

## Data Sheet

Customer:

Product: Automotive Grade Surge Withstanding Chip Resistor –  
SWR..A Series

Size: 0402/0603/0805/1206/1210/2010/2512

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## Automotive Grade Surge Withstanding Chip Resistor – SWR..A Series

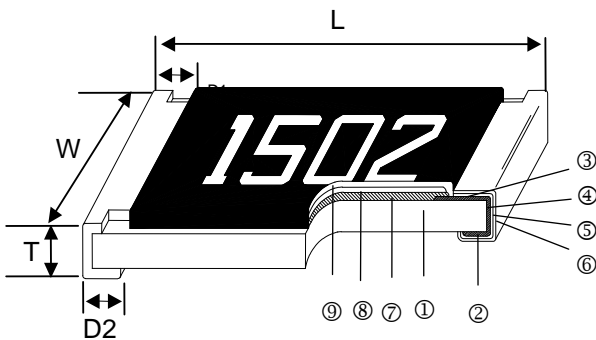
### ■ Features

- High power rating
- Excellent surge withstanding & pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512
- Special construction to prevent sulfuration in a sulfur containing environment
- AEC-Q200 Compliance
- 100% CCD inspection



### ■ Applications

- Metering (Testing/Measurement)
- Medical Devices
- Power supply
- Charger
- Inverter
- LCD Video Monitors

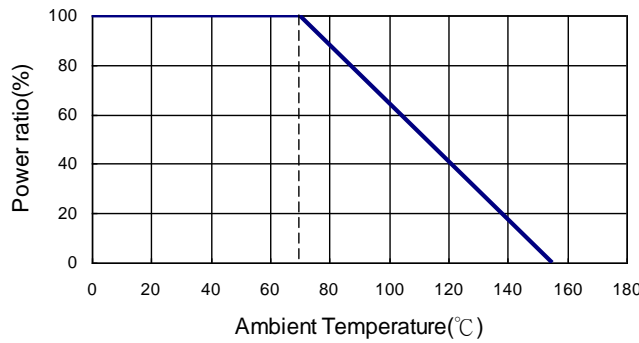


① Alumina Substrate	⑥ External Electrode
② Bottom Electrode	⑦ Resistor Layer
③ Top Electrode	⑧ Primary Overcoat
④ Edge Electrode	⑨ Secondary Overcoat
⑤ Barrier Layer	

### ■ Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
SWR02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10	0.64
SWR03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
SWR05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20	4.368
SWR05(1/2W)	0805	2.00±0.10	1.25±0.10	0.55±0.10	0.35±0.20	0.40±0.20	5
SWR06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20	8.947
SWR06(3/4W)	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.60±0.25	0.55±0.25	9.2
SWR13	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20	15.959
SWR10	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20	24.241
SWR12	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20	39.448
SWR12(2W)	2512	6.35±0.20	3.15±0.15	0.60±0.10	0.80±0.25	0.60±0.30	42

**Derating Curve**



**Part Numbering**

SWR	05	J	T	E	V	1001	A
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	J: ±5% K: ±10% M: ±20%	T: Taping Reel	E: ±100 F: ±200 G: ±300 4: ±350	A: 1.5W T: 1W Q: 3/4W U: 1/2W G: 2/5W O: 1/3W V: 1/4W W: 1/8W P: 1/5W S: 2W	1001: 1KΩ 1004: 1MΩ 1005: 10MΩ	A: Automotive Grade NA: Automotive Grade & No Marking

**Standard Electrical Specifications**

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range(E24)			TCR (PPM/°C)
					±5%	±10%	±20%	
SWR02 (0402)	1/5W	-55 ~ +155°C	50V	100V	1Ω - 20Ω			±300
					22Ω - 1MΩ			±100
SWR03 (0603)	1/8W	-55 ~ +155°C	50V	100V	10Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	1/4W	-55 ~ +155°C	150V	300V	1Ω - 270Ω			±200
					300Ω - 20MΩ			±100
SWR06 (1206)	1/3W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR13 (1210)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR10 (2010)	3/4W	-55 ~ +155°C	400V	800V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100
SWR12 (2512)	1.5W	-55 ~ +155°C	500V	1000V	1Ω - 20Ω			±200
					22Ω - 20MΩ			±100

**High Power & Ultra High Power Rating Electrical Specifications**

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range (E24)			TCR (PPM/°C)
					±5%	±10%	±20%	
SWR03 (0603)	1/4W	-55 ~ +155°C	75V	150V	10Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	2/5W	-55 ~ +155°C	150V	300V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR05 (0805)	1/2W *	-55 ~ +155°C	400V	600V	1Ω - 270Ω			±200
					300Ω - 1MΩ			±100
SWR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR06 (1206)	3/4W *	-55 ~ +155°C	500V	1000V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR13 (1210)	3/4W	-55 ~ +155°C	200V	400V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR10 (2010)	1W	-55 ~ +155°C	400V	800V	1Ω - 20Ω			±200
					22Ω - 1MΩ			±100
SWR12 (2512)	2W *	-55 ~ +155°C	500V	1000V	1Ω - 10Ω			±350
					11Ω - 200KΩ			±100

\*: Ultra High Power: double side printed resistor element

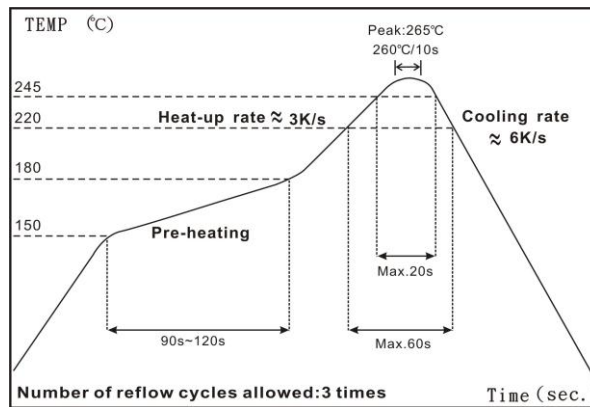
Operating Voltage= $\sqrt{P \cdot R}$  or Max. Operating Voltage listed above, whichever is lower.

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

The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155 ° C.

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

**Soldering Condition**



IR Reflow Soldering

(1) Time of IR reflow soldering at maximum temperature point 260°C : 10s

**Environmental Characteristics**

Item	Requirement	Test Method
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
Short Time Overload	±(1.0%+0.05Ω)	<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	±(3.0%+0.05Ω)	<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.
Biased Humidity	±(3.0%+0.05Ω)	<b>MIL-STD-202 Method 103</b> 1000 hrs 85°C/85%RH 10% of operating power
High Temperature Exposure	±(1.0%+0.05Ω)	<b>MIL-STD-202 Method 108</b> at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	<b>AEC-Q200-005</b> Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	<b>JIS-C-5201-1 4.17</b> <b>IEC-60115-1 4.17</b> 245±5°C for 3 seconds
Resistance to Soldering Heat	±(1.0%+0.05Ω)	<b>JIS-C-5201-1 4.18</b> <b>IEC-60115-1 4.18</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	±(1%+0.05Ω)	<b>JESD22 Method JA-104</b> -55°C to +125°C, 1000 cycles
Mechanical Shock	±(1%+0.05Ω)	<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	±(1%+0.05Ω)	<b>MIL-STD-202 Method 204</b> 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)	<b>AEC-Q200-002</b> Human body model 0402/0603: 1KV 0805 and above: 2KV
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.
Terminal Strength	No broken	<b>AEC-Q200-006</b> Force of 1.8kg for 60 seconds.

**Automotive Grade Surge Withstanding Chip Resistor**

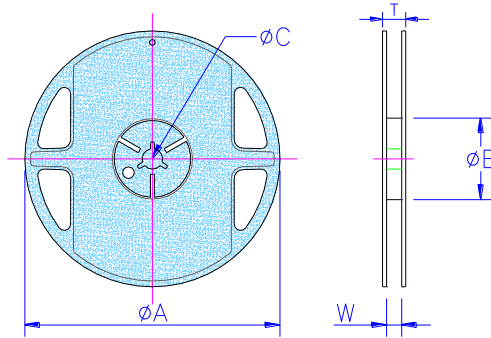
Item	Requirement	Test Method
Flammability	No ignition of the tissue paper or scorching or the pinewood board	<b>UL-94</b> V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	$\Delta R \pm 5\%$	<b>EIA-977 (Condition A)</b> 60 $\pm$ 2°C, no power rating for 500 hrs.

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

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

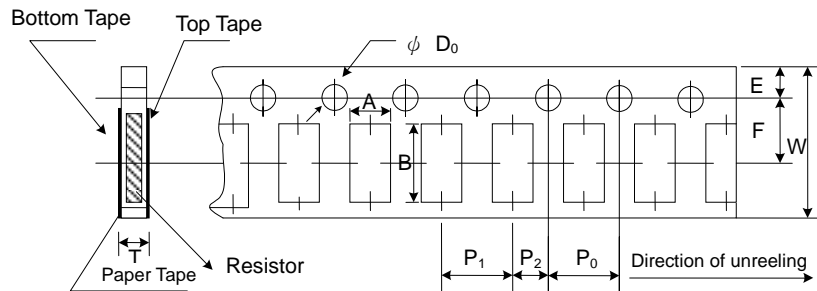
■ **Packaging**

Reel Specifications & Packaging Quantity



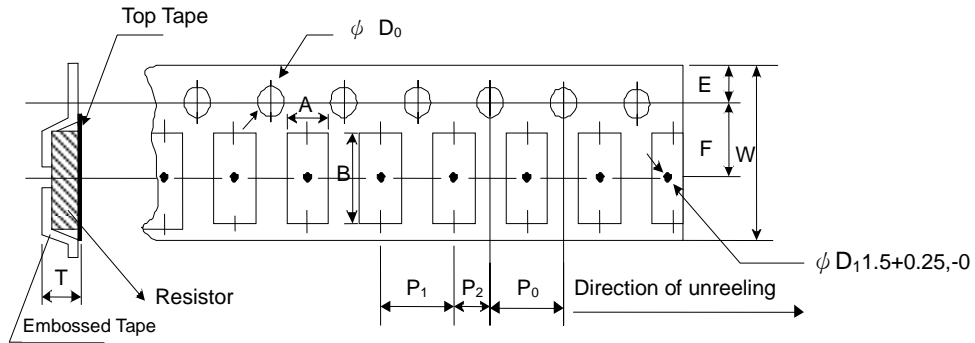
Type	Packaging Quantity	Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)
SWR02	Paper 10K	8mm	7 inch	178.5 $\pm$ 1.5	60 <sup>+1/-0</sup>	13.0 $\pm$ 0.2	9.0 $\pm$ 0.5	12.5 $\pm$ 0.5
SWR03 SWR05 SWR06 SWR13	Paper 5K	8mm	7 inch	178.5 $\pm$ 1.5	60 <sup>+1/-0</sup>	13.0 $\pm$ 0.2	9.0 $\pm$ 0.5	12.5 $\pm$ 0.5
SWR10 SWR12	Embossed 4K	12mm	7 inch	178.5 $\pm$ 1.5	60 <sup>+1/-0</sup>	13.0 $\pm$ 0.5	13.0 $\pm$ 0.5	15.5 $\pm$ 0.5

Paper 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)
SWR02	0.65 $\pm$ 0.10	1.15 $\pm$ 0.10	8.0 $\pm$ 0.2	1.75 $\pm$ 0.1	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	2.00 $\pm$ 0.05	2.00 $\pm$ 0.05	1.50+0.1,-0	0.45 $\pm$ 0.1
SWR03	1.10 $\pm$ 0.10	1.90 $\pm$ 0.1	8.0 $\pm$ 0.2	1.75 $\pm$ 0.1	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.05	2.00 $\pm$ 0.05	1.50+0.1,-0	0.70 $\pm$ 0.1
SWR05	1.60 $\pm$ 0.10	2.40 $\pm$ 0.2	8.0 $\pm$ 0.2	1.75 $\pm$ 0.1	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.05	2.00 $\pm$ 0.05	1.50+0.1,-0	0.85 $\pm$ 0.1
SWR06	1.90 $\pm$ 0.10	3.50 $\pm$ 0.2	8.0 $\pm$ 0.2	1.75 $\pm$ 0.1	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.05	2.00 $\pm$ 0.05	1.50+0.1,-0	0.85 $\pm$ 0.1
SWR13	2.90 $\pm$ 0.10	3.50 $\pm$ 0.2	8.0 $\pm$ 0.2	1.75 $\pm$ 0.1	3.50 $\pm$ 0.05	4.00 $\pm$ 0.10	4.00 $\pm$ 0.05	2.00 $\pm$ 0.05	1.50+0.1,-0	0.85 $\pm$ 0.1

Embossed 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)
SWR10	2.8±0.10	5.5±0.10	12.0±0.3	1.75±0.1	5.5±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1, -0	1.2 <sup>+0</sup>
SWR12	3.5±0.10	6.7±0.10	12.0±0.3	1.75±0.1	5.5±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1, -0	1.2 <sup>+0</sup>

**■ Marking**

No Marking for 0402

0805~2512 4 digits marking for Example

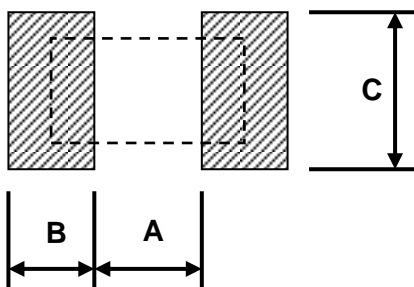
Resistance	100Ω	2.2KΩ	10KΩ	100KΩ	1MΩ
Marking	1000	2201	1002	1003	1004

0603: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1<sup>st</sup> and 2<sup>nd</sup> are E24 code and 3<sup>rd</sup> code is multiplier)

E24 code	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91
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**■ Recommend Land Pattern**

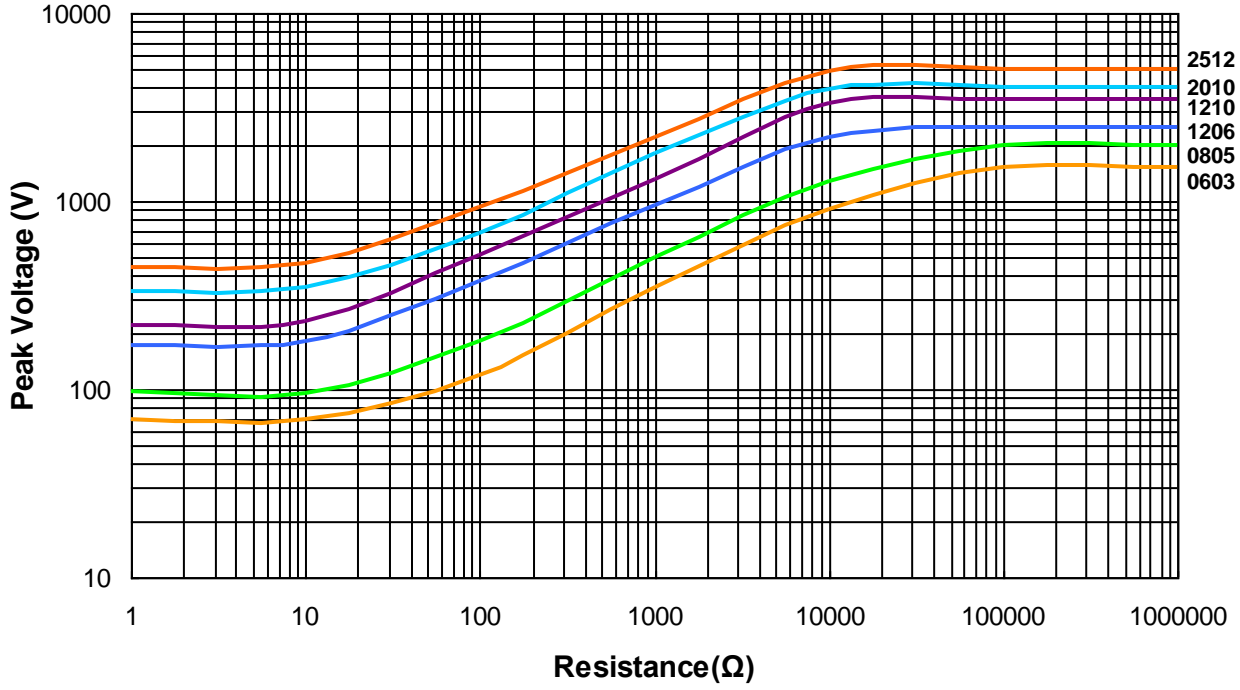


Type	A (mm)	B (mm)	C (mm)
SWR02	0.50	0.45	0.60
SWR03	0.90	0.60	0.90
SWR05	1.20	0.70	1.30
SWR06	2.00	0.90	1.60
SWR13	2.00	0.90	2.80
SWR10	3.80	0.90	2.80
SWR12	4.90	1.00	3.40

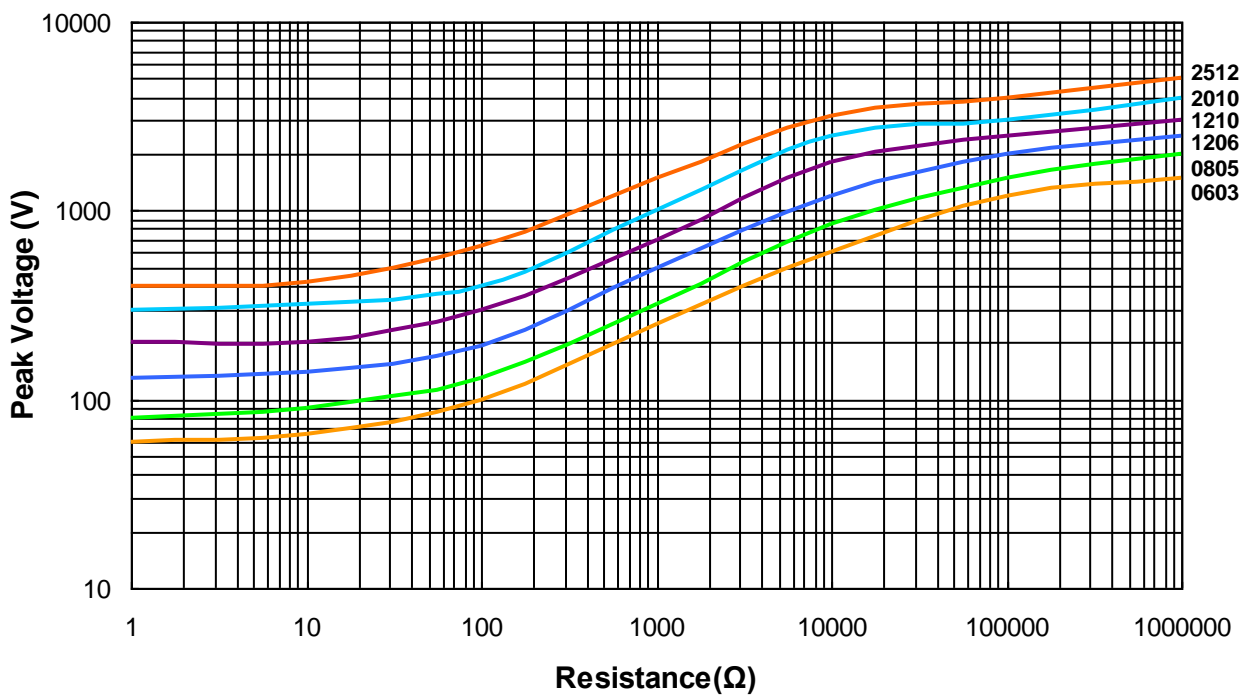
**Lightning Surge**

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

SWR Series 1.2/50us Lightning Surge



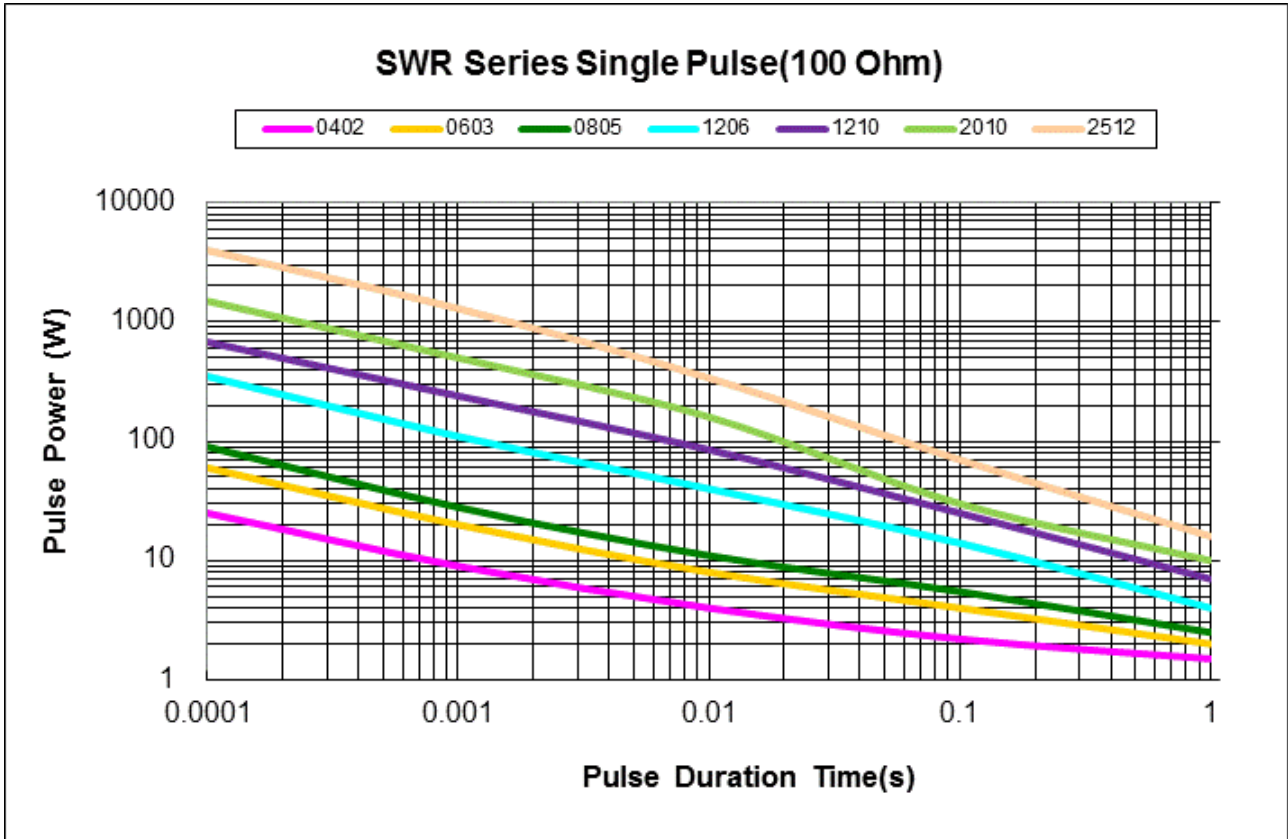
SWR Series 10/700us Lightning Surge





**■ Pulse withstanding capacity**

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.

