

THINKING ELECTRONIC INDUSTRIAL CO., LTD.

HEAD OFFICE: 12F, No.93, Dashun 1st Rd., Zuoying Dist., Kaohsiung, Taiwan

TEL: 886-7-5577660 FAX: 886-7-5570560

MANUFACTURING SITE

- ☒ KAOHSIUNG FACTORY: No.6, Xinjian S. Rd., Nanzi Dist., Kaohsiung City 811644, Taiwan
TEL: 886-7-9616668 FAX: 886-7-3866990
- ☐ KAOHSIUNG FACTORY 2: No. 2-2, Xinjian S. Rd., N.E.P.Z., Kaohsiung City 81170, Taiwan
TEL: 886-7-9630001 FAX: 886-7-3635113
- ☐ CHANGZHOU FACTORY: No.6 Longmen Rd., Wujin High & New-Tech Industrial Development Zone, Changzhou, Jiangsu, China 213161
TEL: 86-519-86578999 FAX: 86-519-86558643
- ☐ DONG GUAN FACTORY: No.45, East Rd., Sha-Tao Dist., Chang-An Town, Dongguan City, Guangdong, China 523863
TEL: 86-769-85542016 FAX: 86-769-85546890
- ☐ YICHANG FACTORY: No. 283 Xiaoting Avenue, Xiaoting Dist., Yichang City 443007, Hubei, China
TEL: 86-717-6510010 FAX: 86-717-6511430
- ☐ JIANGXI FACTORY: Tangying Road, Ceramics Industry Garden, Jingdezhen City, Jiangxi, China 333400
TEL: 86-798-2621372 FAX: 86-798-2126372

**SPECIFICATION FOR APPROVAL**

CUSTOMER Blume-Fresenius

CERTIFIED _____

MODEL/TYPE _____

PART NO. TVM3C220K132R (RoHS+HF)

APPLICATION _____

CUSTOMER P/N _____

ISSUE DATE Sep. 18, 2023

REV. NO. _____

REV. DATE _____

FOR CUSTOMER APPROVAL	CHECKED BY
	<i>Shu Ling Fu</i>
	APPROVED BY
	<i>Chun Chu Tu</i>





REVISED RECORD SHEET

REV. NO	REV. DATE	REVISED CONTENT



INDEX	Page
■ Part Number Code	1
■ Structure and Dimensions	2
■ Electrical Characteristics	2
■ Reliability	3 ~ 5
■ Soldering Recommendation	6
■ Power Derating Curve	7
■ Surge Current Standard Waveform	7
■ Recommended Soldering Pad Dimensions	8
■ RoHS Compliant Declaration	8
■ Warehouse Storage Conditions of Products	8
■ Packaging	9
■ Certificates & Test Report	10
■ Max. Surge Current Derating Curve	11
■ Max. Leakage Current and Max. Clamping Voltage Curve	12

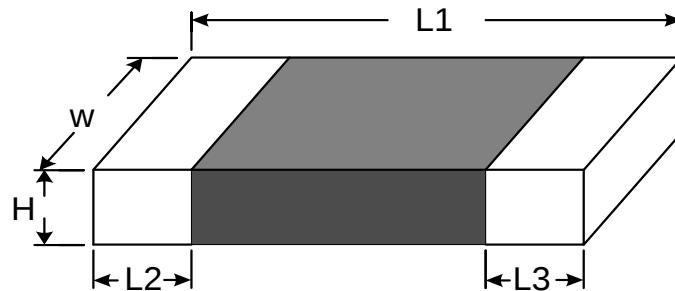
Part Number Code

Example :

TVM **3** **C** **220** **K132** **R**
(1) (2) (3) (4) (5) (6)

No.	Item	Digit	Specification
(1)	Product Type	TVM	Thinking varistor TVM type
(2)	Size (EIA)	3	1206
(3)	Type Series	C	Automotive series
(4)	Max. Continuous Voltage (V_{DC})	220	$22 \times 10^0 V = 22 V_{DC}$
(5)	Typical Capacitance	K132	$13 \times 10^2 pF = 1300 pF (@1KHz)$
(6)	Packaging	R	Reel

Structure and Dimensions



(unit : mm)

L1	W	H max.	L2 and L3
3.20±0.30	1.60±0.20	1.50	0.50±0.20

Electrical Characteristics

Part No.	Max. Continuous Voltage		Varistor Voltage	Max. Clamping Voltage (8 / 20μS)		Max. Surge Current (8 / 20μS)
	V _{AC} (V)	V _{DC} (V)	V _{1mA} (V)	V _P (V)	I _P (A)	I _{max} (A)
TVM3C220K132R	17	22	24.3 ~ 29.7	48	1	200

Part No.	Max. Energy (10 / 1000μS)	Typical Capacitance @1KHz	Operating Temperature Range	Storage Temperature Range
	W _{max} (J)	C (pF)	(°C)	(°C)
TVM3C220K132R	0.6	1300±20%	-55 ~ +125	-55 ~ +150

Reliability

Tests of SMD Varistor are based on AEC-Q200 Rev-C.

1、Preconditioning Reflow Requirements Before Reliability Stress Testing

Required Reliability Stress Tests after Preconditioning	High Temperature Exposure	Temperature Cycling	Operational Life	Moisture Resistance
Number of reflow passes required onto test boards	2	2	2	2

Required Reliability Stress Tests after Preconditioning	Biased Humidity	Thermal Shock	Terminal Strength	Board Flex
Number of reflow passes required onto test boards	2	2	2	2

2、Table of Test Methods

Item	Standard	Test conditions / Methods	Specifications																																												
High Temperature Exposure (Storage)	MIL-STD-202 Method 108	Test temp.: 150 +3/-0°C Duration: 1000 h Unpowered Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10 %																																												
Temperature Cycling	JESD22 Method JA-104	Lower test temp. : -40 +0/-3°C Upper test temp. : 125 +3/-0°C Soak Time at Lower or Upper Temp. : 1 min Cycle time : 2 Cycles/hr Number of cycles : 1000 Measurement at 24±2 hours after test conclusion.	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10 %																																												
Moisture Resistance	MIL-STD-202 Method 106	Duration of 1 cycle: 24 h Number of cycles: 10 , Unpowered Measurement at 24±2 hours after test conclusion. <table><tr><th rowspan="2">Step</th><th colspan="2">Temp.</th><th>humidity</th><th>Period</th></tr><tr><th>Start</th><th>Finish</th><th>(%)</th><th>(hr)</th></tr><tr><td>1</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr><tr><td>2</td><td>65</td><td>65</td><td>90~100</td><td>3.0</td></tr><tr><td>3</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr><tr><td>4</td><td>25</td><td>65</td><td>90~100</td><td>2.5</td></tr><tr><td>5</td><td>65</td><td>65</td><td>90~100</td><td>3.0</td></tr><tr><td>6</td><td>65</td><td>25</td><td>80~100</td><td>2.5</td></tr><tr><td>7</td><td>25</td><td>25</td><td>80~100</td><td>8.0</td></tr></table>	Step	Temp.		humidity	Period	Start	Finish	(%)	(hr)	1	25	65	90~100	2.5	2	65	65	90~100	3.0	3	65	25	80~100	2.5	4	25	65	90~100	2.5	5	65	65	90~100	3.0	6	65	25	80~100	2.5	7	25	25	80~100	8.0	No visible damage $\Delta V_{1mA}/V_{1mA}$ ≤ 10 %
Step	Temp.			humidity	Period																																										
	Start	Finish	(%)	(hr)																																											
1	25	65	90~100	2.5																																											
2	65	65	90~100	3.0																																											
3	65	25	80~100	2.5																																											
4	25	65	90~100	2.5																																											
5	65	65	90~100	3.0																																											
6	65	25	80~100	2.5																																											
7	25	25	80~100	8.0																																											

Reliability

2、Table of Test Methods

Item	Standard	Test conditions / Methods	Specifications
Biased Humidity	MIL-STD-202 Method 103	Test temp.: 85°C Rel. humidity of air: 85% Duration: 1000 h Bias at Working Voltage Vdc. Measurement at 24±2 hours after test conclusion.	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
Operational Life	MIL-STD-202 Method 108	Test temp.: 125 +3/-0°C Duration: 1000 h Bias at Working Voltage Vdc. Measurement at 24±2 hours after test conclusion.	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
External Visual	MIL-STD-883 Method 2009	Inspect device construction, marking and workmanship.	No visible damage
Physical Dimension	JESD22 Method JB-100	Verify physical dimensions to the applicable device detail specification.	Within the specified values
Resistance to Solvents	MIL-STD-202 Method 215	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 part (by volume) of mineral spirits.	No visible damage
Mechanical Shock	MIL-STD-202-213	Test Condition F Peak value : 1500g's Half sine Waveform Normal duration (D) : 0.5ms In 3 directions perpendicularly intersecting each other (total 18 times).	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
Vibration	MIL-STD-202 Method 204	Acceleration : 5 g's Sweep time: 20 min Frequency range: 10 to 2000 Hz 3×12 cycles	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B No pre-heat of samples. Temp. : 260±5°C, Time : 10±1s Immersion and emersion rate : 25mm/s ±6 mm/s Number of heat cycles : 1	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 5\%$
Thermal Shock	MIL-STD-202 Method 107	Lower test temp. : -55 +0/-3°C Upper test temp. : 125 +3/-0°C Maximum transfer time : 20 seconds. Dwell time : 15 minutes. Air-Air. Number of cycles : 300	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$

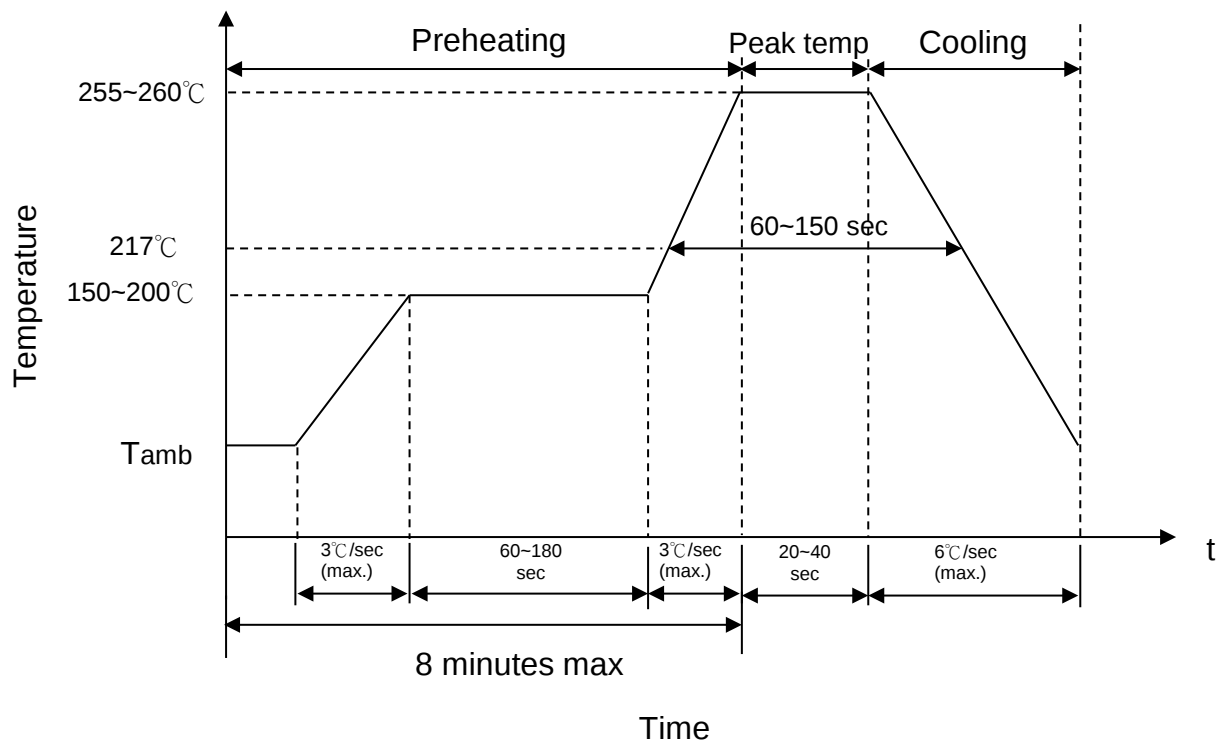
Reliability

2、Table of Test Methods

Item	Standard	Test conditions / Methods	Specifications
ESD	AEC-Q200 -002	Discharge capacitance : 150 pF Charging voltage: 6 kV Contact discharge 1 pulse in each polarity	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
Solderability	IEC60068-2-58 J-STD-002	a) 4 h @ 155°C dry heat Dip @245±5°C 3±0.3sec b) Steam aging 8 h±15min @93±3°C Dip @260±5°C 7±0.5sec	95% of termination wetted
Electrical Characterization	Specifications	$V_{1mA}(-55^{\circ}\text{C})$ 、 $V_{1mA}(25^{\circ}\text{C})$ 、 $V_{1mA}(125^{\circ}\text{C})$	Within the specified values
Board Flex	AEC-Q200 -005 (JIS-C-6429)	Bend the board : 2mm (Min.) Duration of the applied forces : 60 (+5) Sec	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
Terminal Strength	AEC-Q200 -006 (JIS-C-6429)	Apply force : Chip size 0402:0.5kg (5 N) Chip size 0603:1.0kg (10 N) Chip size $\geq$ 0805:1.8kg (17.7 N) Duration : 60 (+1) Sec	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$
Electrical Transient Conduction	ISO-7637-2	Test pulses 5a Number of pulses: 10 Test Energy : W_{LD} (Load dump)	No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 15\%$

Soldering Recommendation

■ IR-reflow soldering profile

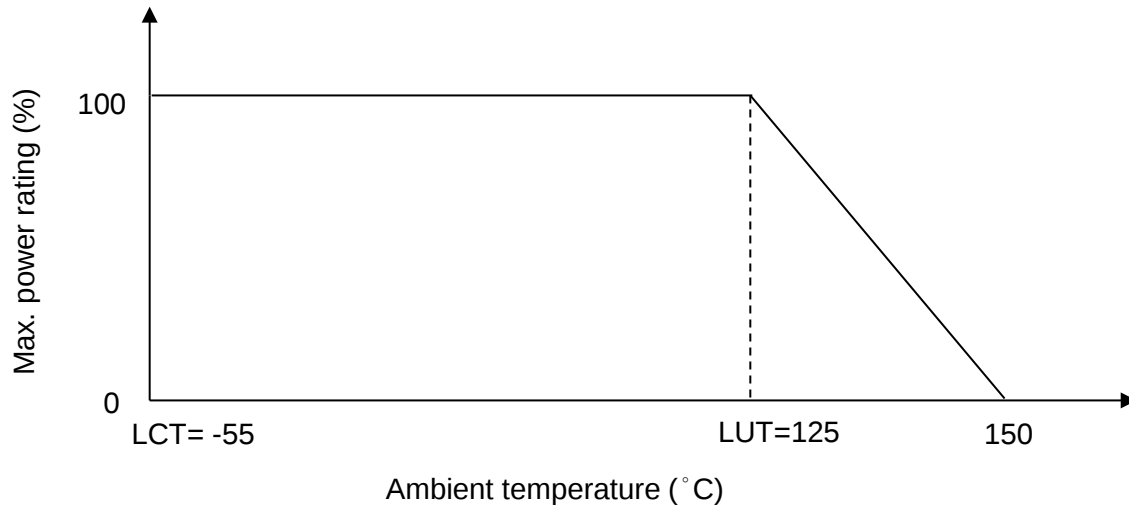


■ Recommended Reworking Conditions with Soldering Iron

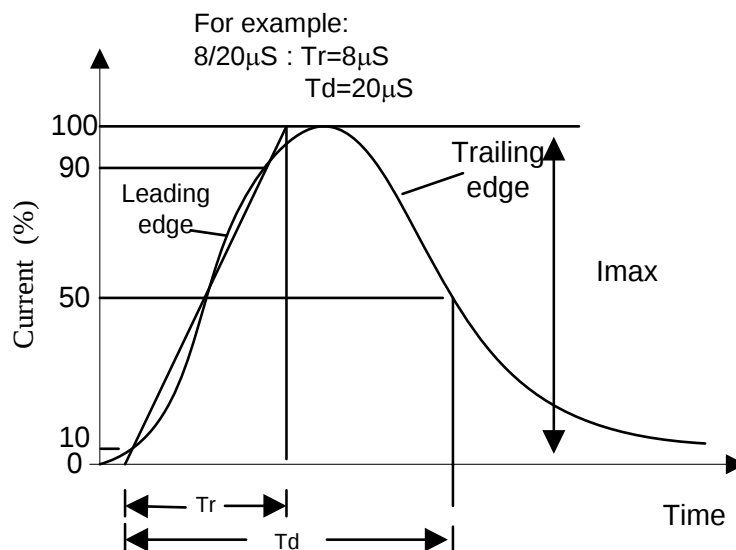
Item	Conditions
Temperature of Soldering Iron-tip	360°C (max.)
Soldering Time	3 sec (max.)
Diameter of Soldering Iron-tip	φ 3mm (max.)
Caution:Not to touch the component surface with soldering iron directly to prevent component damage.	

Power Derating Curve

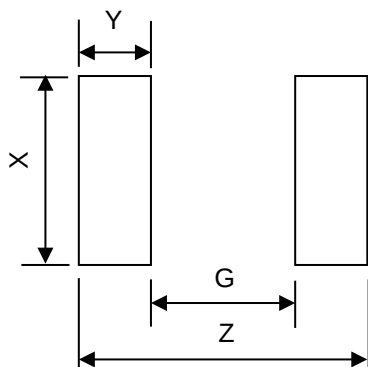
When operating temperature exceeds 125 °C, the power should be derated as below figure.



Surge Current Standard Waveform



Recommended Soldering Pad Dimensions



Size (EIA)	1206
Z	4.5 mm
G	2.1 mm
X	1.8 mm
Y	1.2 mm

RoHS Compliant Declaration

We hereby declare that the components delivered to your company are compliant with RoHS directive 2015/863/EU.

Warehouse Storage Conditions of Products

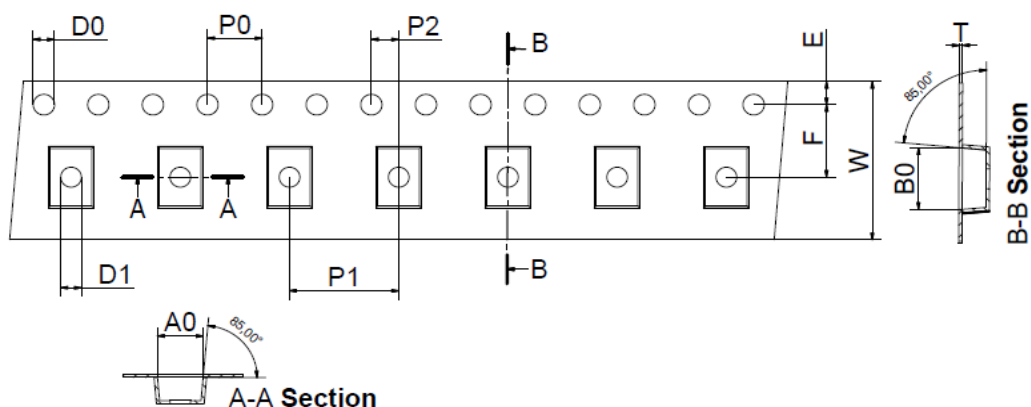
(I) Storage Conditions :

- 1.Storage Temperature : -10°C ~+40°C
- 2.Relative Humidity : $\leq 75\%RH$
- 3.Keep away from corrosive atmosphere and sunlight.

(II) Period of Storage : 1 year

Packaging

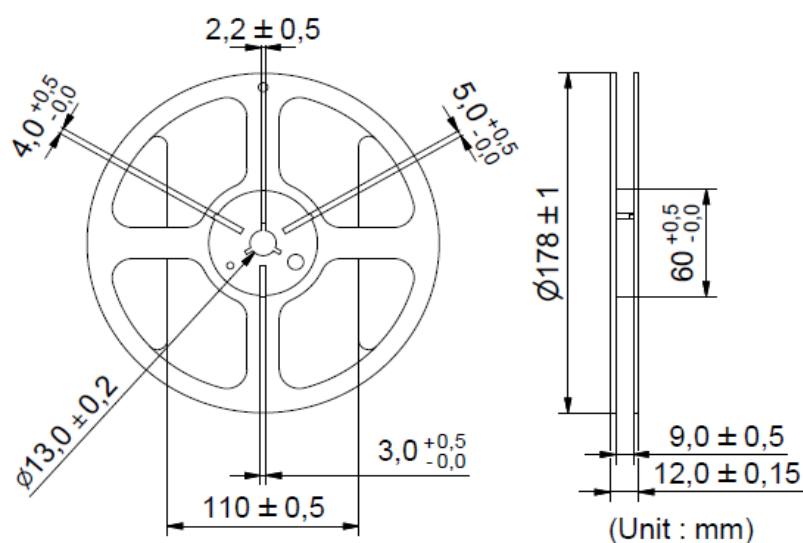
■ Taping Specification (1206 Series)



(Unit : mm)

Index	A_0	B_0	W	E	F	P_1	P_2	P_0	D_0	D_1	T
Size	± 0.2	± 0.2	± 0.2	± 0.1	± 0.05	± 0.1	± 0.05	± 0.1	± 0.1	± 0.1	± 0.1
1206	1.85	3.45	8	1.75	3.5	4	2	4	1.55	1	0.25

■ Quantity (2500 pcs / reel)



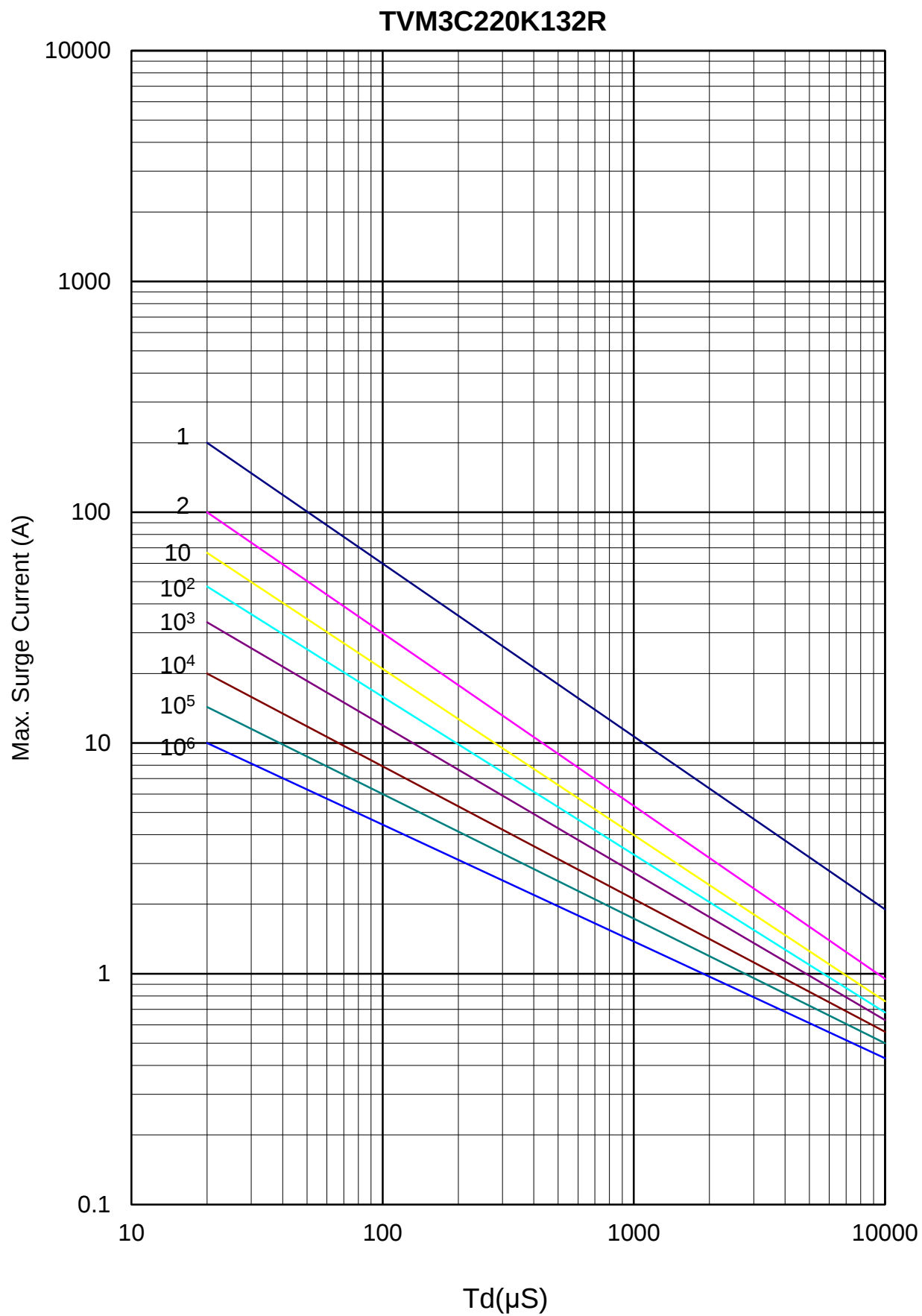
Certificates

- (1) IATF 16949 certificate
- (2) ISO 9001 certificate
- (3) QC 080000 certificate

Test Report

- (1) RoHS test report
- (2) Halogen-free test report

Max. Surge Current Derating Curves





Max. Leakage Current and Max. Clamping Voltage Curve

