

# APPROVAL SHEET

**WF06A, WF08A, WF12A, WF10A, WF20A, WF25A**

Jumper, 1 ~ 1Mohm,  $\pm 5\%$ ,  $\pm 1\%$

Thick Film Triple Power Chip Resistors

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

RoHS 2 Compliant with exemption 7C-1  
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-1 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.

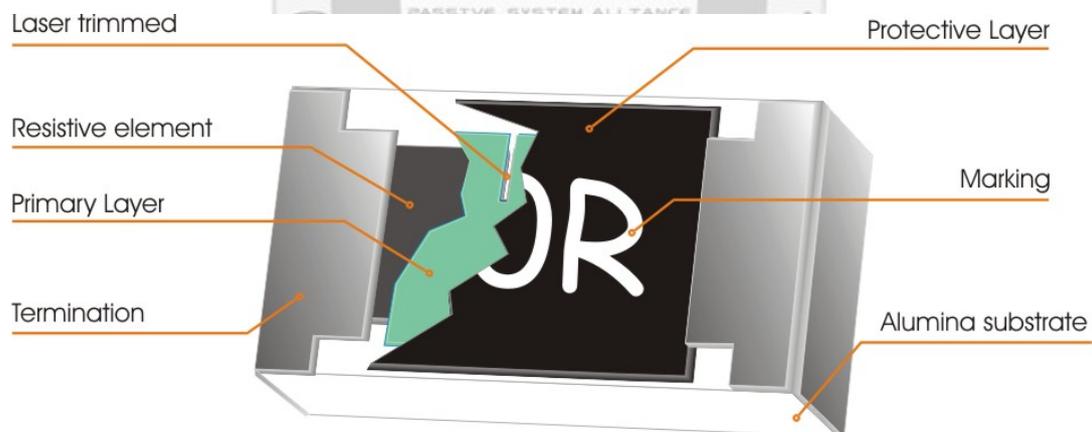


Fig 1. Construction of Chip-R

## QUICK REFERENCE DATA

Type	Size	Power Rating at 70°C	Max. RCWV	Max. Overload Voltage	Resistance Tolerance	Temperature Coefficient (ppm/°C)	Resistance Range		Standard Resistance Values
							Min.	Max.	
WF06A	0603	1/3W	75V	125V	±1%(F)	±100ppm	10Ω	1MΩ	E96/E24
					±1%(F)	±200ppm	1Ω	9.76Ω	E96/E24
					±5%(J)	±200ppm	1Ω	1MΩ	E24
WF08A	0805	1/2W	200V	300V	±1%(F)	±100ppm	10Ω	1MΩ	E96/E24
					±1%(F)	±150ppm	1Ω	9.76Ω	E96/E24
					±5%(J)	±200ppm	1Ω	1MΩ	E24
WF12A	1206	3/4W	250V	500V	±1%(F)	±100ppm	1Ω	1MΩ	E96/E24
					±5%(J)	±200ppm	1Ω	1MΩ	E24
WF10A	1210	3/4W	250V	500V	±1%(F)	±100ppm	1Ω	1MΩ	E96/E24
					±5%(J)	±200ppm	1Ω	1MΩ	E24
WF20A	2010	1.5W	250V	500V	±1%(F)	±100ppm	1Ω	1MΩ	E96/E24
					±5%(J)	±200ppm	1Ω	1MΩ	E24
WF25A	2512	3W	250V	500V	±1%(F)	±100ppm	1Ω	1MΩ	E96/E24
					±5%(J)	±200ppm	1Ω	1MΩ	E24

Application Note :  $RCWV = (P \times R)^{1/2}$  or Max. RCWV listed above, whichever is lower.

RCWV : Working Voltage (V) · P : Rated Power (W) · R : Resistance Value (Ω)

Solder-pad and trace size should be evaluated and board surface temperature should not exceed 105°C when applied full rated power.

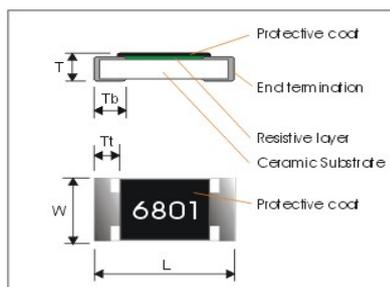
## High Current Power Jumpers:

Type	Size	Description	Max. Rated Current	Max. Overload Current	Resistance
WF06A	0603	Zero Ohm , Jumper	6 A	12 A	≤ 10mΩ
WF08A	0805	Zero Ohm , Jumper	7 A	14 A	≤ 10mΩ
WF12A	1206	Zero Ohm , Jumper	9 A	18 A	≤ 10mΩ
WF10A	1210	Zero Ohm , Jumper	9 A	18 A	≤ 10mΩ
WF20A	2010	Zero Ohm , Jumper	12 A	24 A	≤ 10mΩ
WF25A	2512	Zero Ohm , Jumper	14 A	28 A	≤ 10mΩ

Note :

Max. rated/overload 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)

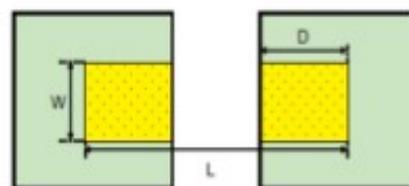


Type	WF06A	WF08A	WF12A	WF10A	WF20A	WF25A
L	1.60 ± 0.10	2.00 ± 0.10	3.10 ± 0.10	3.10 ± 0.10	5.00 ± 0.20	6.40 ± 0.20
W	0.80 ± 0.10	1.25 ± 0.10	1.60 ± 0.10	2.60 ± 0.10	2.50 ± 0.20	3.20 ± 0.25
Tt	0.30 ± 0.20	0.40 ± 0.20	0.50 ± 0.25	0.50 ± 0.25	0.65 ± 0.25	0.45 ± 0.25
Tb	0.30 ± 0.20	0.40 ± 0.20	0.50 ± 0.25	0.50 ± 0.25	0.60 ± 0.25	1.80 ± 0.25
T	0.45 ± 0.10	0.50 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.60 ± 0.10	1.10 ± 0.20

## RECOMMENDED SOLDERING PAD DIMENSIONS:

Type	W	D	L
WF06A	0.90	1.00	3.00
WF08A	1.30	1.15	3.50
WF12A	1.80	1.30	4.70
WF10A	3.00	1.30	4.70
WF20A	3.00	1.50	6.80
WF25A	3.70	2.45	7.60

Unit:mm



## MARKING

For E24 ±5%, 0603/0805/1206/1210/2010/2512 size, each resistor is marked with a three-digit code on the protective coating to designate the nominal resistance value.

For E24 & E96 ±1%, 0805/1206/1210/2010/2512 size, each resistor is marked with a four-digit code on the protective coating to designate the nominal resistance value.

Example:

For E24 ±5%  
0603/0805/1206/1210/2010/2512



$$301 \rightarrow 30 \times 10^1 = 300 \Omega$$

For E24 & E96 ±1%  
0805/1206/1210/2010/2512



$$1542 \rightarrow 154 \times 10^2 = 15.4 \text{ K}\Omega$$

For Jumper, 0603/0805/1206/1210 size defines "000", 2010/2512 size defines "0000"

For E24 & E96 ±1%, 0603 size, each resistor is marked with a three-digit code on the protective coating to designate the nominal resistance value.

Example:

E24 ±1% : 3 Digits marking to identify the resistance value

0603



$$222 \rightarrow 22 \times 10^2 = 2.2 \text{ K}\Omega$$

E96 ±1% : 3 Digits marking to identify the resistance value

0603



01B → Refer 0603 marking table = 1 KΩ

## Appendix

### 0603 1% Marking Table (Table 1)

Code	E48	E96									
01	100	100	25	178	178	49	316	316	73	562	562
02		102	26		182	50		324	74		576
03	105	105	27	187	187	51	332	332	75	590	590
04		107	28		191	52		340	76		604
05	110	110	29	196	196	53	348	348	77	619	619
06		113	30		200	54		357	78		634
07	115	115	31	205	205	55	365	365	79	649	649
08		118	32		210	56		374	80		665
09	121	121	33	215	215	57	383	383	81	681	681
10		124	34		221	58		392	82		698
11	127	127	35	226	226	59	402	402	83	715	715
12		130	36		232	60		412	84		732
13	133	133	37	237	237	61	422	422	85	750	750
14		137	38		243	62		432	86		768
15	140	140	39	249	249	63	442	442	87	787	787
16		143	40		255	64		453	88		806
17	147	147	41	261	261	65	464	464	89	825	825
18		150	42		267	66		475	90		845
19	154	154	43	274	274	67	487	487	91	866	866
20		158	44		280	68		499	92		887
21	162	162	45	287	287	69	511	511	93	909	909
22		165	46		294	70		523	94		931
23	169	169	47	301	301	71	536	536	95	953	953
24		174	48		309	72		549	96		976

Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>6</sup>	10 <sup>7</sup>	10 <sup>-1</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>

## 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

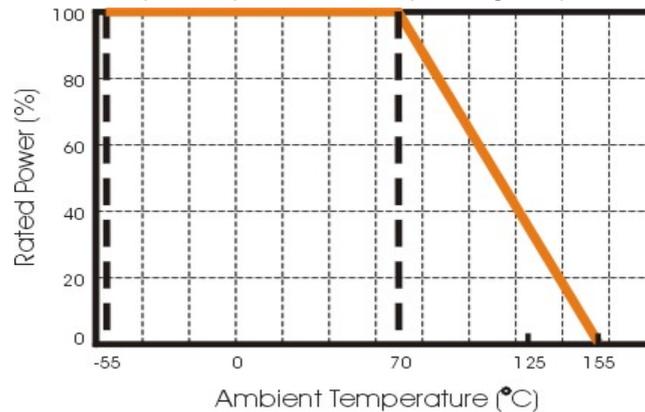


Fig.2 Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

## STORAGE TEMPERATURE

... Products are recommended to be used up within one year as ensured shelf life.

Check solder ability in case shelf life extension is needed.

... To store products with following condition:

Temperature: 5 to 40°C ; Humidity: 20 to 70% relative humidity.

## 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.

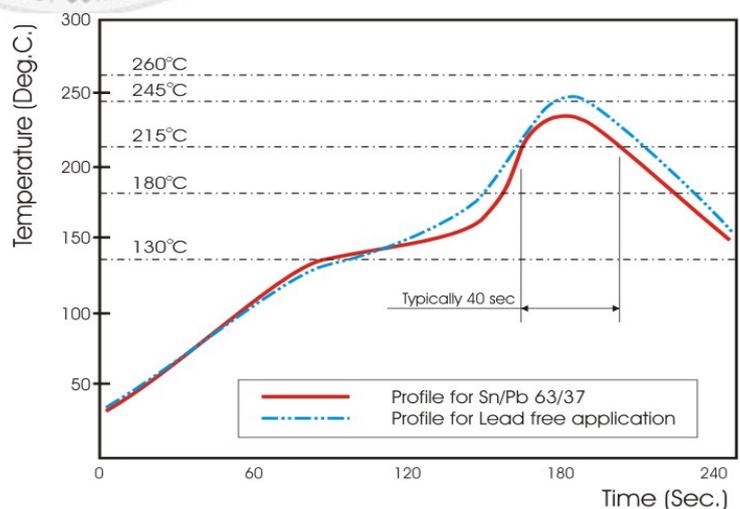


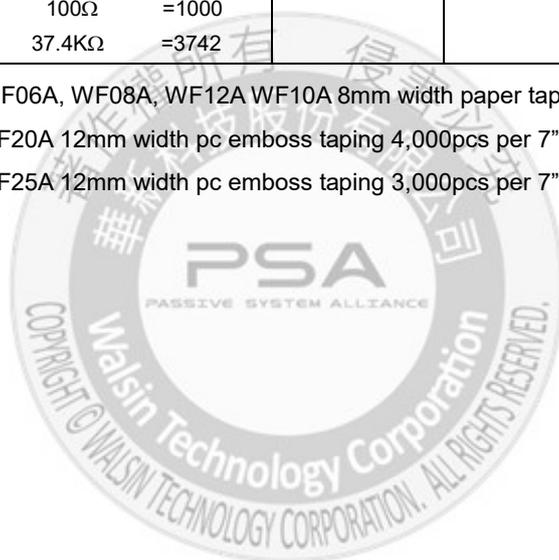
Fig 3. Infrared soldering profile for Chip Resistors

## CATALOGUE NUMBERS

The resistors have a catalogue number starting with.

WF06	A	510_	F	T	L
<b>Size code</b> WF06: 0603 WF08: 0805 WF12: 1206 WF10: 1210 WF20: 2010 WF25: 2512	<b>Type code</b> <b>A</b> : Triple Power 0603 = 1/3W 0805 = 1/2W 1206 = 3/4W 1210 = 3/4W 2010 = 1.5W 2512 = 3W	<b>Resistance code</b> 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	<b>Tolerance</b> J : ±5% F : ±1% P : Jumper	<b>Packaging code</b> T : 7" Reeled taping Z : 7" Reeled taping (WF25A)	<b>Termination code</b> L = Sn base (lead free)

- Reeled packaging : WF06A, WF08A, WF12A WF10A 8mm width paper taping 5,000pcs per 7" reel.
- WF20A 12mm width pc emboss taping 4,000pcs per 7" reel.
- WF25A 12mm width pc emboss taping 3,000pcs per 7" reel.



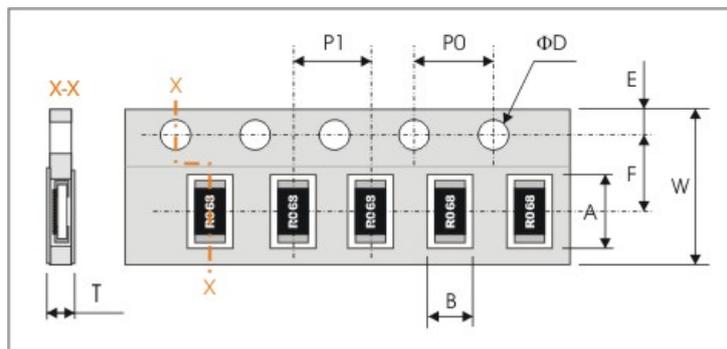
## TEST AND REQUIREMENTS

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> : 25°C+1°C-1°C.	Refer to quick reference data for T.C.R specification
<b>Clause 4.18</b> Resistance to soldering heat(R.S.H)	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C.	No visible damage J: ΔR/R max. : ≤ ±(1%+0.05Ω) F: ΔR/R max. : ≤ ±(0.5%+0.05Ω) Jumper : ≤ 10mΩ
<b>Clause 4.17</b> Solderability	Un-mounted chips completely immersed for 3±0.5 second in a SAC solder bath at 245°C±2°C.	Good tinning (>95% covered) No visible damage
<b>Clause 4.33</b> Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 2 mm, once for 10 seconds.	No visible damage J: ΔR/R max. : ≤ ±(1%+0.05Ω) F: ΔR/R max. : ≤ ±(0.5%+0.05Ω) Jumper : ≤ 10mΩ
<b>Clause 4.13</b> 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) Jumper : ≤ 10mΩ
<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 J: ΔR/R max. : ≤ ±(3%+0.05Ω) F: ΔR/R max. : ≤ ±(1%+0.05Ω) Jumper : ≤ 10mΩ
<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, 1.5 hours on and 0.5 hours off.	No visible damage J: ΔR/R max. : ≤ ±(3%+0.05Ω) F: ΔR/R max. : ≤ ±(1%+0.05Ω) Jumper : ≤ 10mΩ
<b>Clause 4.19</b> 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) Jumper : ≤ 10mΩ
<b>Clause 4.6</b> Insulation Resistance	Apply the insulation voltage 100+15Vdc for 1minute.	R ≥ 1GΩ

## PACKAGING

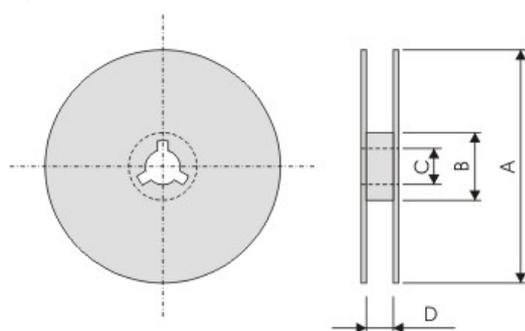
### Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF06A	1.90±0.20	1.10±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
WF12A	3.60±0.20	2.00±0.20	8.00±0.30	3.50±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
WF20A	5.50±0.20	2.80±0.20	12.00±0.30	5.50±0.05	1.75±0.10
WF25A	6.70±0.20	3.50±0.20	12.00±0.30	5.50±0.05	1.75±0.10

Series No.	P1	P0	ΦD	T
WF06A	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 0.80
WF08A	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.00
WF12A	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.00
WF10A	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.00
WF20A	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.00
WF25A	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.50

### 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