

# Metal Oxide Varistor: TVB ES Series

## Plastic Encapsulated Type Varistor for Surge Protection



### ■ Features

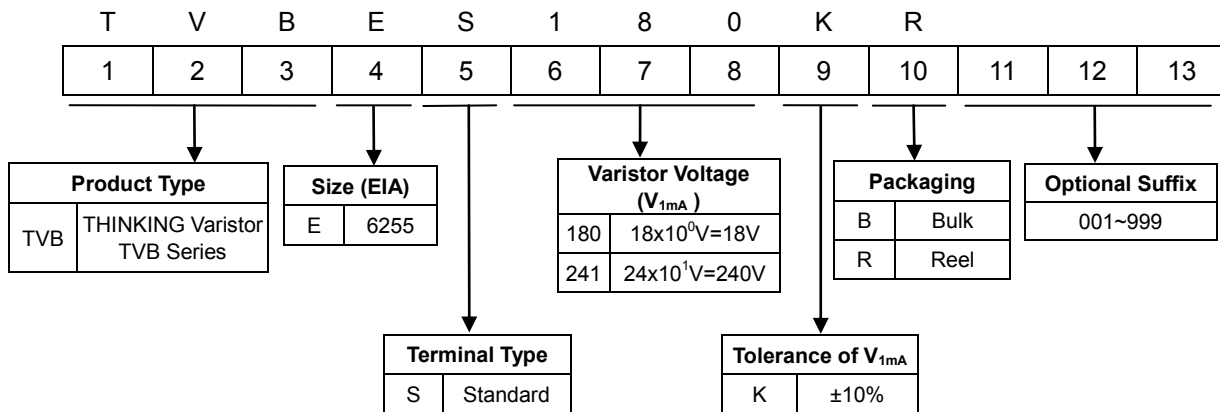
1. Low profile and space saving
2. Electrical characteristics equivalent to leaded type TVR14 series
3. Operating voltage ranges from 17V to 460V
4. Recommended for wave soldering and IR-reflow soldering
5. Flame-retardant encapsulation material (meeting UL94-V0 requirement)
6. RoHS compliant
7. Operating temperature range:  $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$   
Storage temperature range:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
8. Agency recognition: UL/cUL/TUV/CQC



### ■ Recommended Applications

1. Power supply
2. Power supply for home appliance
3. Industrial equipment
4. Telecommunication system

### ■ Part Number Code

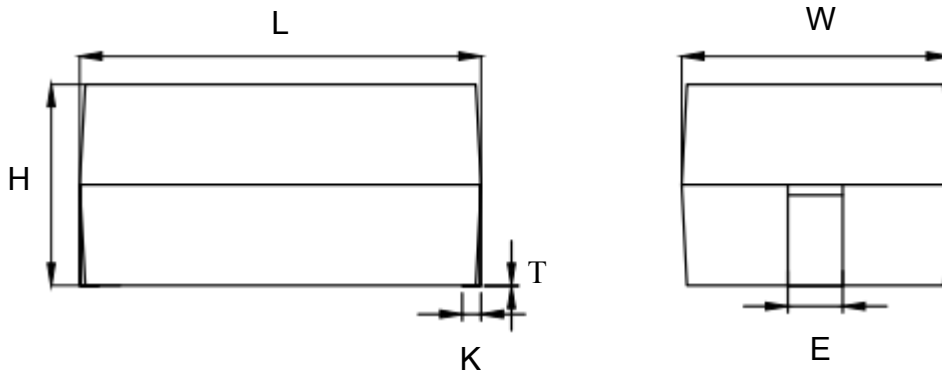


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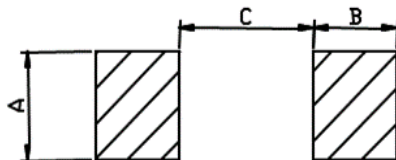
### Structures and Dimensions



(Unit:mm)

Size (EIA)	V <sub>1mA</sub> (V)	L	W	H	K	T	E
6255	V <sub>1mA</sub> =180 ~ 361	15.8+/- 0.3	14.0+/- 0.3	4.0+/- 0.3	2.0+/- 0.3	0.15+/- 0.05	4.0+/- 0.3
	V <sub>1mA</sub> =391 ~ 751			6.0+/- 0.3			

### Soldering Pads



(Unit: mm)

Item	A	B	C	L
Size (EIA)	6255	4.5	3.3	10.2
				--

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### Electrical Characteristics

Part No.	Varistor Voltage (@ 1mA DC)	Max. Continuous Voltage		Max. Clamping Voltage (8/20 $\mu$ s)		Max. Surge Current (8/20 $\mu$ s)	Max. Energy (10/1000 $\mu$ s)	Rated Power	Safety Approvals *2		
	V <sub>1mA</sub> (V)	V <sub>AC(rms)</sub> (V)	V <sub>DC</sub> (V)	V <sub>P</sub> (V)	I <sub>P</sub> (A)	I <sub>max</sub> (A)	W <sub>max</sub> (J)	P (W)	UL 1449 &cUL	TUV	CQC
TVBES270	27(24~30)	17	22	53	10	1000	6	0.1	√	√	√
TVBES330	33(30~36)	20	26	65	10	1000	7	0.1	√	√	√
TVBES390	39(35~43)	25	31	77	10	1000	8	0.1	√	√	√
TVBES470	47(42~52)	30	38	93	10	1000	10	0.1	√	√	√
TVBES560	56(50~62)	35	45	125	10	1000	12	0.1	√	√	√
TVBES680	68(61~75)	40	56	135	10	1000	15	0.1	√	√	√
TVBES820	82(74~90)	50	65	150	50	4500	21	0.6	√	√	√
TVBES101	100(90~110)	60	85	165	50	4500	26	0.6	√	√	√
TVBES121	120(108~132)	75	100	200	50	4500	31	0.6	√	√	√
TVBES151	150(135~165)	95	125	250	50	4500	40	0.6	√	√	√
TVBES181	180(162~198)	115	150	300	50	4500	47	0.6	√	√	√
TVBES201	205(185~226)	130	170	340	50	4500	52	0.6	√	√	√
TVBES221	220(198~242)	140	180	360	50	4500	58	0.6	√	√	√
TVBES241	240(216~264)	150	200	395	50	4500	64	0.6	√	√	√
TVBES271	270(243~297)	175	225	455	50	4500	67	0.6	√	√	√
TVBES301	300(270~330)	195	250	500	50	4500	70	0.6	√	√	√
TVBES331	330(297~363)	215	275	550	50	4500	72	0.6	√	√	√
TVBES361	360(324~396)	230	300	595	50	4500	76	0.6	√	√	√
TVBES391	390(351~429)	250	320	650	50	4500	82	0.6	√	√	√
TVBES431	430(387~473)	275	350	710	50	4500	93	0.6	√	√	√
TVBES471	475(428~523)	300	385	775	50	4500	99	0.6	√	√	√
TVBES511	510(459~561)	320	410	845	50	4500	107	0.6	√	√	√
TVBES561	560(504~616)	350	450	930	50	4500	113	0.6	√	√	√
TVBES621	620(558~682)	395	510	1020	50	4500	125	0.6	√	√	√
TVBES681	680(612~748)	420	560	1120	50	4500	128	0.6	√	√	√
TVBES751	750(675~825)	460	615	1235	50	4500	134	0.6	√	√	√

Note:

\*1. Nominal discharge current (I<sub>n</sub>) is the parameter measured with 8/20 $\mu$ s current waveform for UL 1449 4<sup>th</sup> edition.

\*2. UL 1449 4<sup>th</sup> / cUL file no.: E314979, TUV IEC 61051 file no.: J50477949

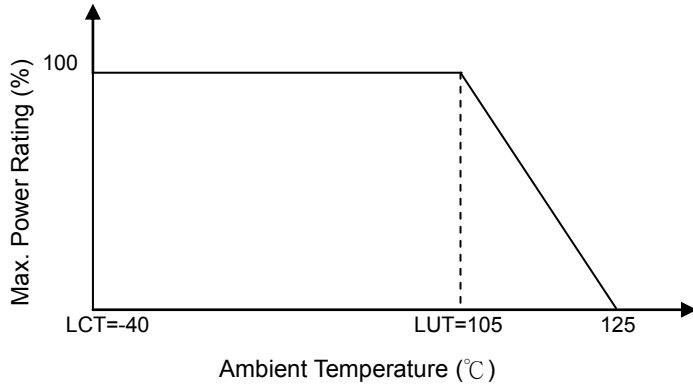
CQC GB/T10193-1997 and GB/T10194-1997 file no.: CQC20001267007

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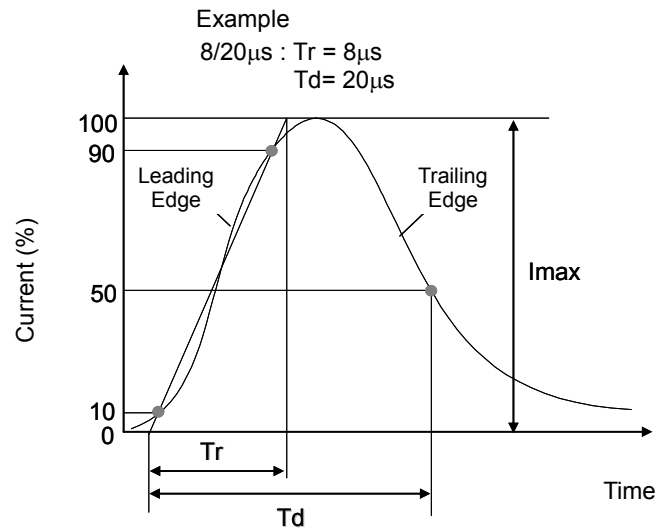
## Plastic Encapsulated Type Varistor for Surge Protection



### Power Derating Curve

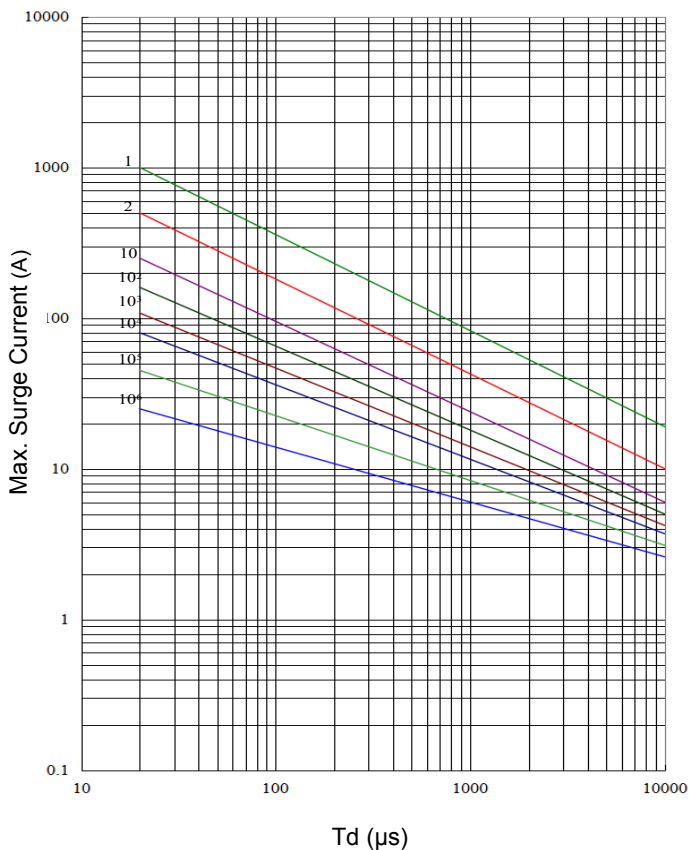


### Surge Current Standard Waveform

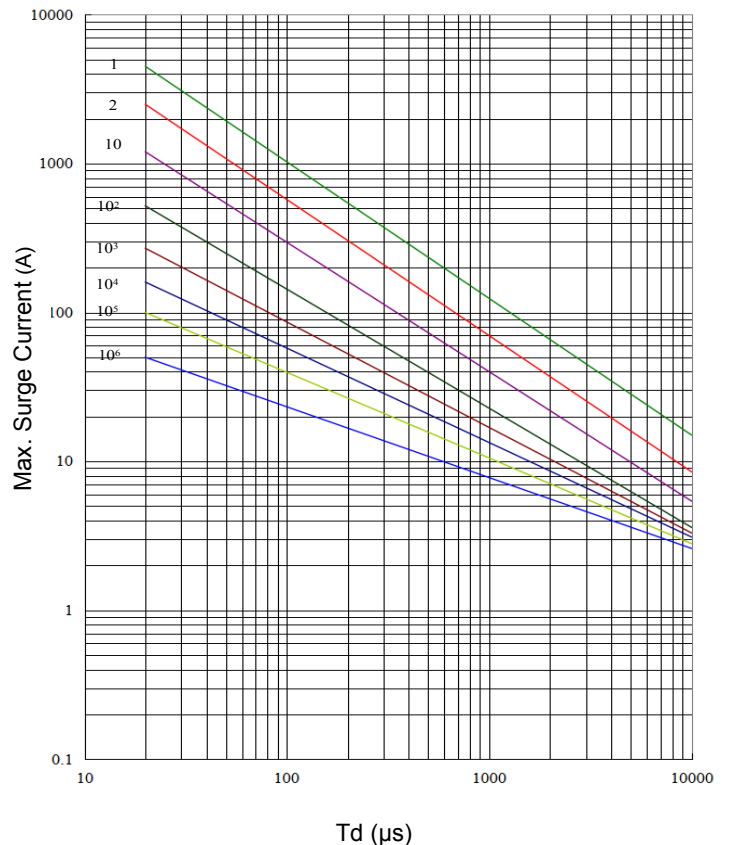


### Max. Surge Current Derating Curves

TVBES270 to TVBES680



TVBES820 to TVBES751



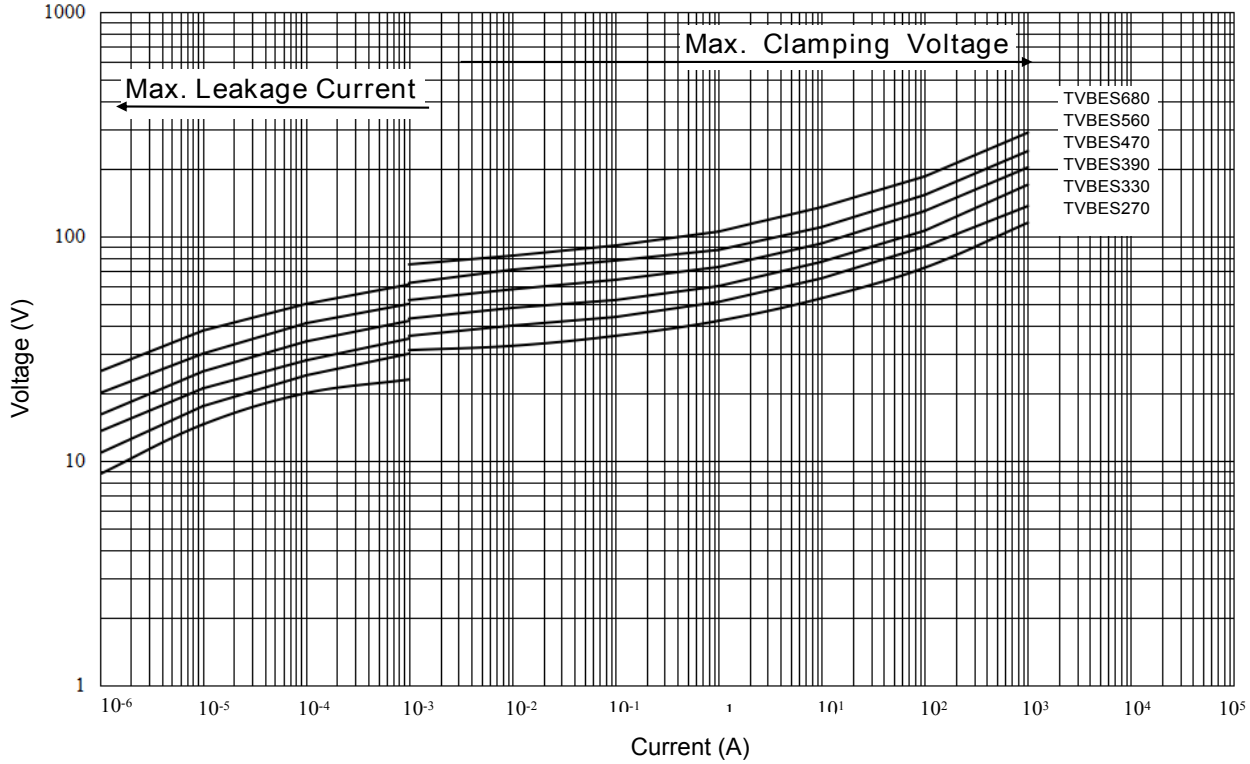
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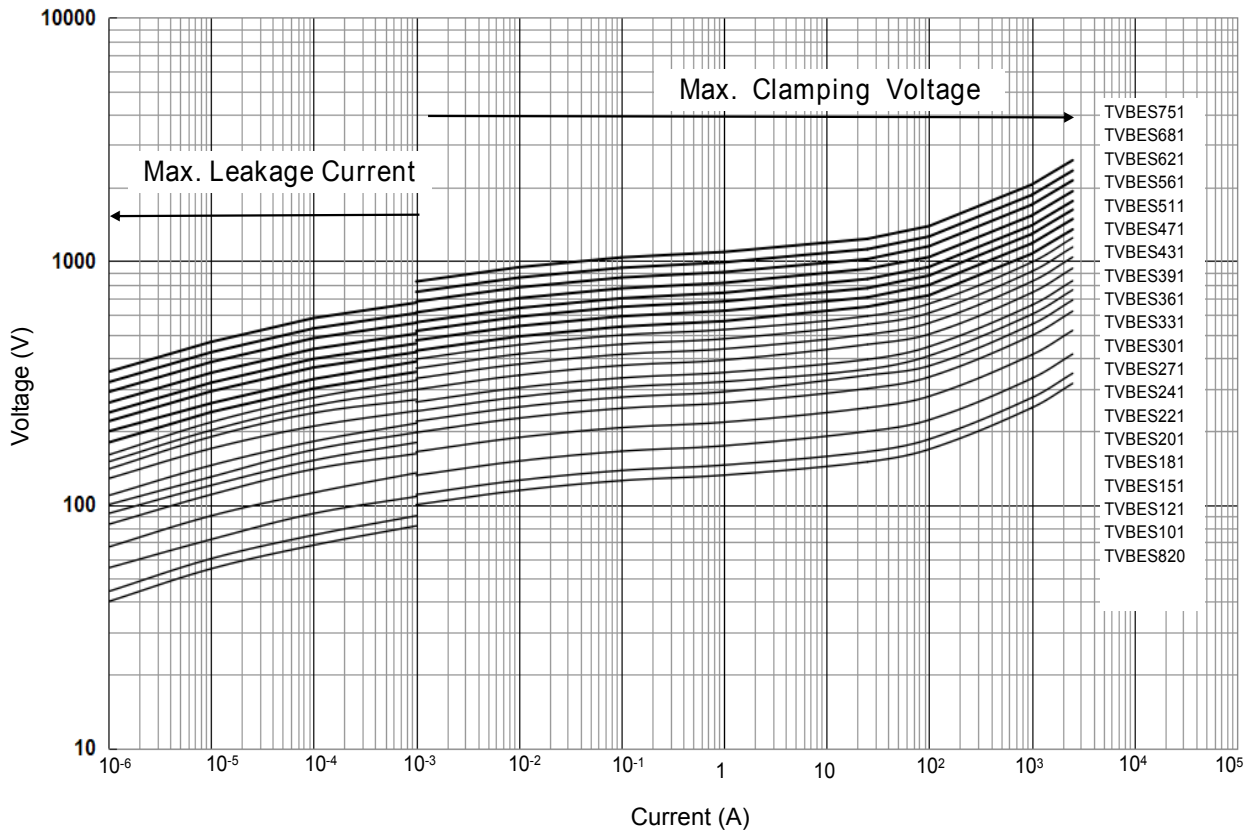


### Max. Leakage Current and Max. Clamping Voltage Curves

Max. Leakage Current and Max. Clamping Voltage Curves (TVB ES 270 to TVB ES 680)



Max. Leakage Current and Max. Clamping Voltage Curves (TVB ES 820 to TVB ES 751)



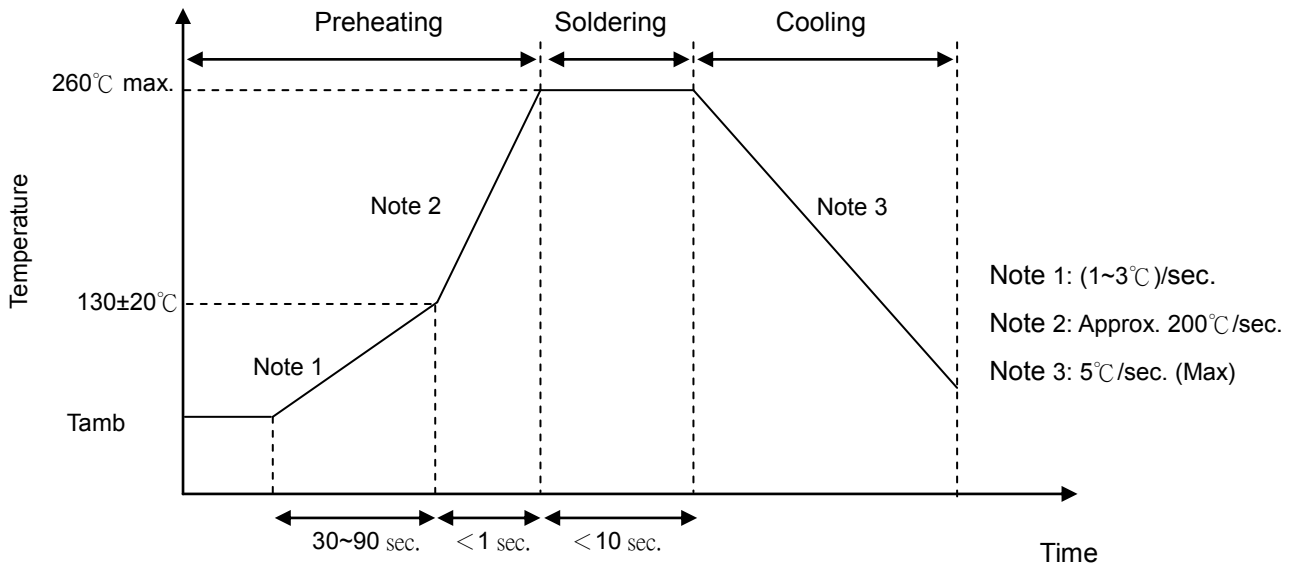
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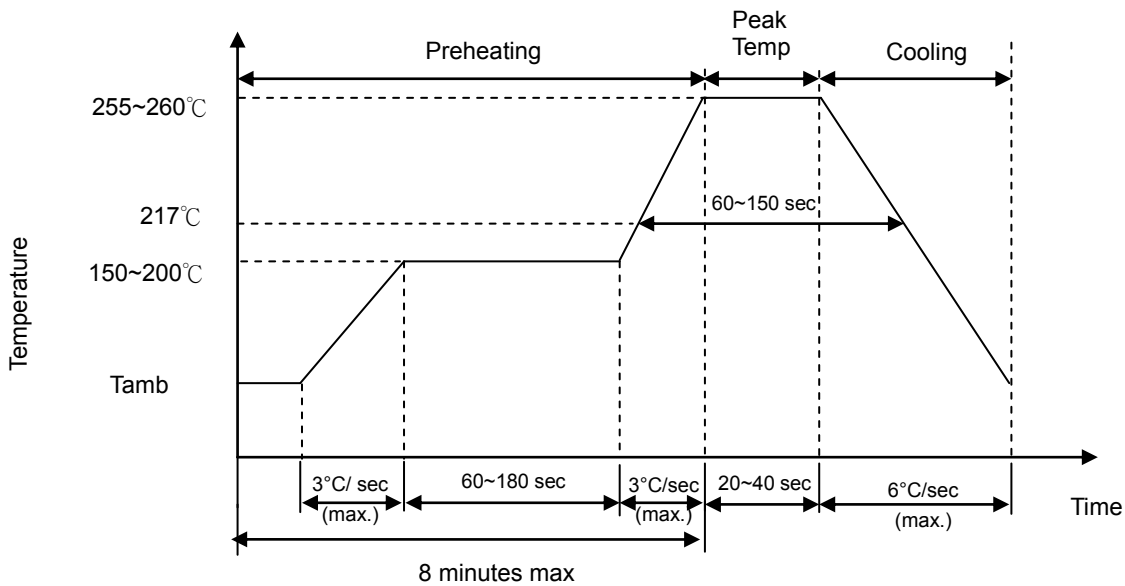


### ■ Soldering Recommendation

#### ● Wave Soldering Profile



#### ● IR-reflow Soldering Profile



#### ● Recommended Reworking Conditions with Soldering Iron

Item	Conditions
Temperature of Soldering Iron-tip	350°C (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	Φ3 mm (max.)

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### ■ Reliability

Item	Standard	Test conditions / Methods	Specifications															
Vibration	IEC 60068-2-6	Frequency range: 10~55Hz Amplitude: 0.75mm or 98m/s <sup>2</sup> Direction: 6hrs (3 x 2 hrs)	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage															
Solderability	IEC 60068-2-20	245±3°C, 3±0.3 sec.	At least 95% of terminal electrode is covered by new solder															
Resistance to Soldering Heat	IEC 60068-2-20	260±3°C, 10±1 sec.	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage															
High Temperature Storage	IEC 60068-2-2	125±5°C x 1000 ±24 hrs	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage															
Damp Heat, Steady State	IEC 60068-2-78	a. 40±2°C, 90 ~ 95 % RH, 1344 hrs. b. 40±2°C, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage Insulation Resistance ≥ 100MΩ															
Rapid Change of Temperature	IEC 60068-2-14	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>5±3</td> </tr> <tr> <td>3</td> <td>105±2</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>5±3</td> </tr> </tbody> </table>	Step	Temperature (°C)	Period (minutes)	1	-40±3	30±3	2	Room temperature	5±3	3	105±2	30±3	4	Room temperature	5±3	$ \Delta V_{1mA} / V_{1mA}  \leq 5\%$ No visible damage
Step	Temperature (°C)	Period (minutes)																
1	-40±3	30±3																
2	Room temperature	5±3																
3	105±2	30±3																
4	Room temperature	5±3																
High Temp. Load	MIL-STD-202 Method 108	105°C, 1000±24 hrs at V <sub>rms</sub> (Max. Continuous Voltage) V <sub>AC(rms)</sub> is applied to 180-151 V <sub>DC</sub> is applied to 181-751	$ \Delta V_{1mA} / V_{1mA}  \leq 10\%$ R ≥ 1000MΩ No visible damage															
8/20μs Surge Life	IEC 61051-1	8/20μs waveform, 10 surge currents, unipolar, interval 30 sec, amplitude	$ \Delta V_{1mA} / V_{1mA}  \leq 10\%$ No visible damage															
10/1000μs Surge Life	IEC 61051-1	10/1000μs waveform, 10 surge currents, unipolar, interval 2 mins	$ \Delta V_{1mA} / V_{1mA}  \leq 10\%$ No visible damage															
Voltage Proof	IEC 61051-1	Metal balls method, 2500 V <sub>ac</sub> 1 min	No visible damage															
Varistor Voltage Temp. Coefficient	Specification Standard	Varistor voltage is measured at -40°C, +105°C, and +25°C	-0.05 ≤ T <sub>C</sub> ≤ 0.05 (%/°C)															

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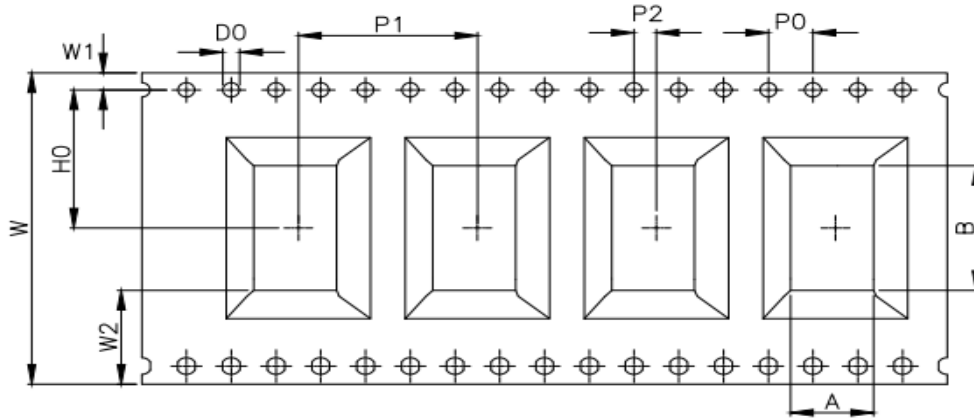
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### ■ Packaging

#### ● Taping Specification

16mm plastic embossed

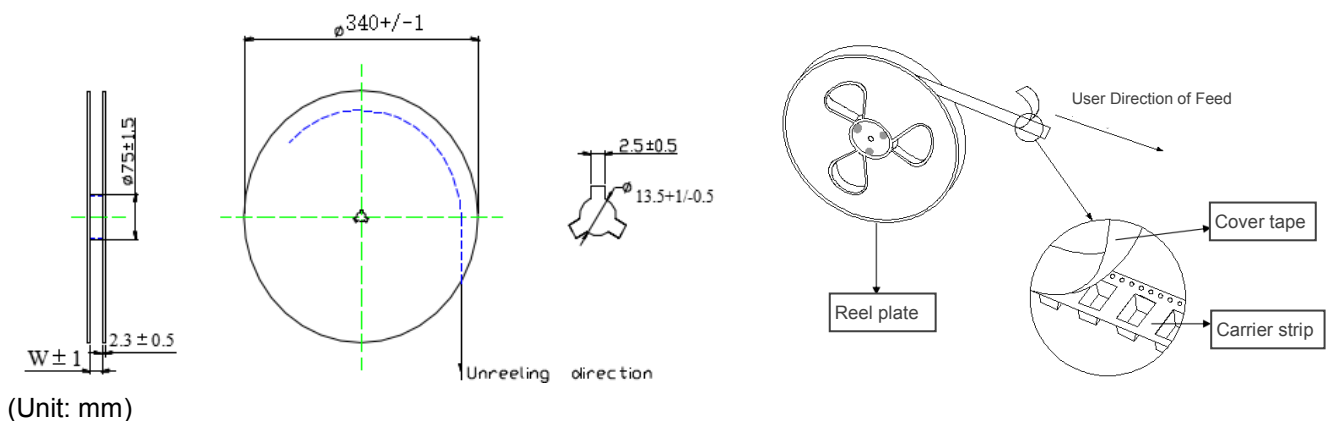


(Unit: mm)

Item	A*B	P0	P1	P2	H0	W	W1	W2	D0	
Tolerance	±0.2	±0.1	±0.1	±0.05	±0.05	±0.3	±0.1	Min.	+0.1/0	
Size	6255	14.4*16.2	4.0	20.0	2.0	14.2	32	1.75	7.9	1.5

#### ● Quantity

Reel Packing



(Unit: mm)

Size	Quantity (pcs/reel)	W
6255	500	33±1



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### ■ Warehouse Storage Conditions of Products

- Storage Conditions:
  1. Storage Temperature:  $-10^{\circ}\text{C} \sim +40^{\circ}\text{C}$
  2. Relative Humidity:  $\leq 75\% \text{RH}$
  3. Keep away from corrosive atmosphere and sunlight.
- Period of Storage: 1 year