

TCR *MULTILAYER CHIP VARISTORS*

PART NO. MVR0603-5R5E0R2

1. Electrical Specification

1-1 Test condition

Varistor voltage	$I_n = 1 \text{ mA DC}$
Leakage current	$V_{dc} = 5.5 \text{ V DC}$
Maximum clamping voltage	$I_c = 1 \text{ A}$
Rated peak single pulse transient current	8 / 20 μs waveform, +/- each 1 time induce
Capacitance	10/1000 μs waveform
Insulation resistance after reflow soldering	$f = 1\text{MHz}, V_{rms} = 0.5 \text{ V}$

Reflow soldering condition

Soldering paste : Tamura (Japan) RMA-20-21L
Stencil : SUS, 120 μm thickness
Pad size : 0.8 (Width) x 0.9 (Length)
0.8 (Distance between pads)
Soldering profile : $260 \pm 5 \text{ }^\circ\text{C}$, 5 sec.

1-2 Electrical specification

Maximum allowable continuous DC voltage	5.5	V	
trigger voltage / Varistor voltage / breakdown voltage	90-120	V	
Maximum clamping voltage	250	V	Maximum
Rated peak single pulse transient current	1	A	Maximum
Nonlinearity coefficient	> 12		
Leakage current at continuous DC voltage	< 0.1	μA	
Response time	< 0.5	ns	
Varistor voltage temperature coefficient	< 0.05	$\% / ^\circ\text{C}$	
Capacitance measured at 1MHz	0.2	pF	Typical
Capacitance tolerance	-50 to +80	%	
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 _{max} 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

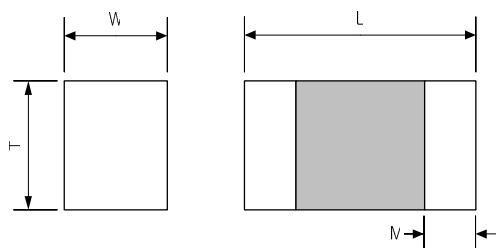
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Mechanical Reliability	Solderability	<u>IEC 68-2-58</u> Solder bath method, 230 ± 5°C, 2s	At least 95% of terminal electrode is covered by new solder
	Resistance to soldering heat	<u>IEC 68-2-58</u> Solder bath method, 260 ± 5°C, 10 ± 0.5s, 270 ± 5°C, 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



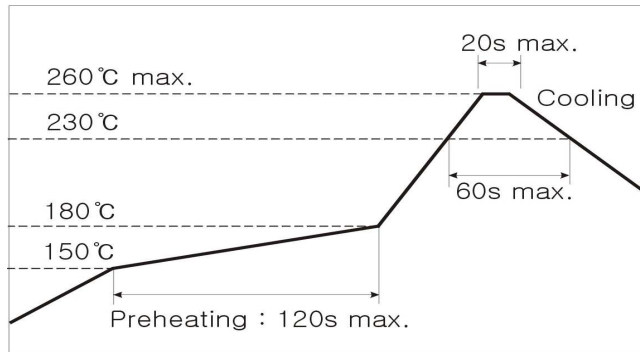
Size	L (mm)	W (mm)	T (mm)	M (mm)
0402	1.0 ± 0.10	0.5 ± 0.10	≤ 0.6	0.20 ± 0.10
0603	1.6 ± 0.15	0.8 ± 0.15	≤ 0.9	0.35 ± 0.10

4. Soldering Recommendations

4-1 Soldering profile

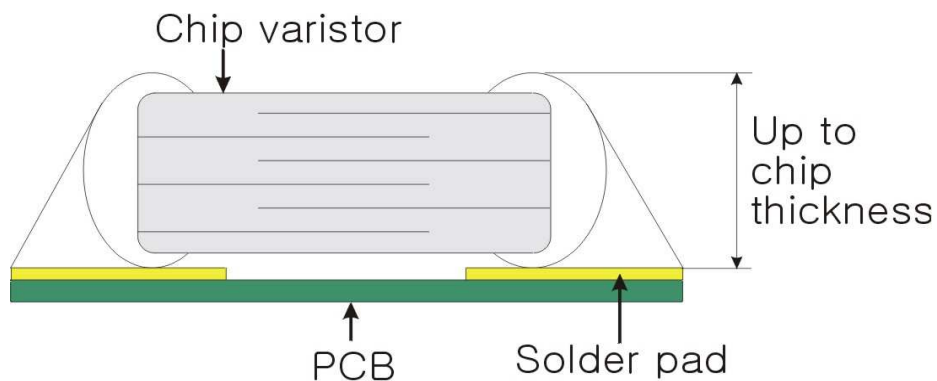
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4-1-1 Pb free solder paste



4-1-2 Repair soldering

- Allowable time and temperature for making correction with a soldering iron : 350 ± 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 : MVR0603-5R5E0R2

MVR: Series name

0603 : Chip size –0603 (1.6 x 0.8 mm) size

5R5 : Maximum continuous working voltage – 5.5Vdc

E : Product function – E for ESD

0R2 : Capacitance value – means 0.2 pF

Quantity : 4,000 pcs

- Quantity of shipping chip varistor