

APPROVAL SHEET

**WF25P, WF20P, WF10P, WF12P, WF08P,
WF06P, WF04P**

±1%, ±5% 0Ω, 1Ω~10MΩ

Thick Film High Power Lead Free Chip Resistors

Size 2512,2010,1210,1206,0805,0603,0402

RoHS Exemption free and Lead free products

Lead content <100ppm

Halogen free

*Contents in this sheet are subject to change without prior notice.

FEATURES

1. High power rating
2. High reliability and stability
3. RoHS exemption free and total lead free products

APPLICATIONS

- High accuracy dc-power supply
- Digital multi-meter
- Telecommunication
- Computer
- Automotive industry
- Medical and military equipment

DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal 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 give the approximate resistance required and the value is trimmed to nominated value within tolerance which controlled by laser trimming of 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 (lead free) alloy.

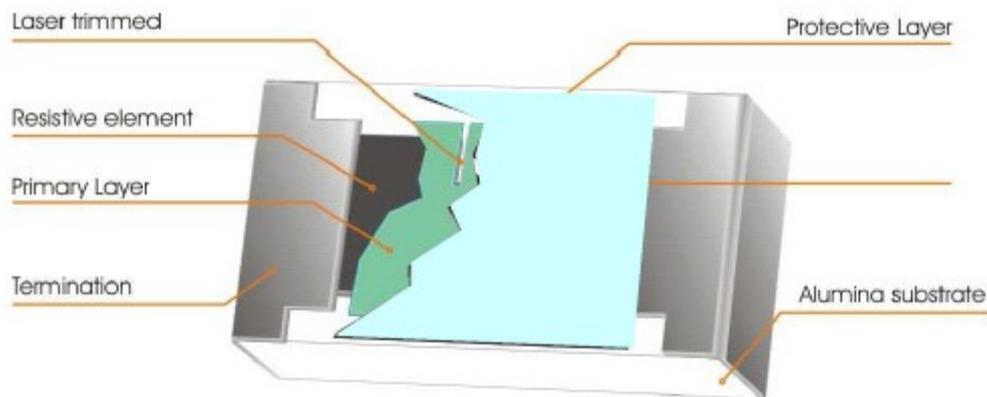


Fig 1. Construction of Chip-R

QUICK REFERENCE DATA

Item	General Specification						
Series No.	WF25P	WF20P	WF10P	WF12P	WF08P	WF06P	WF04P
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±1% (E96+E24 series), ±5% (E24 series)						
Resistance Range	0Ω, 1~ 10MΩ						
TCR (ppm/°C)							
10Ω ~ 10MΩ	≤ ± 100	≤ ± 100	≤ ± 100	≤ ± 100	≤ ± 100	≤ ± 100	≤ ± 100
< 10Ω	≤ ± 100	≤ ± 100	≤ ± 100	≤ ± 100	≤ ± 150	≤ ± 150	≤ ± 200
Max. dissipation at T _{amb} =70°C	2 W	1 W	1/2 W	1/2 W	1/4 W	1/8W	1/8W
Max. Operation Voltage	250V	200V	200V	200V	150V	75V	50V
Max. Overload Voltage	500V	400V	400V	400V	300V	150V	100V
Operation temperature	-55 ~ +155°C						

Note :

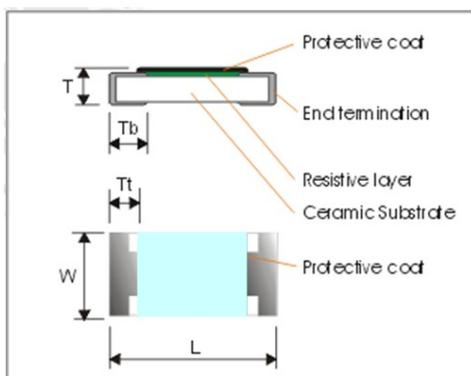
1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

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

For Jumper (0Ω) :

Item	General Specification						
Series No.	WF25P	WF20P	WF10P	WF12P	WF08P	WF06P	WF04P
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
TCR (ppm/°C)	TCR is not applicable for Jumper product						
Resistance Range	Max.20mΩ	Max.20mΩ	Max.20mΩ	Max.20mΩ	Max.20mΩ	Max.20mΩ	Max.50mΩ
Max. dissipation at T _{amb} =70°C	2 W	1 W	1/2 W	1/2 W	1/4 W	1/8W	1/8W
Rated Current	10A	7A	5A	5A	4A	2A	1.5A
Peak Current	25A	17.5A	12.5A	12.5A	10A	5A	3.8A
Operation temperature	-55 ~ +155°C						

DIMENSIONS(unit : mm)



Series No.	WF25P	WF20P	WF10P	WF12P	WF08P	WF06P	WF04P
L	6.30 ± 0.20	5.00 ± 0.20	3.10 ± 0.15	3.10 ± 0.15	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	3.10 ± 0.20	2.50 ± 0.20	2.50 ± 0.15	1.60 ± 0.15	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.60 ± 0.15	0.60 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tt	0.60 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10
Tb	1.80 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10

CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

WF08	P	1002	F	T	R
Size code WF04: 0402 WF06: 0603 WF08: 0805 WF12: 1206 WF10: 1210 WF20: 2010 WF25: 2512	Type code P :Power	Resistance code 5% E24: 2 significant digits followed by No. of zeros and a blank 4.7Ω =4R7_ 10Ω =100_ 220Ω =221_ Remark: " _ " means a blank 1% E24+E96: 3 significant digits followed by No. of zeros 100Ω =1000 37.4KΩ =3742	Tolerance J : ±5% F : ±1% P : Jumper	Packaging code T : 7" Reeled taping	Termination code R= Total Lead free (Lead content < 100 ppm)

Tape packaging

WF25, WF20: 12mm width plastic taping 4,000pcs per reel.

WF12, WF10, WF08, WF06 : 8mm width paper taping 5,000pcs per reel.

WF04: 8mm width paper taping 10,000pcs per reel.

MARKING

All series are defined as no marking!

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E96&E24 series for resistors with a tolerance of $\pm 1\%$, $\pm 5\%$. The values of the E96/E24 series are in accordance with "IEC publication 60063".

Derating Curve

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

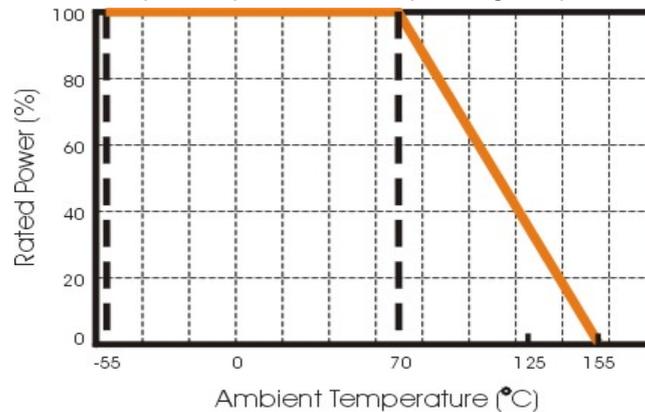


Fig.2 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

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.

Storage and Handling Conditions:

1. Products are recommended to be used up within two years since operation date as ensured shelf life. Check solderability in case shelf life extension is needed.
2. To store products with following condition:
 - Temperature :5 to 40°C
 - Humidity :20 to 70% relative humidity
3. Caution:
 - a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid. It may cause oxidation of electrode, which easily be resulted in poor soldering.
 - b. To store products on the shelf and avoid exposure to moisture.
 - c. Don't expose products to excessive shock, vibration, direct sunlight and so on

SOLDERING CONDITION follows J-STD-020D

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.

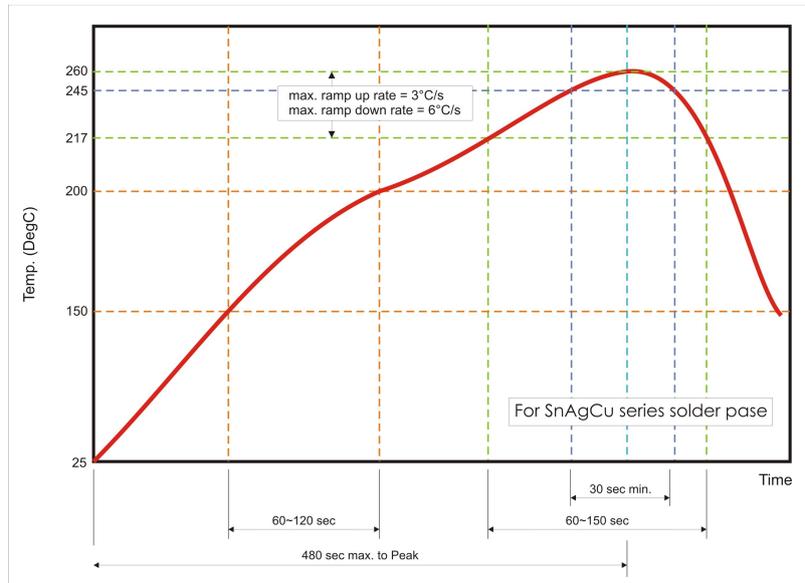


Fig 3. Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

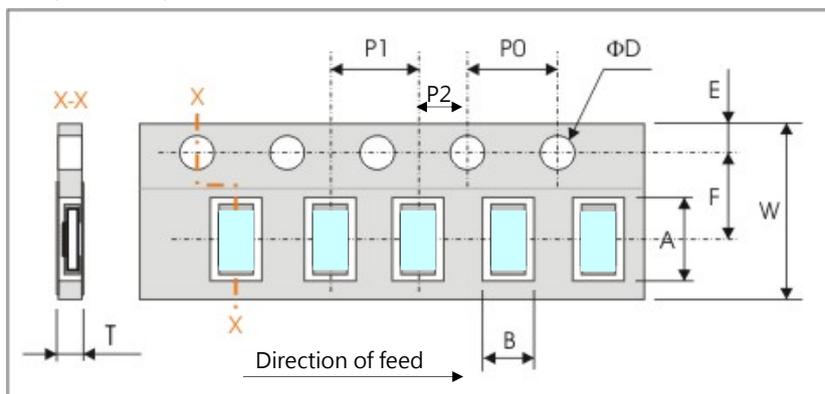
TEST AND REQUIREMENTS

Basic specification : JIS C 5201-1 : 1998

TEST	PROCEDURE	REQUIREMENT
Clause 4.8 Temperature Coefficient of Resistance (TCR)	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (ppm/°C) R ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature t ₁ : 20°C+5°C-1°C	Refer to quick reference data for T.C.R specification
Clause 4.13 Short time overload	5.0× Rated power or Max. Overload Voltage for 5 sec. Measure resistance after 30 minutes..	ΔR/R max. J: ≤ ±(2%+0.1Ω) F: ≤ ±(1%+0.05Ω)
Clause 4.18 Resistance to soldering heat	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C ±5°C	No visible damage ΔR/R max. J: ≤ ±(1%+0.1Ω) F: ≤ ±(0.5%+0.05Ω)
Clause 4.17 Solderability	Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C±5°C	Good tinning (>95% covered) No visible damage
Clause 4.18 Leach Test	Un-mounted chips completely immersed for 60±1second in a solder bath at 260°C±5°C	Ditto
Clause 4.19 Temperature cycling	30 minutes at -55°C±3°C, 2~3 minutes at 20°C+5°C-1°C, 30 minutes at +155°C±3°C, 2~3 minutes at 20°C+5°C-1°C, total 5 continuous cycles	No visible damage ΔR/R max. J ≤ ±(1%+0.1Ω) F ≤ ±(0.5%+0.05Ω)
Clause 4.25 Load life (endurance)	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off	No visible damage ΔR/R max. J ≤ ±(3%+0.1Ω) F ≤ ±(1%+0.05Ω)
Clause 4.24 Load life in Humidity	1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller at 40°C±2°C and 90~95% relative humidity, 1.5hours on and 0.5 hours off	No visible damage ΔR/R max. J ≤ ±(3%+0.1Ω) F ≤ ±(1%+0.05Ω)
Clause 4.33 Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 2 mm(2512;2010) 3mm(others), once for 10 seconds	No visible damage ΔR/R max. J ≤ ±(1%+0.1Ω) F ≤ ±(0.5%+0.05Ω)
Clause 4.32 Adhesion	Pressurizing force: 5N, Test time: 10±1sec	No remarkable damage or removal of the terminations
Clause 4.6 Insulation resistance	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10GΩ
Clause 4.7 Dielectric withstand voltage	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover

PACKAGING

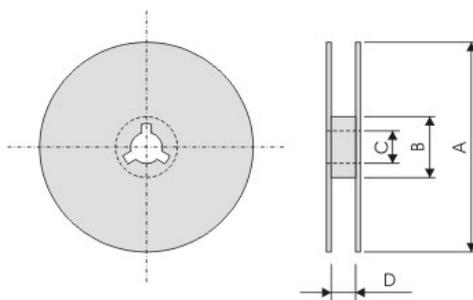
Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF25P	6.90±0.20	3.20±0.20	12.00±0.30	5.50±0.20	1.75±0.10
WF20P	5.50±0.20	2.80±0.20			
WF10P	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.20	
WF12P	3.60±0.20	2.00±0.20			
WF08P	2.40±0.20	1.65±0.20			
WF06P	1.90±0.20	1.10±0.20			
WF04P	1.20±0.10	0.70±0.10			

Series No.	P1	P0	P2	ΦD	T
WF25P	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.2
WF20P					
WF10P					
WF12P					
WF08P					
WF06P	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.70±0.05
WF04P	2.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.50±0.05

Reel dimensions



unit: mm

Symbol	A	B	C	D
7" 12mm tape	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	12.4±1.0
7" 8mm tape	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5