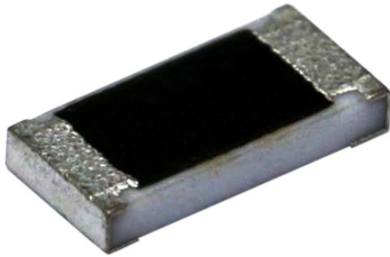


# Chip Resistors

## Pulse Withstanding



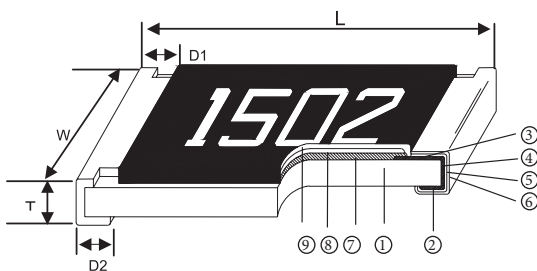
### Features:

- Tolerance from  $\pm 0.5\%$  to  $5\%$
- High power rating
- Excellent pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0603 to 2512

### Applications:

- Metering (Testing/Measurement)
- Diagnostic Equipment
- Medical Devices
- Industrial Controls
- Plasma
- LCD Video Monitors

### Construction:



|   |                                        |
|---|----------------------------------------|
| ① | Alumina Substrate                      |
| ② | Bottom Electrode (Ag)                  |
| ③ | Top Electrode (Ag-Pd)                  |
| ④ | Edge Electrode (NiCr)                  |
| ⑤ | Barrier Layer (Ni)                     |
| ⑥ | External Electrode (Sn)                |
| ⑦ | Resistor Layer (RuO <sub>2</sub> / Ag) |
| ⑧ | Primary Overcoat (Glass)               |
| ⑨ | Secondary Overcoat (Epoxy)             |

### Dimensions:

| Part Number | Size (Inch) | L         | W         | T         | D1        | D2       | Weight (g)<br>(1,000 pieces) |
|-------------|-------------|-----------|-----------|-----------|-----------|----------|------------------------------|
| MCPWR05     | 0805        | 2 ±0.1    | 1.25 ±0.1 | 0.5 ±0.1  | 0.35 ±0.2 | 0.4 ±0.2 | 4.368                        |
| MCPWR06     | 1206        | 3.1 ±0.1  | 1.55 ±0.1 | 0.55 ±0.1 | 0.5 ±0.25 | 0.5 ±0.2 | 8.947                        |
| MCPWR10     | 2010        | 5 ±0.1    | 2.5 ±0.15 |           | 0.6 ±0.25 |          | 24.241                       |
| MCPWR12     | 2512        | 6.35 ±0.1 | 3.1 ±0.15 |           |           |          | 39.448                       |

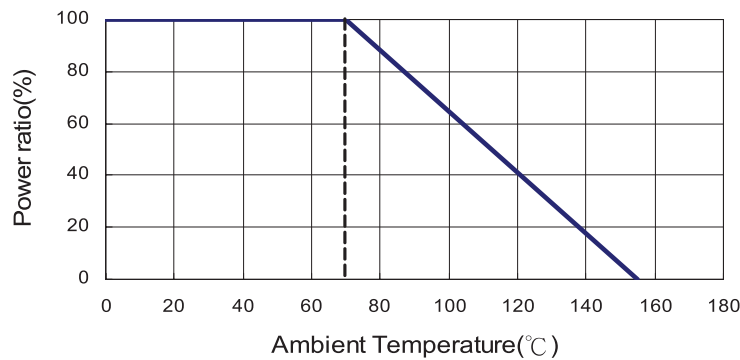
Dimensions : Millimetres

# Chip Resistors

## Pulse Withstanding



### Derating Curve:



### Standard Electrical Specifications:

| Item<br>Type      | Power Rating<br>at 70°C | Operating<br>Temperature<br>Range | Maximum<br>Operating<br>Voltage | Resistance Range |           |     |     |      | TCR<br>(PPM/°C) |
|-------------------|-------------------------|-----------------------------------|---------------------------------|------------------|-----------|-----|-----|------|-----------------|
|                   |                         |                                   |                                 | ±0.5%            | ±1%       | ±2% | ±3% | ±5%  |                 |
| MCPWR05<br>(0805) | 1/8W                    | -55 to<br>+155°C                  | 150V                            | 10Ω - 299Ω       | 1Ω - 299Ω |     |     |      | ±200            |
|                   |                         |                                   |                                 | 300Ω - 20MΩ      |           |     |     | ±100 |                 |
| MCPWR06<br>(1206) | 1/3W                    |                                   | 200V                            | 10Ω - 20Ω        | 1Ω - 20Ω  |     |     |      | ±200            |
|                   |                         |                                   |                                 | 20.1Ω - 20MΩ     |           |     |     | ±100 |                 |
| MCPWR10<br>(2010) | 3/4W                    |                                   | 400V                            | 10Ω - 20Ω        | 1Ω - 20Ω  |     |     |      | ±200            |
|                   |                         |                                   |                                 | 20.1Ω - 20MΩ     |           |     |     | ±100 |                 |
| MCPWR12<br>(2512) | 1.5W                    |                                   | 500V                            | 10Ω - 20Ω        | 1Ω - 20Ω  |     |     |      | ±200            |
|                   |                         |                                   |                                 | 20.1Ω - 20 MΩ    |           |     |     | ±100 |                 |

### High Power Rating Electrical Specifications:

| Item<br>Type      | Power Rating<br>at 70°C | Operating<br>Temperature<br>Range | Maximum<br>Operating<br>Voltage | Resistance Range |     | TCR<br>(PPM/°C) |
|-------------------|-------------------------|-----------------------------------|---------------------------------|------------------|-----|-----------------|
|                   |                         |                                   |                                 | ±1%              | ±5% |                 |
| MCPWR05<br>(0805) | 1/4W                    | -55 to<br>+155°C                  | 150V                            | 1Ω - 299Ω        |     | ±200            |
|                   |                         |                                   |                                 | 300Ω - 20MΩ      |     | ±100            |
| MCPWR06<br>(1206) | 1/2W                    |                                   | 200V                            | 1Ω - 20Ω         |     | ±200            |
|                   |                         |                                   |                                 | 20.1Ω - 20MΩ     |     | ±100            |
| MCPWR10<br>(2010) | 1W                      |                                   | 400V                            | 1Ω - 20Ω         |     | ±200            |
|                   |                         |                                   |                                 | 20.1Ω - 20MΩ     |     | ±100            |

Operating voltage =  $\sqrt{P \times R}$  or maximum operating voltage listed above, whichever is lower.

Overload voltage =  $2.5 \times \sqrt{P \times R}$  or maximum overload voltage listed above, whichever is lower.

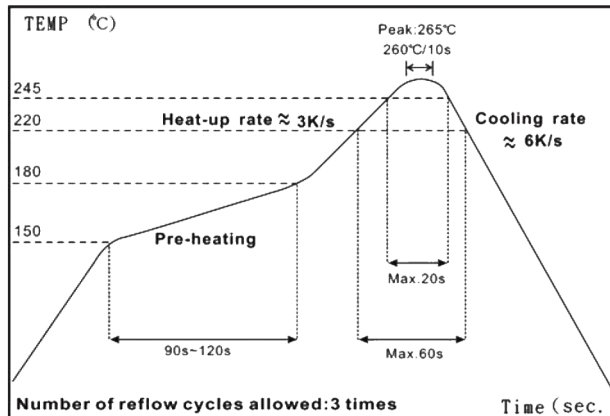
# Chip Resistors

## Pulse Withstanding



### Soldering Condition:

Pulse Withstanding Chip Resistor



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 (TCR) | As specification     | +25 / -55 / +25 / +125 / +25°C                                                                            |
| Short Time Overload                         | $\pm 1\%$            | RCWV $\times 2.5$ or maximum overload voltage for 5s                                                      |
| Insulation Resistance                       | $> 1,000M\Omega$     | Apply 100V DC for 1mins                                                                                   |
| Endurance                                   | $\pm 1\%$            | 70 $\pm 2^\circ C$ , maximum working voltage for 1,000hrs with 1.5hrs "ON" and 0.5hrs "OFF"               |
| Damp Heat with Load                         | $\pm 0.5\%$          | 40 $\pm 2^\circ C$ , 90 to 95% R H maximum working voltage for 1,000hrs with 1.5hrs "ON" and 0.5hrs "OFF" |
| Dry Heat                                    | $\pm 0.5\%$          | at +155°C for 1,000hrs                                                                                    |
| Bending Strength                            | $\pm 1\%$            | Bending amplitude 3mm for 10s                                                                             |
| Solderability                               | 95% minimum coverage | 245 $\pm 5^\circ C$ for 3s                                                                                |
| Resistance to Soldering Heat                | $\pm 0.5\%$          | 260 $\pm 5^\circ C$ for 10s                                                                               |
| Thermal Shock                               |                      | -55°C to 150°C, 100 cycles                                                                                |
| Low Temperature Operation                   |                      | 1hr, -65°C followed by 45mins of RCWV                                                                     |

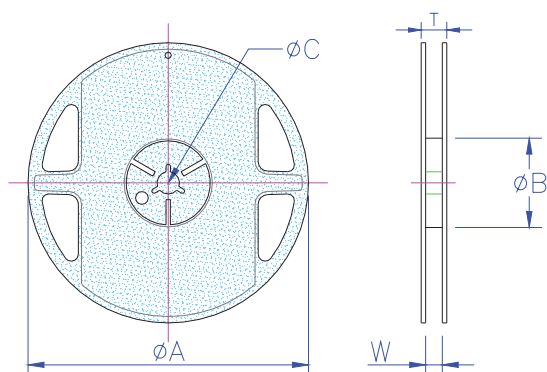
# Chip Resistors

## Pulse Withstanding



### Packaging:

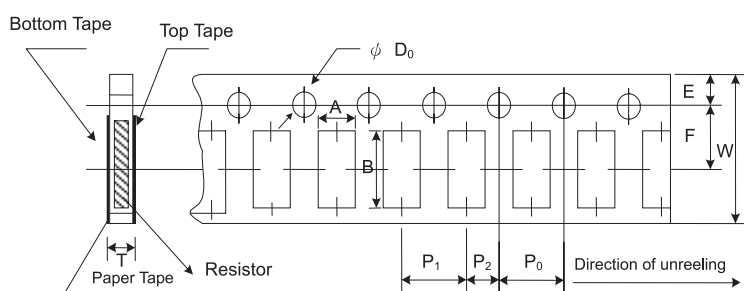
#### Reel Specifications & Packaging Quantity



| Part Number        | Packaging Quantity |     | Tape Width | Reel Diameter (Inches) | ØA         | ØB       | ØC      | W         | T         |
|--------------------|--------------------|-----|------------|------------------------|------------|----------|---------|-----------|-----------|
| MCPWR05<br>MCPWR06 | Paper              | 10K | 8mm        | 10                     | 254 ±1     | 100 ±0.5 | 13 ±0.2 | 9.5 ±0.5  | 13.5 ±0.5 |
| MCPWR10            | Embossed           | 4K  | 12mm       | 7                      | 178.5 ±1.5 | 60+1/-0  | 13 ±0.5 | 13 ±0.5   | 15.5 ±0.5 |
| MCPWR12            |                    | 8K  |            | 10                     | 250 ±1     | 62 ±0.5  |         | 12.5 ±0.5 | 16.5 ±0.5 |

Dimensions : Millimetres

#### Paper Tape Specifications



| Part Number | A        | B        | W      | E         | F         | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | T         |
|-------------|----------|----------|--------|-----------|-----------|----------------|----------------|----------------|-----------------|-----------|
| MCPWR05     | 1.6 ±0.1 | 2.4 ±0.2 | 8 ±0.2 | 1.75 ±0.1 | 3.5 ±0.05 | 4 ±0.1         | 4 ±0.05        | 2 ±0.05        | 1.5+0.1,-0      | 0.85 ±0.1 |
| MCPWR06     | 1.9 ±0.1 | 3.5 ±0.2 |        |           |           |                |                |                |                 |           |

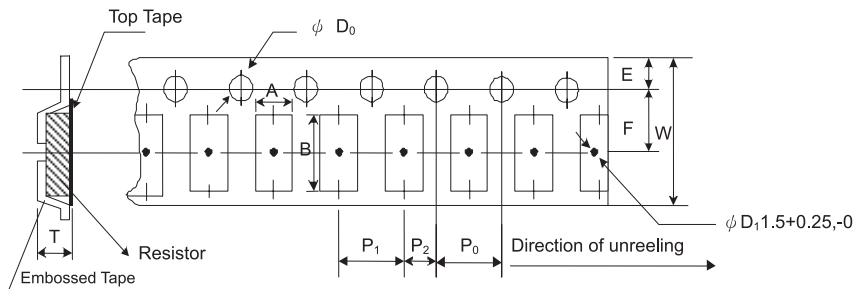
Dimensions : Millimetres

# Chip Resistors

## Pulse Withstanding



### Embossed Plastic Tape Specifications



| Part Number | A        | B        | W       | E         | F         | P <sub>0</sub> | P <sub>1</sub> | P <sub>2</sub> | ØD <sub>0</sub> | T     |
|-------------|----------|----------|---------|-----------|-----------|----------------|----------------|----------------|-----------------|-------|
| MCPWR10     | 2.8 ±0.1 | 5.5 ±0.1 | 12 ±0.3 | 1.75 ±0.1 | 5.5 ±0.05 | 4 ±0.1         | 4 ±0.1         | 2 ±0.05        | 1.5+0.1,-0      | 1.2+0 |
| MCPWR12     | 3.5 ±0.1 | 6.7 ±0.1 |         |           |           |                |                |                |                 |       |

Dimensions : Millimetres

### Marking:

#### 0805 to 2512 4 Digits Marking For Example

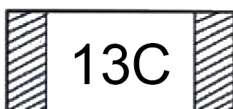
| Resistance | 100Ω  | 2.2kΩ | 10kΩ  | 49.9kΩ | 100kΩ |
|------------|-------|-------|-------|--------|-------|
| Marking    | 1,000 | 2,201 | 1,002 | 4,992  | 1,003 |

#### 3 Digits Marking in E24

Example: 101 = 100Ω      102 = 1kΩ (1st and 2nd are E24 code and 3rd 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 |
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

1% for 0603: 3 Digits Marking in E96 (E96 Series Except E24 Series)



3 Digits Marking for Example: 13C = 13K3Ω    68B = 4K99Ω    68X = 49.9Ω

# Chip Resistors

## Pulse Withstanding



Marking Table:

| Code | E96 | Code | E96 | Code | E96 | Code | E96 |
|------|-----|------|-----|------|-----|------|-----|
| 02   | 102 | 28   | 191 | 52   | 340 | 75   | 590 |
| 03   | 105 | 29   | 196 | 53   | 348 | 76   | 604 |
| 04   | 107 | 31   | 205 | 54   | 357 | 77   | 619 |
| 06   | 113 | 32   | 210 | 55   | 365 | 78   | 634 |
| 07   | 115 | 33   | 215 | 56   | 374 | 79   | 649 |
| 08   | 118 | 34   | 221 | 57   | 383 | 80   | 665 |
| 09   | 121 | 35   | 226 | 58   | 392 | 81   | 681 |
| 10   | 124 | 36   | 232 | 59   | 402 | 82   | 698 |
| 11   | 127 | 37   | 237 | 60   | 412 | 83   | 715 |
| 13   | 133 | 38   | 243 | 61   | 422 | 84   | 732 |
| 14   | 137 | 39   | 249 | 62   | 432 | 86   | 768 |
| 15   | 140 | 40   | 255 | 63   | 442 | 87   | 787 |
| 16   | 143 | 41   | 261 | 64   | 453 | 88   | 806 |
| 17   | 147 | 42   | 267 | 65   | 464 | 89   | 825 |
| 19   | 154 | 43   | 274 | 66   | 475 | 90   | 845 |
| 20   | 158 | 44   | 280 | 67   | 487 | 91   | 866 |
| 21   | 162 | 45   | 287 | 68   | 499 | 92   | 887 |
| 22   | 165 | 46   | 294 | 69   | 511 | 93   | 909 |
| 23   | 169 | 47   | 301 | 70   | 523 | 94   | 931 |
| 24   | 174 | 48   | 309 | 71   | 536 | 95   | 953 |
| 25   | 178 | 49   | 316 | 72   | 549 | 96   | 976 |
| 26   | 182 | 50   | 324 | 73   | 562 | -    | -   |
| 27   | 187 | 51   | 332 | 74   | 576 | -    | -   |

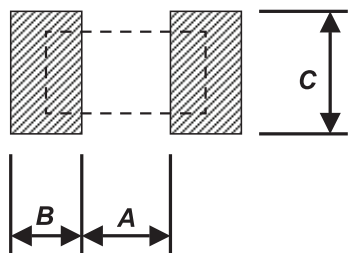
| Code       | A               | B               | C               | D               | E               | F               | G               | X                | Y                |
|------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|
| Multiplier | 10 <sup>0</sup> | 10 <sup>1</sup> | 10 <sup>2</sup> | 10 <sup>3</sup> | 10 <sup>4</sup> | 10 <sup>5</sup> | 10 <sup>6</sup> | 10 <sup>-1</sup> | 10 <sup>-2</sup> |

# Chip Resistors

## Pulse Withstanding



### Recommend Land Pattern:



| Type    | A   | B   | C   |
|---------|-----|-----|-----|
| MCPWR05 | 1.2 | 0.7 | 1.3 |
| MCPWR06 | 2   | 0.9 | 1.6 |
| MCPWR10 | 3.8 |     | 2.8 |
| MCPWR12 |     |     | 3.5 |

Dimensions : Millimetres

### Part Number Explanation:

|              |            |                      |                |              |              |            |         |
|--------------|------------|----------------------|----------------|--------------|--------------|------------|---------|
| MCPWR        | 05         | F                    | T              | F            | W            | 1001       | N       |
| Product Type | Dimensions | Resistance Tolerance | Packaging Code | TCR (PPM/°C) | Power Rating | Resistance | Marking |

|                      |                                                                   |
|----------------------|-------------------------------------------------------------------|
| Dimensions           | : 05 = 0805, 06 = 1206, 10 = 2010 and 12 = 2512                   |
| Resistance Tolerance | : F = $\pm 1\%$                                                   |
| Packaging Code       | : T = Taping Reel                                                 |
| TCR (PPM/°C)         | : E = $\pm 100$ , F = $\pm 200$                                   |
| Power Rating         | : A = 1.5W, O = 1/3W, Q = 3/4W and W = 1/8W                       |
| Resistance           | : 1001 = 1k $\Omega$ , 1004 = 1M $\Omega$ and 1005 = 10M $\Omega$ |
| Marking              | : Standard Marking, N = No Marking                                |

# Chip Resistors

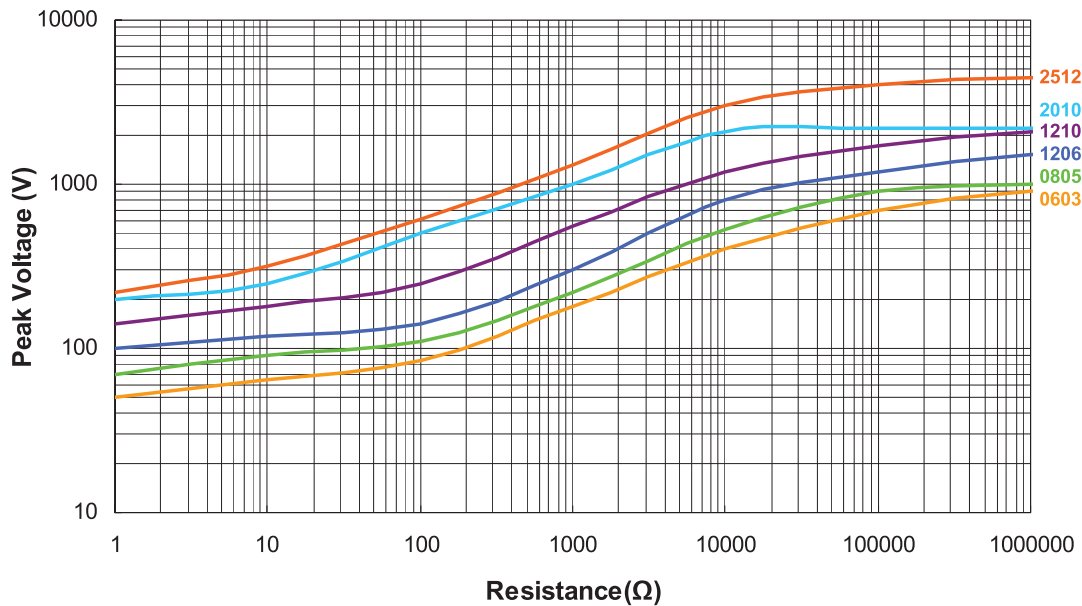
## Pulse Withstanding



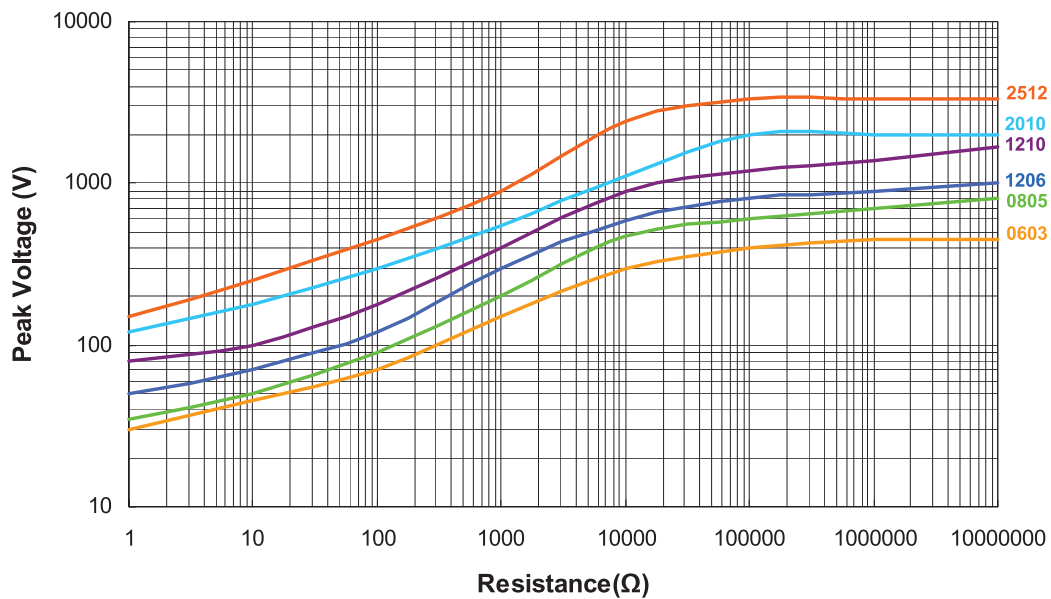
### Lightning Surge:

Resistors are tested in accordance with IEC 60 115-1 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.

PWR Series 1.2/50us Lightning Surge



PWR Series 10/700us Lightning Surge





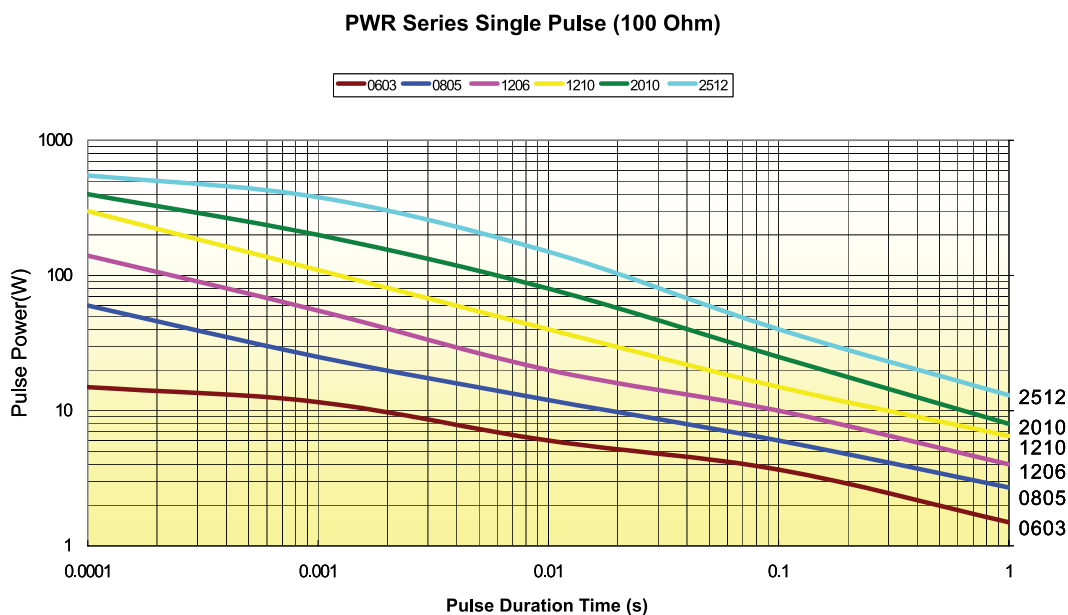
# Chip Resistors

## Pulse Withstanding



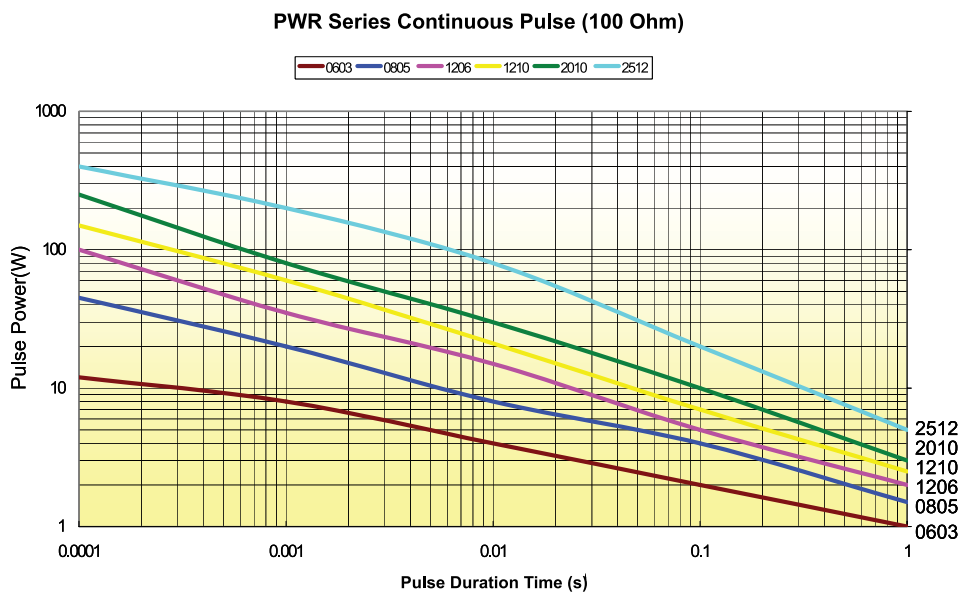
### Pulse Withstanding Capacity:

The single impulse graph is the result of 50 impulses of rectangular shape applied at one-minute intervals. 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.

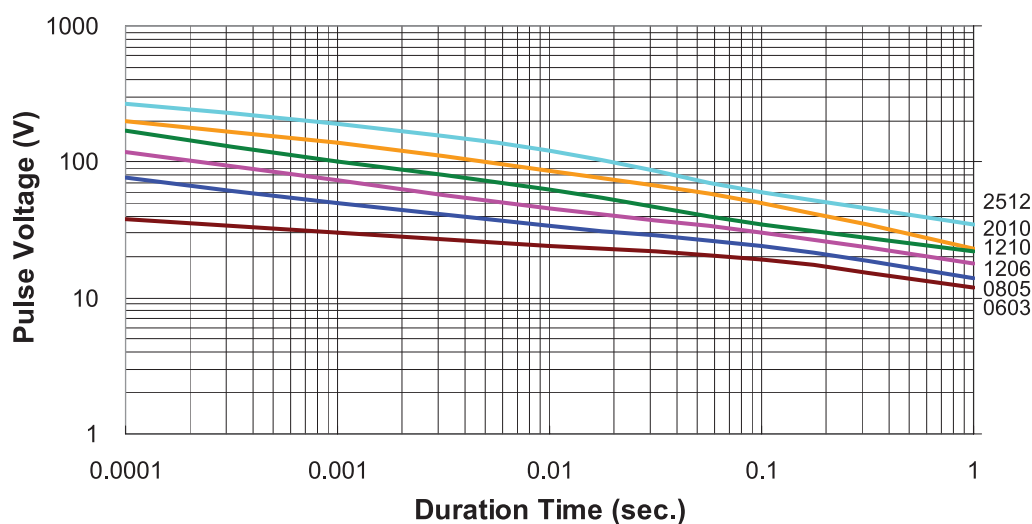


# Chip Resistors

## Pulse Withstanding



PWR Series Pulse Voltage(100 Ohm)



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