APPROVAL SHEET

WF10H, WF12H, WF08H, WF06H, WF04H

±0.5%, ±0.1%

Thick film high precision chip resistors

Size 1210, 1206, 0805, 0603, 0402

(Automotive)

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

FEATURE

1. Automotive grade AEC Q-200 compliant
2. 100% CCD inspection
3. RoHS compliant and Lead free products
4. High precision ±0.5%, ±0.1%

APPLICATION

- Automotive application
- Consumer electrical equipment
- EDP, Computer application
- Telecom application

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.

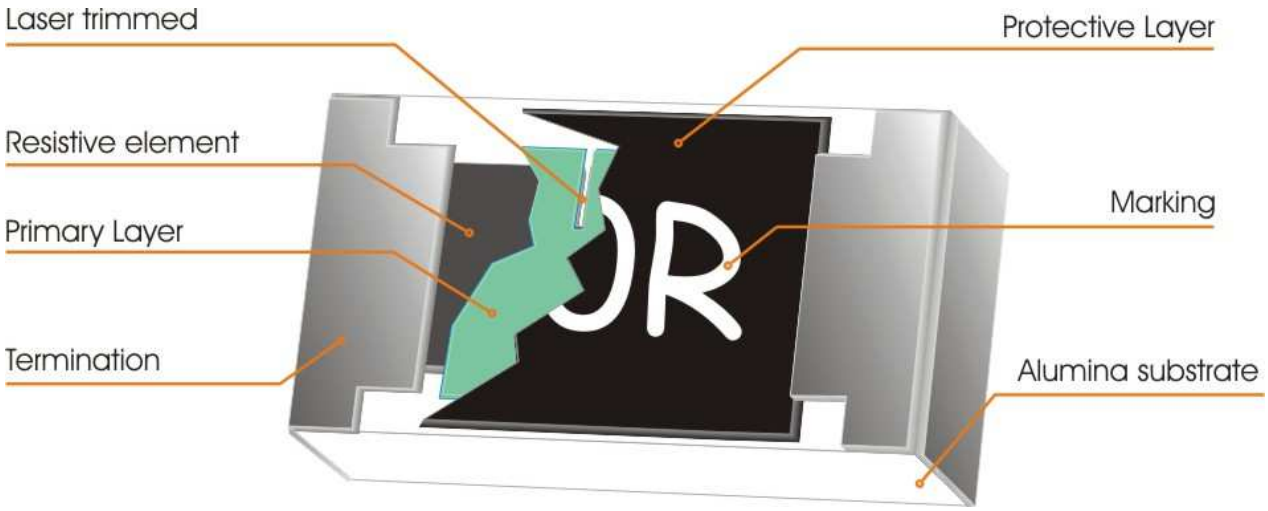


Fig 1. Construction of Chip-R

QUICK REFERENCE DATA

Item	General Specification				
Series No.	WF10H	WF12H	WF08H	WF06H	WF04H
Size code	1210 (3225)	1206 (3216)	0805 (2125)	0603 (1608)	0402 (1005)
Resistance Range	47Ω ~ 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	1/3 W	1/4W	1/8 W	1/10 W	1/16W
Max. Operation Voltage	200V	200V	150V	50V	50V
Max. overload voltage	400V	400V	300V	100V	100V
Climatic category	55/155/56				

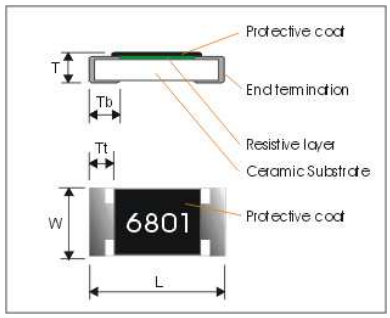
Note :

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. Non E96 series resistance upon requested.

DIMENSIONS(unit : mm)

Part No	WF10H	WF12H	WF08H	WF06H	WF04H
L	3.05 ± 0.10	3.05 ± 0.10	2.0 ± 0.10	1.60 ± 0.10	1.00±0.05
W	2.53 ± 0.10	1.53 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50±0.05
Tt	0.50 ± 0.2	0.50 ± 0.2	0.40 ± 0.20	0.30 ± 0.10	0.20±0.10
Tb	0.50 ± 0.2	0.45 ± 0.2	0.40 ± 0.20	0.30 ± 0.20	0.25±0.10
T	0.55 ± 0.15	0.65 ± 0.15	0.5 ± 0.15	0.45 ± 0.15	0.35±0.05



MARKING

- ***3-digits marking for 0603 size***

WFxxH has same marking rule as WRxx ±1%.

- ***4-digits marking for 1210, 1206, 0805 size***

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, the fourth digit indicates the number of multiple to follow.

Example

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

- ***No marking code for 0402 size***

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

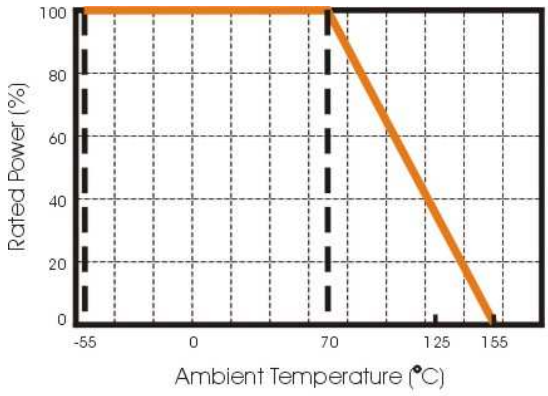


Figure 2. Maximum dissipation in percentage of rated power

As a function of the ambient temperature

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.

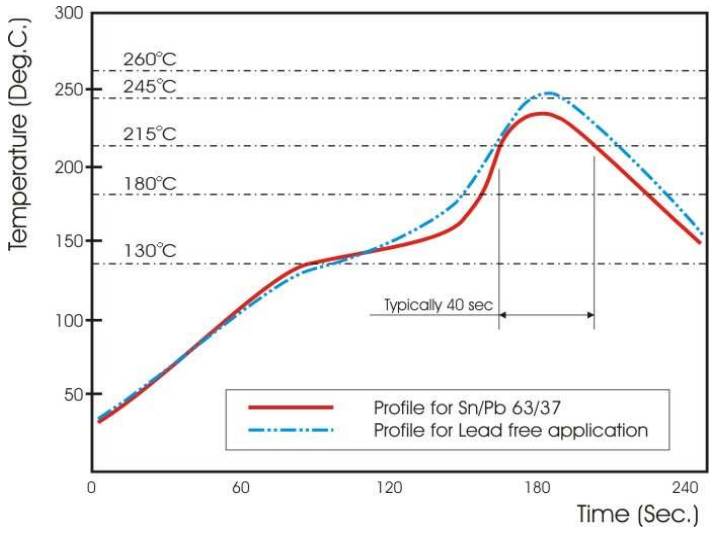


Fig 3. Infrared soldering profile for Chip Resistors

CATALOGUE NUMBERS

The resistors have a catalogue number starting with :

WF06	H	3742	D	T	L	J
Size code WF10 : 1210 WF12 : 1206 WF08 : 0805 WF06 : 0603 WF04 : 0402	**Type code** H : Thick film High precision, <1%,	**Resistance code** E96+E24: 3 significant digits followed by no. of zeros 102Ω =1020 37.4KΩ =3742 220Ω =2200	**Tolerance** D : ±0.5% B : ±0.1%	**Packaging code** T : 7” Reeled taping	**Termination code** L = Sn base (lead free)	**Special code** **J** = Automotive grade

- Reeled tape packaging : 8mm width paper taping 5000pcs per 7” reel for 1210/1206/0805/0603,
- 10000pcs per 7” reel for 0402.

TEST AND REQUIREMENTS

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).

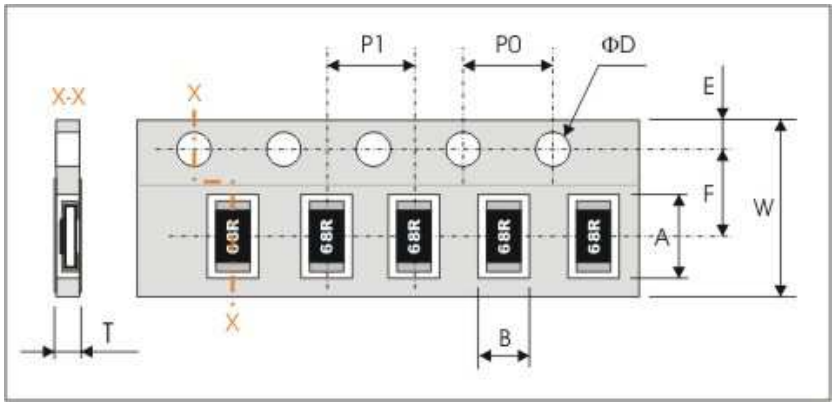
All soldering tests are performed with midly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT
		Resistor
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. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (ppm/°C) t_1 : 20℃+5℃-1℃ R_1 : Resistance at reference temperature R_2 : Resistance at test temperature	Within the specified tolerance Refer to "QUICK REFERENCE DATA"
Resistance to soldering heat(R.S.H) **MIL-STD-202 method 210**	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270℃±5°C	ΔR/R max. ±(1.0%+0.05Ω) no visible damage
Solderability **J-STD-002**	a) Bake the sample for 155℃ dwell time 4hrs/ solder dipping 235℃/ 5sec. b) Steam the sample dwell time 1 hour/ solder dipping 260℃/ 7sec.	95% coverage min., good tinning and no visible damage
Temperature cycling **JESD22** **Method JA-104**	1000 cycles, -55℃ ~ +155℃, dwell time 5~10min	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
Moisture Resistance **MIL-STD-202** **method 106**	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
Bias Humidity **MIL-STD-202** **method 103**	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(2.0%+0.10Ω) No visible damage
Operational Life **MIL-STD-202 method 108**	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(2.0%+0.1Ω) No visible damage

TEST	PROCEDURE / TEST METHOD	REQUIREMENT
		Resistor
High Temperature Exposure **MIL-STD-202 Method 108**	1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C	ΔR/R max. ±(2.0%+0.10Ω) No visible damage
Board Flex **AEC-Q200-005**	Resistors mounted on a 90mm glass epoxy resin PCB(FR4),bending once 2mm for 10sec.	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
Terminal strength **AEC-Q200-006**	Pressurizing force: 1Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations
Thermal shock **MIL-STD-202 method 107**	Test –55 to 155℃/ dwell time 15min/ Max transfer time 20sec 300cycles	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
ESD **AEC-Q200-002**	Test contact 1.0KV (0.5KV for 0402 only)	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
Short Time Overload **JISC5201-1: 1998 Clause 4.13**	2.5 times RCWV or max. overload voltage, for 5seconds	ΔR/R max. ±(2.0%+0.10Ω) No visible damage
Load life in Humidity **JISC5201-1: 1998 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. ±(2%+0.10Ω) No visible damage
Load life (endurance) **JISC5201-1: 1998 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. ±(2%+0.10Ω) No visible damage

PACKAGING

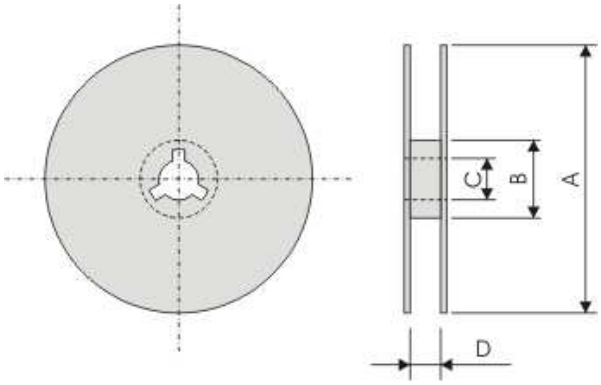
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF10H	3.60±0.20	2.90±0.20	8.00±0.30	3.50±0.2	1.75±0.10
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±0.05	1.75±0.10

Series No.	P1	P0	ΦD	T
WF10H/ WF12H	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	0.65±0.1
WF08H	4.00±0.10	4.00±0.10		0.65±0.1
WF06H	4.00±0.10	4.00±0.10		0.65±0.1
WF04H	2.00±0.10	4.00±0.10		0.40±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

Taping quantity

- Chip resistors 5,000 pcs/reel for WF10H, WF12H, WF08H, WF06H.
- Chip resistors 10,000 pcs/reel for WF04H.