

# APPROVAL SHEET

**WF04P, WF06P, WF08P, WF12P**

**±1%, ±5% 0Ω, 1Ω~10MΩ**

Thick Film High Power Lead Free Chip  
Resistors

Size 0402, 0603, 0805, 1206

RoHS exemption free and Lead <100ppm

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

## FEATURE

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

## APPLICATION

1. High accuracy dc-power supply
2. Digital multi-meter
3. Telecommunication
4. Computer
5. Automotive industry
6. 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.

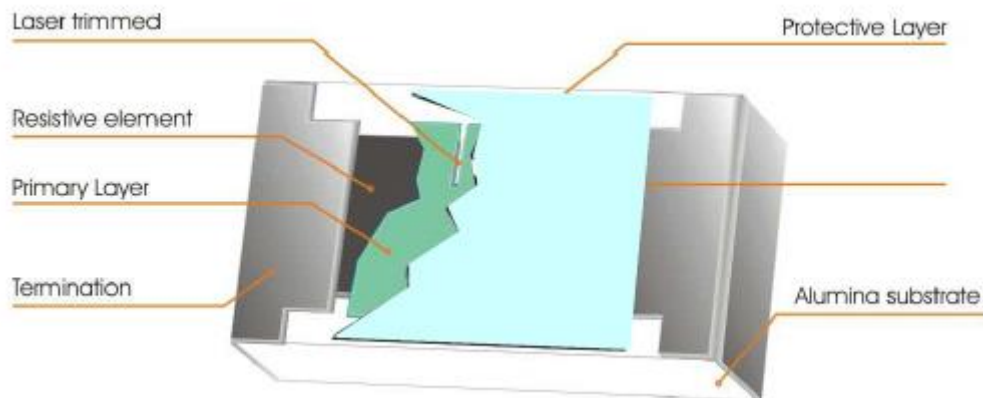


Fig 1. Construction of Chip-R

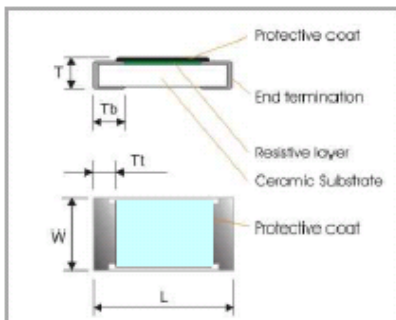
**QUICK REFERENCE DATA**

Item	General Specification			
Series No.	WF04P	WF06P	WF08P	WF12P
Size code	0402 (1005)	0603 (1608)	0805 (2012)	1206 (3216)
Resistance Tolerance	±1%, ±5%			
Resistance Range	0Ω, 1Ω~ 1MΩ (E96+E24 series)	0Ω, 1Ω~ 1MΩ (E96+E24 series)	0Ω, 1Ω~ 10MΩ (E96+E24 series)	0Ω, 1Ω~ 10MΩ (E96+E24 series)
TCR (ppm/°C)				
10Ω ~ 10MΩ	≤ ± 100 ppm/°C	≤ ± 100 ppm/°C	≤ ± 100 ppm/°C	≤ ± 100 ppm/°C
< 10Ω	≤ ± 200 ppm/°C	≤ ± 150 ppm/°C	≤ ± 150 ppm/°C	≤ ± 100 ppm/°C
Max. dissipation at T <sub>amb</sub> =70°C	1/8W	1/8W	1/4 W	1/2 W
Max. Operation Voltage	50V	75V	150V	200V
Max. Overload Voltage	100V	150V	300V	400V
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

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

**DIMENSIONS(unit : mm)**

Part No	WF04P	WF06P	WF08P	WF12P
L	1.00 ± 0.05	1.60 ± 0.10	2.00 ± 0.10	3.10 ± 0.15
W	0.50 ± 0.05	0.80 ± 0.10	1.25 ± 0.10	1.60 ± 0.15
T	0.35 ± 0.05	0.45 ± 0.15	0.50 ± 0.15	0.55 ± 0.10
Tb	0.25 ± 0.10	0.30 ± 0.15	0.40 ± 0.20	0.50 ± 0.25
Tt	0.20 ± 0.10	0.30 ± 0.10	0.40 ± 0.20	0.50 ± 0.25

**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

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

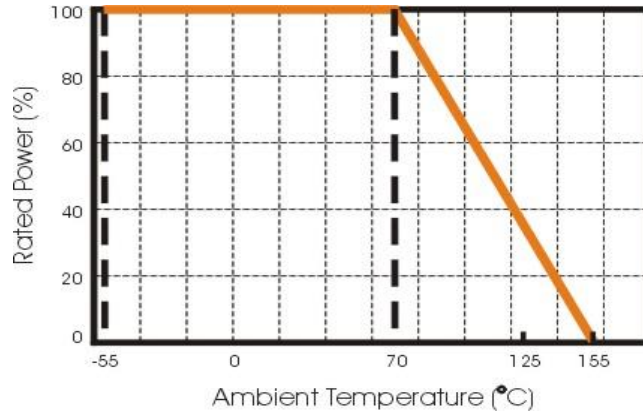


Fig.2 Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

## 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.

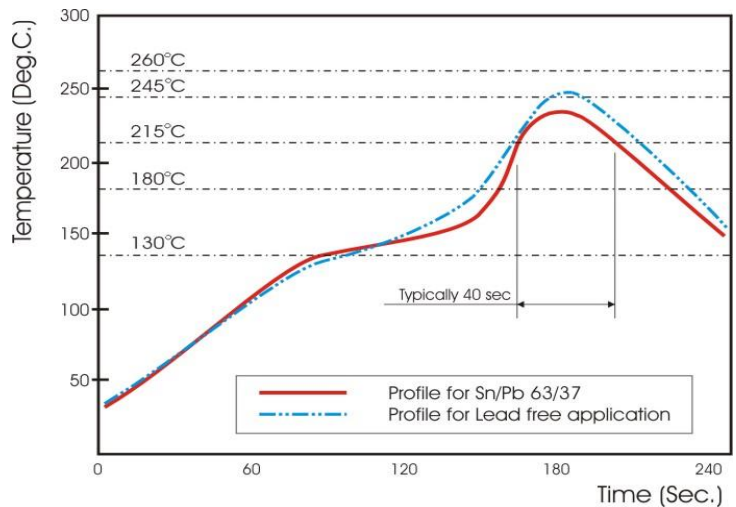


Fig 3. Infrared soldering profile for Chip Resistors

## CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

WF08	P	1002	F	T	R
<b>Size code</b> WF08: 0805 WF12: 1206	<b>Type code</b> P :Power 0805 size = 1/4W 1206 size = 1/2W	<b>Resistance code</b> 5% E24: 2 significant digits followed by No. of zeros e.g.: 3ohm      =3R0 10ohm     =100 56Kohm    =563 1% E24+E96: 3 significant digits followed by No. of zeros 100Ω      =1000 37.4KΩ     =3742	<b>Tolerance</b> J : ±5% F : ±1% P : Jumper	<b>Packaging code</b> T : 7" Reeled taping paper taping 5kpcs/reel.	<b>RoHS code</b> R = lead free ( Lead < 100ppm)

- Reeled tape packaging : 8mm width paper taping 5000pcs per 7" reel.

## TEST CONDITION FOR JUMPER (0 Ω)

Item	WF12P	WF08P	WF06P	WF04P
Power Rating	1/2W	1/4W	1/8W	1/8W
Resistance	Max. 20mΩ	Max. 20mΩ	Max. 20mΩ	Max. 50mΩ
Rated Current	5A	4A	2A	1.5A
Peak Current	12.5A	10A	5A	3.8A
Operating temperature	-55 ~ +155'C			

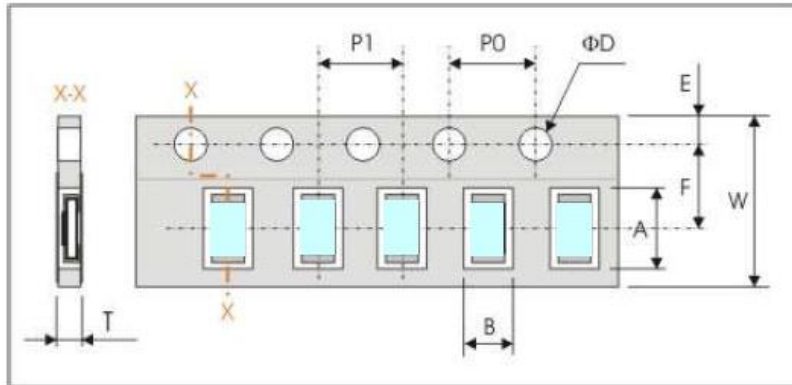
**TEST AND REQUIREMENTS**

Basic specification : JIS C 5201-1 : 1998

TEST	PROCEDURE	REQUIREMENT
<b>Clause 4.8</b> Temperature Coefficient of Resistance (TCR )	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ R <sub>1</sub> : Resistance at reference temperature R <sub>2</sub> : Resistance at test temperature t <sub>1</sub> : 20°C+5°C-1°C	Refer to quick reference data for T.C.R specification
<b>Clause 4.13</b> 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)
<b>Clause 4.18</b> 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)
<b>Clause 4.17</b> 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
<b>Clause 4.18</b> Leach Test	Un-mounted chips completely immersed for 60±1second in a solder bath at 260°C±5°C	Ditto
<b>Clause 4.19</b> 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)
<b>Clause 4.25</b> 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)
<b>Clause 4.24</b> 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)
<b>Clause 4.33</b> Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 2 mm(2512;2010) 3mm(1206), once for 10 seconds	No visible damage ΔR/R max. J: ≤ ±(1%+0.1Ω) F: ≤ ±(0.5%+0.05Ω)
<b>Clause 4.32</b> Adhesion	Pressurizing force: 5N, Test time: 10±1sec	No remarkable damage or removal of the terminations
<b>Clause 4.6</b> Insulation resistance	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10GΩ
<b>Clause 4.7</b> Dielectric withstand voltage	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover

**PACKAGING**

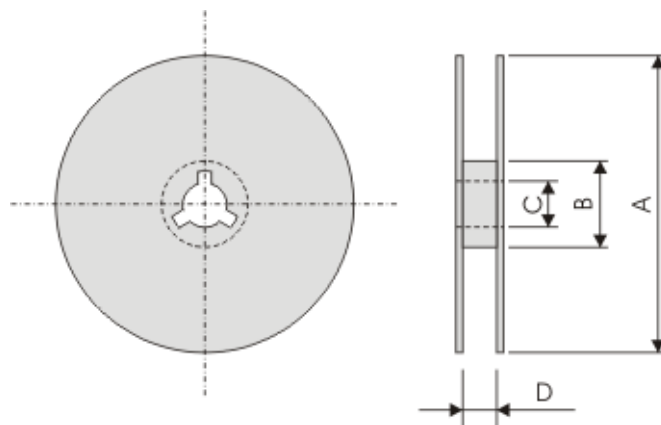
**Paper Tape specifications (unit :mm)**



Series No.	A	B	W	F	E
WF12P	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
WF08P	2.40±0.20	1.65±0.20			
WF06P	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.20	1.75±0.10
WF04P	1.20±0.10	0.70±0.10	8.00±0.30	3.50±0.20	1.75±0.10

Series No.	P1	P0	ΦD	T
WF12P	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.0
WF08P				Max. 1.0
WF06P	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	0.65±0.05
WF04P	2.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	0.40±0.05

**Reel dimensions**



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5

