel</p> 	<p>1000pcs/reel (181K~391K)</p>
	<p>750pcs/reel (431K~561K)</p>