APPROVAL SHEET

WF12J, WF08J, WF06J

±0.5%, ±0.25%, ±0.1%

Thick Film High Precision Low TCR Chip Resistors

Size 1206, 0805, 0603

RoHS 2 Compliant with exemption7C-I

Halogen free

FEATURE

1. Small size and light weight
2. High precision down to 0.1%
3. Suitable for lead free soldering
4. Compatible with wave and reflow soldering
5. RoHS 2 Compliant with exemption 7C-I and Halogen free products

APPLICATION

- Power supply
- Digital meter, Consumer electronics, M/B
- Portable electronics devices

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.

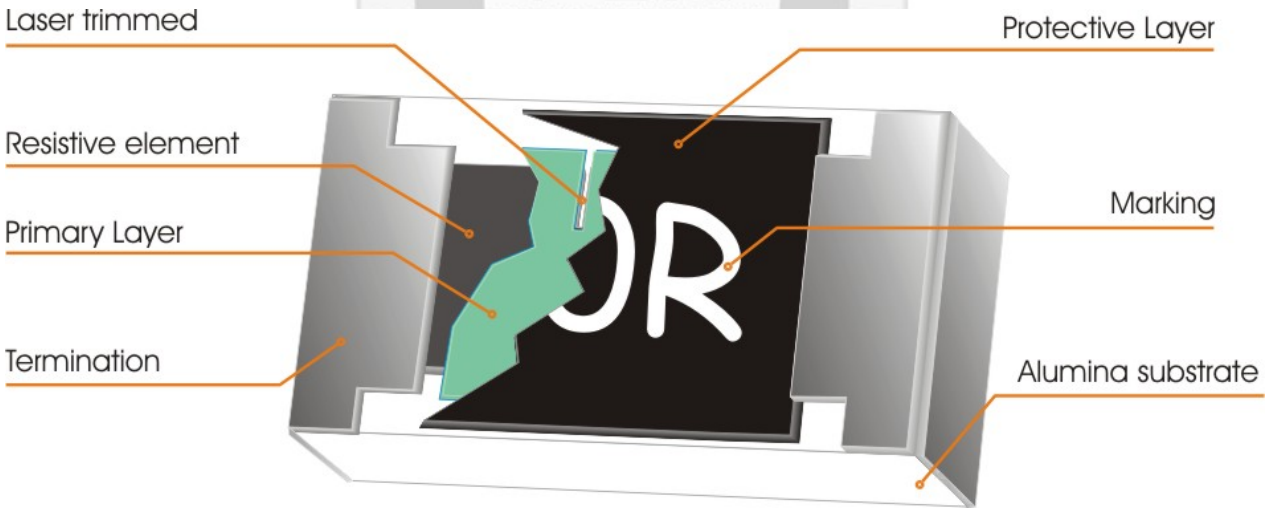


Fig 1. Construction of Chip-R

QUICK REFERENCE DATA

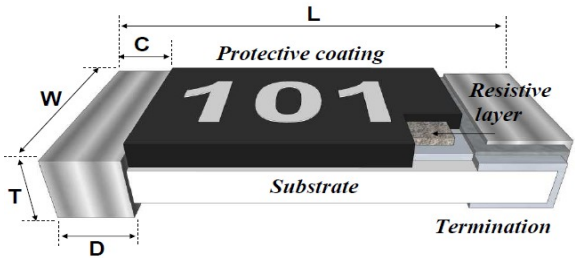
Item	General Specification		
Series No.	WF12J	WF08J	WF06J
Size code	1206 (3216)	0805 (2125)	0603 (1608)
Resistance Range	470Ω ~ 470KΩ (E96+E24 series)		
Resistance Tolerance	±0.5%, ±0.25%, ±0.1%		
*TCR (ppm/°C)	≤ ± 25 ppm/°C		
Max. dissipation at T_{amb}=70°C	1/4 W	1/8 W	1/10 W
Max. Operation Voltage (DC or RMS)	200V	150V	75V
Max. overload voltage (DC or RMS)	400V	300V	100V
Climatic category	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
   $RCWV = \sqrt{Rated\,Power \times Resistance\,Value}$ or Max. RCWV listed above, whichever is lower
3. Please consider the resistance variance may from soldering pad/trace/amount influence, and recommend keep the surface temperature do not exceed 105°C when operating
4. *TCR -55~+25°C is 50ppm

DIMENSIONS(unit : mm)

Series No.	WF12J	WF08J	WF06J
L	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10
W	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10
C	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.20
D	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.20
T	0.55 ± 0.10	0.50 ± 0.10	0.45 ± 0.10



CATALOGUE NUMBERS

The resistors have a catalogue number starting with :

WF06	J	3742	D	T	L
Size code WF12 : 1206 WF08 : 0805 WF06 : 0603	**Type code** J : High precision, Low TCR 25ppm	**Resistance code** E96+E24: 3 significant digits followed by no. of zeros 470Ω =4700 3.32KΩ =3321 37.4KΩ =3742 470KΩ =4703	**Tolerance** B : ±0.10% C : ±0.25% D : ±0.50%	**Packaging code** T : 7" Reeled taping 5Kpcs Q : 10" Reeled taping 10Kpcs G : 13" Reeled taping 20Kpcs	**Termination code** L = Sn base (lead free)

■ MARKING

- **3 digits marking for 0603 size**

Nominal resistance	Description
1.E24 series	2 significant digits followed by No. of zeros . 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 for 0805, 1206 size:**

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. The first 3 digits are significant, and the fourth digit indicates the number of multiple to follow.

Example

RESISTANCE	470Ω	6800Ω	47000Ω	470000Ω
4 digits marking	4700	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 ±0.5%, ±0.1%. The values of the E24/E96 series are in accordance with “IEC publication 60063”.

Derating

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

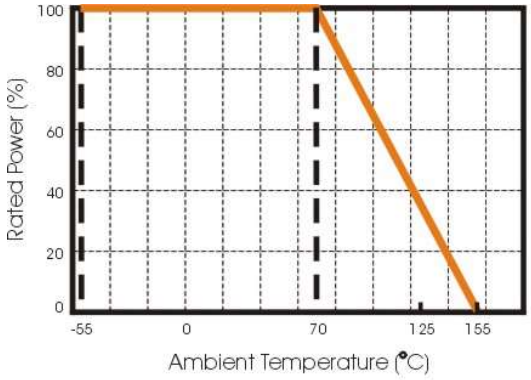


Figure 2. Maximum dissipation in percentage of rated power
As a function of the ambient temperature

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 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 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

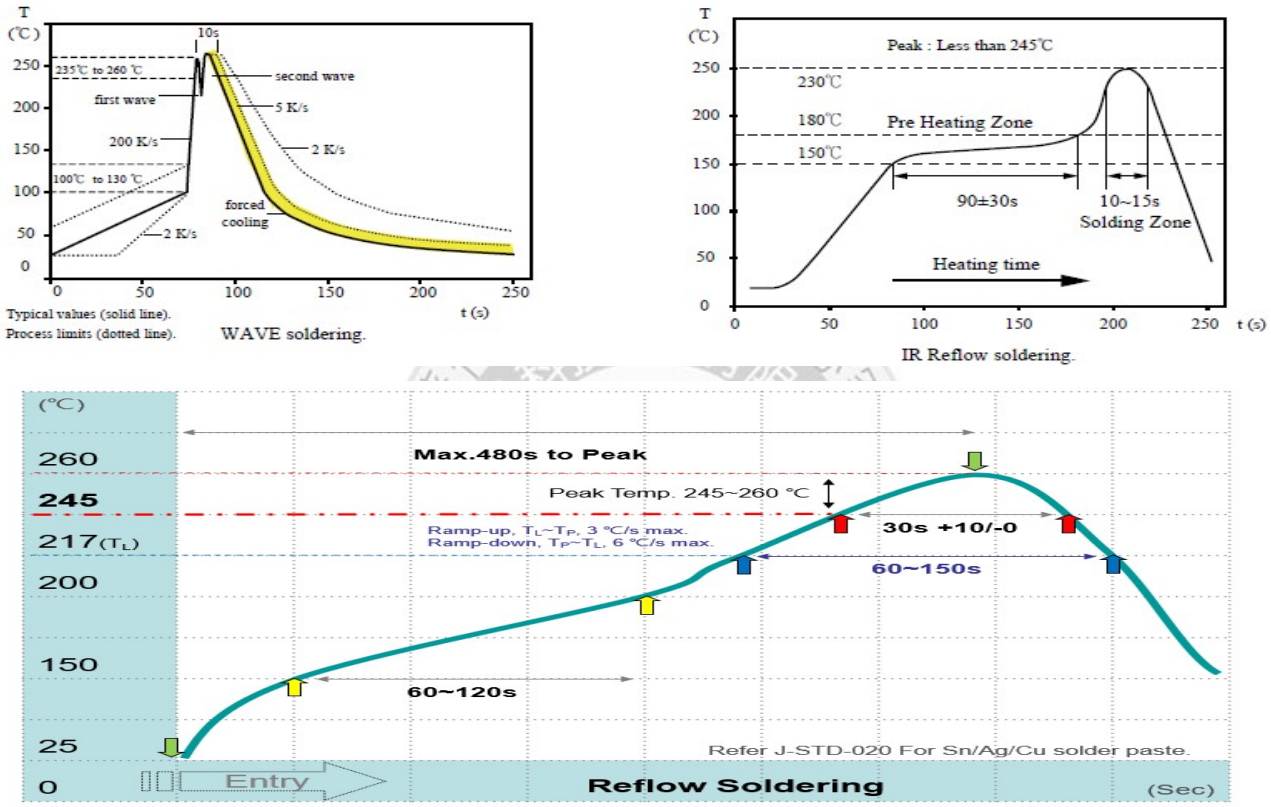
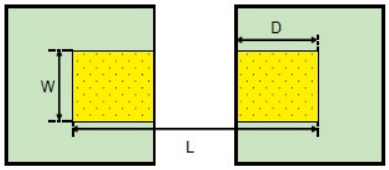


Fig 3. Recommended IR reflow soldering profile for
SMT process with SnAgCu series solder paste

Recommend Solder Pad Dimensions：

Product size	W	D	L
0603	0.90	1.00	3.00
0805	1.30	1.15	3.50
1206	1.80	1.30	4.70



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 : **L**ower **C**ategory **T**emperature, **U**pper **C**ategory **T**emperature; 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%.

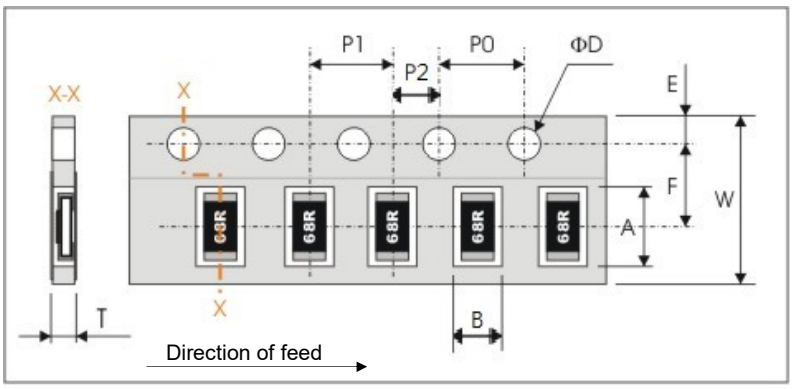
Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

All soldering tests are performed with midly activated flux.

TEST	PROCEDURE	REQUIREMENT
DC Resistance	IEC 60115-1 / JIS C 5201-1, Clause 4.5 Measure the resistance Value.	B: ±0.10%, C: ±0.25% D: ±0.50%
Insulation Resistance	IEC 60115-1, Clause 4.6 Test voltage：100±15V	Between termination and coating must over 1000MΩ
Temperature Coefficient of Resistance (TCR)	IEC 60115-1, 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 : 25°C~ t2 : -55°C (cold)/ +155°C (hot) R1 : Resistance at reference temperature R2 : Resistance at test temperature	Within the spec.
Short Time Overload (STOL)	IEC 60115-1, 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.	D: ΔR/R≦± (1.0%＋0.05Ω) B,C: ΔR/R≦± (0.5%＋0.05Ω)
Solder Ability	IEC 60115-1, Clause 4.17 After immersing flux, dip in the 235±2°C molten solder bath for 3±0.5 sec.	Over 95% of termination must be covered with solder.
Resistance to Solder Heat (RSH)	IEC 60115-1, Clause 4.18 Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C ±5°C	ΔR/R≦± (0.5%+0.05Ω)
Temperature Cycle	IEC 60115-1, Clause 4.19 Repeat 5 cycles as follows: -55°C (30min) → →25°C (2~3min)→155°C (30min)→25°C (2~3min)	ΔR/R≦± (0.5%+0.05Ω)
Load Life Humidity	IEC 60115-1, Clause 4.24 40±2°C with relative humidity 90% ~ 95%, DC rated voltage for 1.5 hours ON 0.5 hours OFF. Cycle repeated 1000 hours.	D: ΔR/R≦± (1.0%+0.05Ω) B,C: ΔR/R≦± (0.5%+0.05Ω)
Load Life	EC 60115-1, Clause 4.25 70±2°C, DC rated voltage for 1.5 hours ON 0.5 hours OFF. Cycle repeated 1000 hours.	D: ΔR/R≦± (1.0%+0.05Ω) B,C: ΔR/R≦± (0.5%+0.05Ω)
Board Flex (Bending)	IEC 60115-1, Clause 4.33 Resistance change after bended on the 90mm PCB. Bending 0603.0805 3mm, 1206 2mm.	ΔR/R≦± (0.5%+0.05Ω) No mechanical damage.
High Temperature Exposure	MIL-STD-202 method 108 1000+48/-0 hours; without load in 155°C.	ΔR/R≦± (1.0%+0.1Ω)

PACKAGING

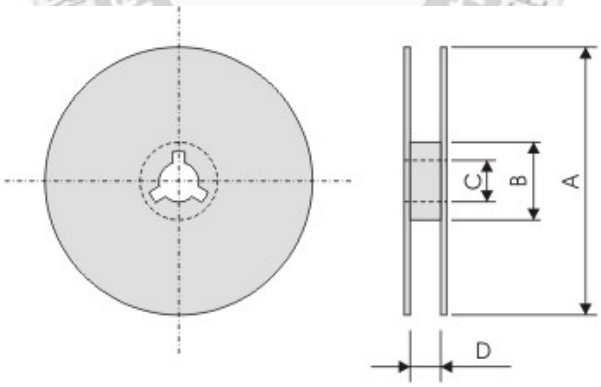
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF12J	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.2	1.75±0.10
WF08J	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.2	1.75±0.10
WF06J	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.2	1.75±0.10

Series No.	P1	P0	P2	ΦD	T
WF12J	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.80±0.1
WF08J	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.80±0.1
WF06J	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.65±0.1

Reel dimensions



Product size	Reel	Taping quantity	A	B	C	D
1206 0805 0603	7”	5K	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
	10”	10K	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5
	13”	20K	Φ330.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5