

Metal Oxide Varistor (MOV) Data Sheet

Features

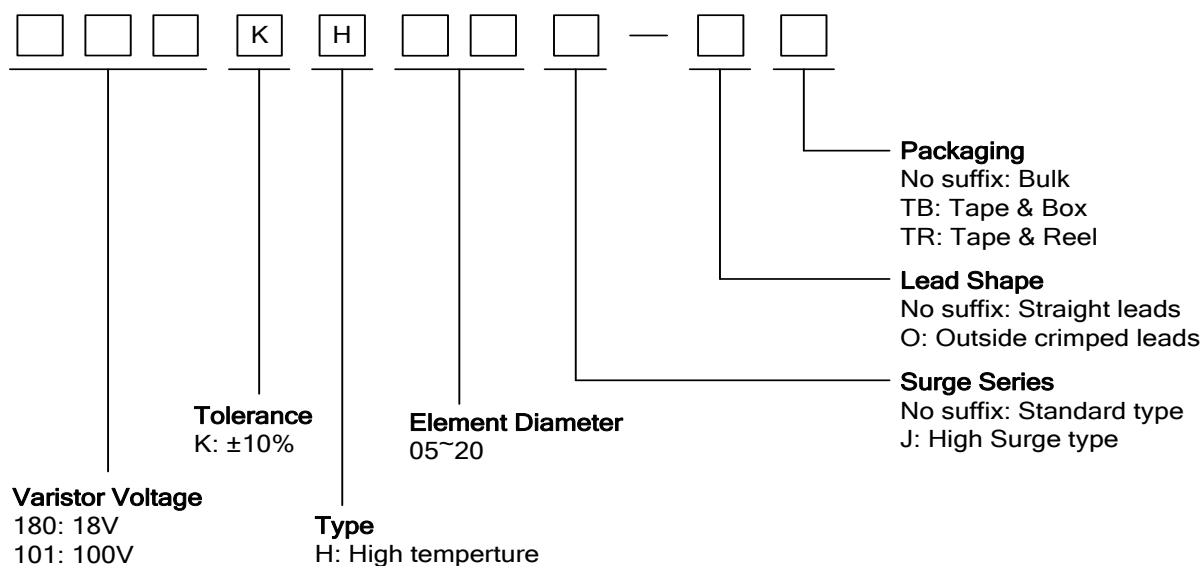
- Wide operating voltage (V_{1mA}) range from 18V to 750V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature : $-40^{\circ}\text{C} \sim +140^{\circ}\text{C}$
- Storage Temperature : $-40^{\circ}\text{C} \sim +140^{\circ}\text{C}$
- Safety certification: UL: E327997
TUV:B170296048003
CQC:17001172541



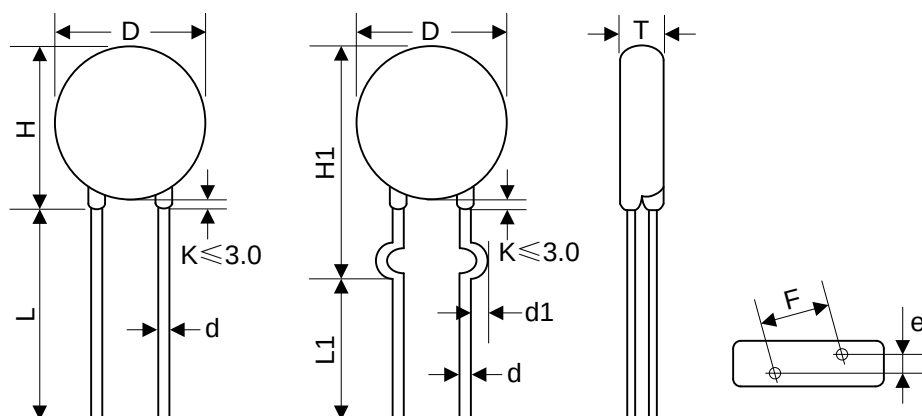
Applications

- 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	5.5~11.0
H1	7.5~13.0
L(min.)	20.0
L1(min.)	15.0
D	5.5~8.0
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	2.03~4.83	1.3	221K	2.58~5.48	1.9
220K	2.12~4.95	1.4	241K	2.66~5.61	2.0
270K	2.22~5.14	1.6	271K	2.78~5.80	2.2
330K	2.34~5.31	1.5	301K	2.90~5.99	2.3
390K	2.30~5.13	1.6	331K	3.02~6.17	2.3
470K	2.42~5.34	1.7	361K	3.14~6.36	2.5
560K	2.56~5.57	1.8	391K	3.26~6.55	2.6
680K	2.75~4.84	2.0	431K	3.42~6.80	2.8
820K	2.18~4.89	1.4	471K	3.58~7.05	3.0
101K	2.28~5.06	1.6	511K	3.74~7.31	3.2
121K	2.40~5.25	1.7	561K	3.94~7.62	3.4
151K	2.30~5.04	1.8	621K	4.18~8.00	3.7
181K	2.42~5.23	1.7	681K	4.42~8.37	4.0
201K	2.52~5.39	1.8	751K	4.67~8.60	4.1

Electrical Characteristics

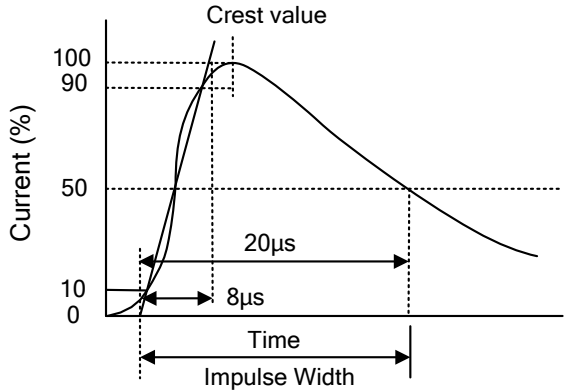
Part Number		Maximum Allowable Voltage		Varistor Voltage	Maximum Clamping Voltage		Withstanding Surge Current		Maximum Energy (10/1000μs)		Rated Power	Typical Capacitance (Reference)
Standard	High Surge	V _{AC} (V)	V _{DC} (V)	V _{1mA} (V)	I _P (A)	V _C (V)	I (A) Standard	I (A) High Surge	(J) Standard	(J) High Surge	(W)	@1KHz (pf)
180KH05	180KH05J	11	14	18(15~21.6)	1	40	100	250	0.4	0.6	0.01	1400
220KH05	220KH05J	14	18	22(19.5~26)	1	48	100	250	0.5	0.7	0.01	1150
270KH05	270KH05J	17	22	27(24~31)	1	60	100	250	0.6	0.9	0.01	930
330KH05	330KH05J	20	26	33(29.5~36.5)	1	73	100	250	0.8	1.1	0.01	760
390KH05	390KH05J	25	31	39(35~43)	1	80	100	250	0.9	1.2	0.01	640
470KH05	470KH05J	30	38	47(42~52)	1	104	100	250	1.1	1.5	0.01	530
560KH05	560KH05J	35	45	56(50~62)	1	123	100	250	1.3	1.8	0.01	450
680KH05	680KH05J	40	56	68(61~75)	1	145	100	250	1.6	2.2	0.01	370
820KH05	820KH05J	50	65	82(74~90)	5	150	400	800	2.5	4.0	0.1	300
101KH05	101KH05J	60	85	100(90~110)	5	175	400	800	3.0	4.1	0.1	250
121KH05	121KH05J	75	100	120(108~132)	5	210	400	800	4.0	4.9	0.1	210
151KH05	151KH05J	95	125	150(135~165)	5	260	400	800	4.8	6.5	0.1	165
181KH05	181KH05J	115	150	180(162~198)	5	320	400	800	4.9	7.5	0.1	140
201KH05	201KH05J	130	170	200(180~220)	5	355	400	800	6.5	8.5	0.1	125
221KH05	221KH05J	140	180	220(198~242)	5	380	400	800	7.0	9.0	0.1	110
241KH05	241KH05J	150	200	240(216~264)	5	415	400	800	8.0	10.5	0.1	100
271KH05	271KH05J	175	225	270(243~297)	5	475	400	800	8.5	11.0	0.1	95
301KH05	301KH05J	190	250	300(270~330)	5	520	400	800	9.0	12.0	0.1	85
331KH05	331KH05J	210	275	330(297~363)	5	570	400	800	9.5	13.0	0.1	75
361KH05	361KH05J	230	300	360(324~396)	5	620	400	800	10.0	16.0	0.1	70
391KH05	391KH05J	250	320	390(351~429)	5	675	400	800	12.0	17.0	0.1	65
431KH05	431KH05J	275	350	430(387~473)	5	745	400	800	13.0	20.0	0.1	60
471KH05	471KH05J	300	385	470(423~517)	5	810	400	800	15.0	21.0	0.1	55
511KH05	511KH05J	320	415	510(459~561)	5	845	400	800	16.0	22.5	0.1	50
561KH05	561KH05J	350	460	560(504~616)	5	920	400	800	16.8	24.0	0.1	45
621KH05	621KH05J	385	505	620(558~682)	5	1025	400	800	17.7	25.0	0.1	40
681KH05	681KH05J	420	560	680(612~748)	5	1120	400	800	19.4	29.0	0.1	38
751KH05	751KH05J	460	615	750(675~825)	5	1240	400	800	21.8	32.0	0.1	36

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

2. Leakage Current (@83% of V_{1mA}) : IR≤40μA (180K~680K)

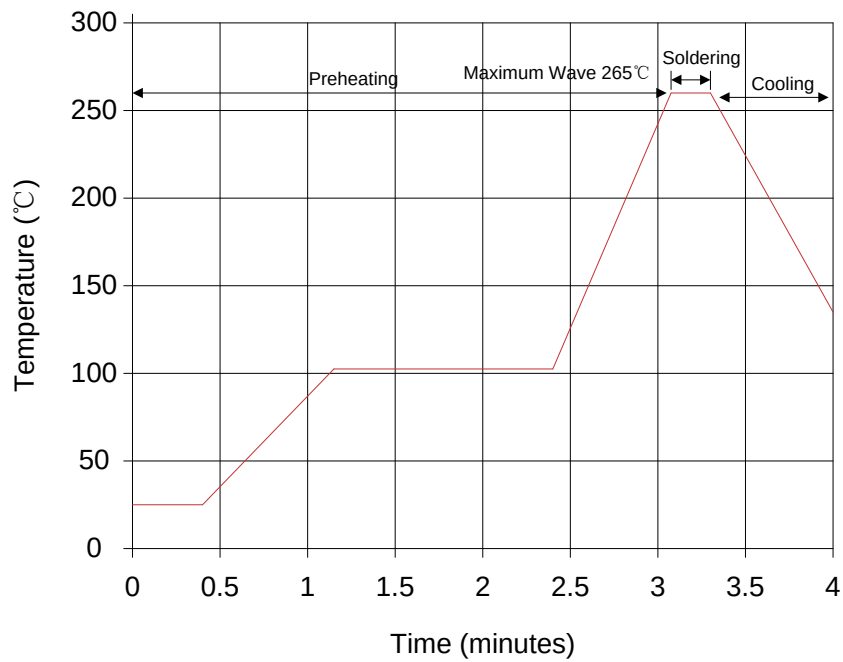
IR≤20μA (820K~751K)

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	The maximum voltage between the two terminals with the specification standard impulse current. Applied waveform: 8/20μs 						
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@140^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{115} \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	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. <table border="1" data-bbox="438 1881 1204 2004"> <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

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.)

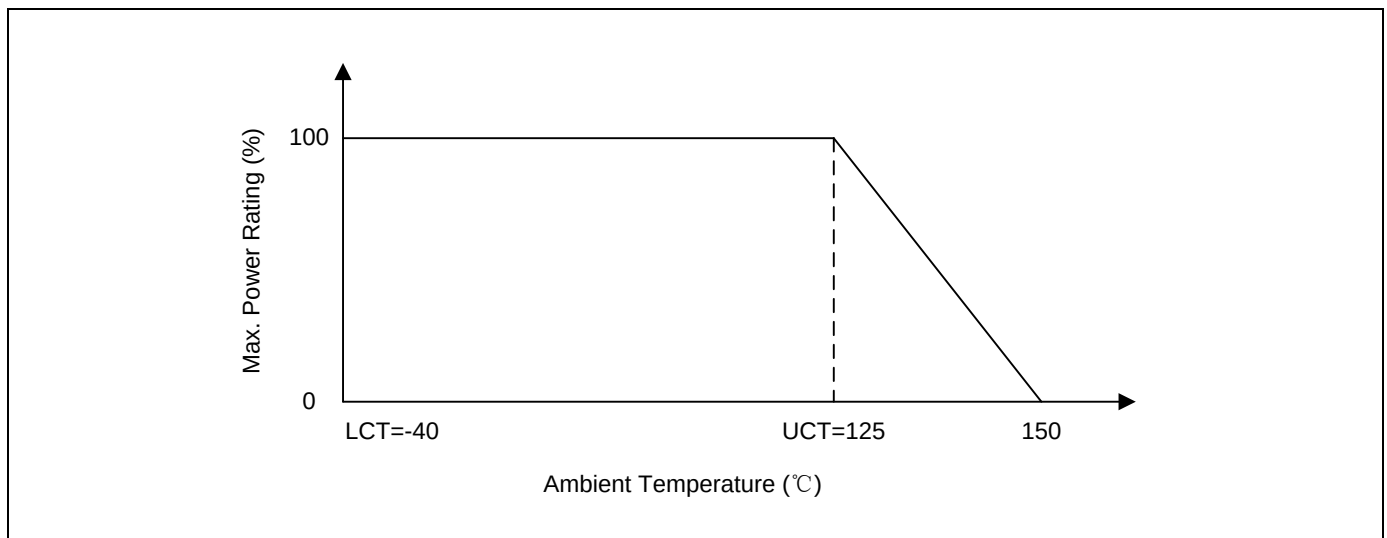
Mechanical Characteristics

Items	Test conditions / Methods	Specifications								
Tensile Strength of Terminals	Gradually applying the force specified and keeping the unit fixed for 10±1 sec. <table><tr><td>Terminal diameter (mm)</td><td>Force (kg)</td></tr><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></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><tr><td>Terminal diameter (mm)</td><td>Force (kg)</td></tr><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></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/s² Direction: 3 mutually perpendicular directions, 2hrs each.	No visible damage $\Delta V_{1mA}/V_{1mA} \leq 5\%$								
Solder ability	Solder Temp: 245±5℃ 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℃ Dipping Time: 10±1 sec	No visible damage $\Delta V_{1mA}/V_{1mA} \leq 10\%$								

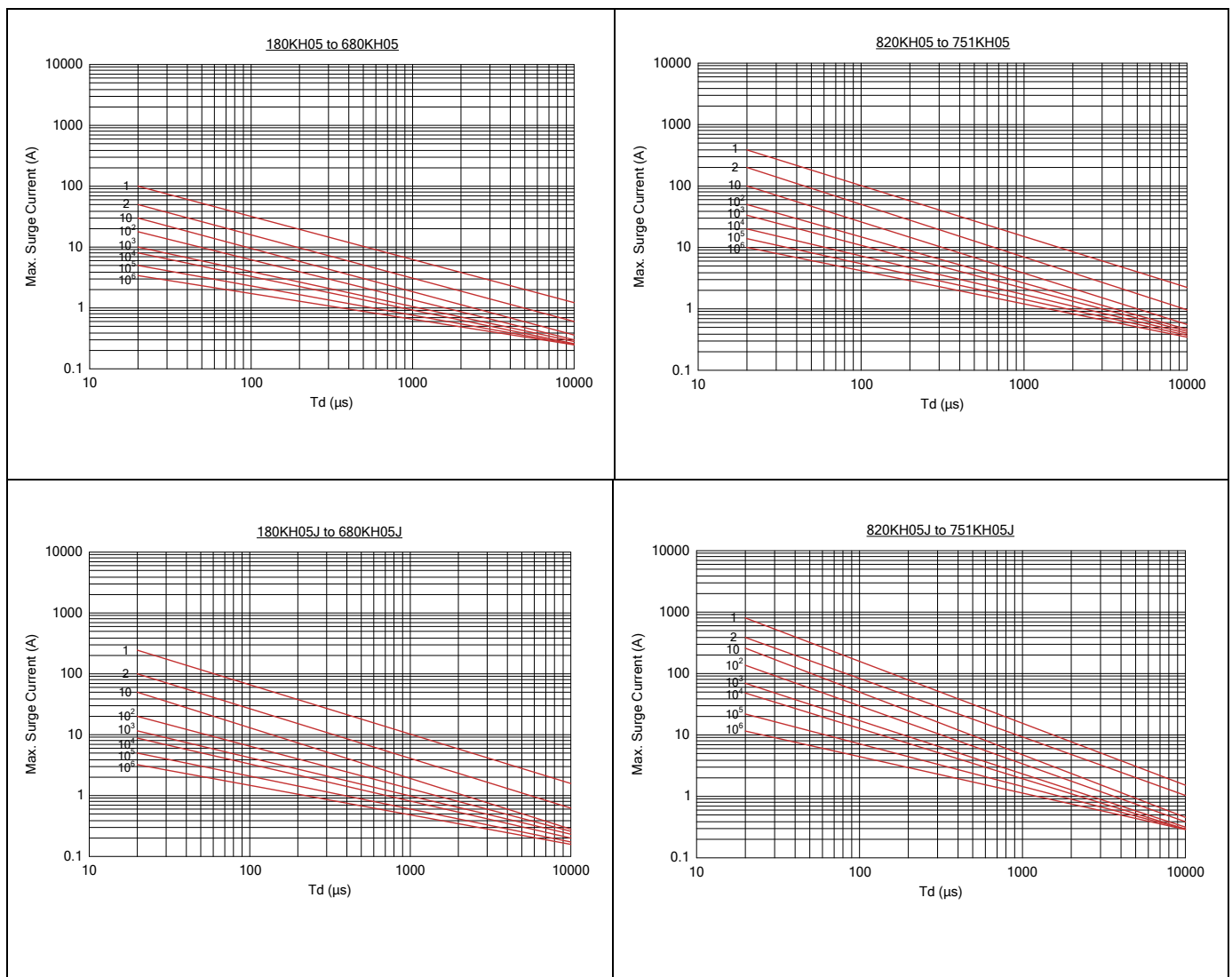
Reliability

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> <tr> <th>Step</th><th>Temperature (°C)</th><th>Period (minutes)</th></tr> <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> </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 Heat Load	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, 1000Vac 1 min.(180K~331K), 1500Vac 1 min.(361K~751K)	No visible damage															

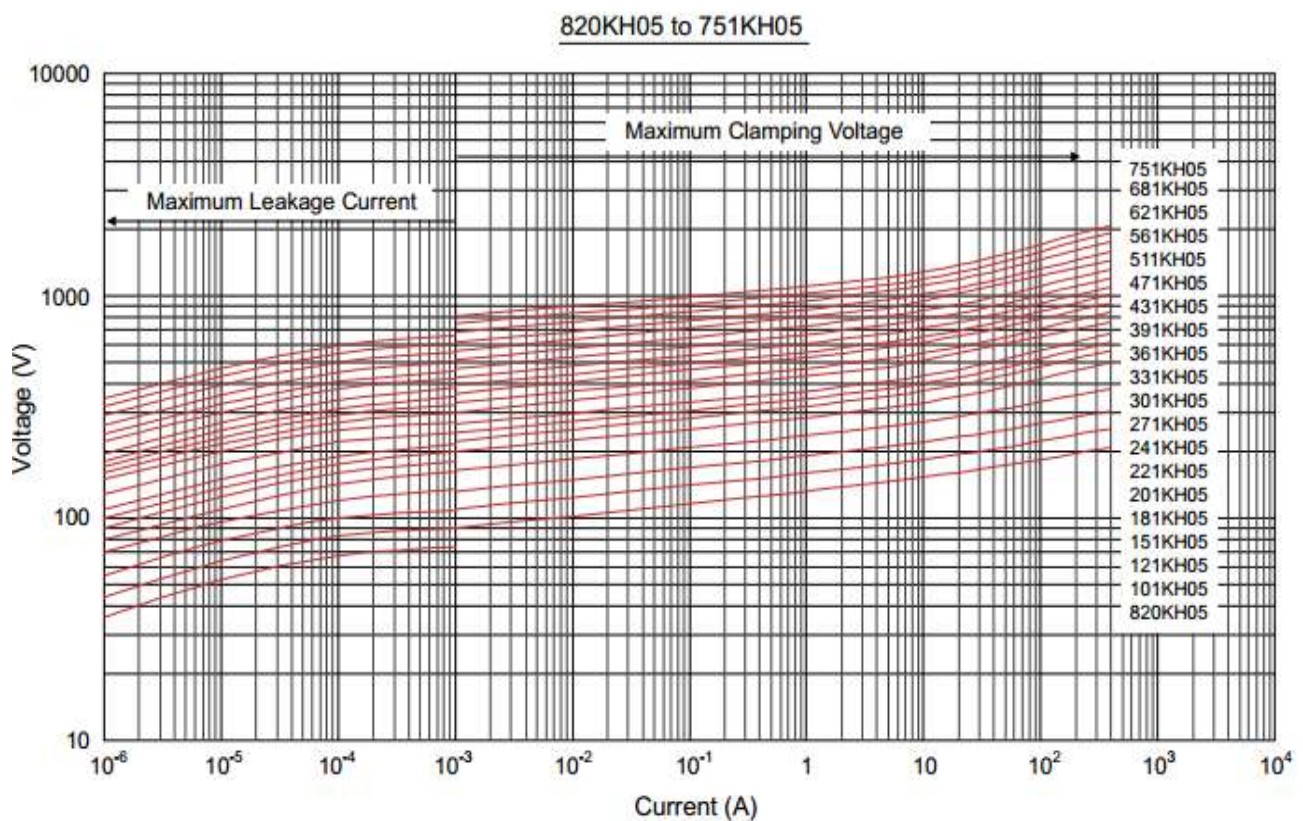
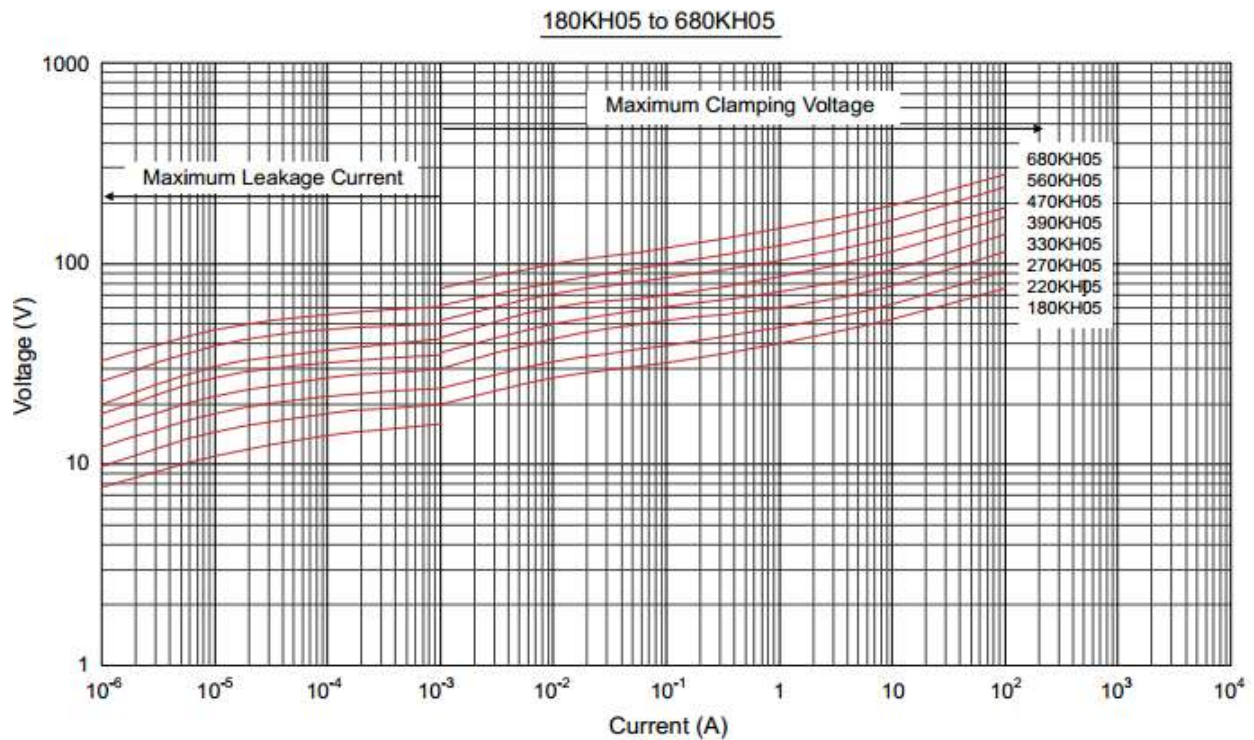
Power Derating Curve



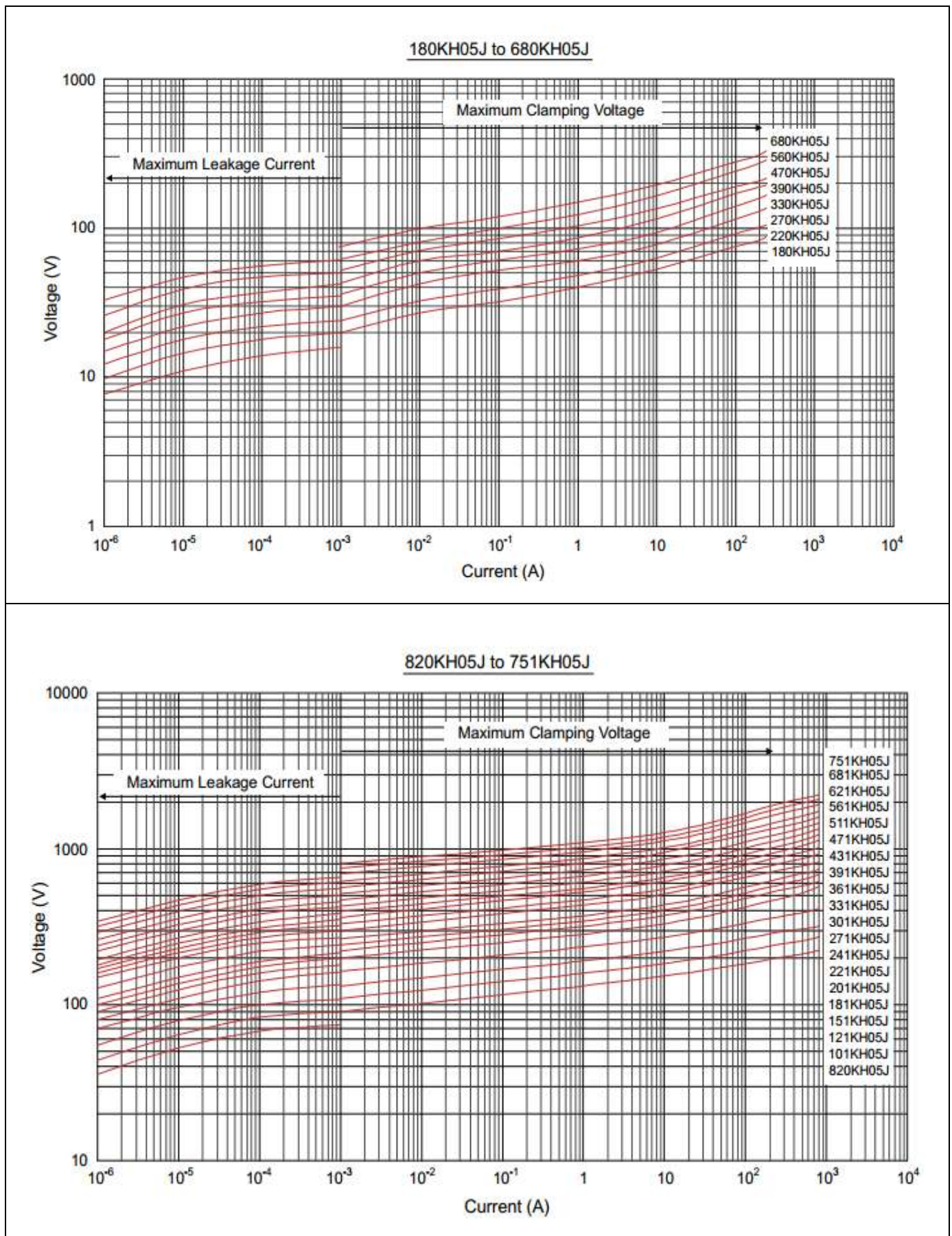
Maximum Surge Current Derating Curve



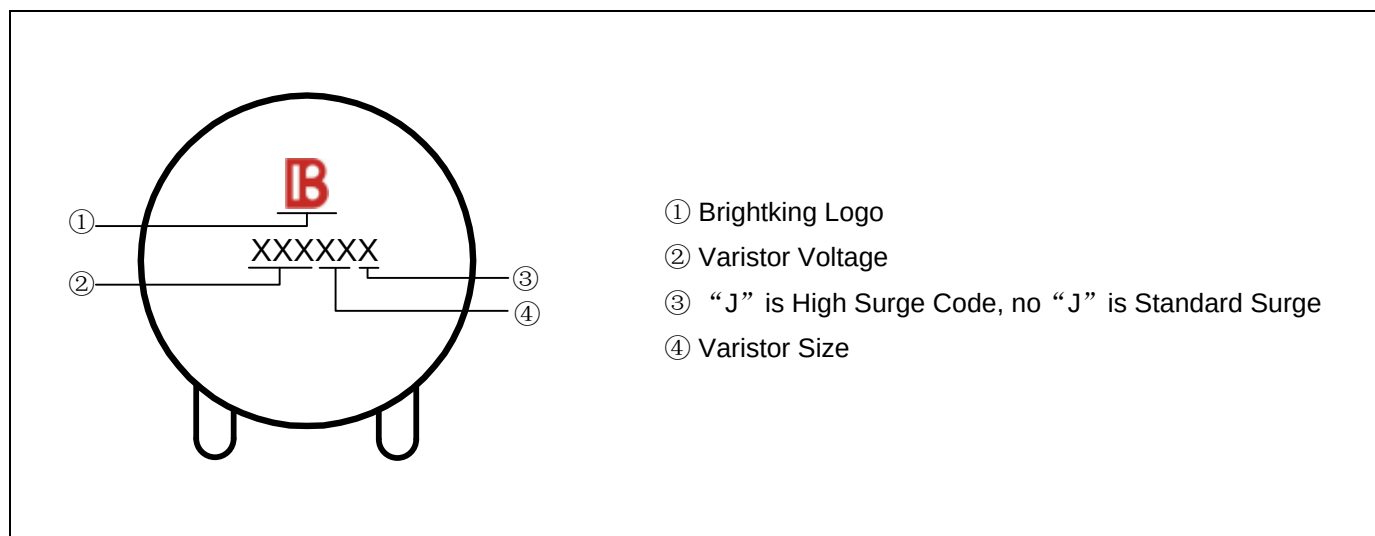
Maximum Leakage Current and Maximum Clamping Voltage Curve



Maximum Leakage Current and Maximum Clamping Voltage Curve



Marking Code



Quantity

Packaging Dimensions (Unit: mm)	Quantity
Bulk	1000pcs/bag 2bags/box