

## 1. Electrical Specification

### 1-1 Test condition

Varistor voltage	$I_n = 1 \text{ mA DC}$
Leakage current	$V_{dc} = 10 \text{ V DC}$
Maximum clamping voltage	$I_c = 1 \text{ A}$
Rated peak single pulse transient current	8 / 20 $\mu\text{s}$ waveform, +/- each 1 time induce
Capacitance	10/1000 $\mu\text{s}$ waveform
Insulation resistance after reflow soldering	$f = 1 \text{ MHz}, V_{rms} = 0.5 \text{ V}$
	Soldering paste : Tamura (Japan) RMA-20-21L
	Stencil : SUS, 120 $\mu\text{m}$ thickness
Reflow soldering condition	Pad size : 0.5 (Width) x 0.6 (Length) 0.5 (Distance between pads)
	Soldering profile : $260 \pm 5 \text{ }^\circ\text{C}$ , 5 sec.

### 1-2 Electrical specification

Maximum allowable continuous DC voltage	10	V	
trigger voltage / Varistor voltage / breakdown voltage	12-18	V	
Maximum clamping voltage	50	V	Maximum
Rated peak single pulse transient current	1	A	Maximum
Nonlinearity coefficient	> 12		
Leakage current at continuous DC voltage	< 0.1	$\mu\text{A}$	
Response time	< 0.5	ns	
Varistor voltage temperature coefficient	< 0.05	%/ $^\circ\text{C}$	
Capacitance measured at 1MHz	22	pF	Typical
Capacitance tolerance	-50 to +50	%	
Insulation resistance after reflow soldering on PCB	> 10	$\text{M}\Omega$	
Operating ambient temperature	-55 to +125	$^\circ\text{C}$	
Storage temperature	-55 to +125	$^\circ\text{C}$	

## 1-3 Reliability testing procedures

Reliability parameter	Test	Test methods and remarks	Test requirement
Pulse current capability	I <sub>max</sub> 8/20 μs	IEC 1051-1, Test 4.5. 10 pulses in the same direction at 2 pulses per minute at maximum peak current	$d V_n /V_n \leq 10\%$ no visible damage
Electrostatic discharge capability	ESD C=150 pF, R=330 Ω	IEC 1000-4-2 Each 10 times in positive/negative direction in 10 sec at 8KV contact discharge (Level 4)	$d V_n /V_n \leq 10\%$ no visible damage
Environmental reliability	Thermal shock	IEC 68-2-14 Condition for 1 cycle Step 1 : Min. -40°C, 30 ± 3 min. Step 2 : Max. +125°C, 30 ± 3 min. Number of cycles: 30 times	$d V_n /V_n \leq 5\%$ no visible damage
	Low temperature	IEC 68-2-1 Place the chip at -40 ± 5°C for 1000 ± 12hrs. Remove and place for 24 ± 2hrs at room temp. condition, then measure	$d V_n /V_n \leq 5\%$ no visible damage
	High temperature	IEC 68-2-2 Place the chip at 125 ± 5°C for 1000 ± 24hrs. Remove and place for 24 ± 2hrs at room temp. condition, then measure	$d V_n /V_n \leq 5\%$ no visible damage
	Heat resistance	IEC 68-2-3 Apply the rated voltage for 1000 ± 48hrs at 85 ± 3°C. Remove and place for 24 ± 2hrs at room temp. condition, then measure	$d V_n /V_n \leq 5\%$ no visible damage
	Humidity resistance	IEC 68-2-30 Place the chip at 40 ± 2°C and 90 to 95% humidity for 1000 ± 24hrs. Remove and place for 24 ± 2hrs at room temp. condition, then measure	$d V_n /V_n \leq 10\%$ no visible damage
	Pressure cooker test	Place the chip at 2 atm, 120°C, 85%RH for 60 hrs. Remove and place for 24 ± 2hrs at room temp. condition, then measure	$d V_n /V_n \leq 10\%$ no visible damage
	Operating life	Apply the rated voltage for 1000 ± 48hrs at 125 ± 3°C. Remove and place for 24 ± 2hrs at room temp. condition, then measure	$d V_n /V_n \leq 10\%$ no visible damage

<b>Mechanical Reliability</b>	Solderability	<u>IEC 68-2-58</u> Solder bath method, 230±5℃, 2s	At least 95% of terminal electrode is covered by new solder
	Resistance to soldering heat	<u>IEC 68-2-58</u> Solder bath method, 260±5℃, 10±0.5s, 270±5℃, 3±0.5s	$d V_n /V_n \leq 5\%$ no visible damage
	Bending strength	<u>IEC 68-2-21</u> Warp:2mm, Speed:0.5mm/sec, Duration: 10sec. The measurement shall be made with board in the bent position	$d V_n /V_n \leq 5\%$ no visible damage
	Adhesive strength	<u>IEC 68-2-22</u> Applied force on SMD chip by fracture from PCB	Strength>10 N no visible damage

## 2. Material Specification

Body	ZnO based ceramics
Internal electrode	Silver – Palladium
External electrode	Silver – Nickel – Tin
Thickness of Ni/Sn plating layer	Nickel > 1 μm, Tin > 2 μm

## 3. Dimension Specification

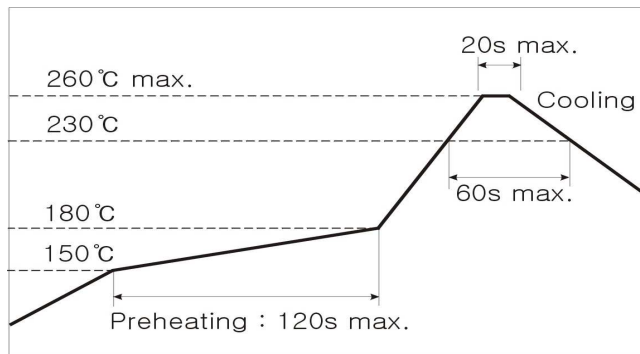


Size	L(mm)	W(mm)	T(mm)	M(mm)
0402	1.0±0.10	0.5±0.10	≤ 0.6	0.20±0.10
0603	1.6±0.15	0.8±0.15	≤ 0.9	0.35±0.10

## 4. Soldering Recommendations

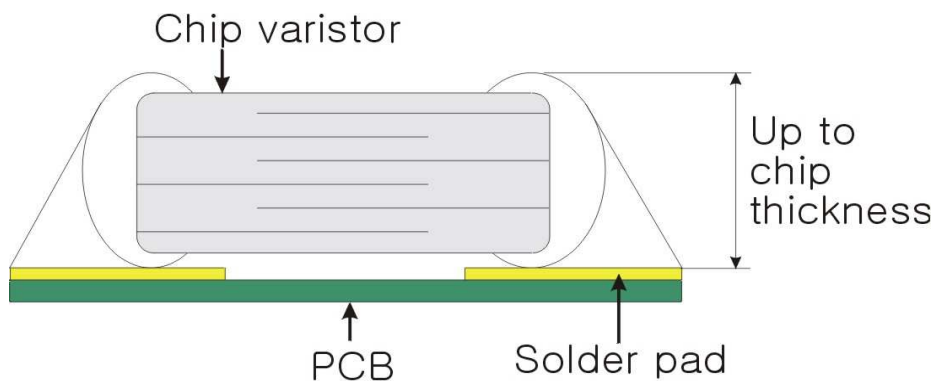
### 4-1 Soldering profile

## 4-1-1 Pb free solder paste



## 4-1-2 Repair soldering

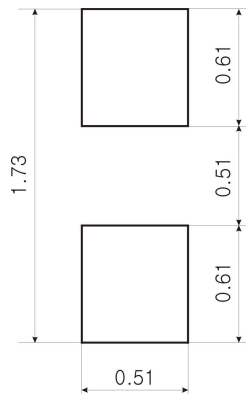
- Allowable time and temperature for making correction with a soldering iron :  $350 \pm 10$  °C, 3 sec.
- Optimum solder amount when corrections are made using a soldering iron



## 4-2 Soldering guidelines

- Our chip varistors are designed for reflow soldering only. Do not use flow soldering
- Use non-activated flux (Cl content 0.2% max.)
- Follow the recommended soldering conditions to avoid varistor damage.

## 4-3 Solder pad layout



## 5. Storage condition

- Storage environment must be at an ambient temperature of 25~35 °C and an ambient humidity of 40~60 % RH
- Chip varistors can experience degradation of termination solderability when subjected to high temperature of humidity, or if exposed to sulfur or chlorine gases.
- Avoid mechanical shock (ex. Falling) to the chip varistor to prevent mechanical cracking inside of the ceramic dielectric due to its own weight.
- Use chips within 6 months.  
If 6 months of more have elapsed, check solderability before use.-

## 6. Description about package label

### **Type : MVR0402-100E220**

MVR: Series name

0402 : Chip size –0402 (1.0 x 0.5 mm) size

100 : Maximum continuous working voltage – 10Vdc

E : Product function – E for ESD

220 : Capacitance value – means 22pF

### **Quantity : 10,000 pcs**

- Quantity of shipping chip varistor