

## Metal Oxide Varistor Data Sheet

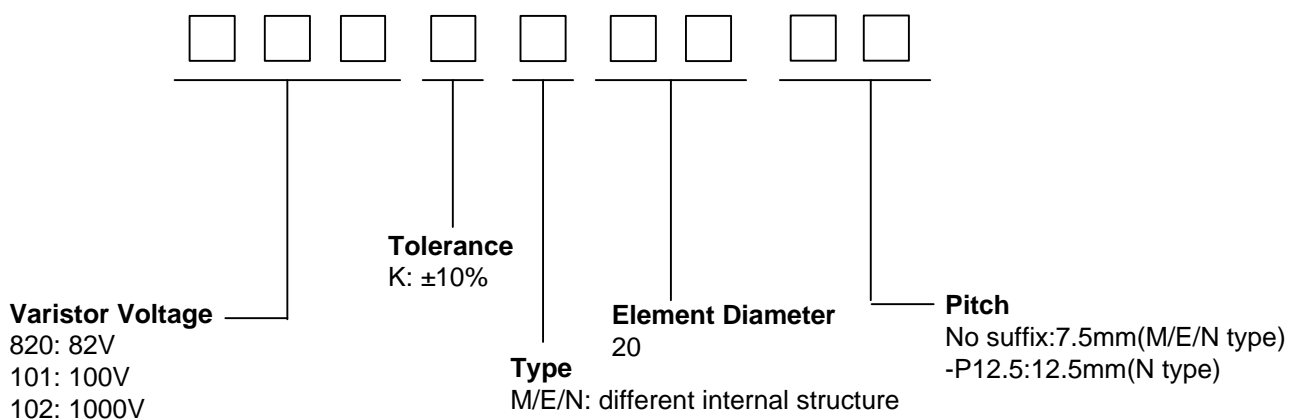
### Features

- TMOV integrated thermal protection device
- High peak surge current rating up to 10KA
- Designed to facilitate compliance to UL1449 for TVSS products
- Wide operating voltage ( $V_{1mA}$ ) range from 18V to 1200V
- Rated current: 15A
- Rated Functioning Temperature: 136(°C)
- Fast responding to transient over-voltage and limited current
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Three-lead version available for indication purposes
- Meets MSL level 1, per J-STD-020
- Operating Temperature: -40°C ~ +85°C
- Storage Temperature: -40°C ~ +85°C
- Safety certification: UL: E327997

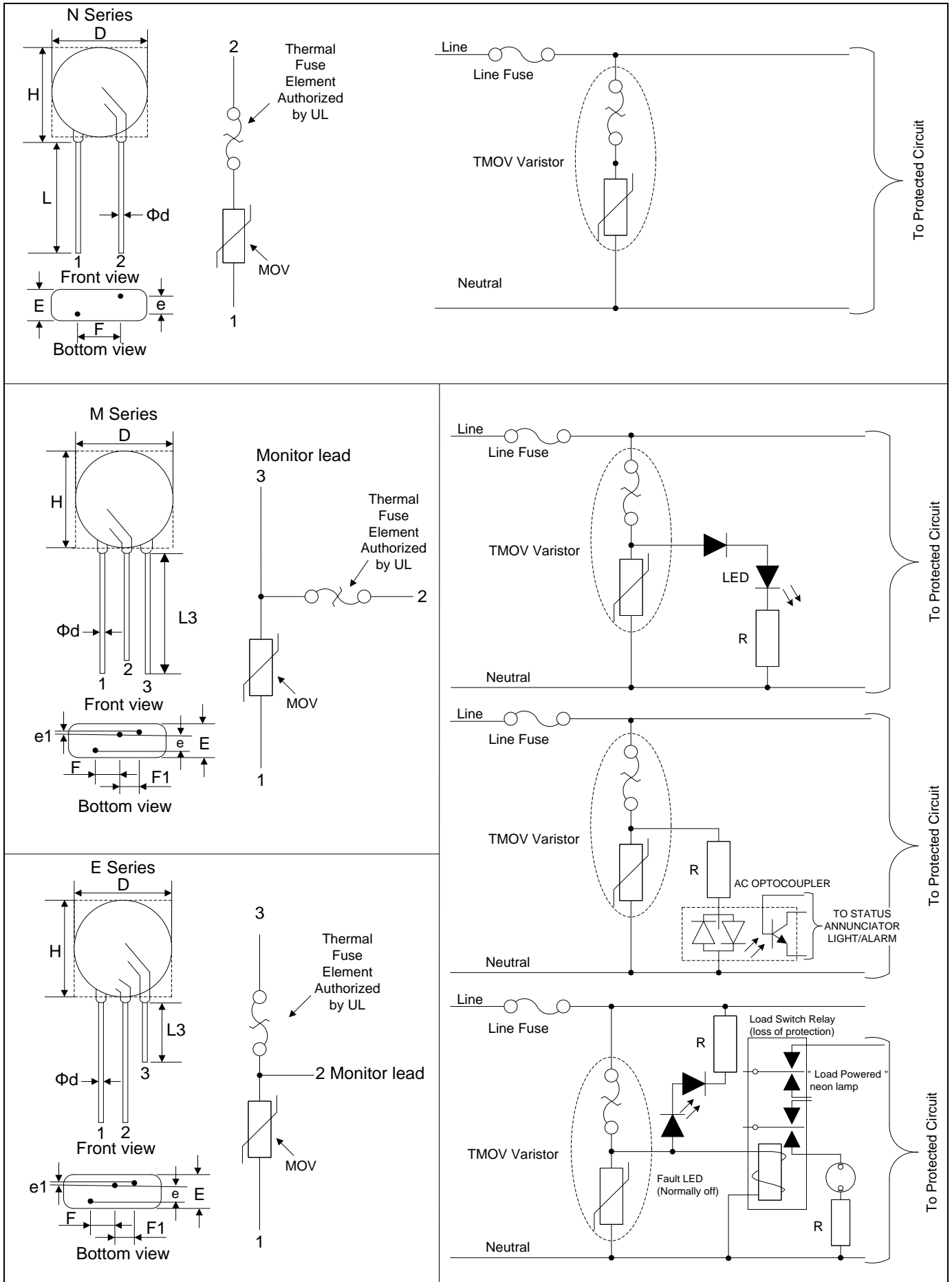
### Applications

- AC power line or AC/DC supplies
- 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
- AC panel protection Modules

### Part number code



**Lead configurations and application examples**



**Dimensions**

Symbol		BK'S M / E / N Varistor		
		20M	20E	20N
D (max.)		24.0	24.0	24.0
H (max.)		26.0	26.0	26.0
F ( $\pm 1.0$ )		7.5	7.5	12.5 / 7.5
F1 ( $\pm 1.0$ )		5.0	5.0	-
e (max.)	180K~121K	3.0	3.0	3.0
	151K~391K	3.8	3.8	3.8
	431K~621K	5.5	5.5	5.5
	681K~911K	7.8	7.8	7.8
	102K~122K	10.0	10.0	10.0
e1	180K~121K	1.5 $\pm$ 1.0	1.5 $\pm$ 1.0	-
	151K~391K			
	431K~621K			
	681K~911K			
	102K~122K			
E (max.)	180K~121K	9.0	9.0	9.0
	151K~391K	9.8	9.8	9.8
	431K~621K	11.5	11.5	11.5
	681K~911K	13.8	13.8	13.8
	102K~122K	16.0	16.0	16.0
L (min.)		20.0	20.0	20.0
L3 (min.)		10.0	10.0	-
$\Phi d$		1.0		

**Electrical characteristics**

Part Number	Maximum Allowable Voltage		Varistor Voltage	Maximum Clamping Voltage		Maximum Peak Current (8/20 $\mu$ s)		Maximum Energy (Joule)		Rated Power (W)	Typical Capacitance (Reference) @1KHz (pf)
	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)	1 time	2 times	10/1000 $\mu$ s	2ms		
							(A)				
180KM(E,N)20	11	14	18(15~21.6)	20	36	3000	2000	13	10	0.2	28500
220KM(E,N)20	14	18	22(19.5~26)	20	43	3000	2000	16	12	0.2	18500
270KM(E,N)20	17	22	27(24~31)	20	53	3000	2000	19	14	0.2	13000
330KM(E,N)20	20	26	33(29.5~36.5)	20	65	3000	2000	24	18	0.2	11500
390KM(E,N)20	25	31	39(35~43)	20	77	3000	2000	28	21	0.2	8500
470KM(E,N)20	30	38	47(42~52)	20	93	5000	3000	34	25	0.2	7400
560KM(E,N)20	35	45	56(50~62)	20	110	5000	3000	41	30	0.2	6500
680KM(E,N)20	40	56	68(61~75)	20	135	5000	3000	49	37	0.2	5800
820KM(E,N)20	50	65	82(74~90)	100	135	6500	4500	56	42	1.0	4900
101KM(E,N)20	60	85	100(90~110)	100	165	6500	4500	70	52	1.0	4000
121KM(E,N)20	75	100	120(108~132)	100	200	6500	4500	85	63	1.0	3300
151KM(E,N)20	95	125	150(135~165)	100	250	10000	8000	100	70	1.0	2700
181KM(E,N)20	115	150	180(162~198)	100	300	10000	8000	110	80	1.0	2200
201KM(E,N)20	130	170	200(185~225)	100	340	10000	8000	140	100	1.0	2000
221KM(E,N)20	140	180	220(198~242)	100	365	10000	8000	155	110	1.0	1800
241KM(E,N)20	150	200	240(216~264)	100	395	10000	8000	170	120	1.0	1650
271KM(E,N)20	175	225	270(243~297)	100	455	10000	8000	190	135	1.0	1500
301KM(E,N)20	190	250	300(270~330)	100	500	10000	8000	205	145	1.0	1300
331KM(E,N)20	210	275	330(297~363)	100	550	10000	8000	215	150	1.0	1200
361KM(E,N)20	230	300	360(324~396)	100	595	10000	8000	225	160	1.0	1100
391KM(E,N)20	250	320	390(351~429)	100	650	10000	8000	240	170	1.0	1000
431KM(E,N)20	275	350	430(387~473)	100	710	10000	8000	270	190	1.0	930
471KM(E,N)20	300	385	470(423~517)	100	775	10000	8000	350	250	1.0	850
511KM(E,N)20	320	415	510(459~561)	100	845	10000	8000	380	270	1.0	780
561KM(E,N)20	350	460	560(504~616)	100	920	10000	8000	400	280	1.0	710
621KM(E,N)20	385	505	620(558~682)	100	1025	10000	8000	425	300	1.0	650
681KM(E,N)20	420	560	680(612~748)	100	1120	10000	8000	435	310	1.0	600
751KM(E,N)20	460	615	750(675~825)	100	1240	10000	8000	455	327	1.0	530
781KM(E,N)20	485	640	780(702~858)	100	1290	10000	8000	461	335	1.0	510
821KM(E,N)20	510	670	820(738~902)	100	1355	10000	8000	475	344	1.0	500
911KM(E,N)20	550	745	910(819~1001)	100	1500	10000	8000	500	350	1.0	440
102KM(E,N)20	625	825	1000(900~1100)	100	1650	10000	8000	560	400	1.0	400
112KM(E,N)20	680	895	1100(990~1210)	100	1815	10000	8000	610	430	1.0	360
122KM(E,N)20	750	990	1200(1080~1320)	100	1980	10000	8000	650	460	1.0	320

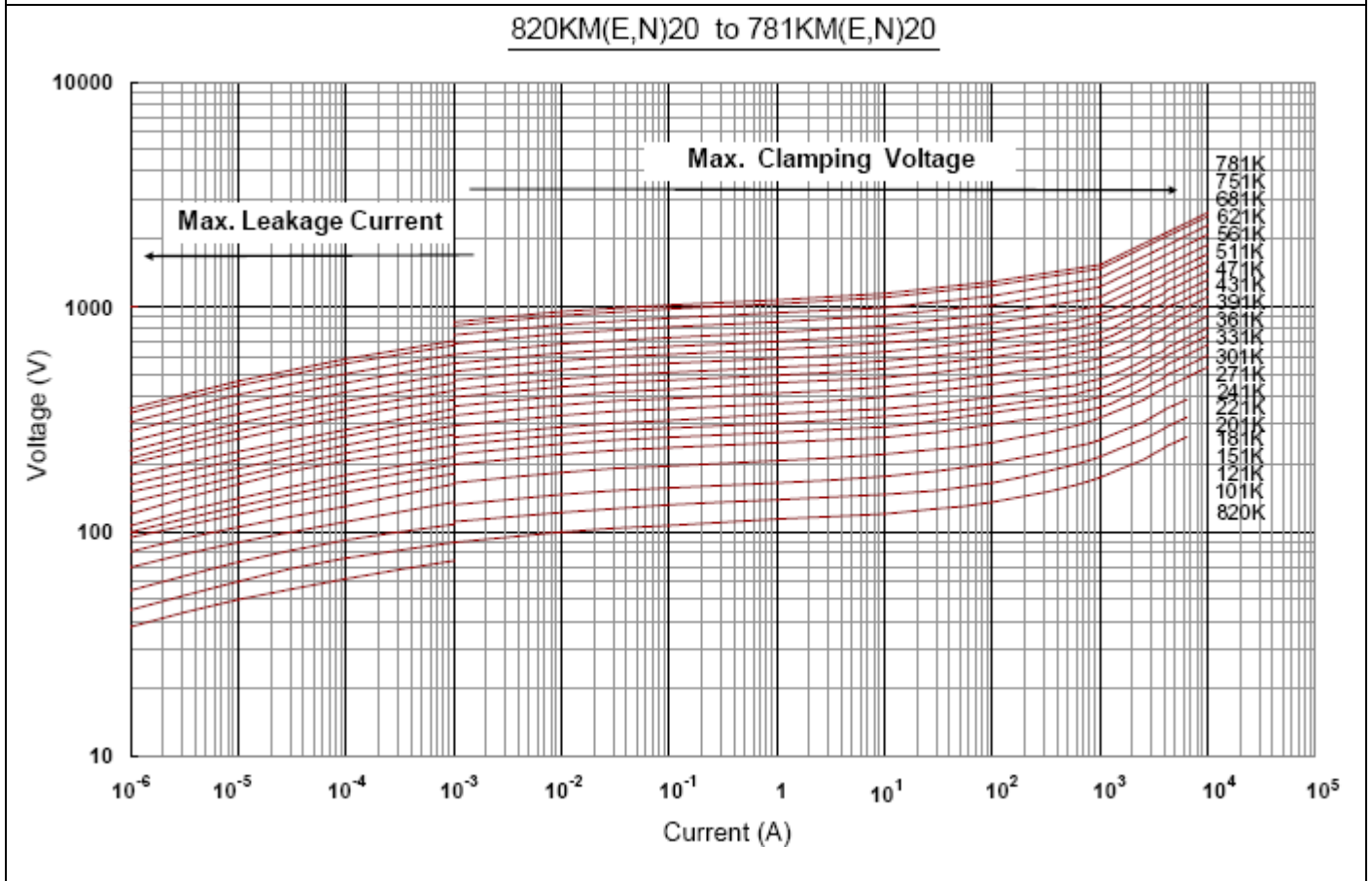
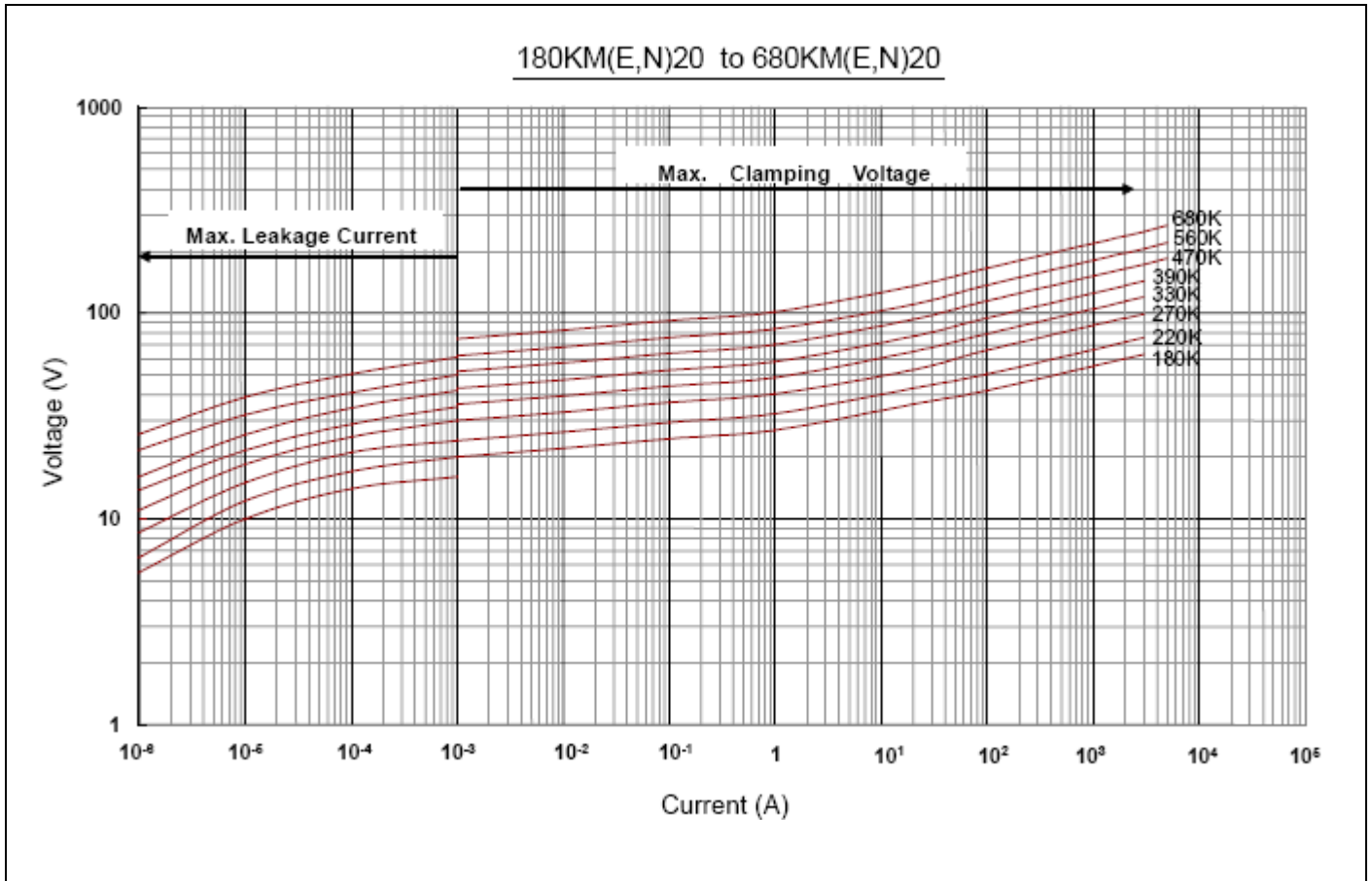
**Mechanical Characteristics**

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"> <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"> <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 sec	No visible damage  ΔV <sub>1mA</sub> /V <sub>1mA</sub>   ≤10%								

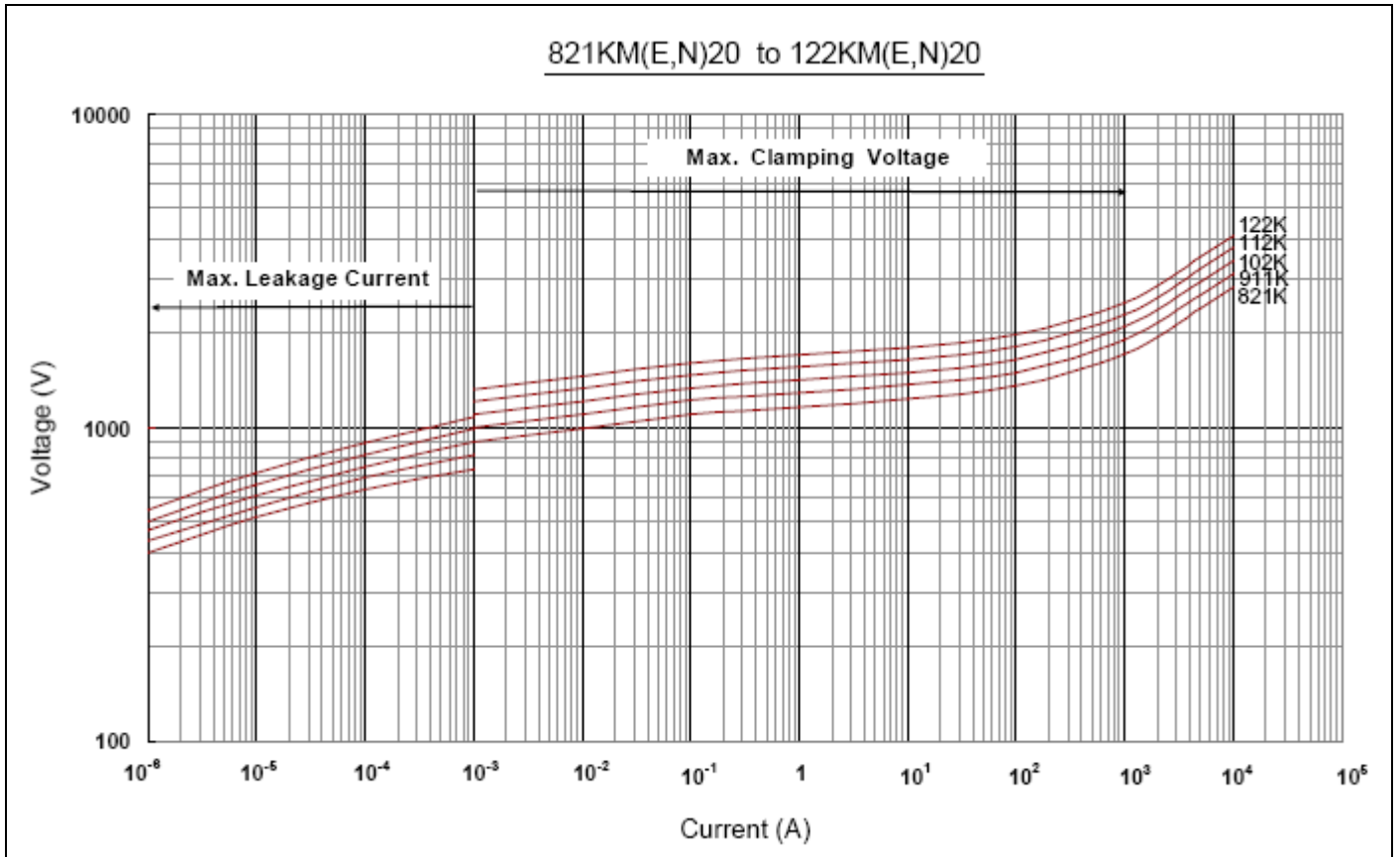
**Reliability**

Items	Test conditions / Methods	Specifications															
High Temperature Storage	Ambient Temp: 85±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"> <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>85±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	85±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	85±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 <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															

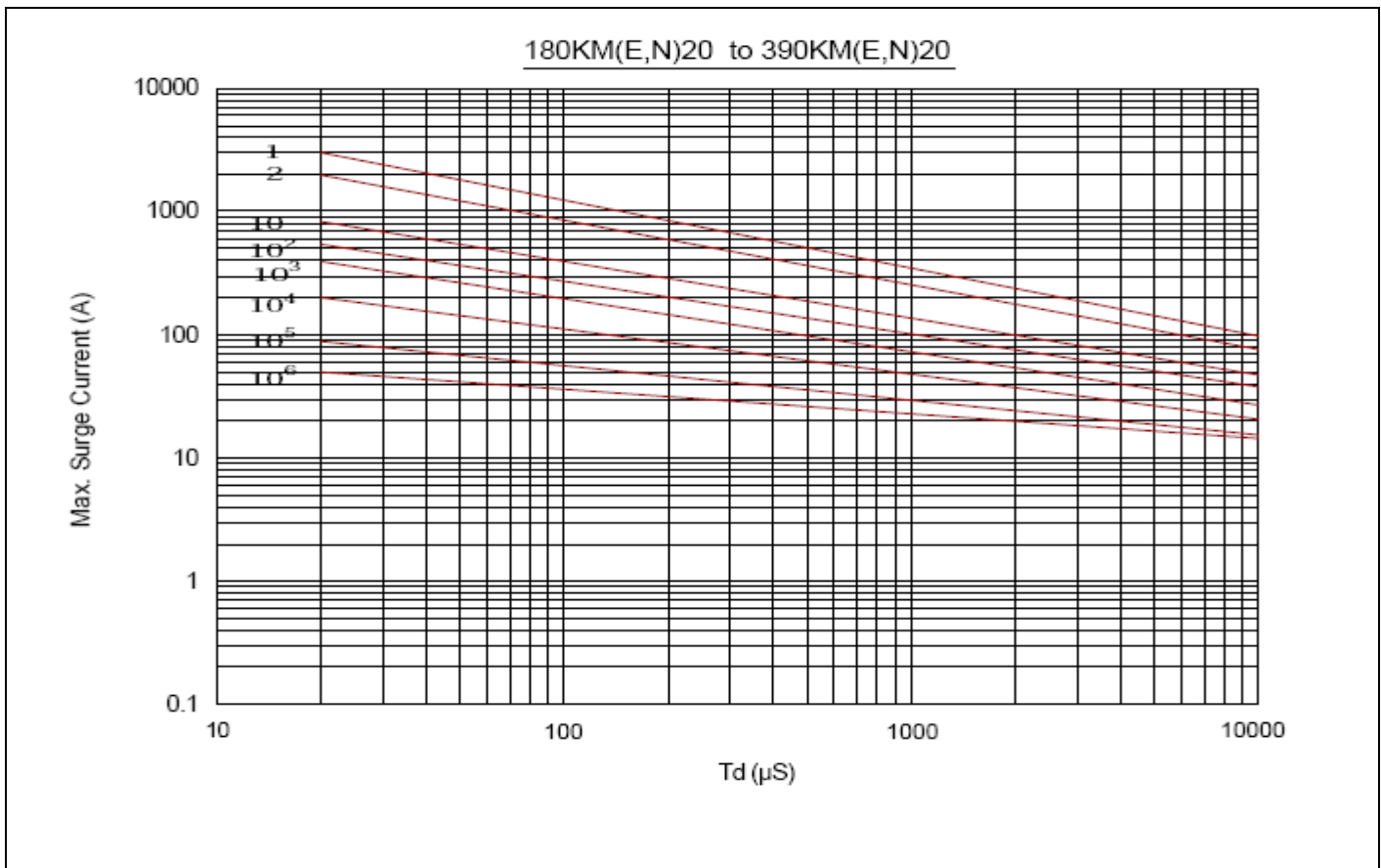
**Maximum Leakage Current and Maximum Clamping Voltage Curve**



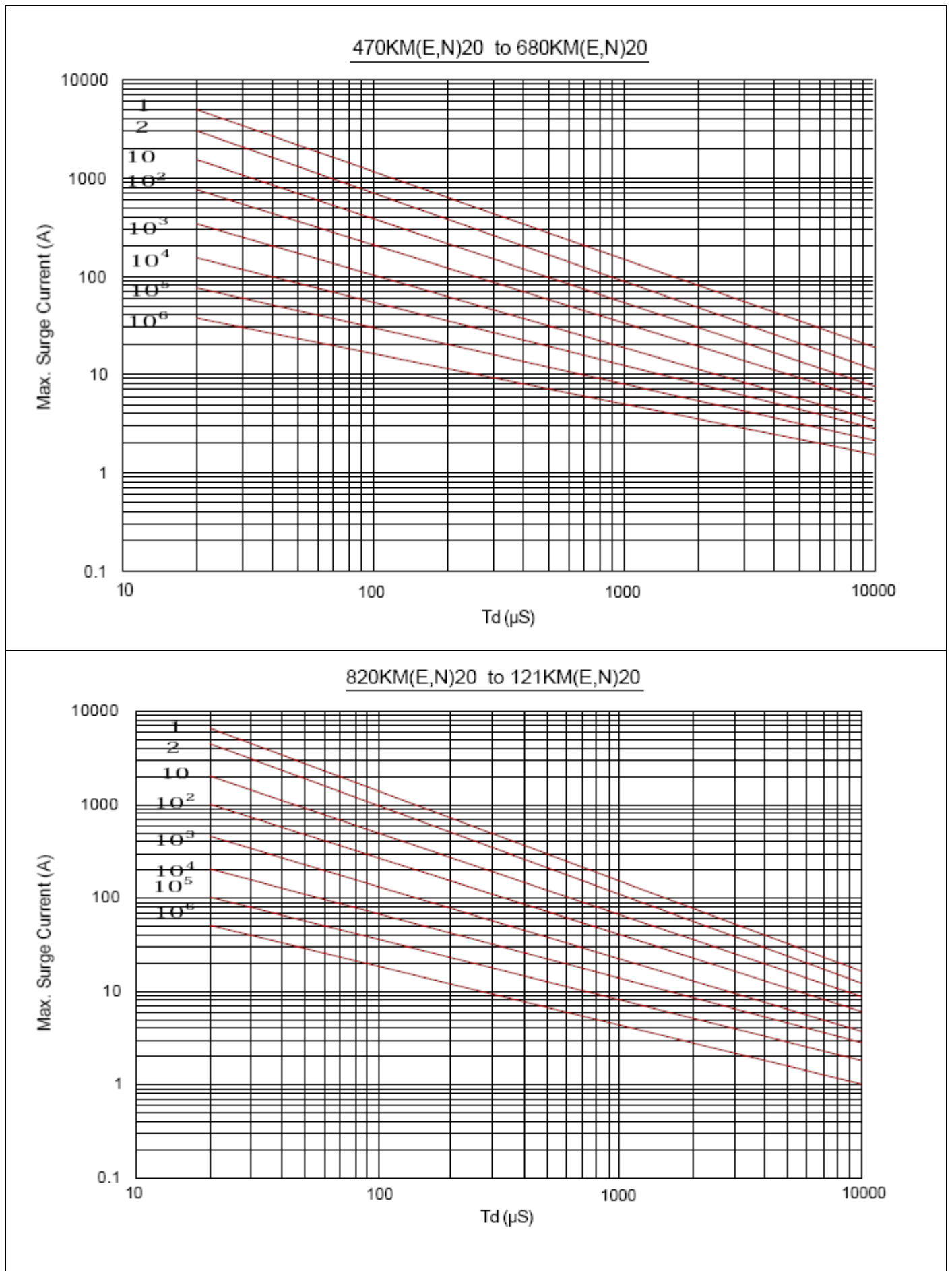
**Maximum Leakage Current and Maximum Clamping Voltage Curve**



**Maximum Surge Current Derating Curve**

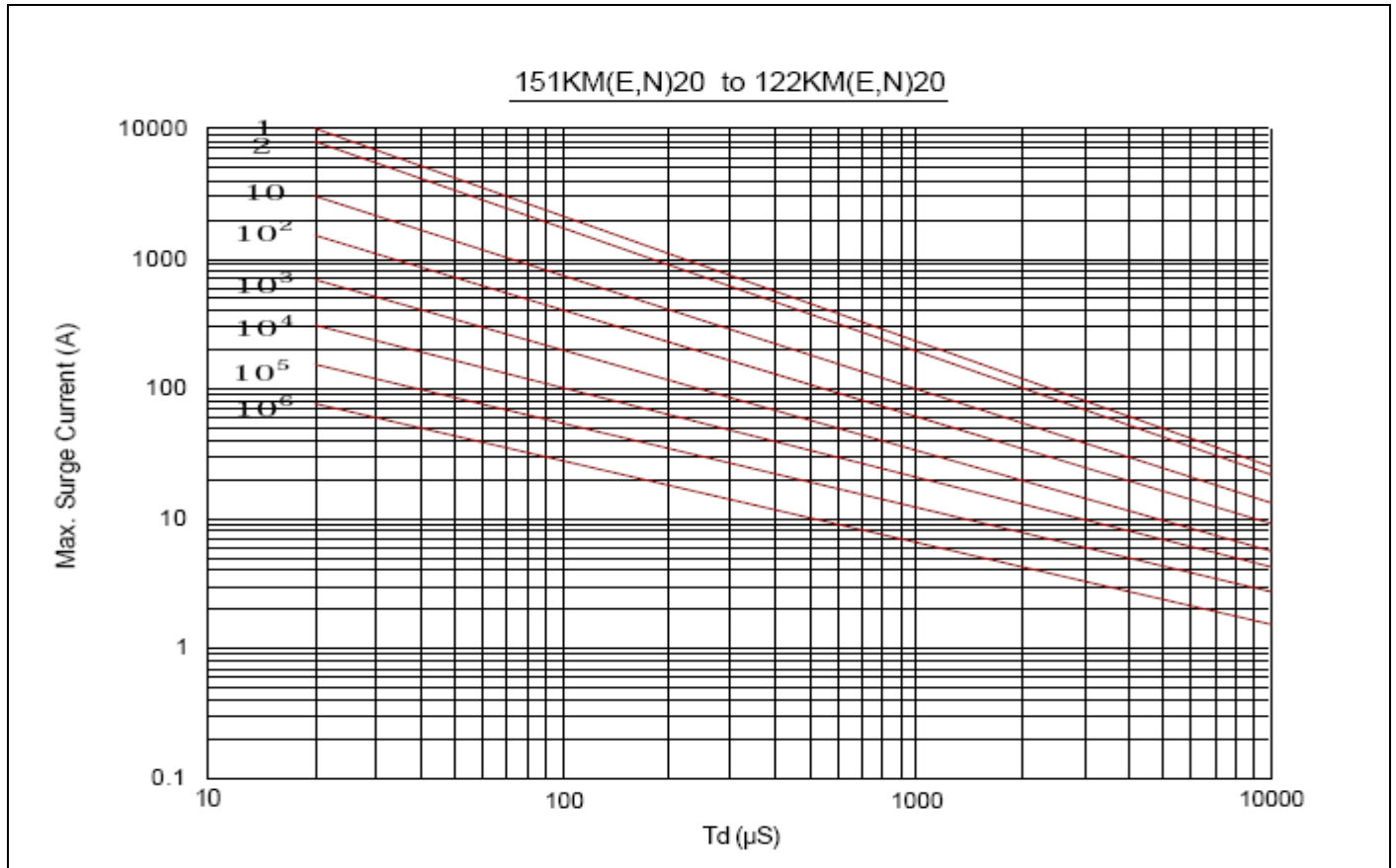


**Maximum Surge Current Derating Curve**

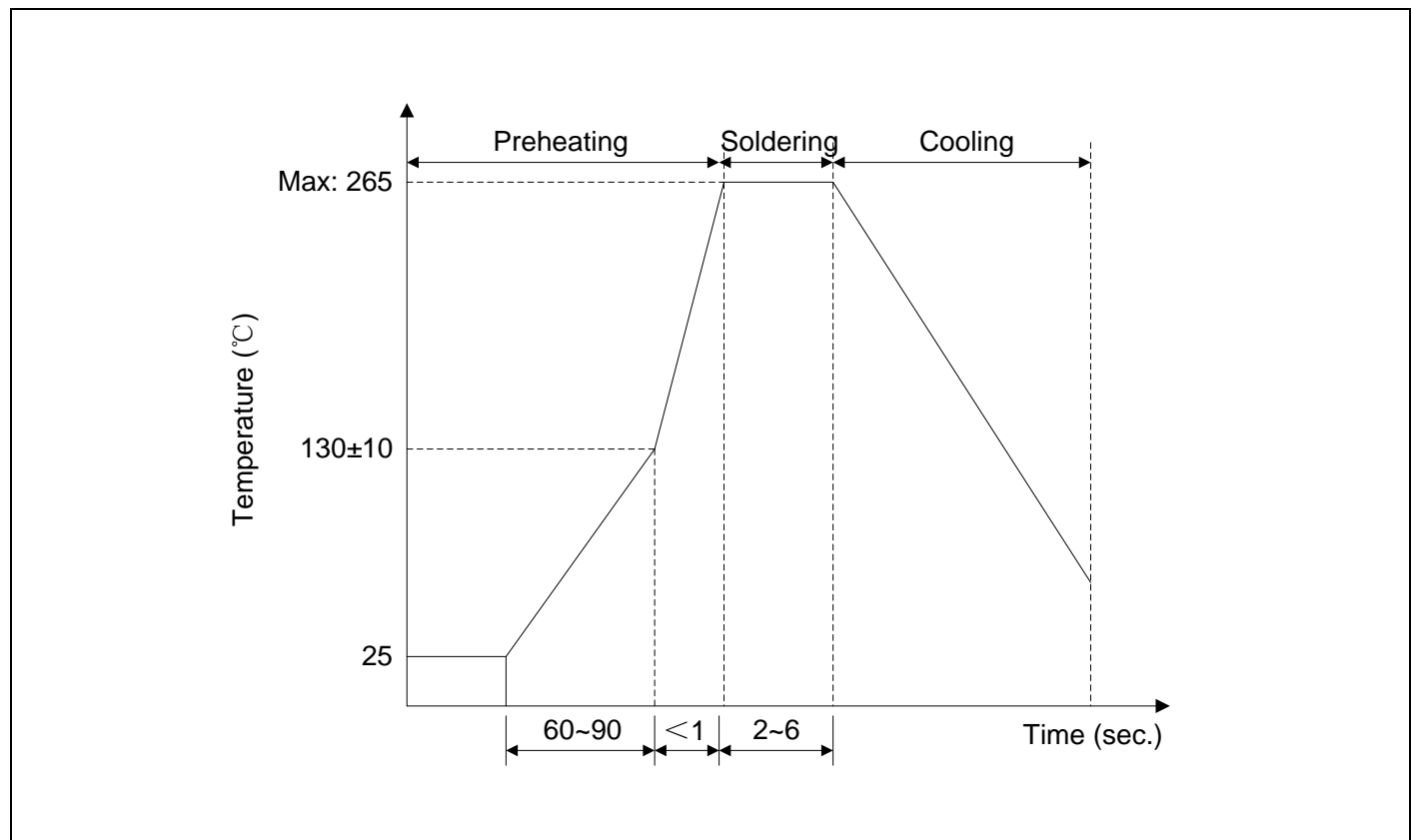




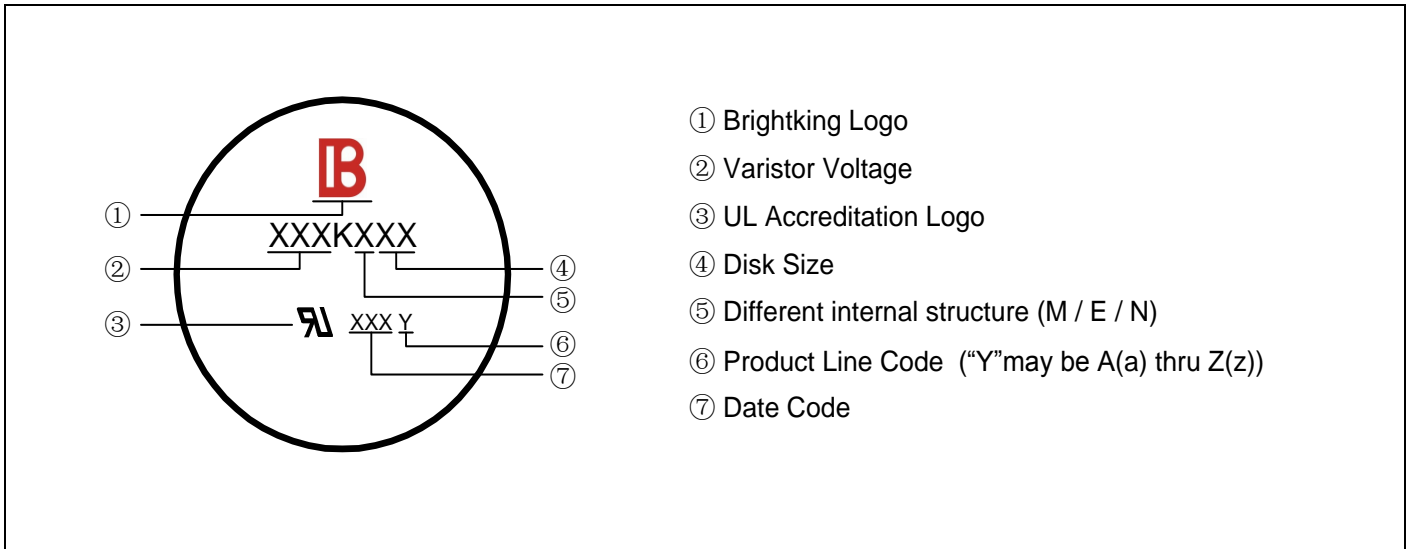
**Maximum Surge Current Derating Curve**



**Soldering Recommendation**



**Marking code**



**Quantity**

Packaging Dimensions (Unit: mm)	Quantity
<p>Bulk</p> <p>65 Max.                  245 Max.                  185 Max.</p>	<p>100pcs/bag                  2bags/box</p>