APPROVAL SHEET

WF25A, WF20A, WF10A, WF12A, WF08A, WF06A, WF04A

±1%, ±5%, Jumper

Thick Film Triple Power Chip Resistors

Size 2512 3W, 2010 1.5W, 1210 3/4W
1206 3/4W, 0805 1/2W, 0603 1/3W, 0402 1/5W

RoHS 2 Compliant with exemption 7C-I
Halogen free

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

FEATURE

1. Small size and light weight
2. High reliability and stability
3. Reduced size of final equipment
4. High power
5. RoHS 2 Compliant with exemption 7C-I and Halogen free products
6. Flammability against UL94-V0

APPLICATION

- 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.	WF25A	WF20A	WF10A	WF12A	WF08A	WF06A	WF04A
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±1% (E24+E96) ±5% (E24)						
Resistance Range	1Ω ~ 1MΩ						10Ω ~ 1M2Ω
TCR (ppm/°C) 1% 10Ω~1M2Ω 1% 1~9.76Ω	±100 ±100	±100 ±100	±100 ±100	±100 ±200	±100 ±150	±100 ±200	±100
TCR (ppm/°C) 5% 1~1M2Ω	±200	±200	±200	±200	±200	±200	±100
Max. dissipation at T_{amb}=70°C	3 W	1.5 W	3/4 W	3/4 W	1/2 W	1/3 W	1/5 W
Max. Operation Voltage	250V	250V	250V	250V	200V	75V	50V
Max. Overload Voltage	500V	500V	500V	500V	300V	125V	100V
Operation Temperature	- 55~+155°C						

Notes:

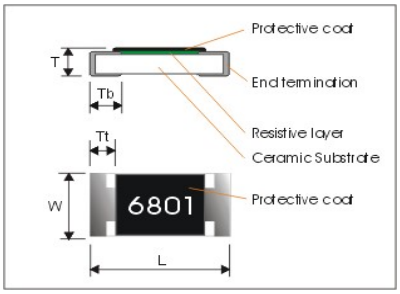
1. RCWV is Rated Voltage, V= $\sqrt{P*R}$ or Max. Working Voltage whichever is lower.
2. V：Working Voltage(V)，P：Rated Power (W)，R：Resistance Value(Ω)
3. Please consider the resistance variance from soldering pad/trace/amount, and keep the surface temperature do not exceed 105°C when working.

High Current Power Jumpers (0Ω)

Item	General Specification						
Series No.	WF25A	WF20A	WF10A	WF12A	WF08A	WF06A	WF04A
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Range	≦10mΩ	≦10mΩ	≦10mΩ	≦10mΩ	≦10mΩ	≦10mΩ	≦20mΩ
TCR (ppm/°C)	TCR is not applicable for Jumper product						
Max. dissipation @ T_{amb}=70°C	3 W	1.5 W	3/4 W	3/4 W	1/2 W	1/3 W	1/5 W
Max Rated Current	14 A	12 A	9 A	9 A	7 A	6 A	3 A
Max Overload Current	28 A	24 A	18 A	18 A	14 A	12 A	6 A
Operation temperature	- 55~+155°C						

Notes:
Max.rated (Rated Current) /Overload current (Peak Current) and resistance listed above, TCR is not applicable of Jumper products, and keep the surface temperature do not exceed 105°C when working.

DIMENSIONS (unit : mm)



Series	WF25A	WF20A	WF10A	WF12A	WF08A	WF06A	WF04A
L	6.40 ± 0.20	5.00 ± 0.20	3.10 ± 0.10	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	3.20 ± 0.25	2.50 ± 0.20	2.60 ± 0.10	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	1.10 ± 0.20	0.60 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.10	0.45 ± 0.10	0.35 ± 0.05
Tt	0.45 ± 0.25	0.65 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.20	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 ± 0.20	0.25 ± 0.10

CATALOGUE NUMBERS

The resistors have a catalogue number starting with.

WF06	A	510_	J	T	L
Size code WF25: 2512 WF20: 2010 WF10: 1210 WF12: 1206 WF08: 0805 WF06: 0603 WF04: 0402	**Type code** **A** : Triple Power 2512 = 3W 2010 = 1.5W 1210 = 3/4W 1206 = 3/4W 0805 = 1/2W 0603 = 1/3W 0402 = 1/5W	**Resistance code** 5% E24: 2 significant digits followed by No. of zeros & a blank e.g.: 3ohm =3R0_ 10ohm =100_ 56Kohm =563_ ("_" 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 Z : 7" Reeled taping (WF25A)	**Termination code** L = Sn base (lead free)

■ Reeled packaging

WF25A 12mm width pc emboss taping 3,000pcs per 7" reel

WF20A 12mm width pc emboss taping 4,000pcs per 7" reel

WF10A, WF12A, WF08A, WF06A 8mm width paper taping 5,000pcs per 7" reel

WF04A 8mm width paper taping 10,000pcs per 7" reel

MARKING

Size \ Nr. Of digit of code\tolerance	± 1%, ±5%
2512/2010/1210/1206/0805	± 1%: 4 digits marking; ± 5%: 3 digits marking
0603	3 digits marking
0402	No marking

Size \ Nr. Of digit of code\tolerance	Jumper (0Ω)
2512/2010	4 digits marking
1210/1206/0805/0603	3 digits marking
0402	No marking

3 digits marking （±5% 2512,2010,1210,1206,0805,0603）

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value.

3 digits marking（±1% 0603）

Nominal resistance	Description
1.E24 series	2 significant digits followed by No. of zeros .As *0603 WR06X* ±5% Example

RESISTANCE	4.7Ω	47Ω	470Ω	4K70	47K0	470K	4M70
3 digits marking	4R7	470	471	472	473	474	475

2.E96 series

The 1st two digit codes are referring to the CODE on the table, the 3rd code is the index of resistance value.
Repeat values between E24 and E96 series, whose marking are based on the E96 CODE table.

Code	Z	Y	X	A	B	C	D	E	F	G
Multiplier	10^{-3}	10^{-2}	10^{-1}	10^{0}	10^{1}	10^{2}	10^{3}	10^{4}	10^{5}	10^{6}

Example

RESISTANCE	1.78Ω	17.8Ω	178Ω	1K78	17K8	178K	1M78
3 digits marking	25Y	25X	25A	25B	25C	25D	25E

3. Remark: There is no marking for the items not under E24 and E96 series.

E96 CODE table:

CODE	R value	CODE	R-value	CODE	R-Value	CODE	R-value	CODE	R-value	CODE	R-value	CODE	R-value	CODE	R-value
01	**100**	13	**133**	25	**178**	37	**237**	49	**316**	61	**422**	73	**562**	85	**750**
02	**102**	14	**137**	26	**182**	38	**243**	50	**324**	62	**432**	74	**576**	86	**768**
03	**105**	15	**140**	27	**187**	39	**249**	51	**332**	63	**442**	75	**590**	87	**787**
04	**107**	16	**143**	28	**191**	40	**255**	52	**340**	64	**453**	76	**604**	88	**806**
05	**110**	17	**147**	29	**196**	41	**261**	53	**348**	65	**464**	77	**619**	89	**825**
06	**113**	18	**150**	30	**200**	42	**267**	54	**357**	66	**475**	78	**634**	90	**845**
07	**115**	19	**154**	31	**205**	43	**274**	55	**365**	67	**487**	79	**649**	91	**866**
08	**118**	20	**158**	32	**210**	44	**280**	56	**374**	68	**499**	80	**665**	92	**887**
09	**121**	21	**162**	33	**215**	45	**287**	57	**383**	69	**511**	81	**681**	93	**909**
10	**124**	22	**165**	34	**221**	46	**294**	58	**392**	70	**523**	82	**698**	94	**931**
11	**127**	23	**169**	35	**226**	47	**301**	59	**402**	71	**536**	83	**715**	95	**953**
12	**130**	24	**174**	36	**232**	48	**309**	60	**412**	72	**549**	84	**732**	96	**976**

4 digits marking（±1% 2512,2010,1210,1206,0805）

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. For values below 97Ω6 the R is used as a digit. For values of 100Ω or greater, the first 3 digits are significant, and the fourth digit indicates the number of multiple to follow.

Example

RESISTANCE	Jumper (0Ω)	4.7Ω	10Ω	12Ω	100Ω	6800Ω	47000Ω	470000Ω
3 digits marking ±5% 2512,2010,1210,1206,0805,0603 Jumper 1210,1206, 0805, 0603	000	4R7	100	120	101	682	473	474
4 digits marking ±1% 2512,1210,1206,0805 Jumper 2512,2010	0000	4R70	10R0	12R0	1000	6801	4702	4703

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E96&E24 series for resistors with a tolerance of ±1%,±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

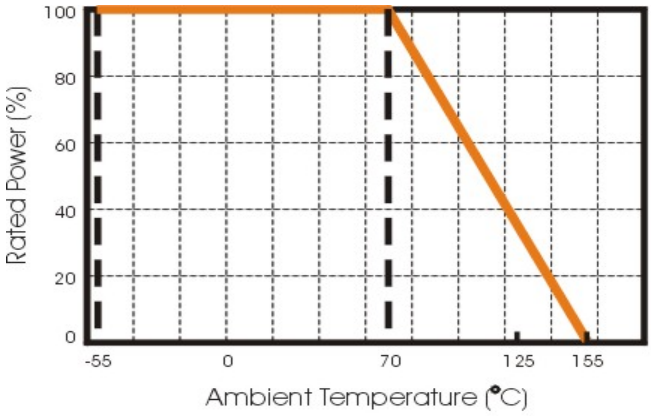


Fig.2 Maximum dissipation in percentage of rated power
As a function of the ambient temperature

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.

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 oxdization 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

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.

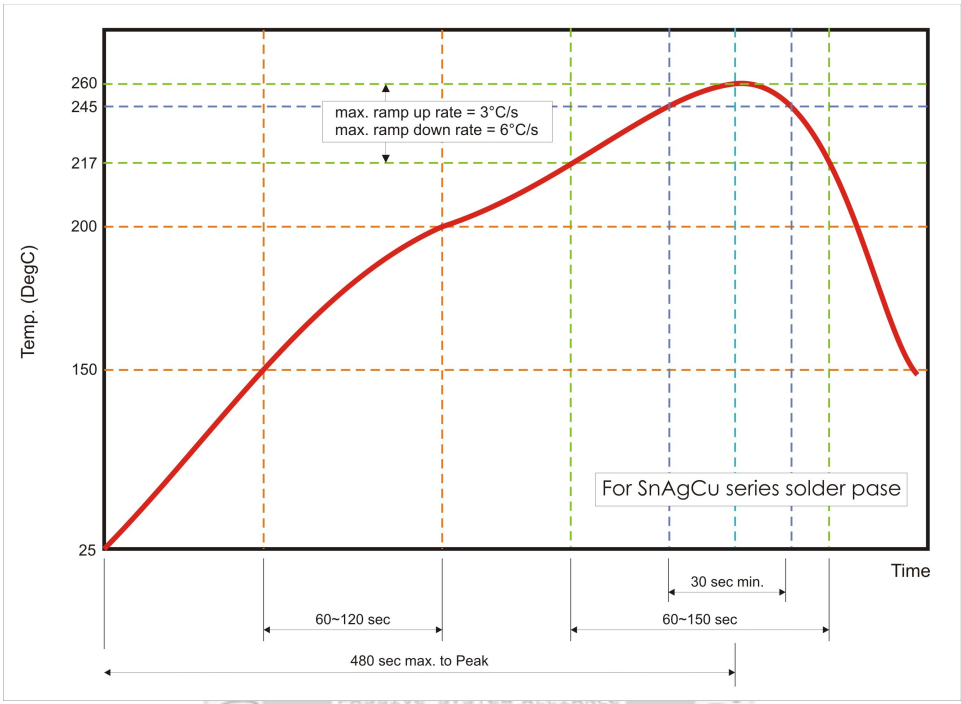
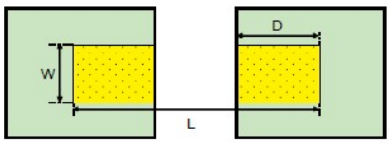


Fig 3. Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

RECOMMENDED SOLDERING PAD DIMENSIONS:

Series No.	W	D	L
WF25A	3.70	2.45	7.60
WF20A	3.00	1.50	6.80
WF10A	3.00	1.30	4.70
WF12A	1.80	1.30	4.70
WF08A	1.30	1.15	3.50
WF06A	0.90	1.00	3.00
WF04A	0.60	0.50	1.50

Unit: mm



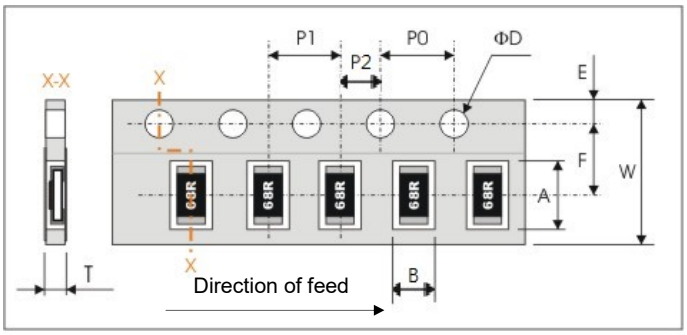
TEST AND REQUIREMENTS

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 : 25°C +1°C -1°C.	Refer to quick reference data for T.C.R specification
Clause 4.18 Resistance to soldering heat(R.S.H)	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260℃±5°C.	No visible damage J: ΔR/R max. :≦ ±(1%+0.05Ω) F: ΔR/R max. :≦ ±(0.5%+0.05Ω) 0402 Jumper : ≦ 20mΩ Others Jumper : ≦10mΩ
Clause 4.17 Solderability	Un-mounted chips completely immersed for 3±0.5 second in a SAC solder bath at 245℃±2℃.	Good tinning (>95% covered) No visible damage
Clause 4.33 Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 0402: 3 mm once for 10 seconds. Others: 2 mm, once for 10 seconds.	No visible damage J: ΔR/R max. ≦ ±(1%+0.05Ω) F: ΔR/R max. :≦±(0.5%+0.05Ω) 0402 Jumper : ≦ 20mΩ Others Jumper : ≦10mΩ
Clause 4.13 Short time overload	5 × Rated power for 5 sec. Measure resistance after 30 minutes.	J: ΔR/R max.:≦ ±(2%+0.05Ω) F: ΔR/R max. :≦±(1%+0.05Ω) 0402 Jumper : ≦ 20mΩ Others Jumper : ≦10mΩ
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 J: ΔR/R max. ≦ ±(3%+0.05Ω) F: ΔR/R max. :≦±(1%+0.05Ω 0402 Jumper : ≦ 20mΩ Others Jumper : ≦10mΩ
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, 1.5 hours on and 0.5 hours off.	No visible damage J: ΔR/R max. ≦ ±(3%+0.05Ω) F: ΔR/R max. :≦±(1%+0.05Ω) 0402 Jumper : ≦ 20mΩ Others Jumper : ≦10mΩ
Clause 4.19 Temperature cycling	1. 30 minutes at -55°C±3°C, 2. 2~3 minutes at 25°C+5°C-1°C, 3. 30 minutes at +155°±3°C, 4. 2~3 minutes at 25°C+5°C-1°C, Total 5 continuous cycles.	No visible damage J: ΔR/R max. ≦±(1%+0.05Ω) F: ΔR/R max. :≦±(0.5%+0.05Ω) 0402 Jumper : ≦ 20mΩ Others Jumper : ≦10mΩ
Clause 4.6 Insulation Resistance	Apply the insulation voltage 100+15Vdc for 1minute.	R≧1GΩ

PACKAGING

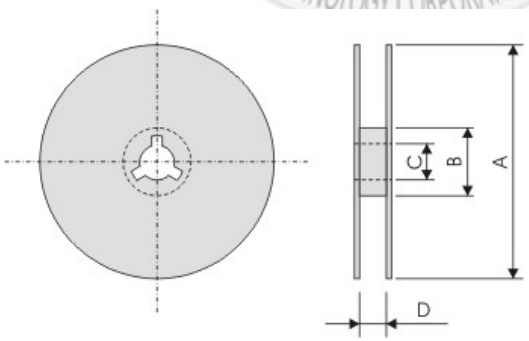
Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF25A	6.70±0.20	3.50±0.20	12.00±0.30	5.50±0.05	1.75±0.10
WF20A	5.50±0.20	2.80±0.20	12.00±0.30	5.50±0.05	1.75±0.10
WF10A	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.05	1.75±0.10
WF12A	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.05	1.75±0.10
WF08A	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.05	1.75±0.10
WF06A	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.05	1.75±0.10
WF04A	1.20±0.10	0.70±0.10	8.00±0.30	3.50±0.20	1.75±0.10

Series No.	P1	P0	P2	ΦD	T
WF25A	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.50
WF20A	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.00
WF10A	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.00
WF12A	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.00
WF08A	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.00
WF06A	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 0.80
WF04A	2.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.40±0.05

Reel dimensions



unit: mm

Symbol	A	B	C	D
7” 8mm tape	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0+1/-0
7” 12mm tape	Φ178.0±2.0	Φ60.0±1.0	13.0±0.5	13.8±1.5

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