

 毫欧电阻 毫欧制造	高精密晶圆电阻HoCSV系列	系列号	HoCSV
		修订日期	2022-10-18
		版本号	Ho-A0

# 规格书 Specification

制造商:深圳市毫欧电子有限公司

适用: 本规格书适用于深圳市毫欧电子有限公司高精密晶圆电阻HoCSV系列产品选型。

## Features

- AEC-Q200 Compliance
- Thin film technology
- Excellent overall stability
- Sn termination on Ni barrier layer
- Tight tolerance down to  $\pm 0.1\%$
- Extremely low TCR down to  $\pm 5 \text{ PPM}/^\circ\text{C}$
- High power rating up to 1 Watts
- SMD enabled structure
- Lead-free and RoHS compliant



## Applications

- Automotive(non-safety parts)
- Industrial
- Telecommunication
- Medical Equipment
- Measurement/Testing Equipment

## Product number

**HoCSV0207-1/4W-1KR-0.5%**

Ho	CSV	0207	1/2W	1KR	2%	50
manufacturers	Product Type	encapsulation	Rated power	resistance	precision	TCR (PPM/ $^\circ\text{C}$ )
毫欧电子	CSV系列	0102: 2.2x1.1 0204: 3.5x1.4 0207: 5.9x2.4	T: 1W U: 1/2W V: 1/4W G: 2/5W P: 1/5W W: 1/8W L: 0.3W	0010: 1 $\Omega$ 1R20: 1.2 $\Omega$ 1000: 100 $\Omega$ 2201: 2200 $\Omega$ 1001: 1K $\Omega$ 1004: 1M $\Omega$	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$	S: $\pm 5$ B: $\pm 10$ N: $\pm 15$ C: $\pm 25$ D: $\pm 50$ E: $\pm 100$ -: Jumper



SGS

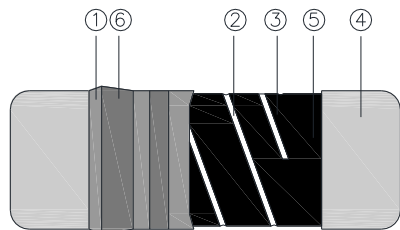
AEC-Q200



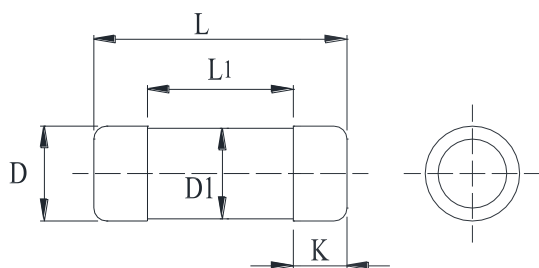
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## Construction & Dimension



① Insulation Coating	④ Electrode Cap
② Trimming Line	⑤ Resistor Layer
③ Ceramic Rod	⑥ Marking



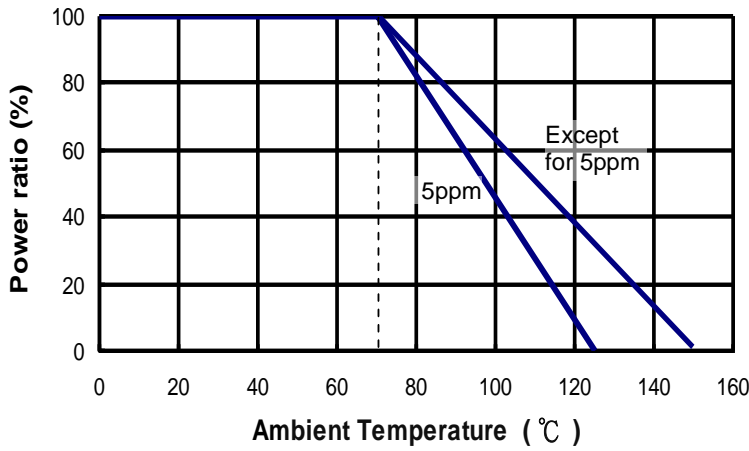
Type	L (mm)	L <sub>1</sub> min. (mm)	ΦD (mm)	ΦD <sub>1</sub> (mm)	K (mm)	Weight 1,000EA (g)
0102	2.20±0.10	1.1	1.10±0.10	D +0/-0.15	0.45±0.05	7.7
0204	3.50±0.2	1.7	1.40±0.15	D +0/-0.2	0.8±0.1	18.7
0207	5.90±0.2	2.9	2.20±0.20	D +0/-0.2	1.3±0.1	80.9

### TECHNICAL SPECIFICATIONS

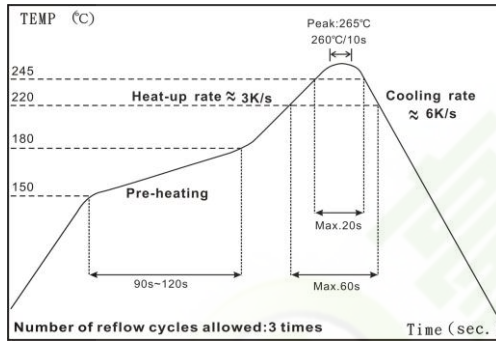
DESCRIPTION	CSV0102		CSV0204		CSV0207	
	Standard	High power	Standard	High power	Standard	High power
Resistance range	1Ω-1MΩ; 0Ω		0.1Ω-3.4MΩ; 0Ω		0.1Ω-3.4MΩ; 0Ω	
Resistance tolerance	±5%; ±1%; ±0.5%; ±0.25%; ±0.1%					
Temperature coefficient	±100ppm/°C; ±50ppm/°C; ±25ppm/°C; ±15ppm/°C		±100ppm/°C; ±50ppm/°C; ±25ppm/°C; ±15ppm/°C; ±10ppm/°C; ±5ppm/°C			
Operation mode	Standard	High power	Standard	High power	Standard	High power
Power rating P <sub>70</sub>	1/8W	1/5W	0.3W	1/4W	2/5W	1W
Operating voltage U <sub>max.</sub>	150V	200V	200V	200V	200V	350V
Operating temperature range	-55°C ~ 155°C					
Max. resistance change at P70 for resistance range, ΔR/R max., after 1000 h	≤0.5%		≤0.5%		≤0.5%	

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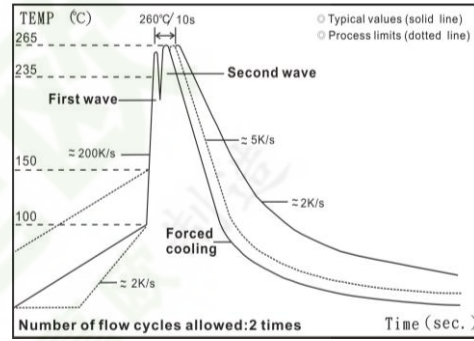
### Derating Curve



### Soldering Condition



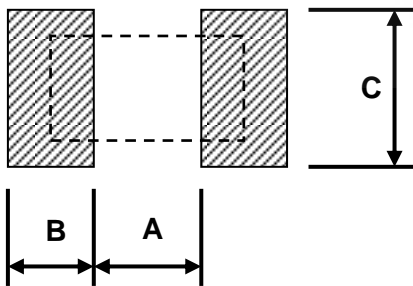
IR Reflow Soldering



Wave Soldering (For  $R > 10\Omega$ )

- (1) Time of IR reflow soldering at maximum temperature point 260°C : 10s
- (2) Time of wave soldering at maximum temperature point 260°C : 10s
- (3) Time of soldering iron at maximum temperature point 410°C : 5s

### Recommend Land Pattern



Type	A (mm)	B (mm)	C (mm)
CSV0102	1.0	0.8	1.5
CSV0204	1.6	1.2	1.6
CSV0207	3.0	1.7	2.4

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### Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)		
					±0.1%	±0.25%	±0.5%	±1%	±5%			
0102	1/8W Jumper:2A	-55 ~ +155°C	150V	300V	100Ω-56KΩ					-	±15	
					100Ω-82KΩ		49.9Ω-200KΩ	49.9Ω-390KΩ			-	±25
					-		1Ω-1MΩ					±50
					-		1Ω-1MΩ					±100
					-					0Ω(<15mΩ)		-
0204	1/4W Jumper:3A	-55 ~ +125°C	200V	400V	10Ω-332KΩ		-			±5		
					49.9Ω-20KΩ					±10		
					10Ω-300KΩ					±15		
		-55 ~ +155°C	200V	400V	10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25		
					10Ω-1MΩ	1Ω-1MΩ	1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50		
					-		0.1Ω-1MΩ		±100			
-				0Ω(<15mΩ)		-						
0207	1/2W Jumper:5A	-55 ~ +125°C	300V	600V	10Ω-332KΩ		-			±5		
					49.9Ω-20KΩ					±10		
					10Ω-300KΩ					±15		
		-55 ~ +155°C	300V	600V	10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25		
					10Ω-1MΩ	1Ω-1MΩ	1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50		
					-		0.1Ω-1MΩ		±100			
-				0Ω(<15mΩ)		-						

### High Power Rating Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range					TCR (PPM/°C)		
					±0.1%	±0.25%	±0.5%	±1%	±5%			
0102	1/5W 0.3W	-55 ~ +155°C	200V	400V	100Ω-56KΩ					-	±15	
					100Ω-82KΩ		49.9Ω-200KΩ	49.9Ω-390KΩ			-	±25
					-		1Ω-1MΩ					±50
					-		1Ω-1MΩ					±100
0204	2/5W	-55 ~ +125°C	200V	400V	10Ω-332KΩ		-			±5		
					10Ω-300KΩ					±15		
		-55 ~ +155°C	200V	400V	10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25		
					10Ω-1MΩ	1Ω-1MΩ	1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50		
					-		0.1Ω-1MΩ		±100			
-				0Ω(<15mΩ)		-						
0207	1W	-55 ~ +125°C	350V	700V	10Ω-332KΩ		-			±5		
					10Ω-300KΩ					±15		
		-55 ~ +155°C	350V	700V	10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25		
					10Ω-1MΩ	1Ω-1MΩ	1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50		
					-		0.1Ω-1MΩ		±100			
-				0Ω(<15mΩ)		-						

Operating Voltage= $\sqrt{P \cdot R}$  or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$  or Max. Overload Voltage listed above, whichever is lower.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

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## 高精密晶圆电阻HoCSV系列

系列号	HoCSV
修订日期	2022-10-18
版本号	Ho-A0

## Environmental Characteristics

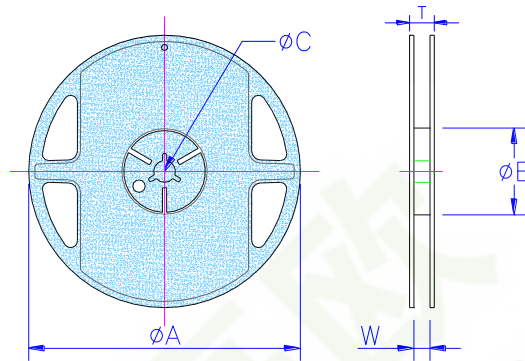
Item	Requirement		Test Method
	5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec		<b>JIS-C-5201-1 4.8</b> <b>IEC-60115-1 4.8</b> At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature 5ppm: At 25°C/-10°C and 25°C/+85°C, 25°C is the reference temperature
Short Time Overload	10Ω-270KΩ: ±(0.1%+0.01Ω) <10Ω & >270KΩ: ±(0.15%+0.01Ω) 0102: ±(0.15%+0.01Ω) 5ppm: ±(0.05%+0.01Ω)	<15mΩ	<b>JIS-C-5201-1 4.13</b> <b>IEC-60115-1 4.13</b> RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		<b>JIS-C-5201-1 4.6</b> <b>IEC-60115-1 4.6</b> Max. Overload Voltage for 1 minute
Operational Life	10Ω-270KΩ: ±(0.25%+0.01Ω) <10Ω & >270KΩ: ±(0.5%+0.01Ω) 0102: ±(0.5%+0.01Ω)	<15mΩ	<b>MIL-STD-202 Method 108</b> Condition D Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion. 5ppm: 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	10Ω-270KΩ: ±(0.5%+0.01Ω) <10Ω & >270KΩ: ±(1%+0.01Ω) 0102: ±(2%+0.01Ω)	<15mΩ	<b>MIL-STD-202 Method 103</b> 1000 hrs 85°C/85%RH 10% of operating power.
High Temperature Exposure	10Ω-270KΩ: ±(0.25%+0.01Ω) <10Ω & >270KΩ: ±(1%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	<b>MIL-STD-202 Method 108</b> at +125°C/+155°C for 1000 hrs
Board Flex	10Ω-270KΩ: ±(0.1%+0.01Ω) <10Ω & >270KΩ: ±(0.5%+0.01Ω) 0102: ±(0.5%+0.01Ω)	<15mΩ	<b>AEC-Q200-005</b> Bending once for 60 seconds with 2mm
Solderability	95% min. coverage		<b>JIS-C-5201-1 4.17</b> <b>IEC-60115-1 4.17</b> <b>J-STD-002</b> 245±5°C for 3 seconds
Resistance to Soldering Heat	10Ω-270KΩ: ±(0.1%+0.01Ω) <10Ω & >270KΩ: ±(0.25%+0.01Ω) 0102: ±(0.25%+0.01Ω) 5ppm: ±(0.05%+0.01Ω)	<15mΩ	<b>MIL-STD-202 Method 210</b> 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover		<b>JIS-C-5201-1 4.7</b> <b>IEC-60115-1 4.7</b> 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%		<b>JIS-C-5201-1 4.18</b> <b>IEC-60068-2-58 8.2.1</b> 260±5°C for 30 seconds
Temperature Cycling	10Ω-270KΩ: ±(0.25%+0.01Ω) <10Ω & >270KΩ: ±(0.5%+0.01Ω) 0102: ±(1%+0.01Ω)	<15mΩ	<b>JESD22 Method JA-104</b> -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.01Ω)	<15mΩ	<b>MIL-STD-202 Method 213</b> Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.01Ω)	<15mΩ	<b>MIL-STD-202 Method 204</b> 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(0.5%+0.01Ω)	<15mΩ	<b>AEC-Q200-002</b> Human body, 0102/0204:2KV; 0207:4KV
Resistance to Solvents	No visible damage on appearance and marking.		<b>MIL-STD-202 Method 215</b> Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.

Item	Requirement		Test Method
	5% and Below	Jumper	
Terminal Strength	No broken		<b>AEC-Q200-006</b> Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		<b>UL-94</b> V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$  or Max. Operating Voltage whichever is lower.

■ Storage Temperature: 15~28°C; Humidity < 80%RH

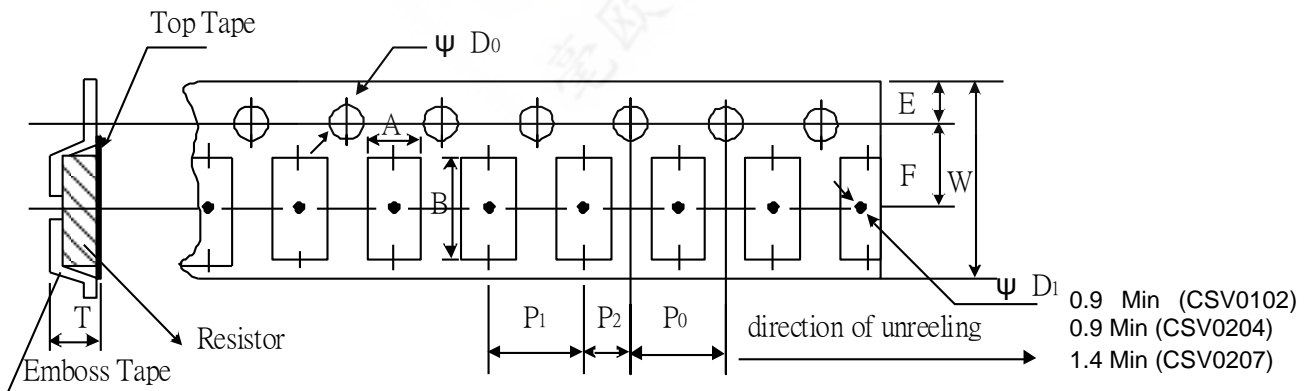
■ Packaging



Packaging Quantity & Reel Specifications

Type	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	Emboss Plastic Tape (EA)
CSV0102	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
CSV0204	7 inch	178.5±1.5	60.0+1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
CSV0207	7 inch	178.5±1.5	60.0+1.0	13.0±0.5	13.0±0.5	15.5±0.5	2,000

Emboss Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P <sub>0</sub> (mm)	P <sub>1</sub> (mm)	P <sub>2</sub> (mm)	ΦD <sub>0</sub> (mm)	T (mm)
CSV0102	1.30±0.10	2.40±0.10	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.50±0.10
CSV0204	1.55±0.10	3.65±0.10	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	1.80±0.10
CSV0207	2.40±0.10	6.15±0.10	12.0±0.10	1.75±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.10	2.70±0.10

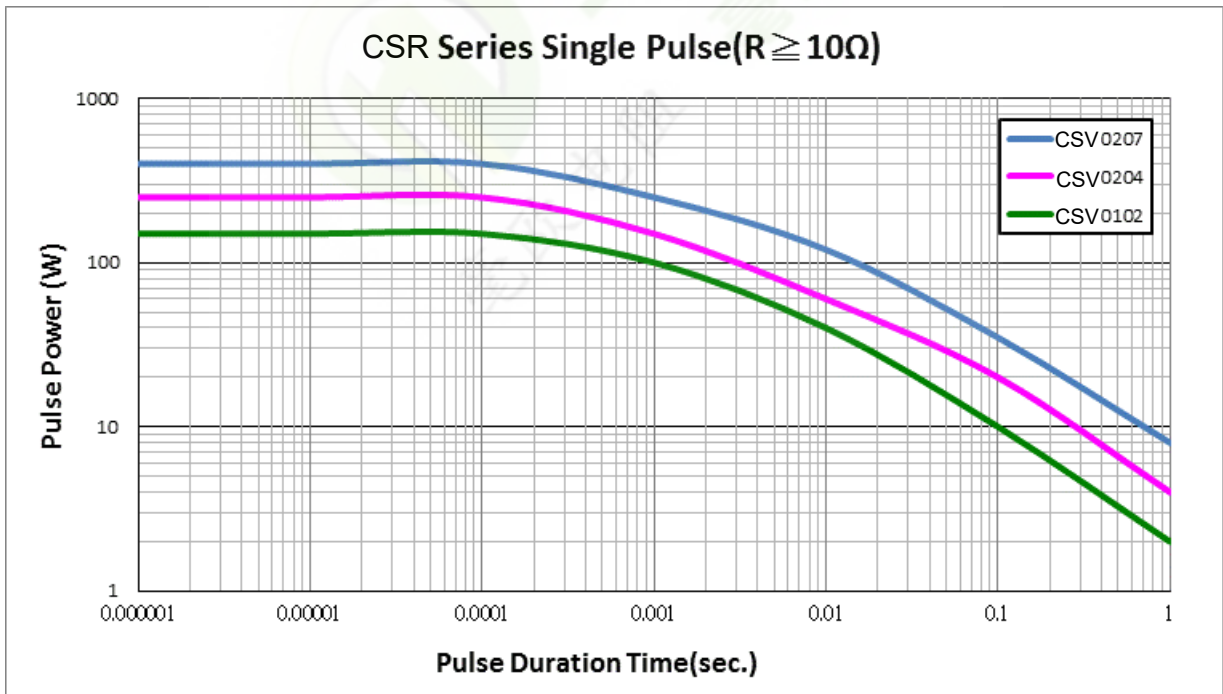
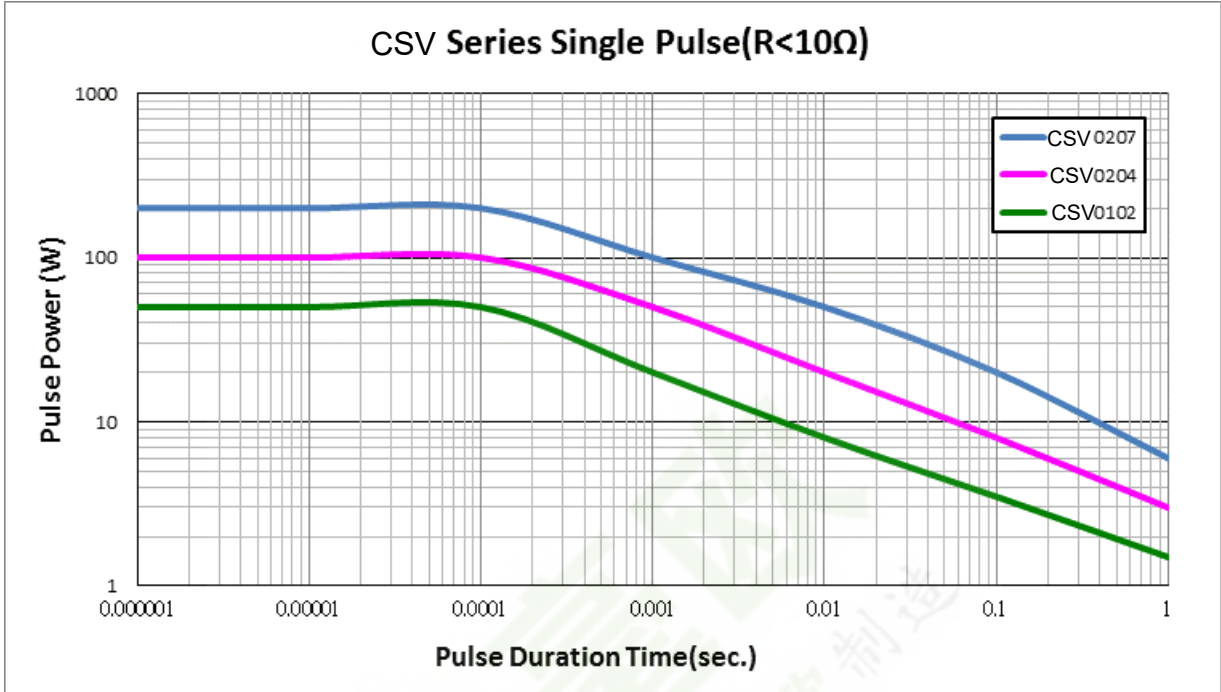
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### ■ Pulse withstanding capacity

The single impulse graph is the result of the impulse of rectangular shape applied. The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown.

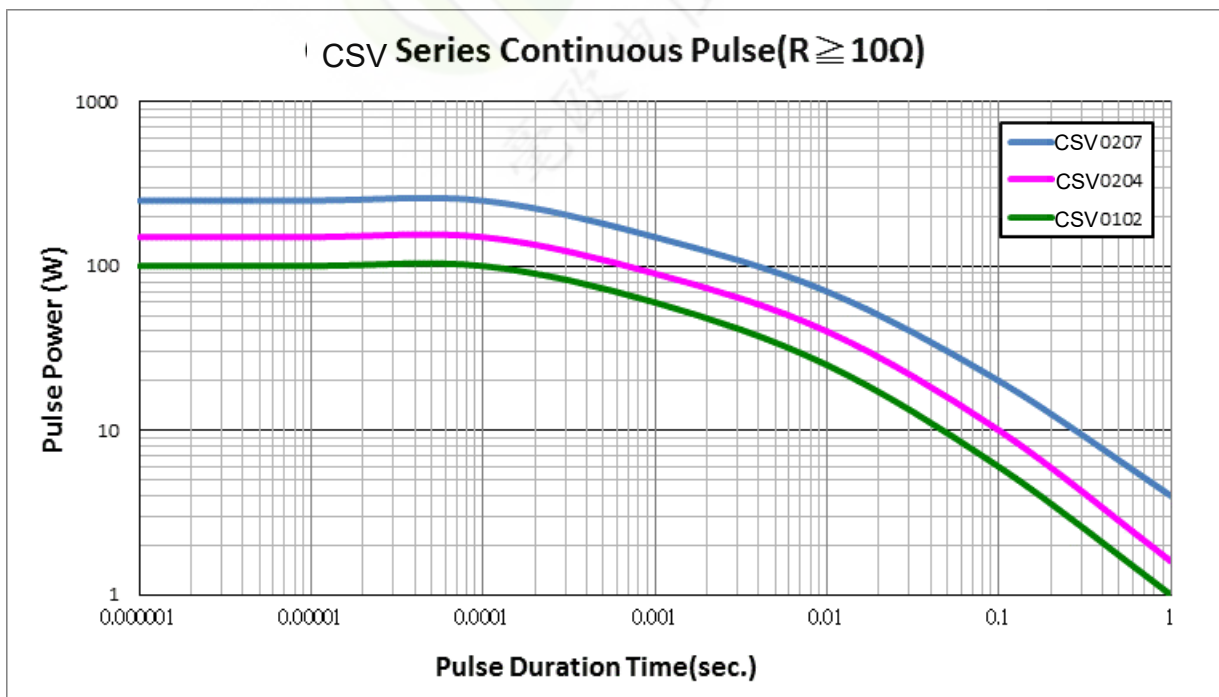
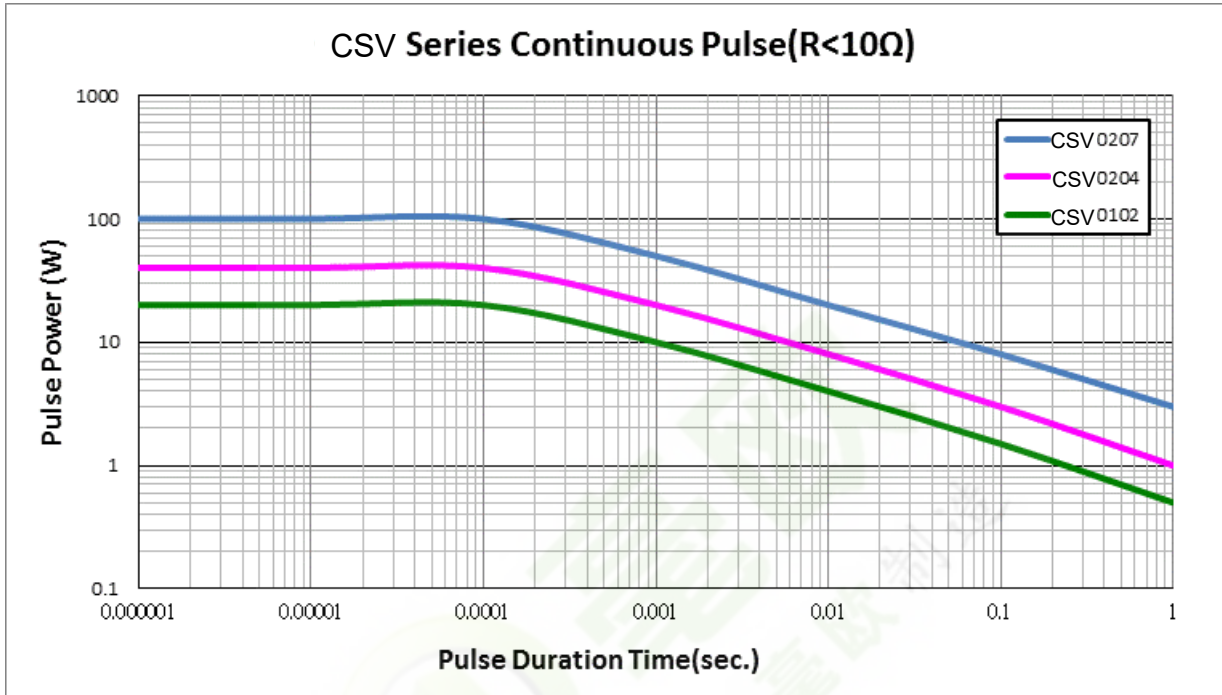


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## Continuous Pulse

The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70°C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value.



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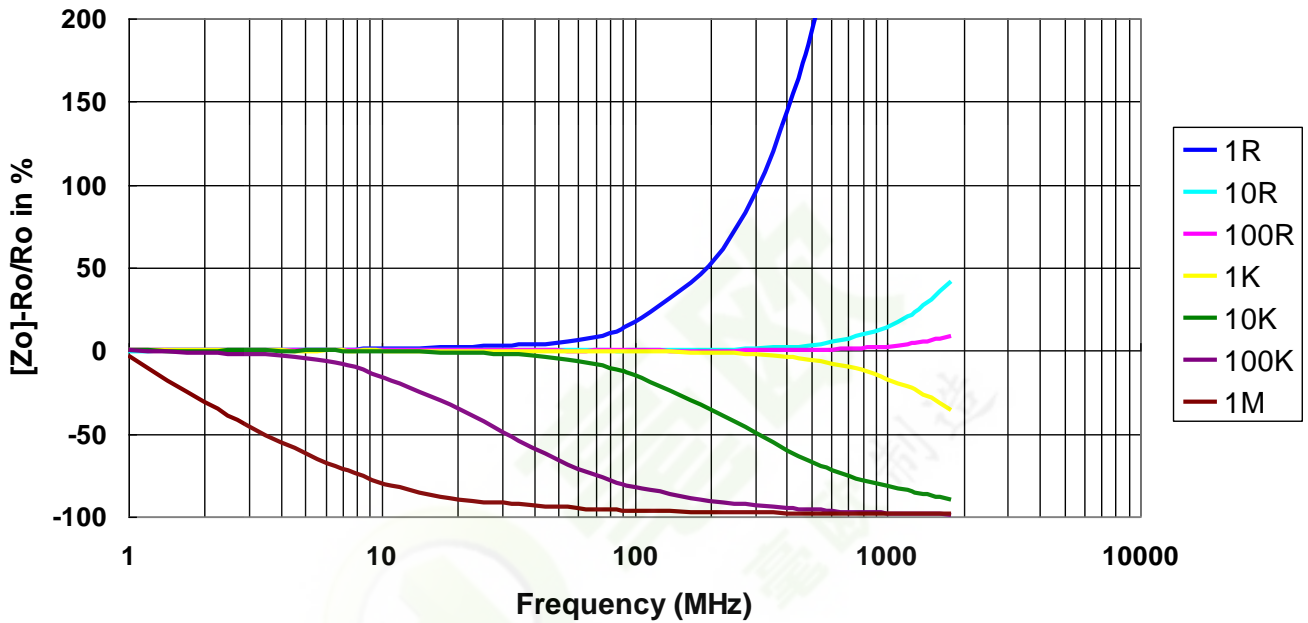
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### Frequency behavior

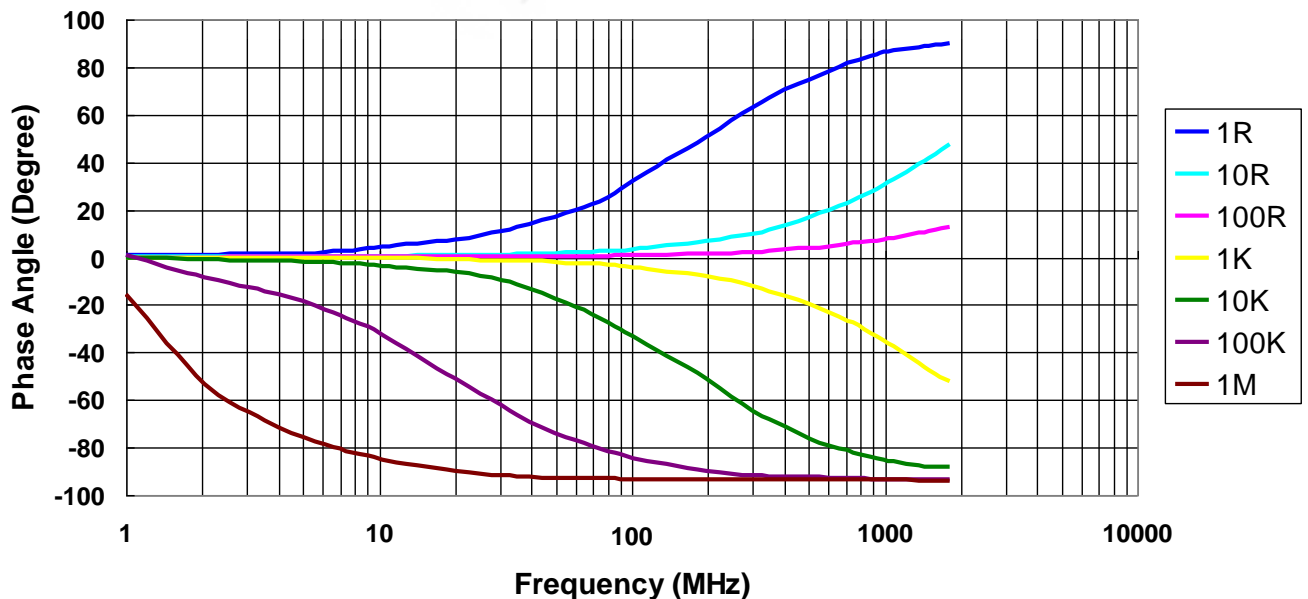
Resistors are designed to function according to ohmic laws. This is basically true of resistors for frequencies up to 100kHz. At higher frequencies, there is an additional contribution to the impedance by an ideal resistor switched in series with a coil and both switched parallel to a capacitor. The values of the capacitance and inductance are mainly determined by the dimensions of the terminations and the conductive path length.

The environment surrounding components has a large influence on the behavior of the component on the printed-circuit board.

## Frequency vs. Impedance CSV Series (CSV0204)



## Frequency vs. Phase Angle CSV Series (CSV0204 )



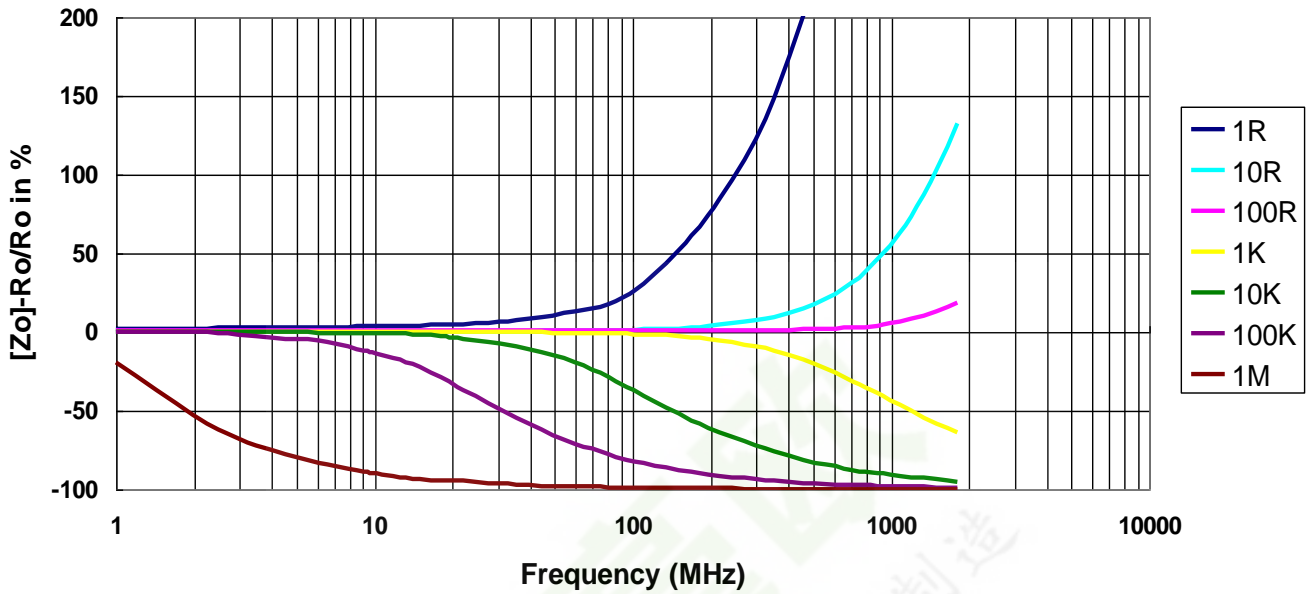
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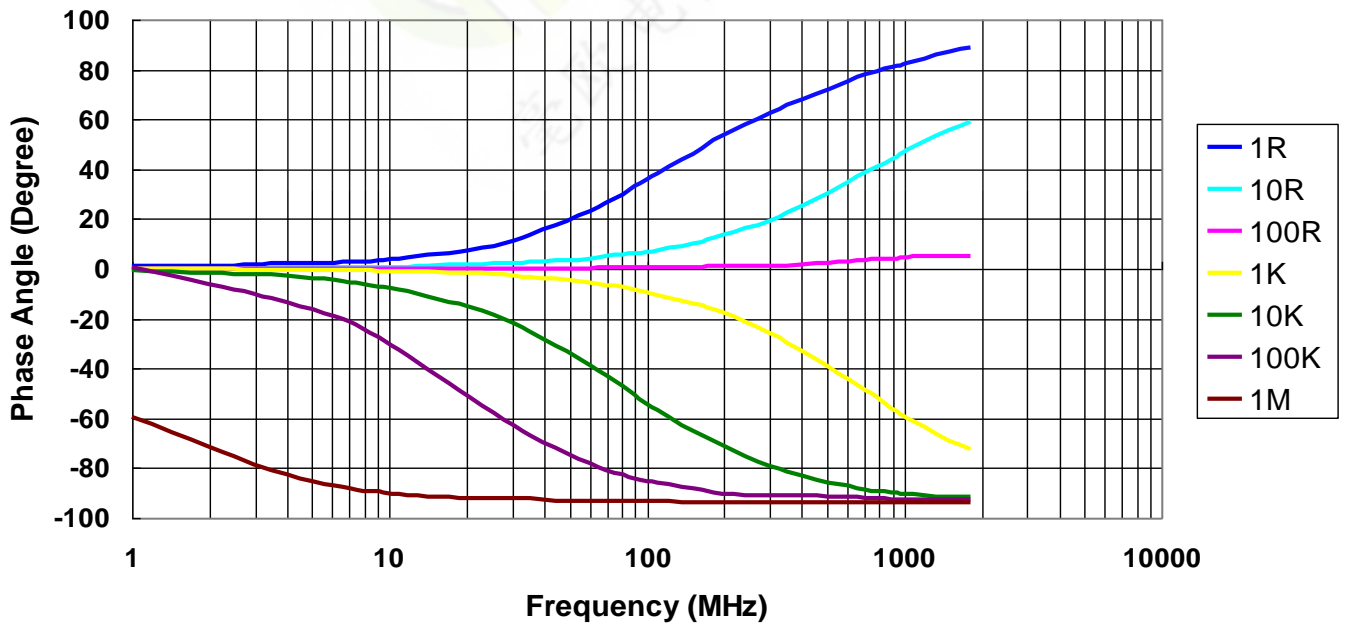
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### Frequency vs. Impedance CSV Series (CSV0207)



### Frequency vs. Phase Angle CSV Series (CSV0207)



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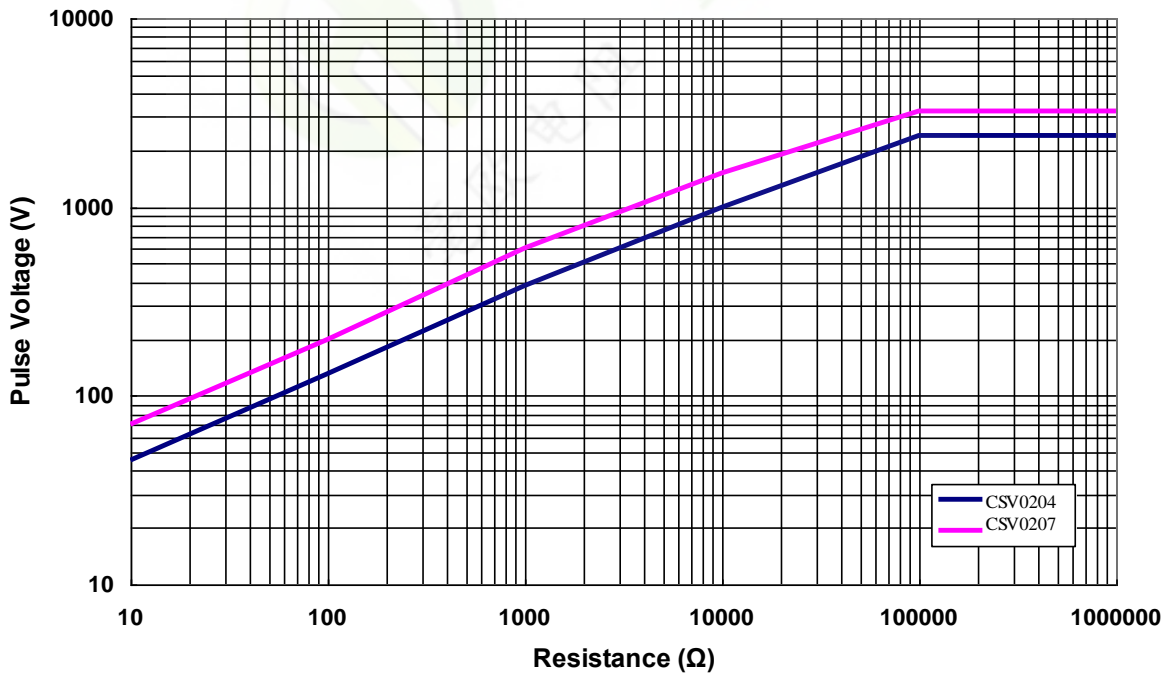
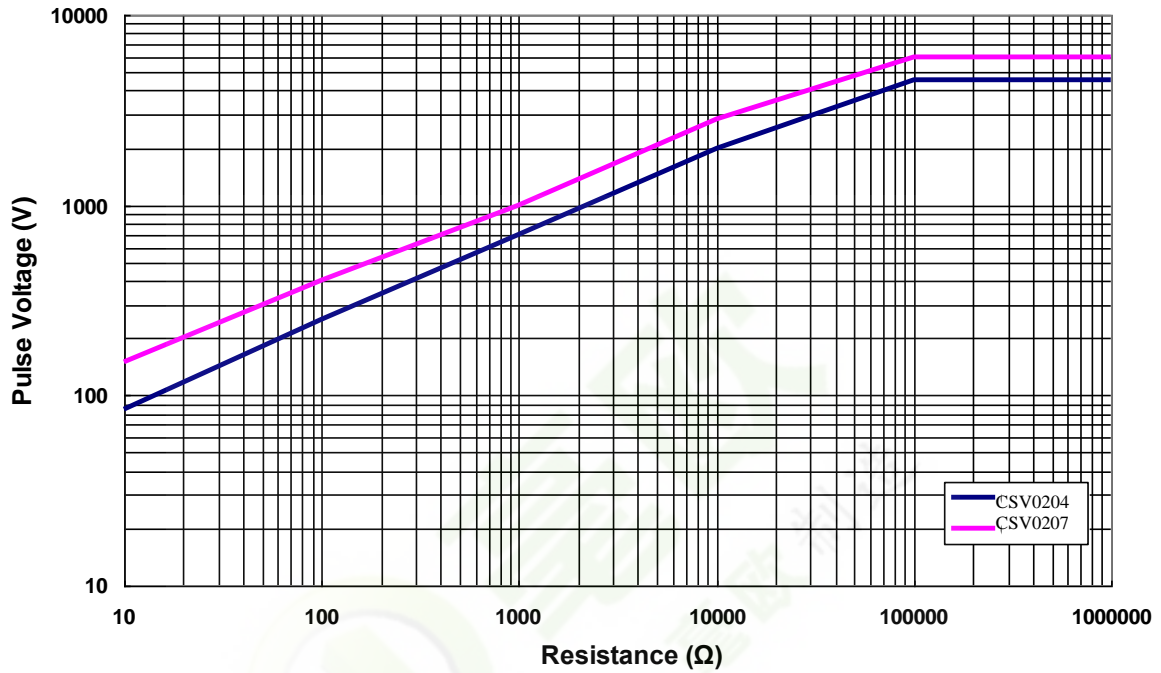
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## Lightning Surge

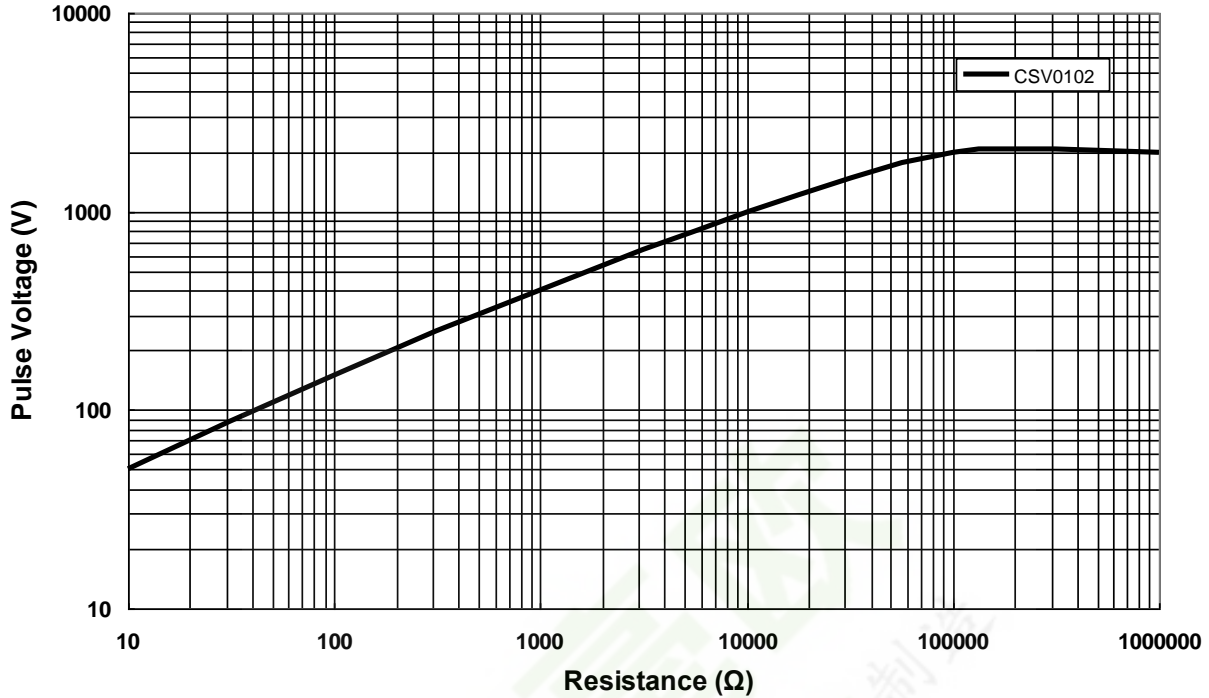
Resistors are tested in accordance with IEC 60115-1 using both 1.2/50us and 10/700us pulse shapes. The limit of acceptance is a shift in resistance of less than 0.5% from the initial value.

### 1.2/50µs Lightning Surge

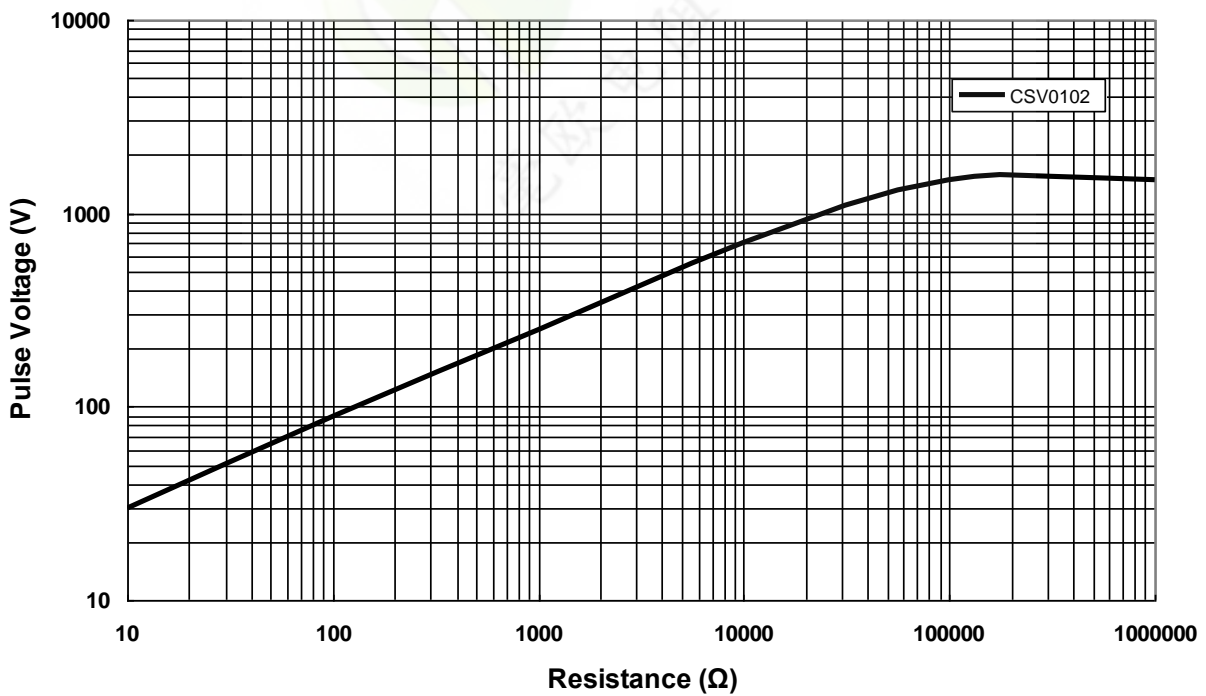


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### 1.2/50 $\mu$ s Lightning Surge

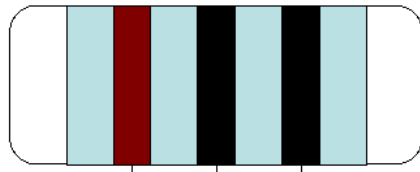


### 10/700 $\mu$ s Lightning Surge



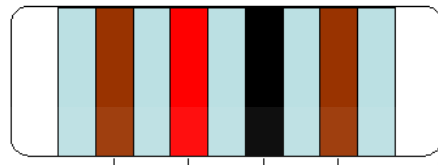
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### Marking & Resistance Tolerance



1st digit      2nd digit      Multiplier

±5%	E-24	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
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1st digit      2nd digit      3digit      Multiplier

±1%	E-96	1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74
		1.78	1.82	1.87	1.91	1.96	2.00	2.05	2.10	2.15	2.21	2.26	2.32	2.37	2.43	2.49	2.55	2.61	2.67	2.74	2.80	2.87	2.94	3.01	3.09
		3.16	3.24	3.32	3.40	3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12	4.22	4.32	4.42	4.53	4.64	4.75	4.87	4.99	5.11	5.23	5.36	5.49
		5.62	5.76	5.90	6.04	6.19	6.34	6.49	6.65	6.81	6.98	7.15	7.32	7.50	7.68	7.87	8.06	8.25	8.45	8.66	8.87	9.09	9.31	9.53	9.76
±0.5% ±0.25% ±0.1%	E-192	10.0	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.3	11.4	11.5	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	13.0	13.2
		13.3	13.5	13.7	13.8	14.0	14.2	14.3	14.5	14.7	14.9	15.0	15.2	15.4	15.6	15.8	16.0	16.2	16.4	16.5	16.7	16.9	17.2	17.4	17.6
		17.8	18.0	18.2	18.4	18.7	18.9	19.1	19.3	19.6	19.8	20.0	20.3	20.5	20.8	21.0	21.3	21.5	21.8	22.1	22.3	22.6	22.9	23.2	23.4
		23.7	24.0	24.3	24.6	24.9	25.2	25.5	25.8	26.1	26.4	26.7	27.1	27.4	27.7	28.0	28.4	28.7	29.1	29.4	29.8	30.1	30.5	30.9	31.2
		31.6	32.0	32.4	32.8	33.2	33.6	34.0	34.4	34.8	35.2	35.7	36.1	36.5	37.0	37.4	37.9	38.3	38.8	39.2	39.7	40.2	40.7	41.2	41.7
		42.2	42.7	43.2	43.7	44.2	44.8	45.3	45.9	46.4	47.0	47.5	48.1	48.7	49.3	49.9	50.5	51.1	51.7	52.3	53.0	53.6	54.2	54.9	55.6
		56.2	56.9	57.6	58.3	59.0	59.7	60.4	61.2	61.9	62.6	63.4	64.2	64.9	65.7	66.5	67.3	68.1	69.0	69.8	70.6	71.5	72.3	73.2	74.1
		75.0	75.9	76.8	77.7	78.7	79.6	80.6	81.6	82.5	83.5	84.5	85.6	86.6	87.6	88.7	89.8	90.9	92.0	93.1	94.2	95.3	96.5	97.6	98.8

Color	Digit	Multiplier
Silver	-	10 <sup>-2</sup>
Gold	-	10 <sup>-1</sup>
Black	0	10 <sup>0</sup>
Brown	1	10 <sup>1</sup>
Red	2	10 <sup>2</sup>
Orange	3	10 <sup>3</sup>
Yellow	4	10 <sup>4</sup>
Green	5	10 <sup>5</sup>
Blue	6	10 <sup>6</sup>
Violet	7	10 <sup>7</sup>
Grey	8	10 <sup>8</sup>
White	9	10 <sup>9</sup>

※ Resistance more than two significant figures(<1R) or more than three significant figures(>1R) will not provide color code.

地址：深圳市龙华新区观澜大布头路南通邦高新产业园 A栋 8 楼