

APPROVAL SHEET

WF12H, WF08H, WF06H, WF04H

±0.5%, ±0.1%

Thick Film High Precision Chip Resistors

Size 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. Small size and light weight
2. High reliability and stability
3. Reduced size of final equipment
4. High precision
5. Higher component and equipment reliability
6. RoHS Exemption free and Lead free products.

APPLICATIONS

- Power supply
- PDA
- Digital meter
- Computer
- Palmtop computers

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. For all series, Overcoat is water blue color. 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.

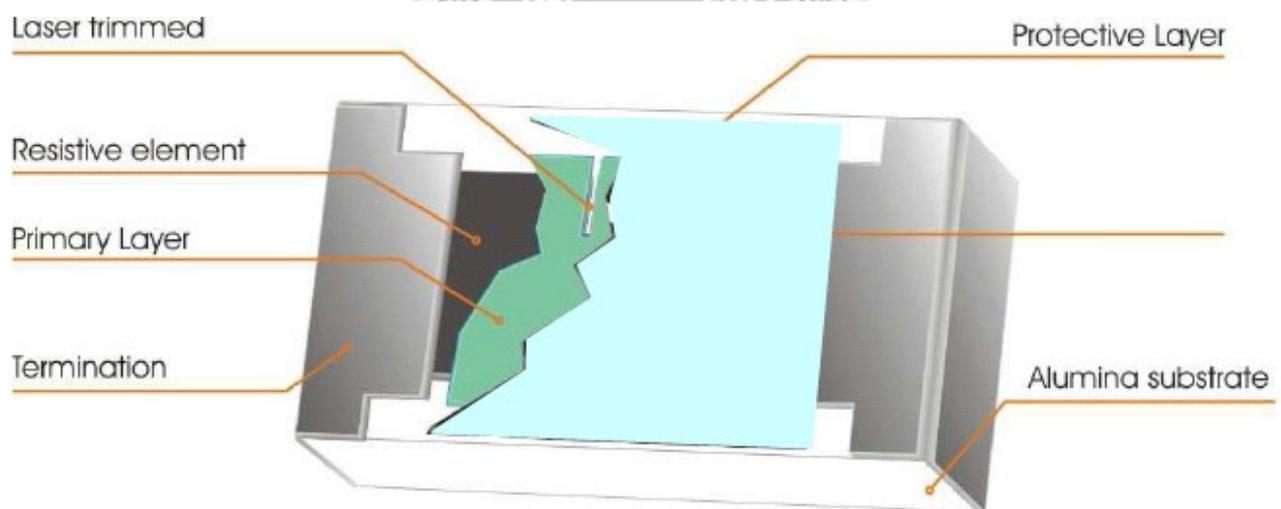


Fig 1. Construction of Chip-R

QUICK REFERENCE DATA

Item	General Specification			
Series No.	WF12H	WF08H	WF06H	WF04H
Size code	1206 (3216)	0805 (2125)	0603 (1608)	0402 (1005)
Resistance Range	10Ω ~ 1MΩ (E96+E24 series)			
Resistance Tolerance	±0.5%, ±0.1%			
TCR (ppm/°C) 10Ω ≤ R ≤ 1MΩ	≤ ± 100 ppm/°C			
Max. dissipation at T _{amb} =70°C	1/4 W	1/8 W	1/10 W	1/16W
Max. Operation Voltage (DC or RMS)	200V	150V	50V	50V
Max. overload voltage (DC or RMS)	400V	300V	100V	100V
Operation temperature	-55 ~ +155°C			

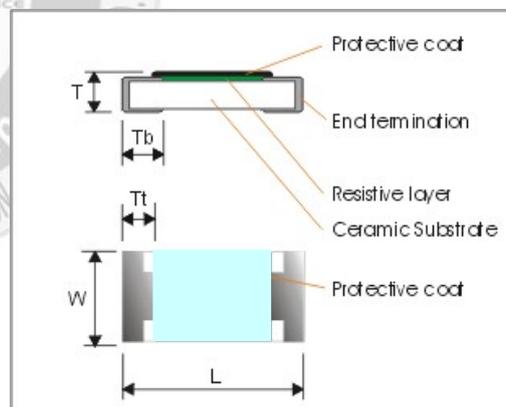
Note :

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

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$
or Max. RCWV listed above, whichever is lower.
3. Non E96 series resistance upon requested.

DIMENSIONS(unit : mm)

Series No.	WF12H	WF08H	WF06H	WF04H
L	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00±0.05
W	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50±0.05
T	0.65 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.35±0.05
Tt	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	0.20±0.10
Tb	0.45 ± 0.20	0.40 ± 0.20	0.30 ± 0.20	0.25±0.10



CATALOGUE NUMBERS

The resistors have a catalogue number starting with :

WF06	H	3742	D	T	R
Size code	Type code	Resistance code	Tolerance	Packaging code	Termination code
WF12 : 1206 WF08 : 0805 WF06 : 0603 WF04 : 0402	H : High precision, <1%, TCR>50ppm	E96+E24: 3 significant digits followed by no. of zeros 102Ω =1020 37.4KΩ =3742 220Ω =2200	D : ±0.5% B : ±0.1%	T : 7" Reeled taping	R= Total Lead free (Lead content < 100 ppm)

LEAD content: below 100ppm with reference to IEC62321, determination of LEAD by ICP-AES

Reeled tape packaging :
8mm width paper taping 5000pcs per 7" reel for 1206/0805/0603, 10000pcs per 7" reel for 0402.

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 ±0.5%, ±0.1%. The values of the E24/E96 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

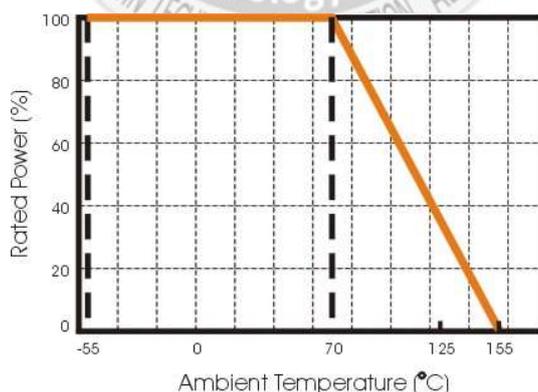


Figure 2. Maximum dissipation in percentage of rated power
As a function of the ambient temperature

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.

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.

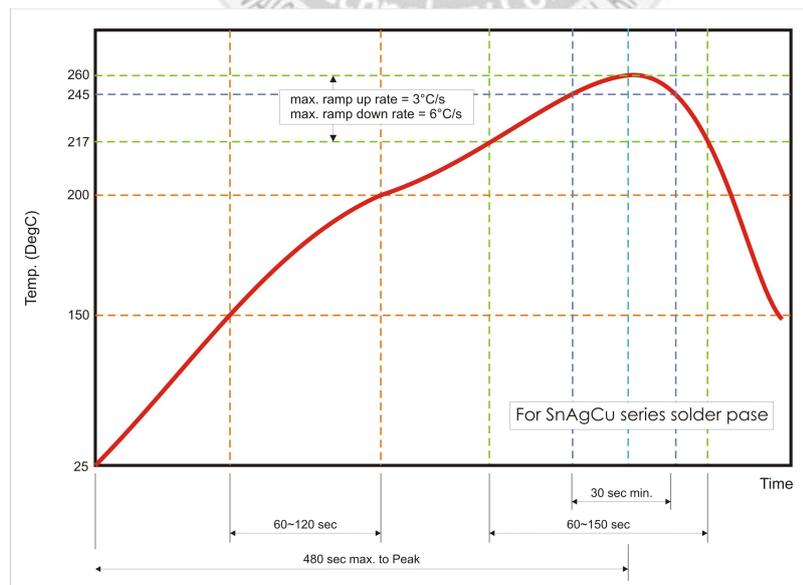


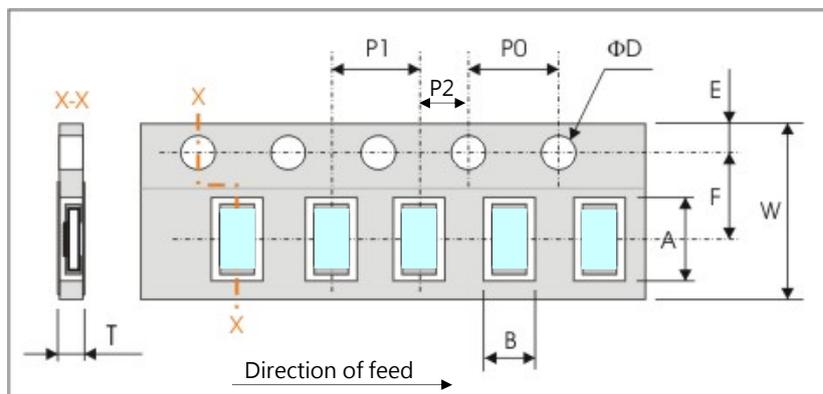
Fig 3. Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

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

TEST	PROCEDURE	REQUIREMENT
DC resistance Clause 4.5	DC resistance values measured at the test voltages specified below : <10Ω@0.1V, <100Ω@0.3V, <1KΩ@1.0V, <10KΩ@3V, <100KΩ@10V, <1MΩ@25V, <10MΩ@30V	Within the specified tolerance
Temperature Coefficient of Resistance(T.C.R) Clause 4.8	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (ppm/°C) ; t1 : 20°C+5°C-1°C R1 : Resistance at reference temperature R2 : Resistance at test temperature	Refer to "QUICK REFERENCE DATA"
Short time overload (S.T.O.L) Clause 4.13	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.	ΔR/R max. ±(0.25%+0.05Ω)
Resistance to soldering heat(R.S.H) Clause 4.18	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C	no visible damage Δ R/R max. ±(0.25%+0.05Ω)
Solderability Clause 4.17	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
Temperature cycling Clause 4.19	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. ±(0.25%+0.05Ω)
Load life (endurance) Clause 4.25	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off	ΔR/R max. ±(1%+0.1Ω)
Load life in Humidity Clause 4.24	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	ΔR/R max. ±(1%+0.1Ω)
Bending strength Clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 3 mm, once for 10 seconds	ΔR/R max. ±(0.25%+0.05Ω)
Adhesion Clause 4.32	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations.
Insulation Resistance Clause 4.6	Apply the maximum overload voltage (DC) for 1minute	R≥ 10GΩ
Dielectric Withstand Voltage Clause 4.7	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover

PACKAGING

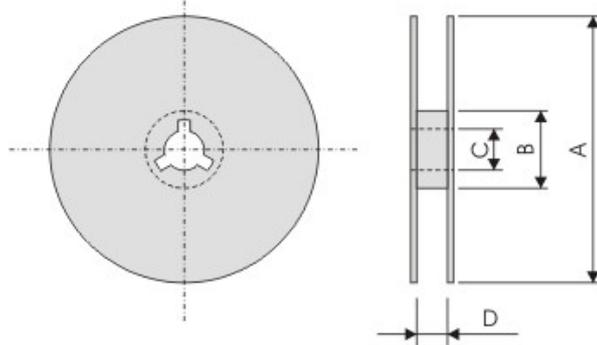
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF12H	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.2	1.75±0.10
WF08H	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.2	1.75±0.10
WF06H	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.2	1.75±0.10
WF04H	1.20±0.10	0.7±0.10	8.00±0.30	3.50±0.2	1.75±0.10

Series No.	P1	P0	P2	ΦD	T
WF12H	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.65±0.1
WF08H	4.00±0.10	4.00±0.10	2.00±0.10		0.65±0.1
WF06H	4.00±0.10	4.00±0.10	2.00±0.10		0.65±0.1
WF04H	2.00±0.10	4.00±0.10	2.00±0.10		0.50±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