

 毫欧电阻 毫欧制造	HoCSR 晶圆电阻系列	系列号	HoCSR
		修订日期	2022-12-21
		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度晶圆电阻HoCSR 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

Part Numbering

HoCSR0204-1/4W-1KR-0.5%-TCR50

Ho	CSR	0204	1/4W	1KR	0.5%	TCR50
↓	↓	↓	↓	↓	↓	↓
manufacturers	Product Type	encapsulation	Rated power	resistance	precision	TCR (PPM/° C)
毫欧电子	CSR	0102: 2.2x1.1 0204: 3.5x1.4 0207: 5.9x2.2	T: 1W U: 1/2W V: 1/4W G: 2/5W P: 1/5W W: 1/8W L: 0.3W	0010: 1Ω 0100: 10Ω 2201: 2200Ω 1001: 1KΩ 1004: 1MΩ R050: 0.05Ω 22R1: 22.1Ω R0R0: 0Ω	B: $\pm 0.1\%$ C: $\pm 0.25\%$ D: $\pm 0.5\%$ F: $\pm 1\%$ J: $\pm 5\%$ or Jumper	S: ± 5 B: ± 10 N: ± 15 C: ± 25 D: ± 50 E: ± 100 -: Jumper

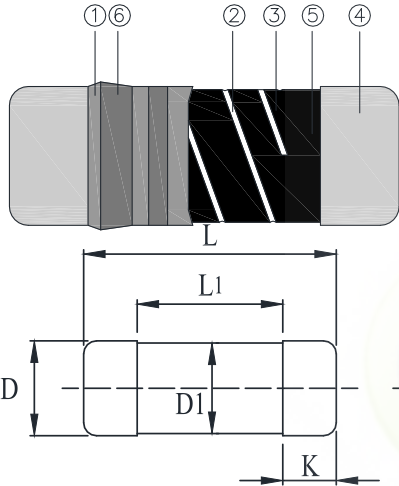


地址：深圳市龙华新区观澜大布头路南通邦高新产业园 A 栋 8 楼

 毫欧电阻 毫欧制造	HoCSR 晶圆电阻系列	系列号	HoCSR
		修订日期	2022-12-21
		版本号	Ho-A0

TECHNICAL SPECIFICATIONS							
DESCRIPTION	CSR0102			CSR0204		CSR0207	
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 ₇₀	1/8W	1/5W	0.3W	1/4W	2/5W	1/2W	1W
Operating voltage U _{max.}	150V	200V	200V	200V	200V	300V	350V
Operating temperature range	-55℃~155℃						
Max. resistance change at P70 for resistance range, ΔR/R max., after 1000 h	≤0.5%			≤0.5%		≤0.5%	

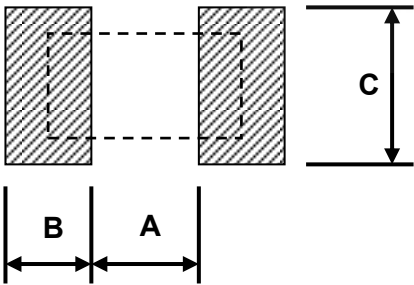
Construction & Dimension



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

Type	L (mm)	L _{1 min.} (mm)	ΦD (mm)	ΦD ₁ (mm)	K (mm)	Weight 1,000EA (g)
CSR0102	2.20±0.10	1.1	1.10±0.10	D +0/-0.15	0.45±0.05	7.7
CSR0204	3.50±0.2	1.7	1.40±0.15	D +0/-0.2	0.8±0.1	18.7
CSR0207	5.90±0.2	2.9	2.20±0.20	D +0/-0.2	1.3±0.1	80.9

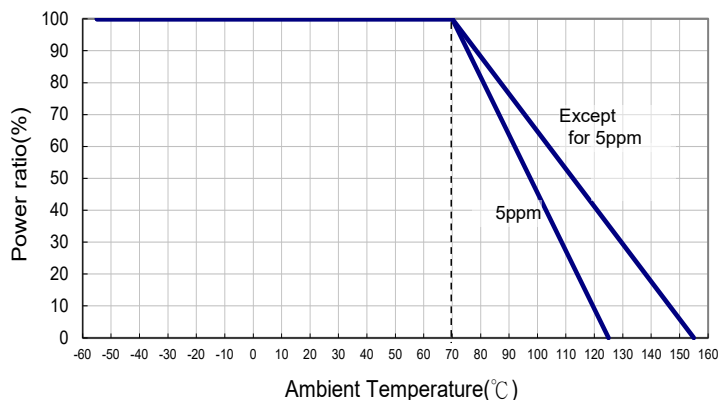
Recommend Land Pattern



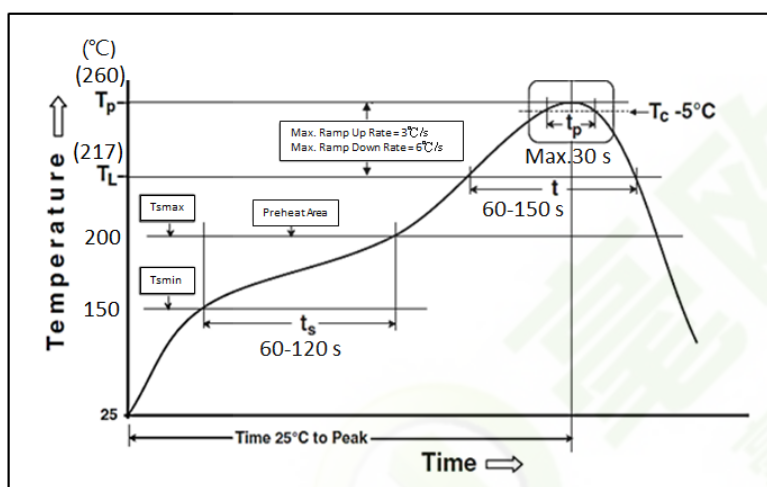
Type	A (mm)	B (mm)	C (mm)
CSR0102	1.0	0.8	1.5
CSR0204	1.6	1.2	1.6
CSR0207	3.0	1.7	2.4

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

Derating Curve



Soldering Condition (IPC/JEDEC J-STD-020)



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	-55 ~ +155°C	150V	300V	100Ω-56KΩ				-	±15
					100Ω-82KΩ		49.9Ω- 200KΩ	49.9Ω- 390KΩ	-	±25
					-		1Ω-1MΩ			±50
					-			1Ω-1MΩ		±100
0204	1/4W	-55 ~ +125°C	200V	400V	10Ω-332KΩ		-			±5
					49.9Ω-20KΩ			-	±10	
		-55 ~ +155°C	200V	400V	10Ω-300KΩ			-	±15	
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50
					-			0.1Ω-3.4MΩ		±100
0207	1/2W	-55 ~ +125°C	300V	600V	10Ω-332KΩ		-			±5
					49.9Ω-20KΩ			-	±10	
		-55 ~ +155°C	300V	600V	10Ω-300KΩ			-	±15	
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50
					-			0.1Ω-3.4MΩ		±100

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

 毫欧电阻 毫欧制造	HoCSRV 晶圆电阻系列	系列号	HoCSRV
		修订日期	2022-12-21
		版本号	Ho-A0

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	-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
		-55 ~ +155°C	200V	400V	49.9Ω-20KΩ				-	±10
					10Ω-300KΩ				-	±15
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50
					-			0.1Ω-3.4MΩ		±100
0207	1W	-55 ~ +125°C	350V	700V	10Ω-332KΩ		-			±5
		-55 ~ +155°C	350V	700V	49.9Ω-20KΩ				-	±10
					10Ω-300KΩ				-	±15
					10Ω-1MΩ		10Ω-3.4MΩ	1Ω-3.4MΩ		±25
					10Ω-1MΩ		1Ω-3.4MΩ	0.2Ω-3.4MΩ		±50
					-			0.1Ω-3.4MΩ		±100

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.

Jumper Specifications

Item Type	Power Rating	Operating Temp.Range	Resistance	Rated Current
CSR0102	1/8W	-55 ~ +155°C	0Ω(<15mΩ)	2A
	1/5W			
	0.3W			
CSR0204	1/4W	-55 ~ +155°C		3A
	2/5W			
CSR0207	1/2W	-55 ~ +155°C		5A
	1W			

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

 毫欧电阻 毫欧制造	HoCSRV晶圆电阻系列	系列号	HoCSRV
		修订日期	2022-12-21
		版本号	Ho-A0

■Environmental Characteristics

Item	Requirement		Test Method
	5% and Below	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec		JIS-C-5201-1 4.8 IEC-60115-1 4.8 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: $\pm(0.1\%+0.01\Omega)$ <10Ω & >270KΩ: $\pm(0.15\%+0.01\Omega)$ 0102: $\pm(0.15\%+0.01\Omega)$ 5ppm: $\pm(0.05\%+0.01\Omega)$	<15mΩ	JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G		JIS-C-5201-1 4.6 IEC-60115-1 4.6 Max. Overload Voltage for 1 minute
Operational Life	10Ω-270KΩ: $\pm(0.25\%+0.01\Omega)$ <10Ω & >270KΩ: $\pm(0.5\%+0.01\Omega)$ 0102: $\pm(0.5\%+0.01\Omega)$	<15mΩ	MIL-STD-202 Method 108 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: $\pm(0.5\%+0.01\Omega)$ <10Ω & >270KΩ: $\pm(1\%+0.01\Omega)$ 0102: $\pm(2\%+0.01\Omega)$	<15mΩ	MIL-STD-202 Method 103 1000 hrs 85°C/85%RH 10% of operating power. (≤ 100 V)
High Temperature Exposure	10Ω-270KΩ: $\pm(0.25\%+0.01\Omega)$ <10Ω & >270KΩ: $\pm(1\%+0.01\Omega)$ 0102: $\pm(1\%+0.01\Omega)$	<15mΩ	MIL-STD-202 Method 108 at +125°C/+155°C for 1000 hrs
Board Flex	10Ω-270KΩ: $\pm(0.1\%+0.01\Omega)$ <10Ω & >270KΩ: $\pm(0.5\%+0.01\Omega)$ 0102: $\pm(0.5\%+0.01\Omega)$	<15mΩ	AEC-Q200-005 Bending once for 60 seconds with 2mm
Solderability	95% min. coverage		JIS-C-5201-1 4.17 IEC-60115-1 4.17 J-STD-002 245±5°C for 3 seconds
Resistance to Soldering Heat	10Ω-270KΩ: $\pm(0.1\%+0.01\Omega)$ <10Ω & >270KΩ: $\pm(0.25\%+0.01\Omega)$ 0102: $\pm(0.25\%+0.01\Omega)$ 5ppm: $\pm(0.05\%+0.01\Omega)$	<15mΩ	MIL-STD-202 Method 210 260±5°C for 10 seconds

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

 毫欧电阻 毫欧制造	HoCSRV晶圆电阻系列	系列号	HoCSRV
		修订日期	2022-12-21
		版本号	Ho-A0

Item	Requirement		Test Method
	5% and Below	Jumper	
Voltage Proof	No breakdown or flashover		JIS-C-5201-1 4.7 IEC-60115-1 4.7 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area $\leq 5\%$ Total leaching area $\leq 10\%$		JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 260 $\pm$ 5°C for 30 seconds
Temperature Cycling	10 Ω -270K Ω : $\pm(0.25\%+0.01\Omega)$ <10 Ω & >270K Ω : $\pm(0.5\%+0.01\Omega)$ 0102: $\pm(1\%+0.01\Omega)$	<15m Ω	JESD22 Method JA-104 -55°C to +125°C, 1000 cycles
Mechanical Shock	$\pm(0.25\%+0.01\Omega)$	<15m Ω	MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	$\pm(0.5\%+0.01\Omega)$	<15m Ω	MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	$\pm(0.5\%+0.01\Omega)$	<15m Ω	AEC-Q200-002 Human body, 0102/0204:2KV; 0207:4KV
Resistance to Solvents	No visible damage on appearance and marking.		MIL-STD-202 Method 215 Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken		AEC-Q200-006 Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board		UL-94 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**

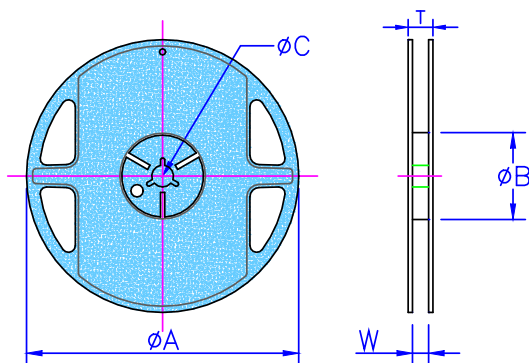
■ **Shelf Life: 2 years from production date.**

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

深圳市毫欧电子有限公司 | 电话: 0755-2 8153 546 | 传真: 0755-22 6301 81 | 网址: www.moolee.com.cn

 毫欧电阻 毫欧制造	HoCSR 晶圆电阻系列		系列号	HoCSR
			修订日期	2022-12-21
			版本号	Ho-A0

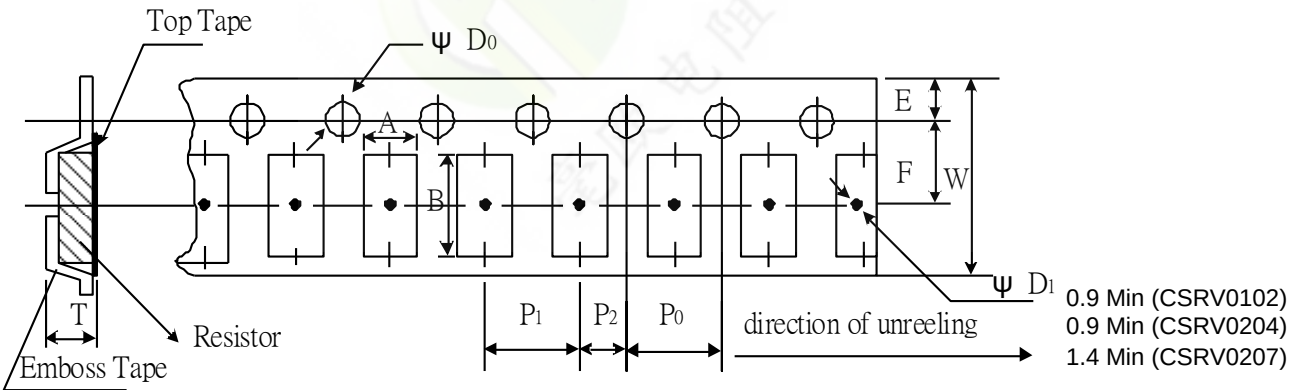
Packaging



Packaging Quantity & Reel Specifications

Type	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)	Emboss Plastic Tape (EA)
CSR0102	7 inch	178.5±1.5	60.0±1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSR0204	7 inch	178.5±1.5	60.0±1.0	13.0±0.2	9.0±0.5	12.5±0.5	3,000
	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5	10,000
CSR0207	7 inch	178.5±1.5	60.0±1.0	13.0±0.5	13.0±0.5	15.5±0.5	2,000
	13 inch	330±1.0	99±0.5	13.5±0.5	13.4±1	17.8±1	6,000

Emboss Plastic Tape Specifications

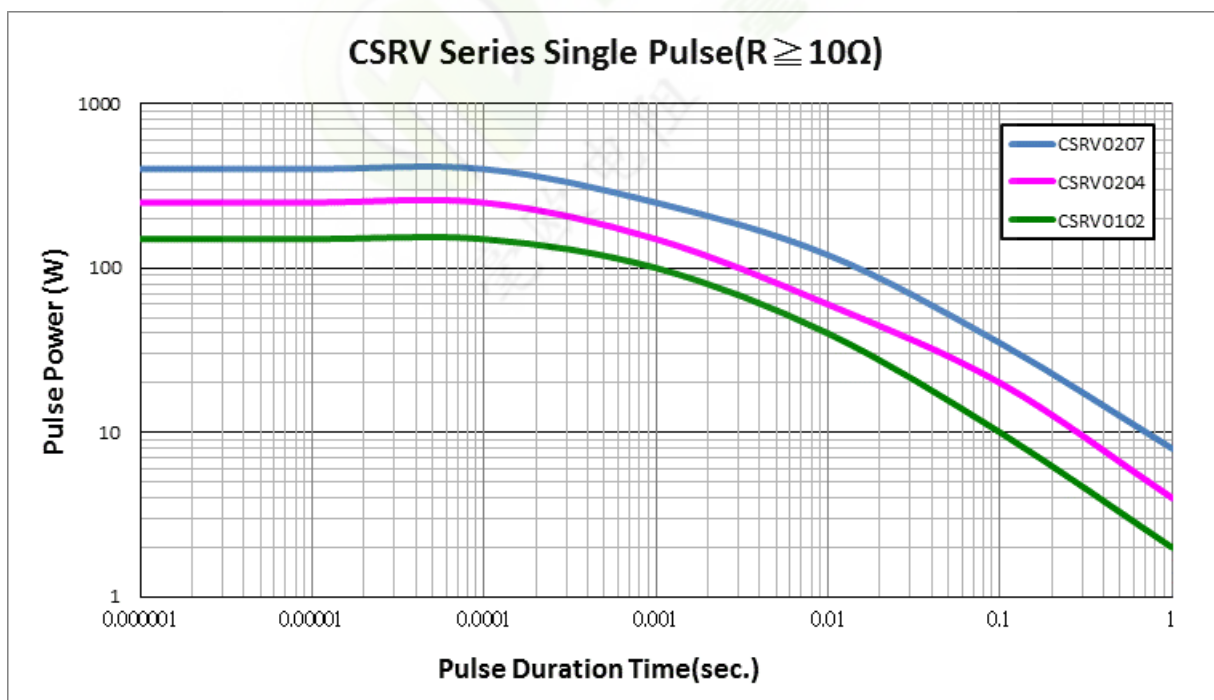
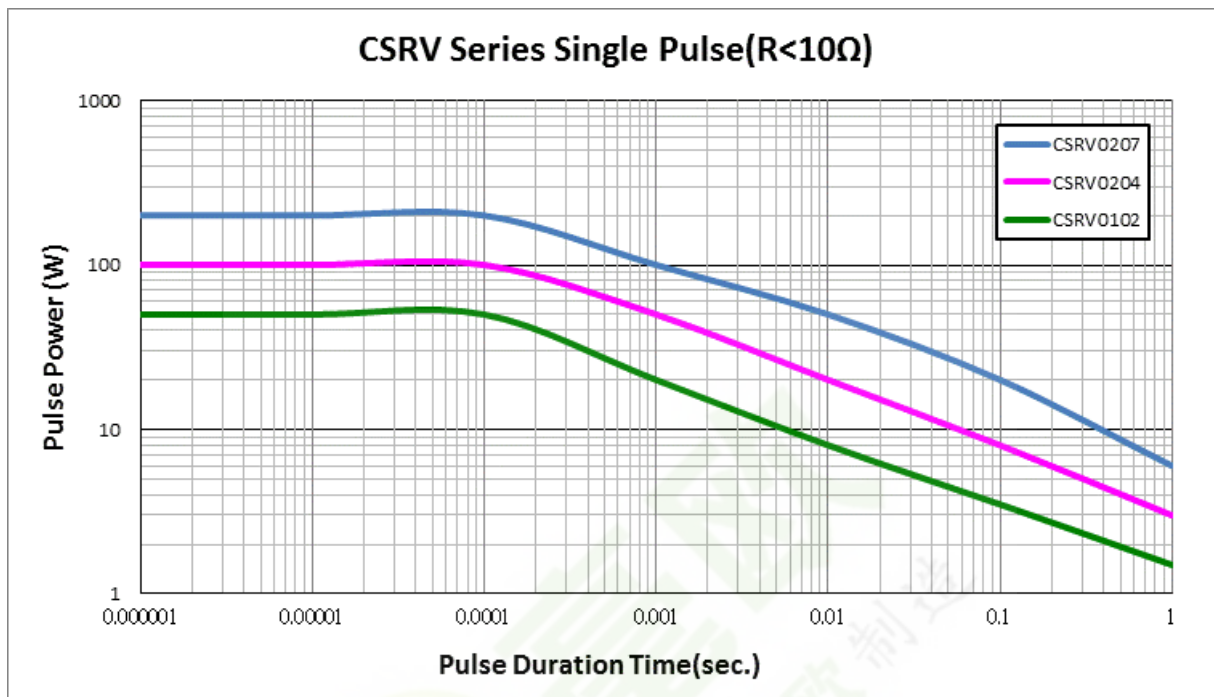


Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P ₀ (mm)	P ₁ (mm)	P ₂ (mm)	ΦD ₀ (mm)	T (mm)
CSR0102	1.30±0.20	2.40±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	1.50±0.10
CSR0204	1.55±0.20	3.65±0.20	8.0±0.10	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	1.80±0.10
CSR0207	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

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

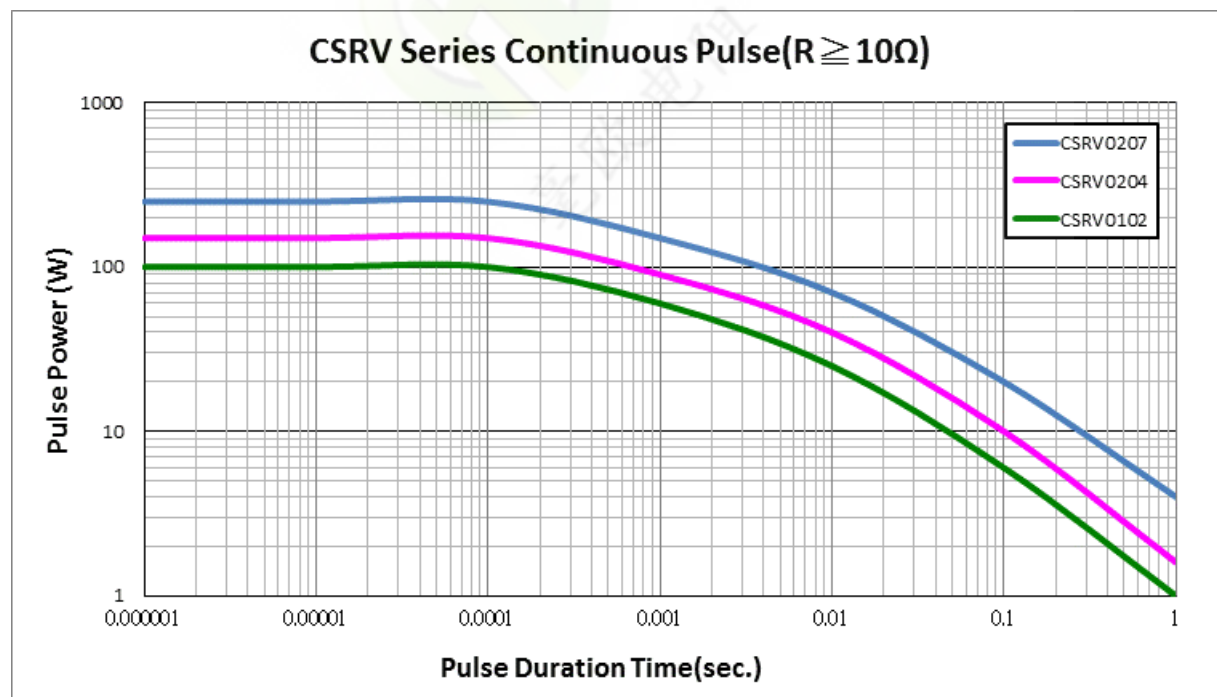
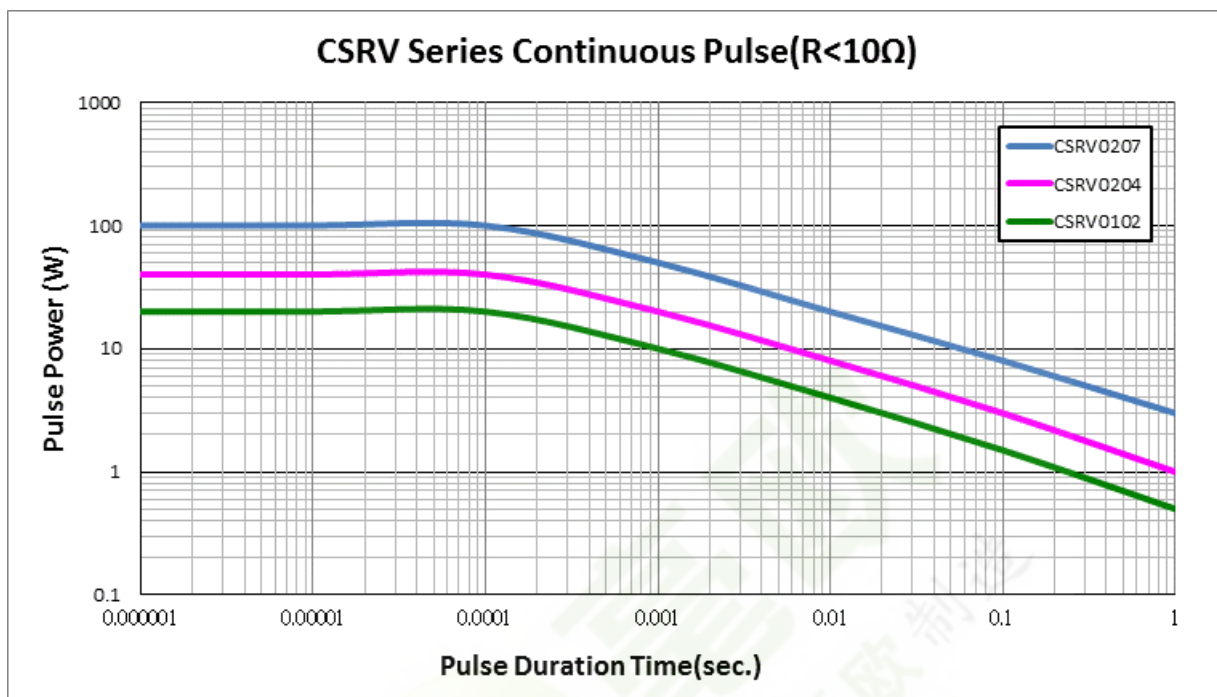
■ Pulse withstanding capacity

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.



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.

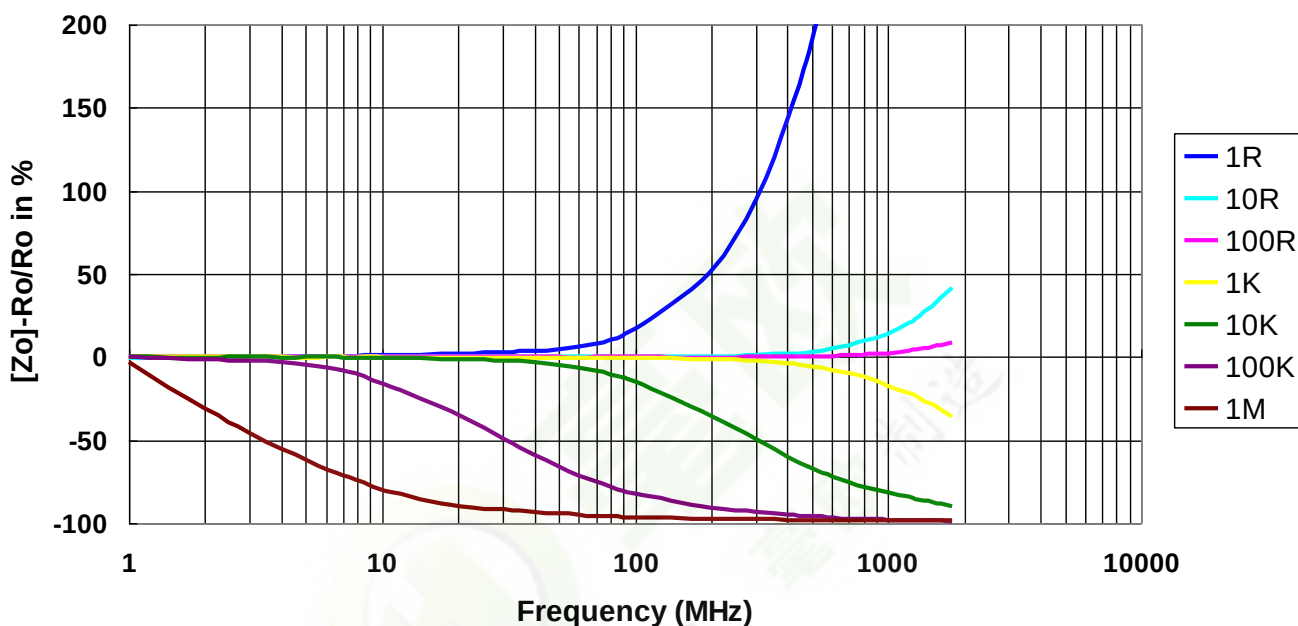


■ Marking & Resistance Tolerance

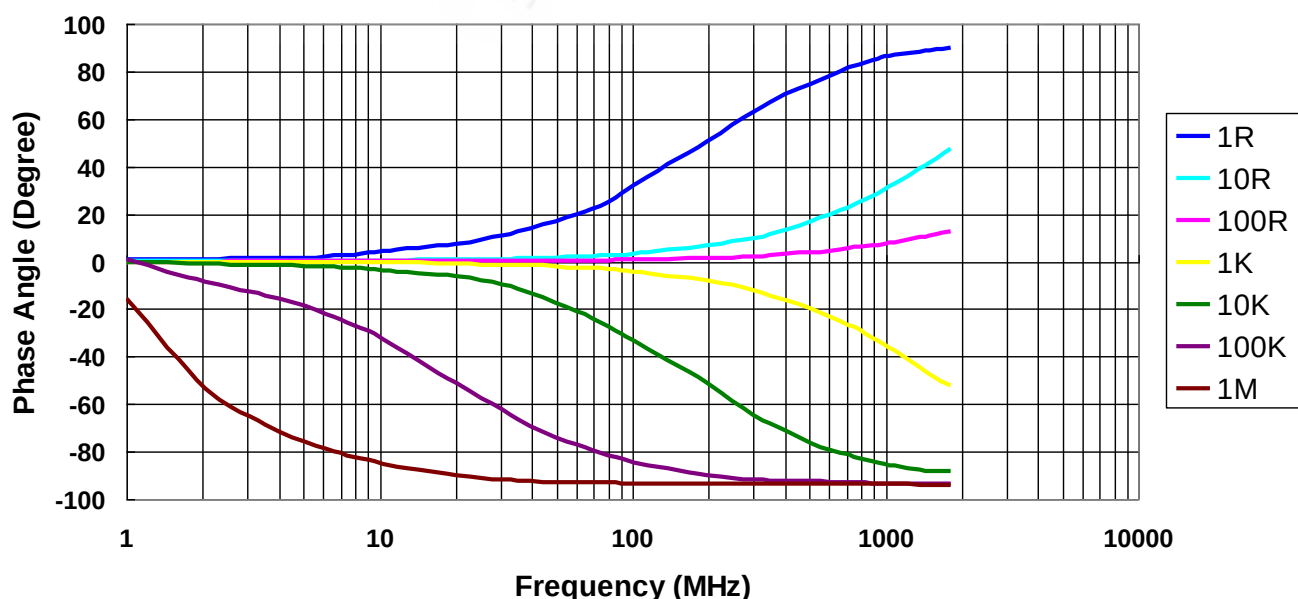
Resistors are designed to function according to ohmic laws. This is basically true of resistors for frequencies up to 100kHz. At higher frequencies, there is an additional contribution to the impedance by an ideal resistor switched in series with a coil and both switched parallel to a capacitor. The 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 CSRV Series (CSRV0204)

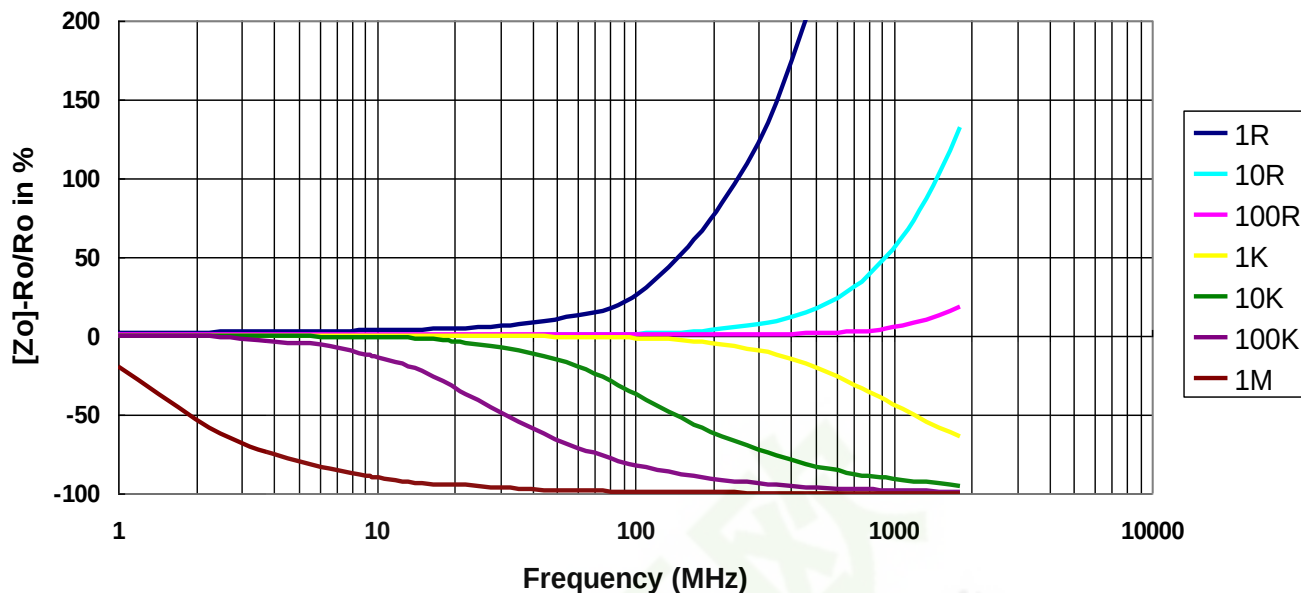


Frequency vs. Phase Angle CSRV Series (CSRV0204)

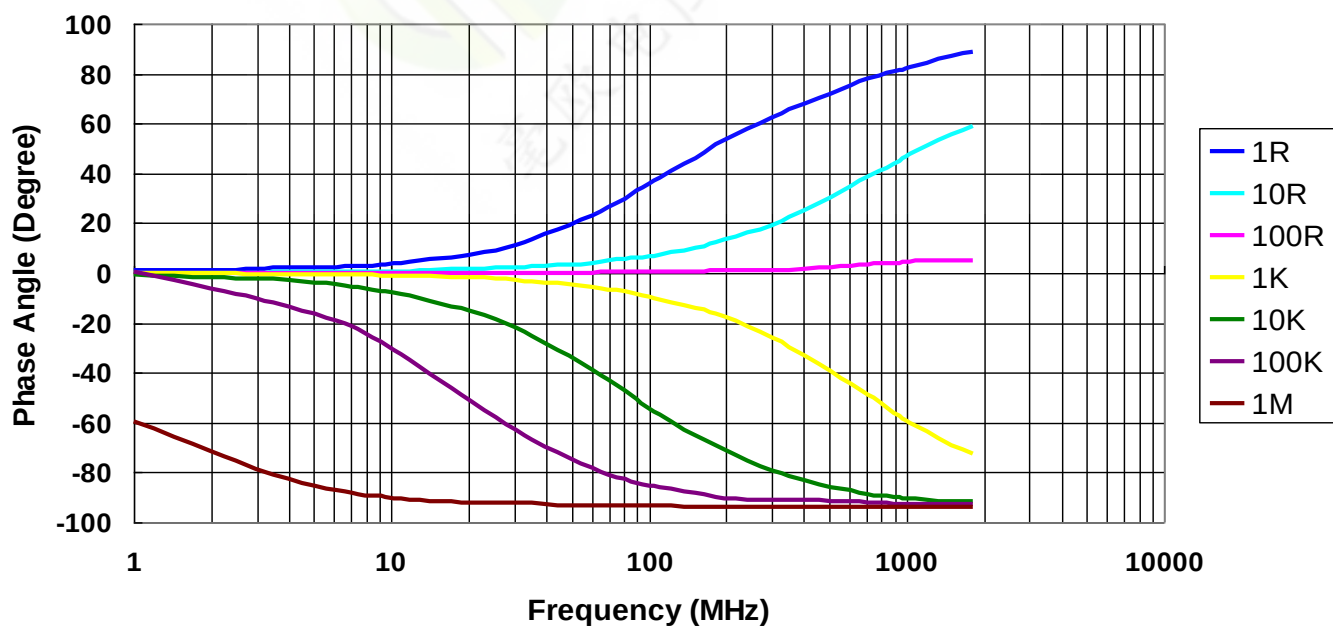


地址：深圳市龙华新区观澜大布头路南通邦高新产业园 A 栋 8 楼

Frequency vs. Impedance CSRV Series (CSRV0207)



Frequency vs. Phase Angle CSRV Series (CSRV0207)

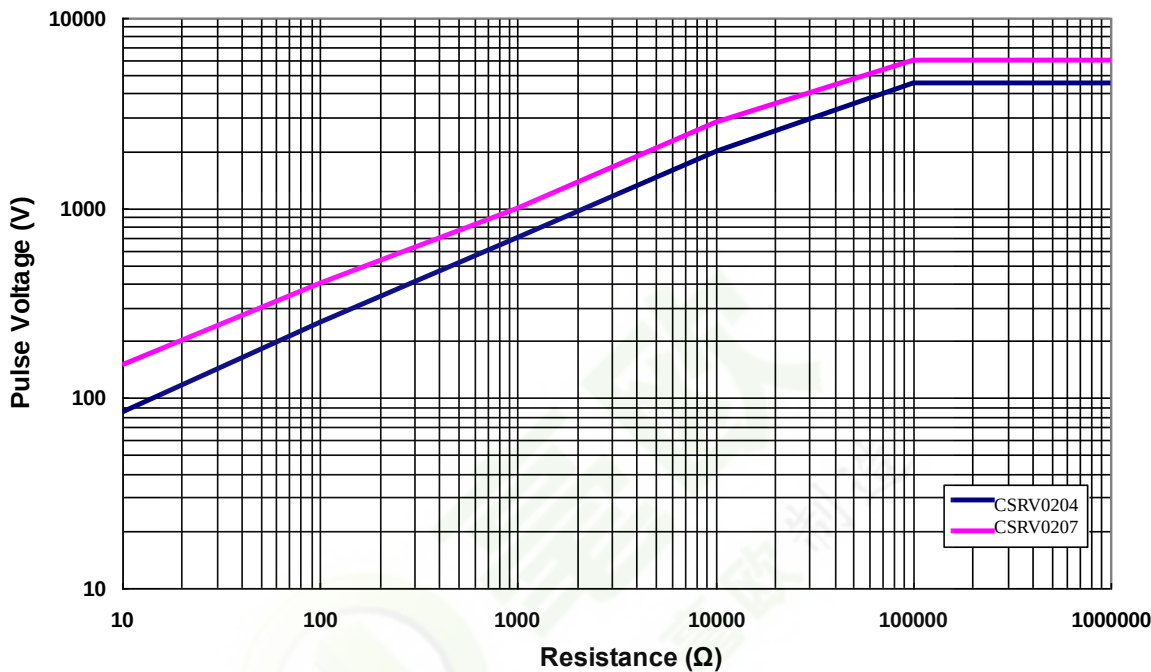


 毫欧电阻 毫欧制造	HoCSRV 晶圆电阻系列		系列号	HoCSRV
			修订日期	2022-12-21
			版本号	Ho-A0

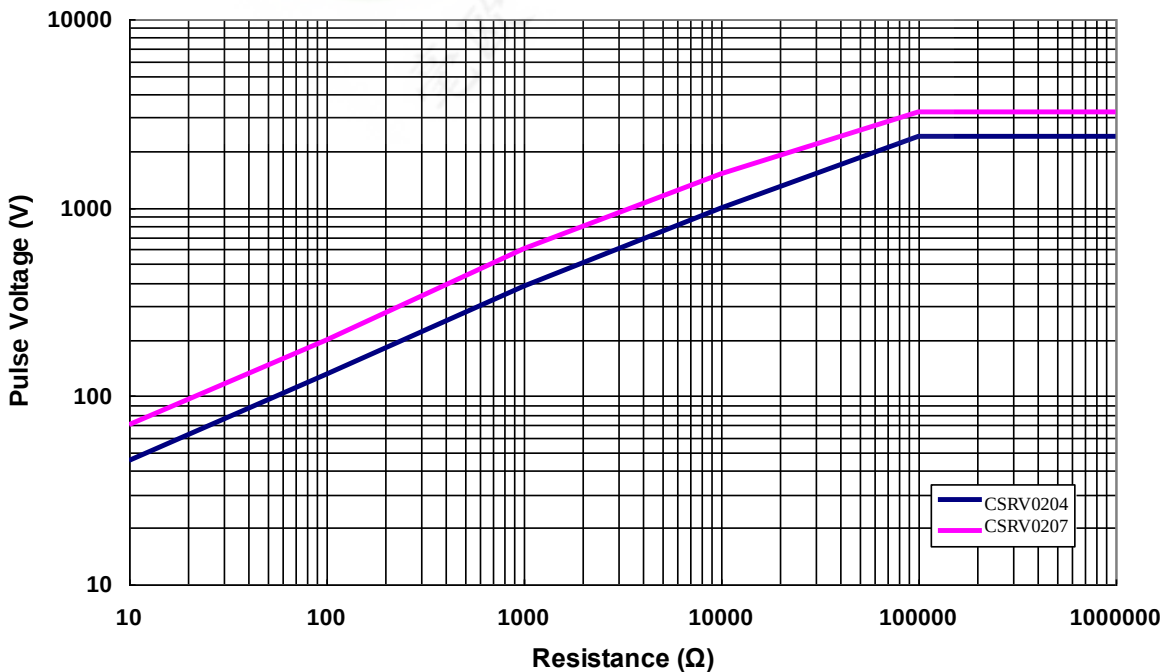
Lightning Surge

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



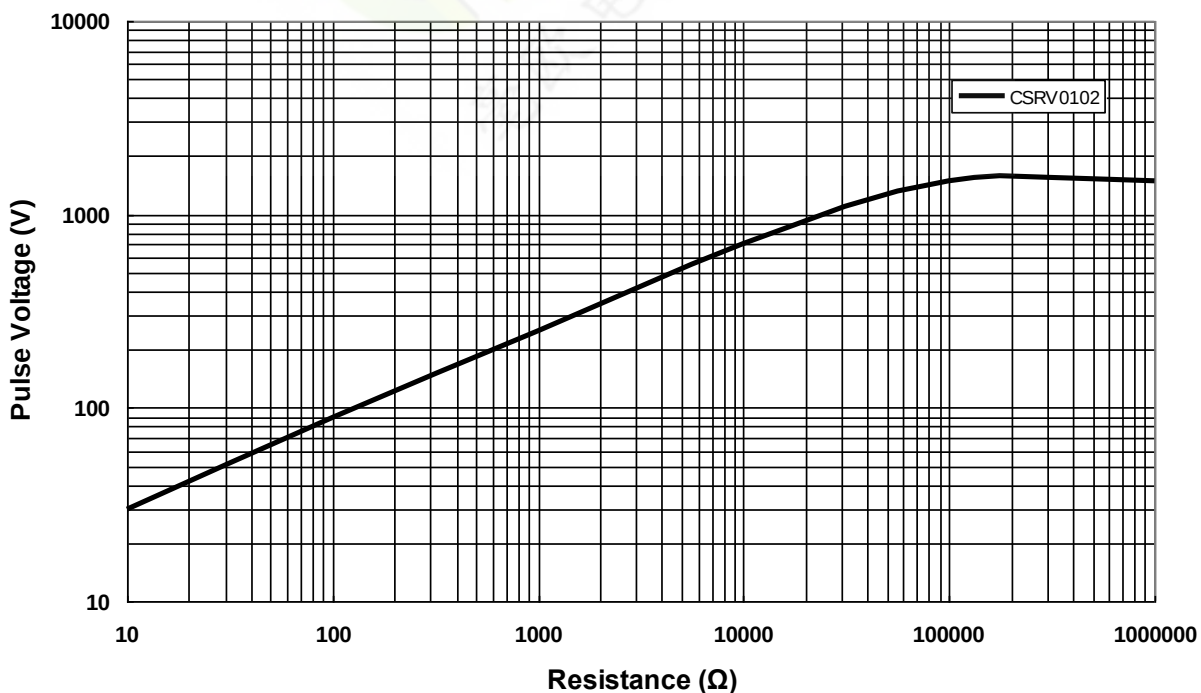
10/700μs Lightning Surge



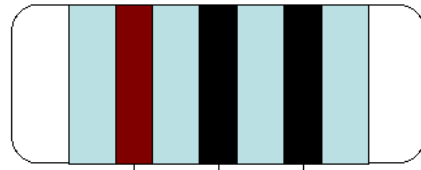
1.2/50 μ s Lightning Surge



10/700 μ s Lightning Surge

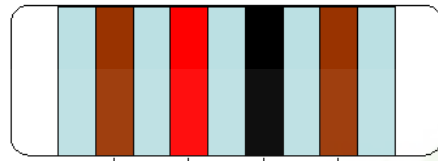


Marking & Resistance Tolerance



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
-----	------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----



1st digit 2nd digit 3rd digit 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 ⁻²
Gold	-	10 ⁻¹
Black	0	10 ⁰
Brown	1	10 ¹
Red	2	10 ²
Orange	3	10 ³
Yellow	4	10 ⁴
Green	5	10 ⁵
Blue	6	10 ⁶
Violet	7	10 ⁷
Grey	8	10 ⁸
White	9	10 ⁹

※ 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