

# VR Series

## High Voltage Thick Film Chip Resistors

Version. C



### FEATURE

- Higher Max. Working Voltage than general purpose series resistors.
- High reliability and stability
- RoHS complaint
- Compatible with reflow and wave soldering
- Applications:
  - Adapters
  - Back-light circuit
  - Camera
  - Industrial Equipment
  - etc.

### MANUFACTURER PART NO.

For example: VR1206J100KT5G00 - VR1206  $\pm 5\%$  100K $\Omega$  T/R-5000

Series	Size	Tol.	Nominal Resistance Value	PKG	SPQ	Feature	TCR
2 codes	4 codes	1 code	2~5 codes	1 code	1 code	1 code	2 codes
VR	1206	J	100K	T	5	G	00
High Voltage Thick Film Chip Resistors	0603 0805 1206 1210 2010 2512	F= $\pm 1\%$ J= $\pm 5\%$	$36K^{\text{①}}$ =36K $\Omega$ 49K9=49.9K $\Omega$ 4M7 <sup>②</sup> =4.7M $\Omega$	T=T/R <sup>③</sup>	4=4K 5=5K	G=Std. S=P.C. <sup>④</sup>	00=Refer to RELIABILITY.

Note: ① K=Kilo,  $10^3$ , K $\Omega$

② M=Mega,  $10^6$ , M $\Omega$

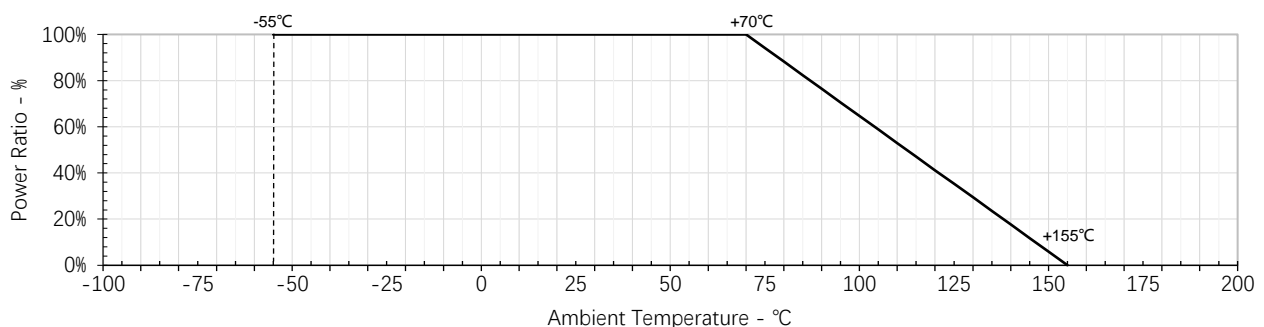
③ T/R=Taping in Reel package type

④ P.C.=Personal and Customized.

### CHARACTERISTICS

Type	Rated Power	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Tolerance	Value Range	Operating Temp.
VR0603	1/10W	350V	500V	500V	$\pm 1, \pm 5\%$	36K $\Omega$ -22M $\Omega$	-55~+155°C
VR0805	1/8W	400V	800V	800V	$\pm 1, \pm 5\%$	100K $\Omega$ -22M $\Omega$	
VR1206	1/4W	500V	1000V	1000V	$\pm 1, \pm 5\%$	100K $\Omega$ -22M $\Omega$	
VR1210	1/2W	800V	1500V	1000V	$\pm 1, \pm 5\%$	50K $\Omega$ -22M $\Omega$	
VR2010	3/4W	2000V	3000V	1000V	$\pm 1, \pm 5\%$	50K $\Omega$ -22M $\Omega$	
VR2512	1W	3000V	4000V	1000V	$\pm 1, \pm 5\%$	39K $\Omega$ -22M $\Omega$	

### POWER DERATING CURVE



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### RATED VOLTAGE

Resistors should have a Rated Voltage DC or AC corresponding to Rated Power which can be calculated by formula as below.

The Rated Voltage of certain resistance value should be the calculated result or Max. Working Voltage of product series whichever less.

Formula:

$$E = \sqrt{P \times R}$$

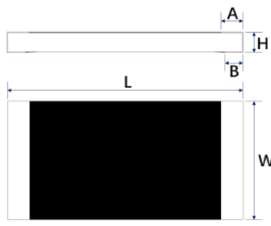
E=Rated voltage(V)

P=Rated power(W)

R=Nominal resistance( $\Omega$ )

### DIMENSIONS

Unit: mm

Figure	Type	L	W	H	A	B
	VR0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
	VR0805	2.00±0.15	1.25±0.15	0.55±0.10	0.40±0.20	0.40±0.20
	VR1206	3.10±0.15	1.55±0.15	0.55±0.10	0.45±0.20	0.45±0.20
	VR1210	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
	VR2010	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
	VR2512	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

### RELIABILITY

Item	Test Method	Acceptable Criterion
Temperature Coefficient of Resistance (T.C.R.)	$TCR(PPM/^{\circ}C) = \frac{(R_2 - R_1)}{R_1 \times (T_2 - T_1)} \times 10^6$ <p> <math>R_1</math>=Value in room temperature  <math>R_2</math>=Value in test temperature -55<math>^{\circ}</math>C or +125<math>^{\circ}</math>C  <math>T_1</math>=Room temperature  <math>T_2</math>=Test temperature -55<math>^{\circ}</math>C or +125<math>^{\circ}</math>C                      Reference: IEC 60115-1 6.2                 </p>	±100PPM/ $^{\circ}$ C
Insulation Resistance	Using the parallel clamp method: 100±15V <sub>DC</sub> voltage is applied between the electrode and the substrate within 60 seconds. Test the insulation resistance between the terminal and the back of the part. Reference: IEC 60115-1 12.1.3.5	≥ 10 <sup>9</sup> Ω
Dielectric Withstanding Voltage	An alternating current with an effective value of the maximum overload voltage is applied between the electrode and the substrate at a rate of approximately 100V/sec. Pressure, maintain 60± 5 sec. The test voltage reference to the DWV in characteristics. Reference: IEC 60115-1 12.2.4	Test to confirm if the presence of current or arc breakdown by ≥10uA
Short Time Over Load	Apply 2.5 times of rated voltage or maximum overload voltage (whichever is the smallest) for 5 seconds Reference: IEC 60115-1 8.1.4.2	1% series: ΔR/R=±1.0% 5% series: ΔR/R=±2.0%
Intermittent Overload	Put it in the thermostat, apply 2.5 times of rated voltage, 1 second ON, 25 seconds OFF, 10000±400 cycles, take it out and stand for 60 minutes, then measure the change rate of resistance value. Reference: IEC 60115-1 8.4.4	ΔR/R=±5.0%
Resistance to Solvent	Immerse in isopropanol solvent at room temperature (23±5 $^{\circ}$ C) for 5min, wipe 10 times with a hard toothbrush, repeat 3 times, take out and blow dry for examination Reference: IEC 60115-1 11.3.2 method1	No obvious damage, peeling, swelling phenomenon

# VR Series

## High Voltage Thick Film Chip Resistors

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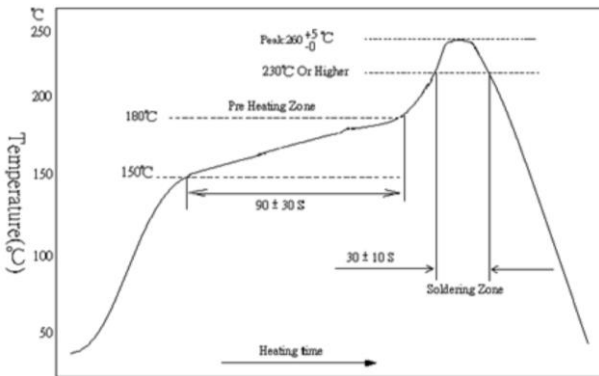


Item	Test Method	Acceptable Criterion										
Solderability	<p>Pretreatment: dry heat 155°C, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs.</p> <p>Test method: 1. Dip the resistance in a tin furnace at 245±3°C for 3 seconds, then take it out and observe the solder area under a microscope; 2. Reflow soldering test, Peak Temperature: 235°C, T=40±5 sec. Reference: IEC 60115-1 11.1.4.3</p>	<p>1. Solder coverage over 95%</p> <p>2. No welding refusal phenomenon, side soldering height is greater than 1/2 of the height</p>										
Leaching	<p>Pretreatment: dry heat 155°C, 4 hrs. or PCT aging for 4 hrs. (equivalent), after take out, stand at room temperature for 2 hrs.</p> <p>dip in a tin furnace at 260±5°C for 30±1 seconds, remove and wash. Observe the area of solder under a microscope Reference: IEC-60068-2-58</p>	No electrode is eroded to expose the substrate phenomenon										
Resistance to Soldering Heat	<p>The tested resistor be immersed into molten solder of 260±5°C for 10 seconds. Then the resistor is left in the room for 1 hr., then measure the change rate of resistance value Reference: IEC 60115-1 11.2.4.3</p>	$\Delta R/R = \pm 1.0\%$										
Thermal Shock	<p>High and low temperature test is carried out according to the upper and lower limits of the application temperature of the parts, the residence time of the upper and lower limits of the temperature is 30min, and the temperature conversion time is less than 30s, lasting 500 cycles Reference: IEC 60115-1 10.1.4</p>	$\Delta R/R = \pm 1.0\%$										
Solder Joint Endurance Test	<p>The SMD resistance was welded to the test board and bent with the standard pressure block. After standing for 60 sec. under the corresponding deformation condition, the change rate of resistance value of the part was tested.</p> <table border="1"> <tr> <td>Size</td> <td>0603, 0805</td> <td>1206, 1210</td> <td>2010, 2512</td> </tr> <tr> <td>Depth</td> <td>5mm</td> <td>3mm</td> <td>2mm</td> </tr> </table> <p>Reference: IEC 60115-1 9.8.4</p>	Size	0603, 0805	1206, 1210	2010, 2512	Depth	5mm	3mm	2mm	$\Delta R/R = \pm 1.0\%$		
Size	0603, 0805	1206, 1210	2010, 2512									
Depth	5mm	3mm	2mm									
Resistance to Dry Heat	<p>Put it in an oven at 155±5°C for 1000±48 hrs., take it out and let it stand for more than 1hr., then measure the change rate of resistance value Reference: IEC 60115-1 7.3</p>	<p>1% series: <math>\Delta R/R = \pm 1.0\%</math></p> <p>5% series: <math>\Delta R/R = \pm 3.0\%</math></p>										
Loading Life in Moisture	<p>Place it in a constant temperature and humidity box with 40±2°C and 90~95%RH and apply the rated voltage with 90 minutes ON and 30 minutes OFF, 1000 hrs. Take it out and stand for 60 minutes, and then measure the change rate Reference: IEC 60115-1 10.4</p>	<p>1% series: <math>\Delta R/R = \pm 1.0\%</math></p> <p>5% series: <math>\Delta R/R = \pm 3.0\%</math></p>										
Load Life	<p>Put in an oven at 70±2°C, apply rated voltage, 90 min ON, 30 min OFF, 1000 hrs., take out and stand for more than 60 min, then measure the resistance change rate. Reference: IEC 60115-1 7.1</p>	<p>1% series: <math>\Delta R/R = \pm 1.0\%</math></p> <p>5% series: <math>\Delta R/R = \pm 3.0\%</math></p>										
Low temperature load test	<p>-55°C, unpowered, 1 hr.: Rated voltage/current for 45 minutes, then unpowered within 15 minutes, return to room temperature, take out and stand for 24 hours, then measure the change rate of resistance value. Reference: IEC 60115-1 10.2.4</p>	<p>1% series: <math>\Delta R/R = \pm 1.0\%</math></p> <p>5% series: <math>\Delta R/R = \pm 2.0\%</math></p>										
Shear force test	<p>Weld the part to the PCB. Apply the corresponding test stress from the side of the part with the test terminal for 10s. Check the appearance of the welded end of the part under the stress condition</p> <table border="1"> <tr> <td>Size</td> <td>0603</td> <td>0805</td> <td>1206, 1210</td> <td>2010, 2512</td> </tr> <tr> <td>Test force</td> <td>5N</td> <td>9N</td> <td>25N</td> <td>45N</td> </tr> </table> <p>Reference: IEC 60115-1 9.7</p>	Size	0603	0805	1206, 1210	2010, 2512	Test force	5N	9N	25N	45N	Without obvious damage.
Size	0603	0805	1206, 1210	2010, 2512								
Test force	5N	9N	25N	45N								
Safety test	<p>1.2/50us pulse, 10 consecutive pulses with alternating polarity, each pulse interval 60s, U=2.5KV Reference: IEC-62368 Table D.1 circuit2 G.10.3</p>	$\Delta R/R = \pm 10\%$										

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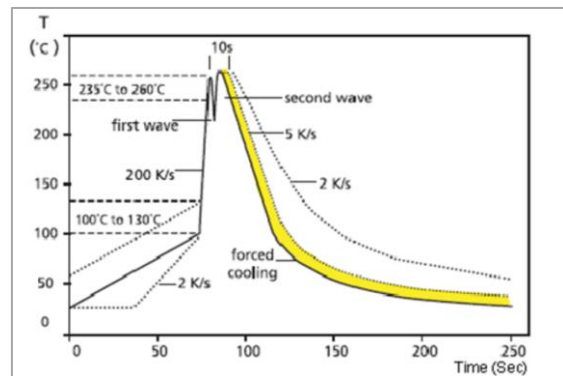
**SOLDERING**

Lead Free IR Reflow Soldering Profile



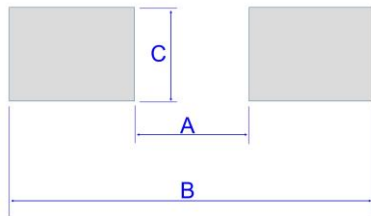
- Top temperature should be under 260 +5/-0 °C ,10Sec.
- Reference: J-STD-020D

Lead Free Double-Wave Soldering Profile



- Suitable for 0603 above size products
- 350±10°C within 3 Sec. if soldering iron.

**SOLDERING PAD**



Type	A	B	C
VR0603	0.8	2.1	0.9
VR0805	1.2	3.0	1.3
VR1206	2.2	4.2	1.6
VR1210	2.2	4.2	2.8
VR2010	3.5	6.1	2.8
VR2512	3.8	8.0	3.5

**WORKING ENVIRONMENT**

If user intends to use products in special environments or states (including but not limited to the following), it is necessary to approve special characteristics and reliability for the following or other application environments.

- High temperature.
- Near the sea, or corrosive gas, such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub> and NO<sub>2</sub>, etc.
- Unverified liquids, such as water, oil, chemical or organic solvent.
- Unverified resin or paint to cover products.
- Products should be washed with water soluble cleaner even if non cleaning flux.

**STORAGE / CARRY CONDITIONS**

- Temperature: 25±5°C
- Humidity: 60±15%RH
- Storage life: 2 years. FIFO
- Please hold box correct orientation when storing and carrying. It is strictly prohibited to fall or squeeze the box, otherwise the product electrode or package may be damaged.

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