

APPROVAL SHEET

WF25H, WF20H

$\pm 0.1\%$, $\pm 0.5\%$

Thick Film High Precision Chip Resistors

Size 2512, 2010

RoHS 2 Compliant with exemption 7C-I

Halogen free

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

FEATURE

1. High power rating and compact size
2. High reliability and stability
3. Reduced size of final equipment
4. High precision of resistance
5. RoHS 2 Compliant with exemption 7C-I and Halogen free products

APPLICATION

- Power supply
- PDA
- Digital meter
- Computer
- Battery charger
- DC-DC power converter

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 Tin (lead free) alloy.

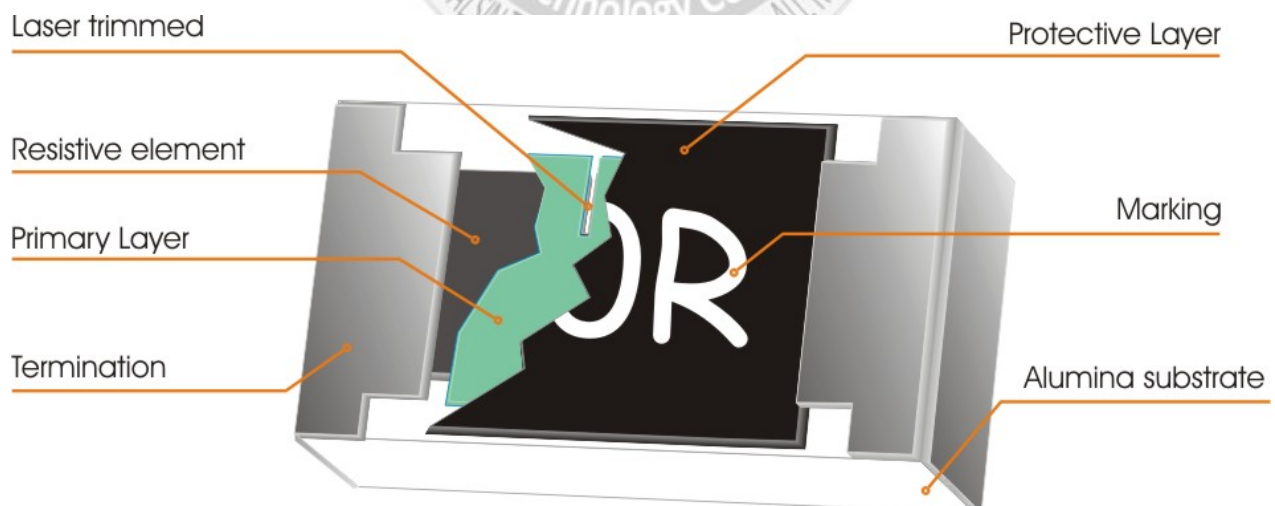


Fig 1. Construction of Chip-R

QUICK REFERENCE DATA

Item	General Specification	
Series No.	WF25H	WF20H
Size code	2512 (6432)	2010 (5025)
Resistance Tolerance	$\pm 0.5\%$; $\pm 0.1\%$ (E24+E96)	
Resistance Range	$1\Omega \sim 10M\Omega$,	
TCR (ppm/°C) $1\Omega \leq R_n \leq 10\Omega$ $10\Omega < R_n \leq 10M\Omega$	± 200 ppm/°C	
	± 100 ppm/°C	
Max. dissipation at $T_{amb}=70^\circ C$	1 W	0.5W
Max. Operation Voltage (DC or RMS)	250V	200V
Max. Overload Voltage (DC or RMS)	500V	400V
Climatic category (IEC 60068)	55/155/56	

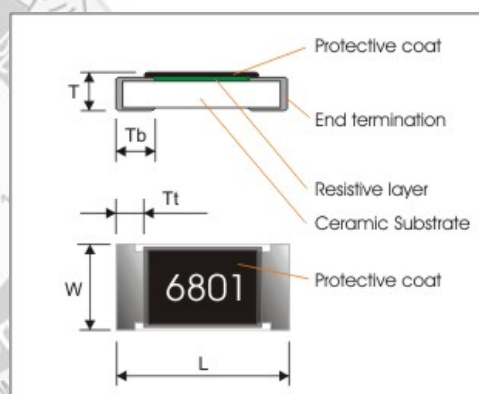
Note :

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

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

MECHANICAL DATA(unit : mm)

Series No.	WF25H	WF20H
L	6.40 ± 0.20	5.00 ± 0.20
W	3.20 ± 0.20	2.50 ± 0.20
T	0.60 ± 0.10	0.55 ± 0.10
Tt	0.65 ± 0.25	0.65 ± 0.25
Tb	0.90 ± 0.25	0.60 ± 0.25



CATALOGUE NUMBERS

The resistors have a catalogue number starting with :

WF25	H	1000	B	T	L
Size code WF25 : 2512 WF20 : 2010	Type code H : Thick film, High precision <1%	Resistance code E24+E96, : 3 significant digits followed by no. of zeros 102 Ω =1020 37.4K Ω =3742	Tolerance B : $\pm 0.1\%$ D : $\pm 0.5\%$	Packaging code T : 7" Reel taping	Termination code L = Sn base (lead free)

MARKING

Each resistor is marked with a four-digit code on the protective coating to designate the nominal resistance value.
Example:

RESISTANCE	10 Ω	12 Ω	100 Ω	6800 Ω	47000 Ω
4 digits marking	10R0	12R0	1000	6801	4702

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E96 & E24 series for resistors with a tolerance of $\pm 0.5\%$ & $\pm 0.1\%$. 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

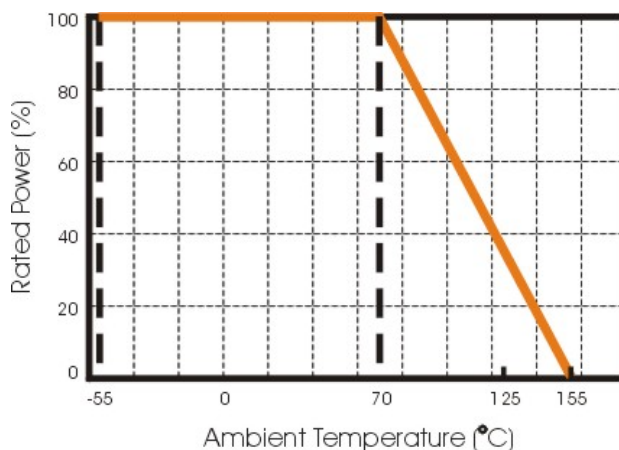


Fig.2 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

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.

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

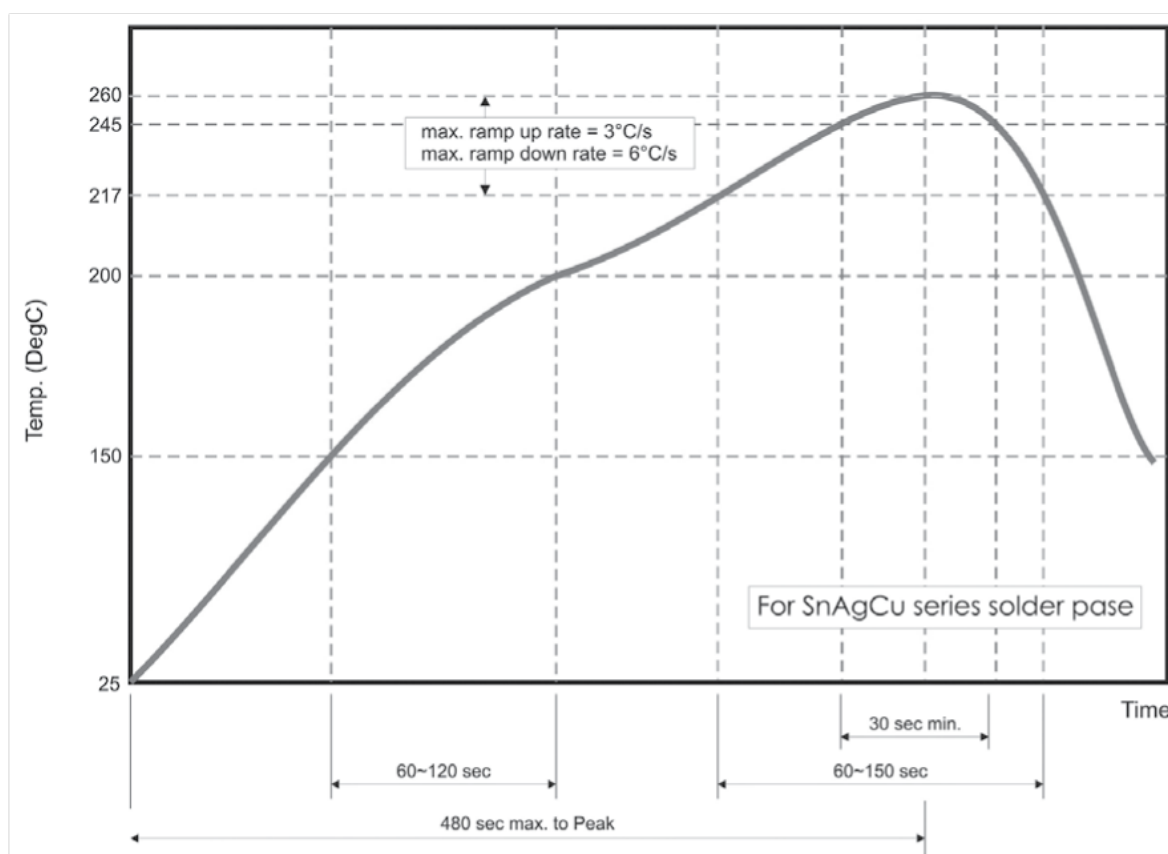


Fig 3. Recommended IR reflow soldering profile for
SMT process with SnAgCu series solder paste

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

Essentially all tests are carried out according to the schedule of IEC publication 115-8, category LCT/UCT/56 (rated temperature range : Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ and JIS.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to IEC 60068-1, subclause 5.3. Unless otherwise specified, the following value supplied :

Temperature: 15°C to 35°C.

Relative humidity: 45% to 75%.

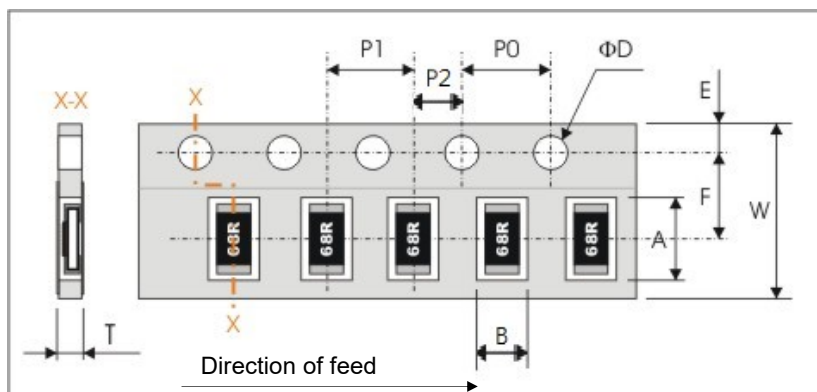
Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

All soldering tests are performed with midly activated flux.

TEST	PROCEDURE	REQUIREMENT
Electrical Characteristics JISC5201-1: 1998 Clause 4.8	DC resistance values measurement Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ $t_1 : 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$ $R_1 : \text{Resistance at reference temperature (20}^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C)}$ $R_2 : \text{Resistance at test temperature (-55}^\circ\text{C or +155}^\circ\text{C)}$	Within the specified tolerance Refer to "QUICK REFERENCE DATA"
Short time overload (STOL) 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.	$\Delta R/R \text{ max. } \pm(1\%+0.05\Omega)$
Resistance to soldering heat Clause 4.17	Un-mounted chips 10±1 seconds, in a SAC solder bath at 260±5°C	no visible damage $\Delta R/R \text{ max. } \pm(1\%+0.05\Omega)$
Solderability Clause 4.18	Un-mounted chips completely immersed for 2±0.5 sec. in a SAC solder bath at 235±5°C	good tinning (>95% covered) no visible damage
Temperature cycling Clause 4.19	1. 30 minutes at -55°C±3°C, 2. 2~3 minutes at 20°C+5°C-1°C, 3. 30 minutes at +155°C±3°C, 4. 2~3 minutes at 20°C+5°C-1°C, Total 5 continuous cycles	no visible damage $\Delta R/R \text{ max. } \pm(1\%+0.05\Omega)$
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	$\Delta R/R \text{ max. } \pm(3\%+0.1\Omega)$
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	$\Delta R/R \text{ max. } \pm(3\%+0.1\Omega)$
Bending strength JISC5201-1: 1998 Clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 2mm for 10sec,	$\Delta R/R \text{ max. } \pm(1\%+0.05\Omega)$
Adhesion JISC5201-1: 1998 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 1minutes	$R \geq 10G\Omega$
Dielectric Withstand Voltage Clause 4.7	Apply the maximum overload voltage (AC) for 1 minutes	No breakdown or flashover

PACKAGING

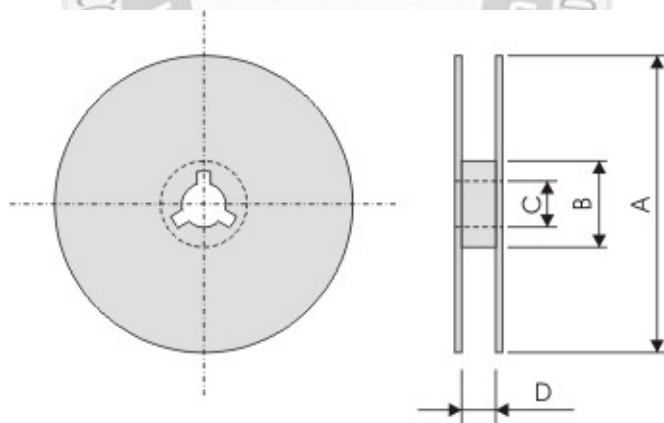
Plastic tape specifications (unit :mm)



Type	A	B	W	F	E
2512	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.1	1.75±0.10
2010	5.50±0.20	2.80±0.20	12.00±0.30	5.50±0.1	1.75±0.10

Type	P1	P0	P2	ΦD	T
2512	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.2
2010	4.00±0.10	4.00±0.10	2.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.2

Reel dimensions



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	14.0±0.2

Taping quantity

- Chip resistors 4,000 pcs per reel.