

# APPROVAL SHEET

**WF25S, WF20S, WF12S, WF08S, WF06S**

**$\pm 5\%$ ,  $\pm 10\%$ ,  $\pm 20\%$**

Power Surge Chip Resistors

Size 2512 , 2010 , 1206 , 0805 , 0603

## FEATURE

1. Power rating and compact size
2. High reliability and stability
3. Reduced size of final equipment
4. Surge protection

## APPLICATION

- Power supply
- Measurement instrument
- Automotive industry
- Medical or Military equipment

## DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to request resistance to nominal value within tolerance which controlled by printing process in this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (Pb free) alloy.

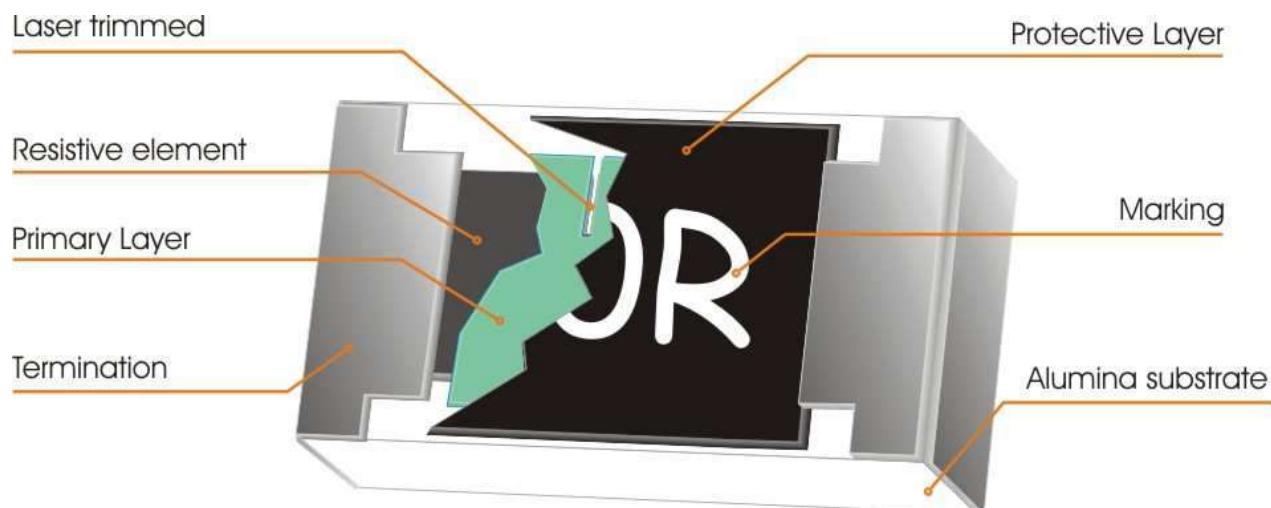


Fig 1. Consctruction of Chip-R

## QUICK REFERENCE DATA

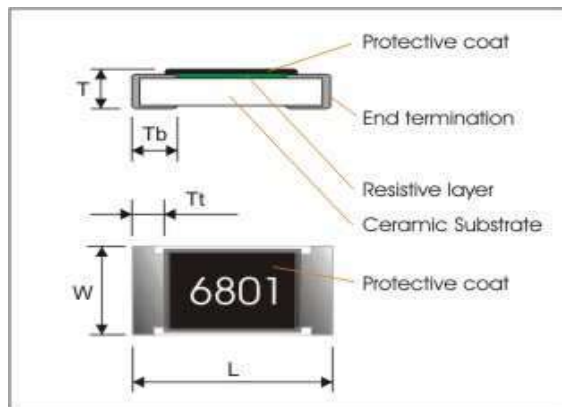
| Item                                                    | General Specification                   |             |               |             |             |
|---------------------------------------------------------|-----------------------------------------|-------------|---------------|-------------|-------------|
| Series No.                                              | WF25S                                   | WF20S       | WF12S         | WF08S       | WF06S       |
| Size code                                               | 2512(6432 )                             | 2010 (5025) | 1206 ( 3216 ) | 0805 (2012) | 0603 (1608) |
| Resistance Tolerance                                    | $\pm 5\% \pm 10\% \pm 20\%$ (E24)       |             |               |             |             |
| Resistance Range                                        | $1\Omega \sim 1M\Omega$                 |             |               |             |             |
| TCR (ppm/°C)                                            | $\pm 100 \text{ ppm }/^{\circ}\text{C}$ |             |               |             |             |
| Max. dissipation at $T_{\text{amb}}=70^{\circ}\text{C}$ | 1 W                                     | 1/2W        | 1/4W          | 1/8W        | 1/10 W      |
| Max. Operation Voltage (DC or RMS)                      | 200V                                    | 200V        | 200V          | 150V        | 50V         |
| Max. Overload Voltage (DC or RMS)                       | 400V                                    | 400V        | 400V          | 300V        | 100V        |
| Climatic category (IEC 60068)                           | 55/155/56                               |             |               |             |             |

Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

$$\text{RCWV} = \sqrt{\text{Rated Power} \times \text{Resistance Value}} \text{ or Max. RCWV listed above, whichever is lower.}$$

## MECHANICAL DATA(unit : mm)



| Symbol | WF25S     | WF20S     | WF12S     | WF08S     | WF06S       |
|--------|-----------|-----------|-----------|-----------|-------------|
| L      | 6.30±0.20 | 5.00±0.20 | 3.10±0.15 | 2.00±0.15 | 1.60 ± 0.10 |
| W      | 3.10±0.20 | 2.50±0.20 | 1.60±0.15 | 1.20±0.15 | 0.80 ± 0.10 |
| T      | 0.60±0.15 | 0.60±0.10 | 0.55±0.10 | 0.50±0.10 | 0.45 ± 0.15 |
| Tt     | 0.60±0.25 | 0.60±0.25 | 0.50±0.25 | 0.40±0.20 | 0.30 ± 0.15 |
| Tb     | 0.60±0.25 | 0.60±0.25 | 0.50±0.25 | 0.40±0.20 | 0.30 ± 0.10 |

## MARKING

1. Each resistor is marked with a three-digit code on the protective coating to designate the nominal resistance value.
2. Surge Resistor is prints underline on three-digit code for identification

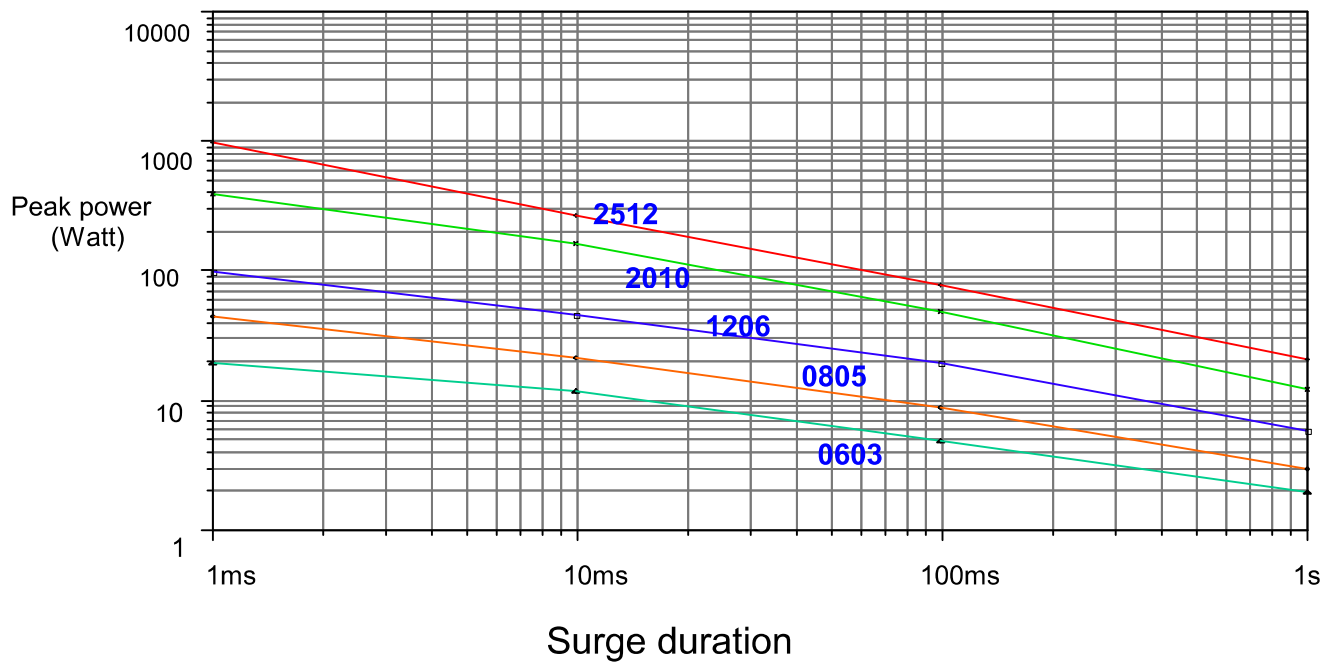
Example:

$$472 = 4700\Omega$$

472

## Surge Performance

WFxxS series



## De-rating curve

The power that the resistor can dissipate depends on the operating temperature; see Fig.2

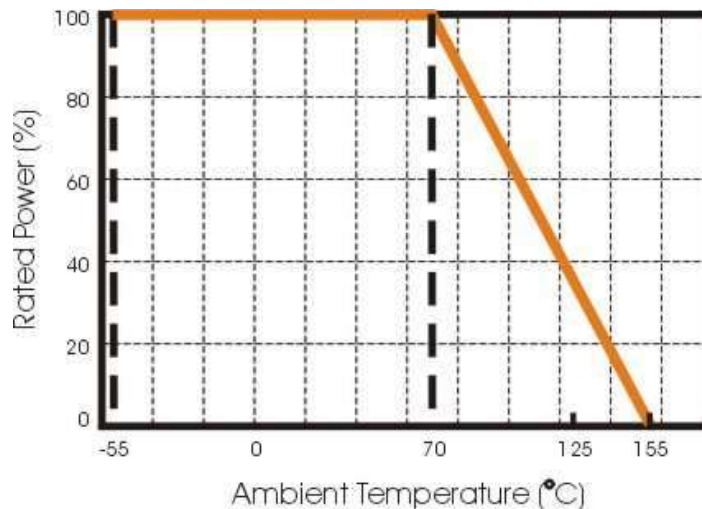


Fig.2 Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

## MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

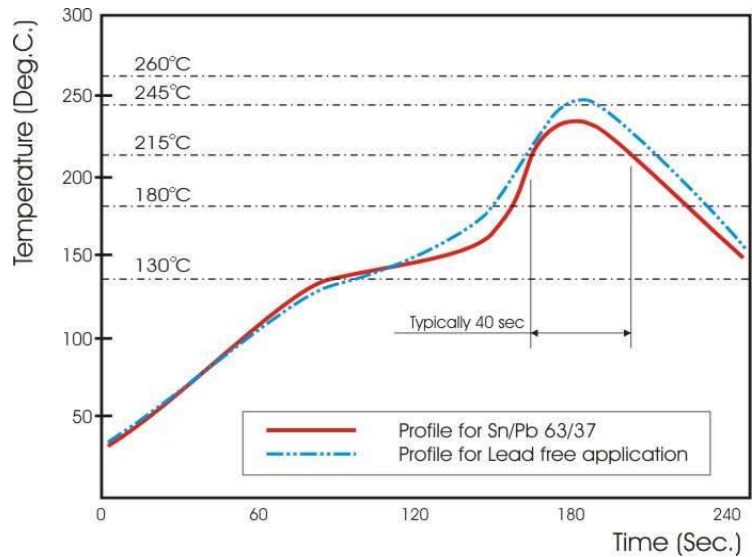
Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

## SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.



**Fig 3. Infrared soldering profile for Chip Resistors WFxxS**

## CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

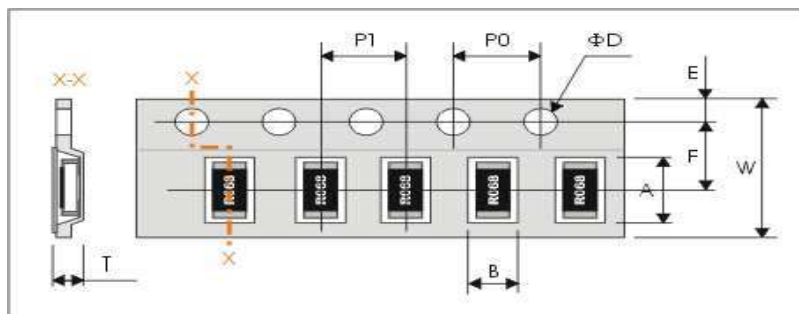
| WF20        | S         | 472_                                                                         | J                            | T                    | L                       |
|-------------|-----------|------------------------------------------------------------------------------|------------------------------|----------------------|-------------------------|
| Size code   | Type code | Resistance code                                                              | Tolerance                    | Packaging code       | Termination code        |
| WF25 : 2512 | S : surge | E24 : 3 significant digits followed by no. of zeros and a blank<br>472 = 4K7 | J: ±5%<br>K: ±10%<br>M: ±20% | T : 7" Reeled taping | L = Sn base (lead free) |
| WF20 : 2010 |           |                                                                              |                              |                      |                         |
| WF12 : 1206 |           |                                                                              |                              |                      |                         |
| WF08 : 0805 |           |                                                                              |                              |                      |                         |
| WF06 : 0603 |           |                                                                              |                              |                      |                         |

## TEST AND REQUIREMENTS(JIS C 5201-1 : 1998)

| TEST                                                              | PROCEDURE                                                                                                                                                                                                                                                                                   | REQUIREMENT                                                  |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Temperature Coefficient of Resistance(T.C.R)<br><b>Clause 4.8</b> | Natural resistance change per change in degree centigrade.<br>$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ $t_1 : 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$<br>$R_1$ : Resistance at reference temperature<br>$R_2$ : Resistance at test temperature | Refer to "QUICK REFERENCE DATA"                              |
| Short time overload (S.T.O.L)<br><b>Clause 4.13</b>               | Permanent resistance change after a 5second application of a voltage 2.5 times RCWV or the maximum overload voltage specified in the above list, whichever is less.                                                                                                                         | $\Delta R/R$ max. $\pm(1\%+0.1\Omega)$                       |
| Resistance to soldering heat(R.S.H)<br><b>Clause 4.18</b>         | Un-mounted chips completely immersed for $10 \pm 1$ second in a solder bath at $260^\circ\text{C} \pm 5^\circ\text{C}$                                                                                                                                                                      | no visible damage<br>$\Delta R/R$ max. $\pm(1\%+0.05\Omega)$ |
| Solderability <b>Clause 4.17</b>                                  | Un-mounted chips completely immersed for $2 \pm 0.5$ second in a solder bath at $235^\circ\text{C} \pm 5^\circ\text{C}$                                                                                                                                                                     | good tinning (>95% covered)<br>no visible damage             |
| Temperature cycling<br><b>Clause 4.19</b>                         | 30 minutes at $-55^\circ\text{C} \pm 3^\circ\text{C}$ , 2~3 minutes at $20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$ , 30 minutes at $+155^\circ\text{C} \pm 3^\circ\text{C}$ , 2~3 minutes at $20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$ , total 5 cycles                     | no visible damage<br>$\Delta R/R$ max. $\pm(1\%+0.05\Omega)$ |
| Load life (endurance)<br><b>Clause 4.25</b>                       | $70 \pm 2^\circ\text{C}$ , 1000 hours, loaded with RCWV or $V_{\max}$ , 1.5 hours on and 0.5 hours off                                                                                                                                                                                      | $\Delta R/R$ max. $\pm(3\%+0.1\Omega)$                       |
| Load life in Humidity<br><b>Clause 4.24</b>                       | 1000 hours, at rated continuous working voltage in humidity chamber controller at $40^\circ\text{C} \pm 2^\circ\text{C}$ and 90~95% relative humidity, 1.5hours on and 0.5 hours off                                                                                                        | $\Delta R/R$ max. $\pm(3\%+0.1\Omega)$                       |
| Bending strength<br><b>Clause 4.33</b>                            | Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 2 mm, once for 10 seconds                                                                                                                                                                                                 | $\Delta R/R$ max. $\pm(1\%+0.05\Omega)$                      |
| Adhesion<br><b>Clause 4.32</b>                                    | Pressurizing force: 5N, Test time: $10 \pm 1$ sec.                                                                                                                                                                                                                                          | No remarkable damage or removal of the terminations          |
| Insulation Resistance<br><b>Clause 4.6</b>                        | Apply the maximum overload voltage (DC) for 1minute                                                                                                                                                                                                                                         | $R \geq 10G\Omega$                                           |
| Dielectric Withstand Voltage<br><b>Clause 4.7</b>                 | Apply the maximum overload voltage (AC) for 1 minute                                                                                                                                                                                                                                        | No breakdown or flashover                                    |

## PACKAGING

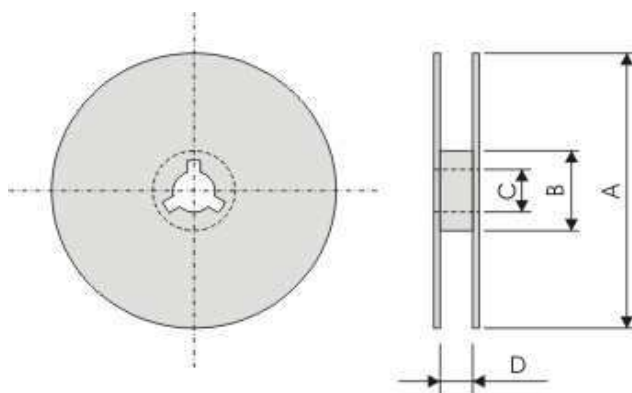
Plastic Tape specifications (unit :mm)



| Series No. | A         | B         | W          | F         | E         |
|------------|-----------|-----------|------------|-----------|-----------|
| WF25S      | 6.70±0.20 | 3.50±0.20 | 12.00±0.30 | 5.50±0.05 | 1.75±0.10 |
| WF20S      | 5.50±0.20 | 2.80±0.20 |            |           |           |
| WF12S      | 3.57±0.20 | 2.00±0.20 | 8.00±0.30  | 3.50±0.05 | 1.75±0.10 |
| WF08S      | 2.40±0.20 | 1.65±0.20 |            |           |           |
| WF06S      | 1.90±0.20 | 1.10±0.20 |            |           |           |

| Series No. | P1        | P0        | ΦD                        | T         |
|------------|-----------|-----------|---------------------------|-----------|
| WF25S      | 4.00±0.10 | 4.00±0.10 | $\Phi 1.50^{+0.1}_{-0.0}$ | Max. 1.2  |
| WF20S      |           |           |                           | Max. 1.0  |
| WF12S      |           |           |                           |           |
| WF08S      |           |           |                           |           |
| WF06S      |           |           |                           | 0.65±0.05 |

### Reel dimensions



| Reel / Tape           | A                    | B                   | C        | D         |
|-----------------------|----------------------|---------------------|----------|-----------|
| 7" reel for 8mm tape  | $\Phi 178.0 \pm 2.0$ | $\Phi 60.0 \pm 1.0$ | 13.0±0.2 | 9.00±0.50 |
| 7" reel for 12mm tape |                      |                     |          | 12.4±1.00 |

### Taping quantity

- 1206 0805 0603 Chip resistors 5,000 pcs per reel.
- 2010 2512 Chip resistors 4,000 pcs per reel.