香 港 電 阻 製 造 廠

香港柴灣安業街十二號長益工業大廈 **10** 字樓 **A** 座

**HONG KONG RESISTORS MANUFACTORY**

(wholly owned by Hong Kong Resistors Manufactory International Ltd.)

AN ISO 9001:2015 CERTIFIED MANUFACTURER

AN ISO 45001 : 2018 MANUFACTURER

AN ISO 14001 : 2015 MANUFACTURER

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# DATASHEET

**Name of Product : Surge Withstanding Chip Resistors-SWR Series**

Sales Executive : _____ Date: _____

| 製造<br>Prepared by | 檢驗<br>Inspected by | 審核<br>Audited by | 核准<br>Authorized by |
|---|---|---|---|
| | | | |
| | | | |
| 客戶<br>customer approval | 客戶<br>customer approval | 客戶<br>customer approval | 客戶<br>customer approval |
| | | | |

# Surge Withstanding Chip Resistor

# (SWR Series)

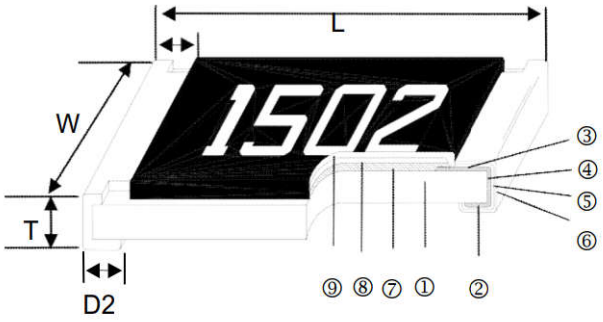



## Features

- High power rating
- Excellent surge withstanding & pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512

## Applications

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

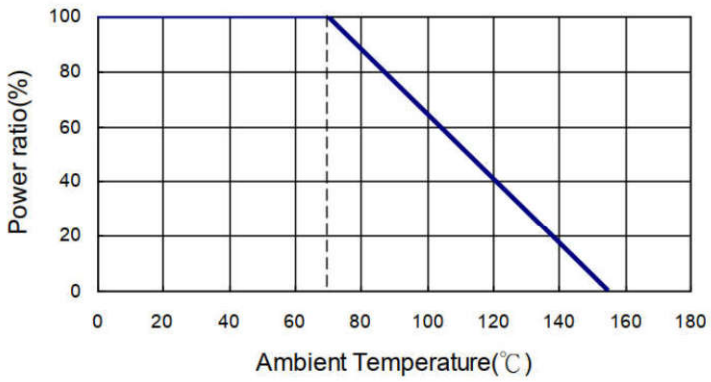



| | | | |
|---|---|---|---|
| ① | Alumina Substrate | ⑥ | External Electrode |
| ② | Bottom Electrode | ⑦ | Resistor Layer |
| ③ | Top Electrode | ⑧ | Primary Overcoat |
| ④ | Edge Electrode | ⑨ | Secondary Overcoat |
| ⑤ | Barrier Layer | | |

## Dimensions

| Type | Size (Inch) | L (mm) | W (mm) | T (mm) | D1 (mm) | D2 (mm) |
|---|---|---|---|---|---|---|
| SWR02 | 0402 | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.20±0.10 |
| SWR03 | 0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.30±0.20 | 0.30±0.20 |
| SWR05 | 0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 |
| SWR05(1/2W) | 0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.40±0.20 |
| SWR06 | 1206 | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| SWR06(3/4W) | 1206 | 3.10±0.10 | 1.55±0.10 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| SWR10 | 1210 | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.50±0.25 | 0.50±0.20 |
| SWR20 | 2010 | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |
| SWR25 | 2512 | 6.35±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.25 | 0.50±0.20 |
| SWR25(2W) | 2512 | 6.35±0.20 | 3.15±0.15 | 0.60±0.10 | 0.60±0.25 | 0.60±0.20 |

## Derating Curve



## Part Numbering

| SWR | 05 | 10K | J | E | 1/4W |
|---|---|---|---|---|---|
| Type | Size | Value | Toleran | TCR | Power |
| | 02 : 0402 | | J : ±5% | E: ± 100PPM | 1/8W |
| | 03 : 0603 | | K : ±10% | F: ±200PPM | 1/5W |
| | 05 : 0805 | | M : ±20% | G:±300PPM | 1/4W |
| | 06 :1206 | | | 4: ±350PPM | 1/3W |
| | 10 :1210 | | | | 2/5W |
| | 20 : 2010 | | | | 1/2W |
| | 25 : 2512 | | | | 3/4W |
| | | | | | 1W |
| | | | | | 1.5W |
| | | | | | 2W |

## Standard Electrical Specifications

| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range(E24) ±5% | Resistance Range(E24) ±10% | Resistance Range(E24) ±20% | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|
| 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 |
| SWR10 (1210) | 1/2W | -55 ~ +155°C | 200V | 400V | 1Ω - 20Ω | | | ±200 |
| | | | | | 22Ω - 20MΩ | | | ±100 |
| SWR20 (2010) | 3/4W | -55 ~ +155°C | 400V | 800V | 1Ω - 20Ω | | | ±200 |
| | | | | | 22Ω - 20MΩ | | | ±100 |
| SWR25 (2512) | 1.5W | -55 ~ +155°C | 500V | 1000V | 1Ω - 20Ω | | | ±200 |
| | | | | | 22Ω - 20MΩ | | | ±100 |

## High Power & Ultra High Power Rating Electrical Specifications

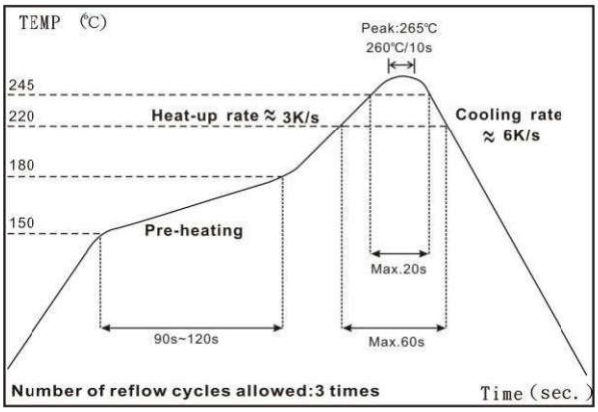
| Item / Type | Power Rating at 70°C | Operating Temp. Range | Max. Operating Voltage | Max. Overload Voltage | Resistance Range (E24) ±5% | Resistance Range (E24) ±10% | Resistance Range (E24) ±20% | TCR (PPM/°C) |
|---|---|---|---|---|---|---|---|---|
| SWR03 (0603) | 1/4W | -55 ~ +155°C | 75V | 150V | 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 |

| 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% | |
| SWR06 (1206) | 3/4W * | -55 ~ +155°C | 500V | 1000V | 1Ω - 20Ω | | | ±200 |
| | | | | | 22Ω - 1MΩ | | | ±100 |
| SWR10 (1210) | 3/4W | -55 ~ +155°C | 200V | 400V | 1Ω - 20Ω | | | ±200 |
| | | | | | 22Ω - 1MΩ | | | ±100 |
| SWR20 (2010) | 1W | -55 ~ +155°C | 400V | 800V | 1Ω - 20Ω | | | ±200 |
| | | | | | 22Ω - 1MΩ | | | ±100 |
| SWR25 (2512) | 2W * | -55 ~ +155°C | 500V | 1000V | 1Ω - 10Ω | | | ±350 |
| | | | | | 11Ω – 200KΩ | | | ±100 |

*: Ultra High Power: double side printed resistor element

Operating Voltage=$\sqrt{(P*R)}$ or Max. Operating Voltage listed above, whichever is lower.
Overload Voltage=2.5*$\sqrt{(P*R)}$ 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.
■ HKR 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. | **JIS-C-5201-1 4.8**<br>**IEC-60115-1 4.8**<br>At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature |
| Short Time Overload | ±(1.0%+0.05Ω) | **JIS-C-5201-1 4.13**<br>**IEC-60115-1 4.13**<br>RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds |
| Insulation Resistance | ≥10G | **JIS-C-5201-1 4.6**<br>**IEC-60115-1 4.6**<br>Max. Overload Voltage for 1 minute |
| Endurance | ±(3.0%+0.05Ω) | **JIS-C-5201-1 4.25**<br>**IEC-60115-1 4.25.1**<br>70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF" |
| Damp Heat with Load | ±(3.0%+0.05Ω) | **JIS-C-5201-1 4.24**<br>**IEC-60115-1 4.24**<br>40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hr "ON" and 0.5 hrs "OFF" |
| Dry Heat | ±(3.0%+0.05Ω) | **JIS-C-5201-1 4.23**<br>**IEC-60115-1 4.23.2**<br>at +155°C for 1000 hrs |

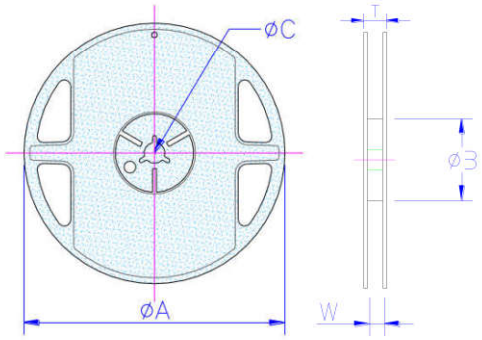
| Item | Requirement | Test Method |
|---|---|---|
| Bending Strength | ±(1.0%+0.05Ω) | **JIS-C-5201-1 4.33**<br>**IEC-60115-1 4.33**<br>Bending once for 5 seconds<br>2010, 2512 sizes: 2mm Other sizes: 3mm |
| Solderability | 95% min. coverage | **JIS-C-5201-1 4.17**<br>**IEC-60115-1 4.17**<br>245±5°C for 3 seconds |
| Resistance to Soldering Heat | ±(1.0%+0.05Ω) | **JIS-C-5201-1 4.18**<br>**IEC-60115-1 4.18**<br>260±5°C for 10 seconds |
| Voltage Proof | No breakdown or flashover | **JIS-C-5201-1 4.7**<br>**IEC-60115-1 4.7**<br>1.42 times Max. Operating Voltage for 1 minute |
| Leaching | Individual leaching area ≦5%<br>Total leaching area ≦ 10% | **JIS-C-5201-1 4.18**<br>**IEC-60068-2-58 8.2.1**<br>260±5°C for 30 seconds |
| Rapid Change of Temperature | ±(1.0%+0.05Ω) | **JIS-C-5201-1 4.19**<br>**IEC-60115-1 4.19**<br>-55°C to +155°C, 5 cycles |

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

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

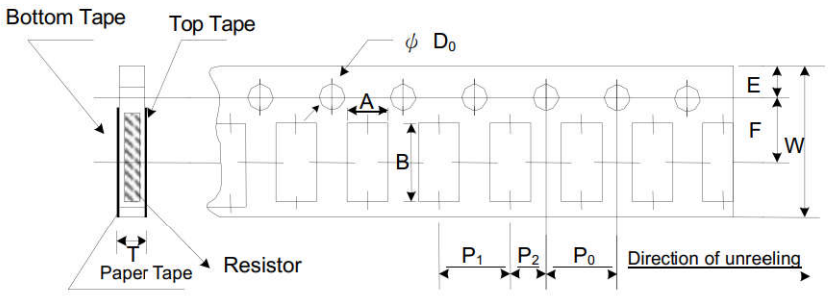
## ■ Packaging

Reel Specifications & Packaging Quantity



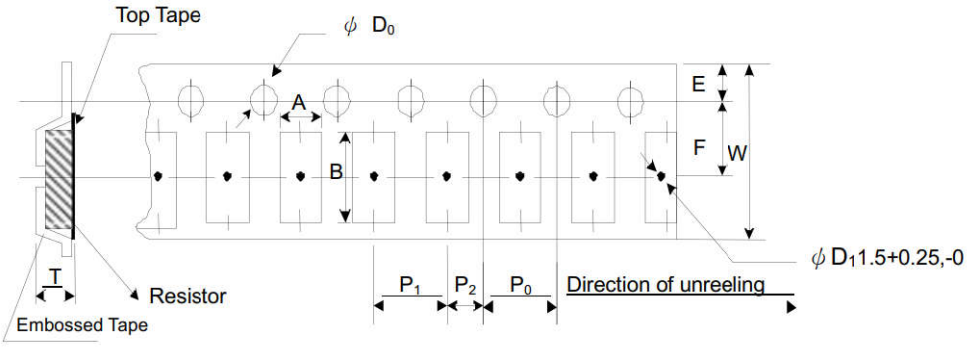

| Type | Packaging Quantity | | Tape Width | Reel Diameter | ΦA (mm) | ΦB (mm) | ΦC (mm) | W (mm) | T (mm) |
|---|---|---|---|---|---|---|---|---|---|
| SWR02 | Paper | 10K | 8mm | 7 inch | 178.5±1.5 | $60^{+1/-0}$ | 13.0±0.2 | 9.0±0.5 | 12.5±0.5 |
| SWR03<br>SWR05<br>SWR06<br>SWR10 | Paper | 5K | 8mm | 7 inch | 178.5±1.5 | $60^{+1/-0}$ | 13.0±0.2 | 9.0±0.5 | 12.5±0.5 |
| SWR20<br>SWR25 | Embossed | 4K | 12mm | 7 inch | 178.5±1.5 | $60^{+1/-0}$ | 13.0±0.5 | 13.0±0.5 | 15.5±0.5 |

Paper Tape Specifications



| Type | A (mm) | B (mm) | W (mm) | E (mm) | F (mm) | $P_0$ (mm) | $P_1$ (mm) | $P_2$ (mm) | $\Phi D_0$ (mm) | T (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| SWR02 | 0.65±0.10 | 1.15±0.10 | 8.0±0.2 | 1.75±0.1 | 3.50±0.05 | 4.00±0.10 | 2.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.45±0.1 |
| SWR03 | 1.10±0.10 | 1.90±0.1 | 8.0±0.2 | 1.75±0.1 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.70±0.1 |
| SWR05 | 1.60±0.10 | 2.40±0.2 | 8.0±0.2 | 1.75±0.1 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.85±0.1 |
| SWR06 | 1.90±0.10 | 3.50±0.2 | 8.0±0.2 | 1.75±0.1 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.85±0.1 |
| SWR10 | 2.90±0.10 | 3.50±0.2 | 8.0±0.2 | 1.75±0.1 | 3.50±0.05 | 4.00±0.10 | 4.00±0.05 | 2.00±0.05 | 1.50+0.1,-0 | 0.85±0.1 |

Embossed Plastic Tape Specifications




| Type | A (mm) | B (mm) | W (mm) | E (mm) | F (mm) | $P_0$ (mm) | $P_1$ (mm) | $P_2$ (mm) | $\Phi D_0$ (mm) | T (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| SWR20 | 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 | $1.2^{+0}$ |
| SWR25 | 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 | $1.2^{+0}$ |

## ■ Marking

No Marking for 0402

0805~2512 4 digits marking for Example

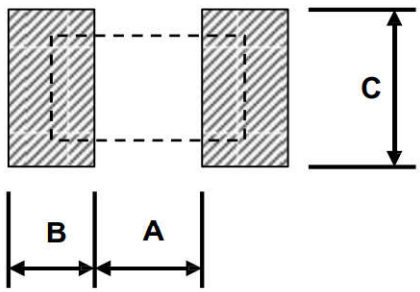
| Resistance | 100Ω | 2.2KΩ | 10KΩ | 100KΩ | 1MΩ |
|---|---|---|---|---|---|
| Marking | 1000 | 2201 | 1002 | 1003 | 1004 |

0603: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ ($1^{st}$ and $2^{nd}$ are E24 code and $3^{rd}$ 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## ■ Recommend Land Pattern

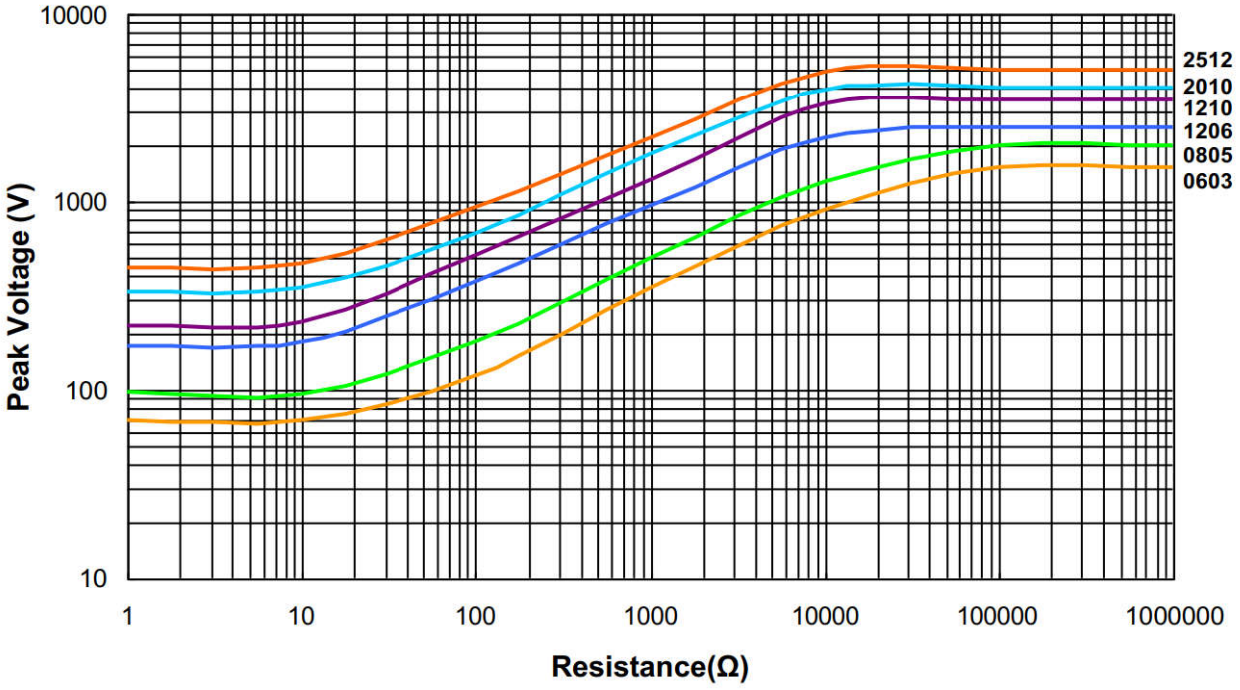



| Type | A (mm) | B (mm) | C (mm) |
|---|---|---|---|
| SWR02 | 0.50 | 0.45 | 0.60 |
| SWR03 | 0.90 | 0.60 | 0.90 |
| SWR05 | 1.20 | 0.70 | 1.30 |
| SWR06 | 2.00 | 0.90 | 1.60 |
| SWR10 | 2.00 | 0.90 | 2.80 |
| SWR20 | 3.80 | 0.90 | 2.80 |
| SWR25 | 4.90 | 1.00 | 3.40 |

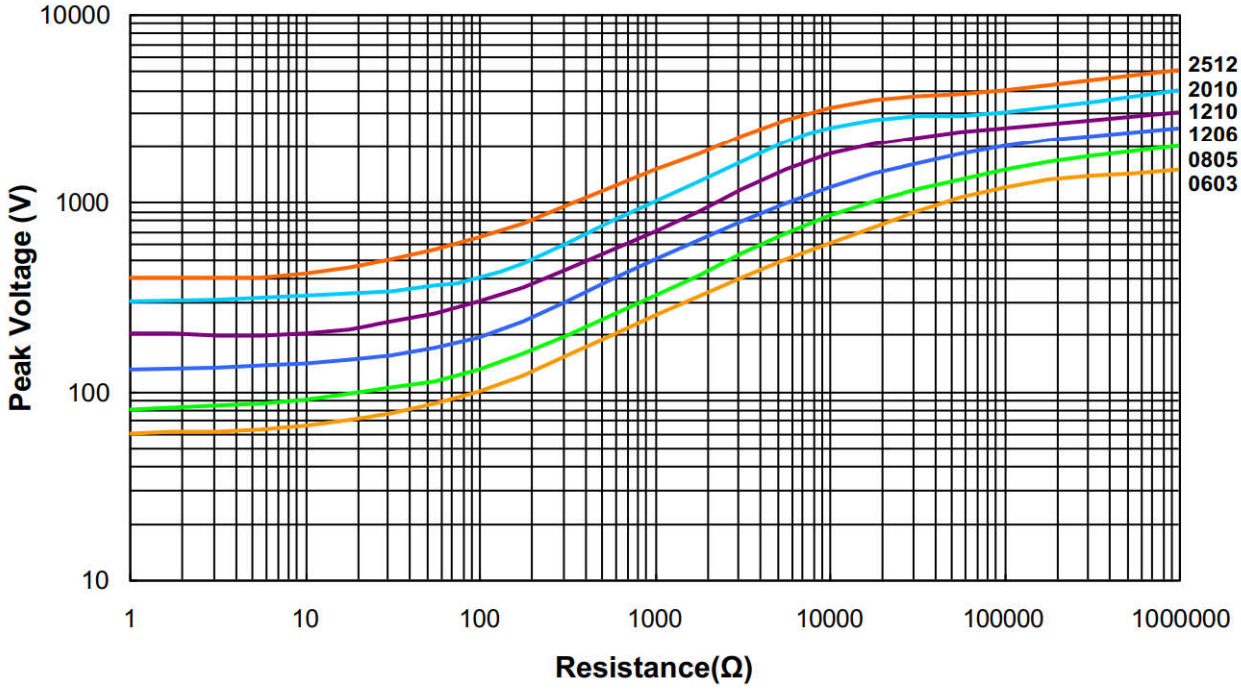
## Lightning Surge

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.

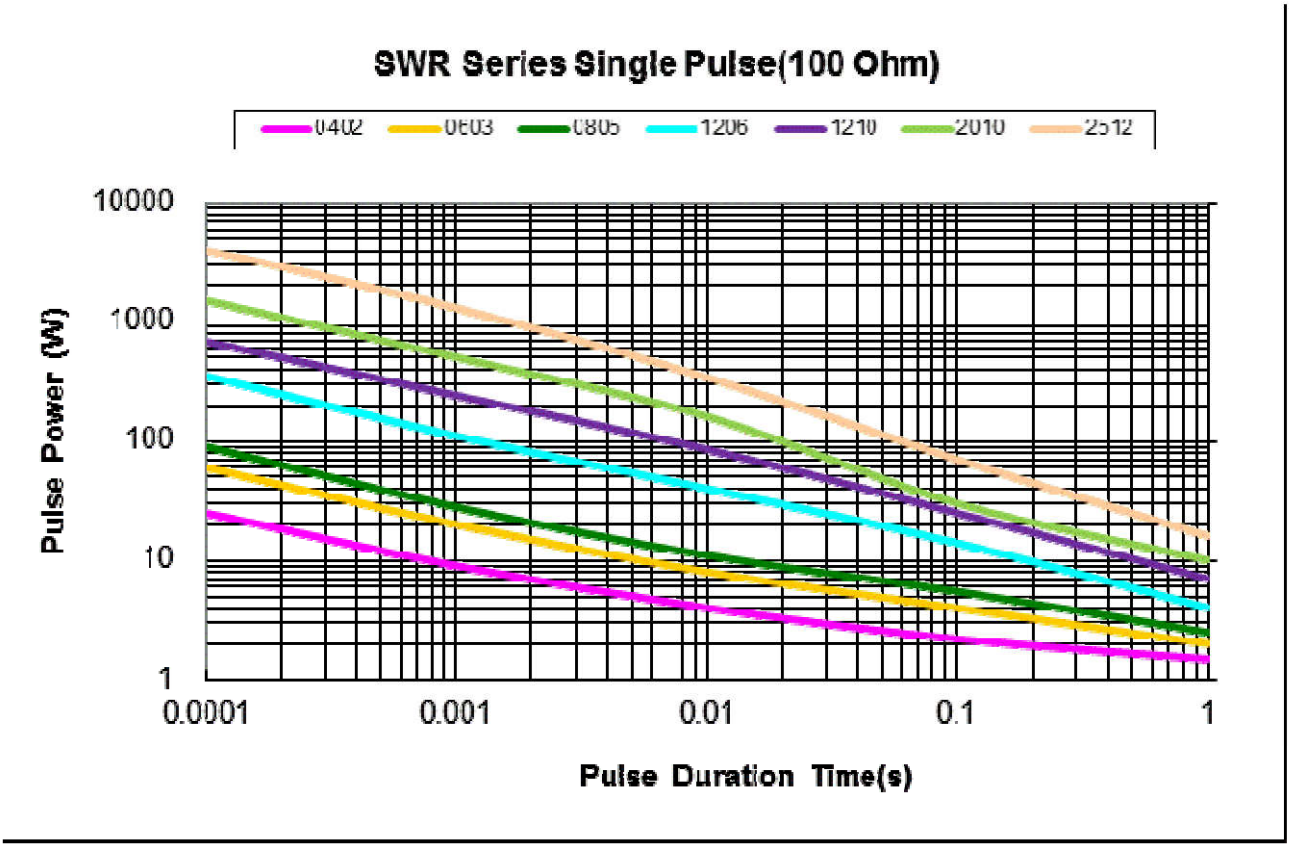
SWR Series 1.2/50us Lightning Surge




SWR Series 10/700us Lightning Surge



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.



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.

