

APPROVAL SHEET

WR12W / WR08W / WR06W / WR04W

$\pm 1\%$ ($1\Omega \sim 9.76\Omega$, $1.02M\Omega \sim 10M\Omega$)

General purpose chip resistors

Size 1206 / 0805 / 0603 / 0402

Customer : _____

Approval No : _____

Issue Date : _____

Customer Approval :



FEATURE

1. High reliability and stability
2. Reduced size of final equipment
3. Lower assembly costs
4. Higher component and equipment reliability
5. Lead (Pb) free product upon customer requested.

APPLICATION

- Consumer electrical equipment
- Automotive application
- 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 within tolerance by laser cutting 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 Lead-tin or Tin (lead free) solder alloy.

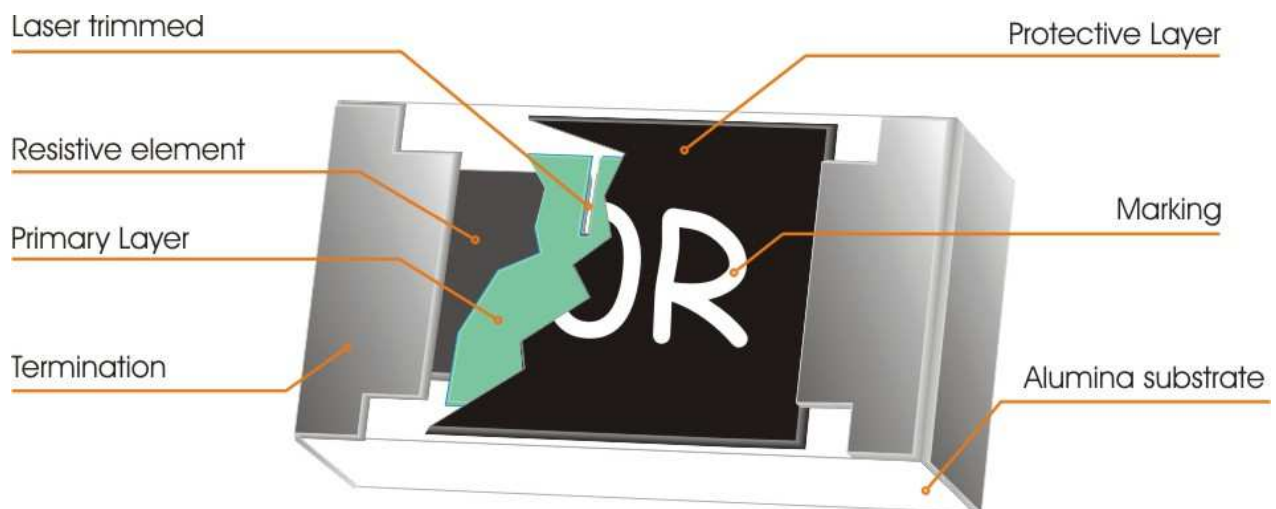


Fig 1. Construction of a Chip-R

**QUICK REFERENCE DATA**

Item	General Specification			
Series No.	WR12W	WR08W	WR06W	WR04W
Size code	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±1% (E96 series)			
Resistance Range	1Ω ~ 9.76Ω, 1.02MΩ ~ 10MΩ			
TCR (ppm/°C) ≥10Ω <10Ω or >1MΩ	≤ ± 100 ppm/°C -300~+500 ppm/°C			
Max. dissipation at T _{amb} =70°C	1/4 W	1/8 W	1/10 W	1/16 W
Max. Operation Voltage (DC or RMS)	200V	150V	50V	50V
Max. Overload Voltage (DC or RMS)	400V	300V	100V	100V
Climatic category	55/155/56			

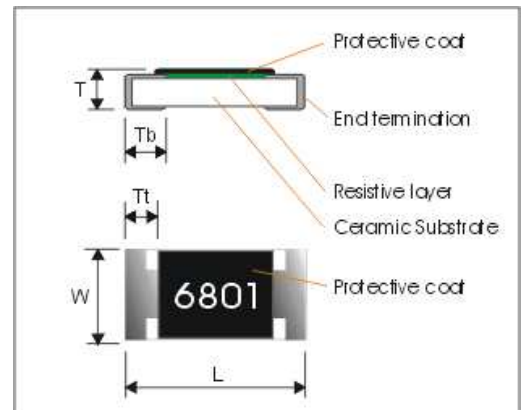
Note :

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

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$
or Max. RCWV listed above, whichever is lower.
3. Lead free terminations upon customer requested.

Dimensions (unit : mm)

	WR12W	WR08W	WR06W	WR04W
L	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.60 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.20 ± 0.10
Tb	0.45 ± 0.20	0.40 ± 0.20	0.30 ± 0.20	0.25 ± 0.10
Tt	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	0.35 ± 0.05



MARKING

3-digits marking ($\pm 5\%$: 1206 & 0805 & 0603)

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value. For values up to 9.1 the R is used as a decimal point. For values of 10.0 or greater the first 2 digits apply to the resistance value and third indicate the number of zeros to follow.

4-digits marking ($\pm 1\%$: 1206/0805)

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. For values of $<97.6\Omega$ the R is used as a decimal point. For values of 100Ω or greater the first 3 digits are significant, the fourth indicates the number of zeros to follow.

Example

RESISTANCE	10 Ω	12 Ω	100 Ω	6800 Ω	47000 Ω
3-digits marking	100	12R	101	682	473
4-digits marking	10R0	12R0	100R	6801	4702

No marking for 0402 size.

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E96 series for resistors with a tolerance of $\pm 1\%$. The values of the 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

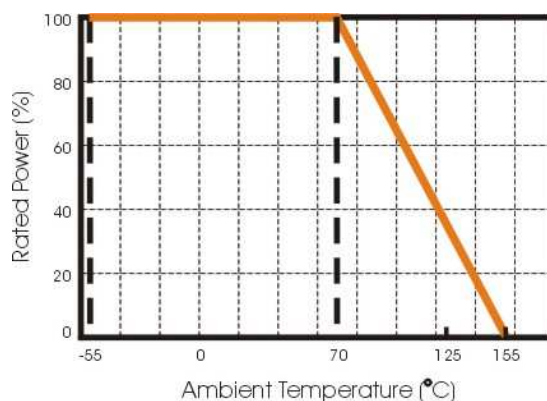


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature

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.

The end terminations guarantee a reliable contact.



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 245°C during 3 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.

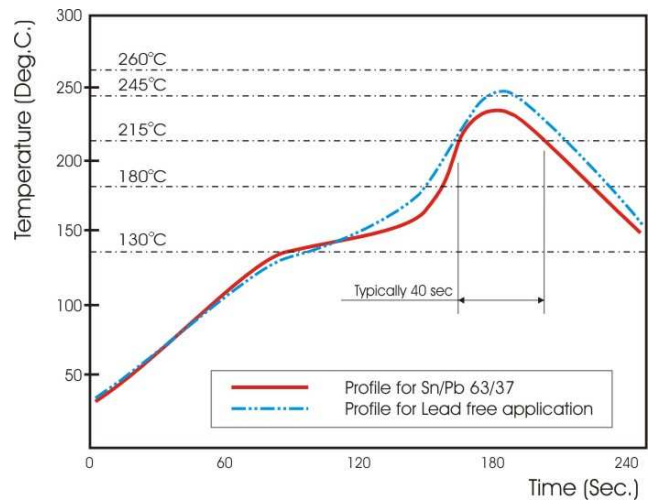


Fig 3. Infrared soldering profile for Chip Resistors

CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

WR12	W	2R15	F	T	L
Size code	Type code	Resistance code	Tolerance	Packaging code	Termination code
WR12 : 1206 WR08 : 0805 WR06 : 0603 WR04 : 0402	W : F tolerance of 1Ω~9.76Ω, 1.02MΩ~10M Ω	E96 : 3 significant digits followed by no. of zeros 2.15Ω =2R15 5.11MΩ =5114	F : ±1%	T : 7" Reeled taping Q : 10" Reeled taping G : 13" Reeled taping B : Bulk	L = Sn base (lead free)

PACKING QUANTITY

Reel size \ Series	WR12W	WR08W	WR06W	WR04W
7" reeled		5,000 pcs		10,000 pcs
10" reeled		10,000 pcs		N/a
13" reeled		20,000 pcs		N/a
Bulk by polybag		5,000 pcs		10,000 pcs

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).

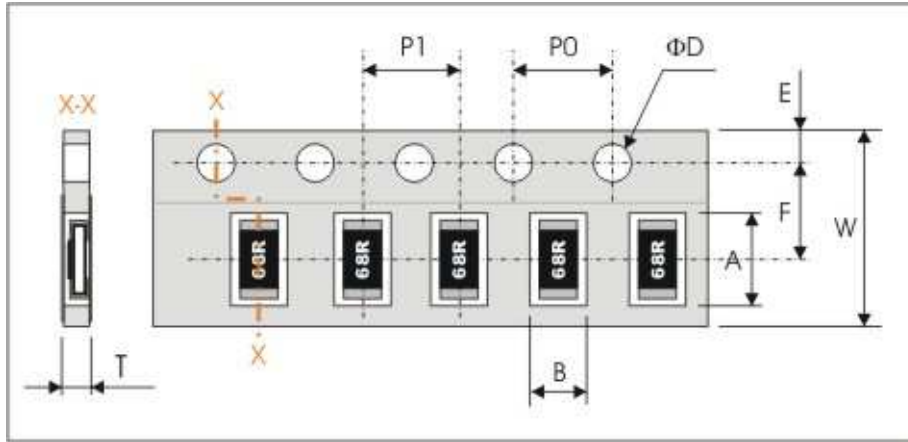
All soldering tests are performed with mildly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT
DC resistance Clause 4.5	JIS C 5202 5.1 / IEC 60115-1 4.5 DC resistance values measured at the test voltages specified below : <10Ω@0.1V,<100Ω@0.3V,<1KΩ@1.0V,<10KΩ@3V,<100KΩ@10V, <1MΩ@25V, <10MΩ@30V	Within the specified tolerance
Temperature Coefficient of Resistance(T.C.R) Clause 4.8	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ $t_1 : 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$ R_1 : Resistance at reference temperature R_2 : Resistance at test temperature	Refer to "QUICK REFERENCE DATA"
Short time overload (S.T.O.L) Clause 4.13	Permanent resistance change after a 5sec application of a voltage 2.5xU _R or max. overload voltage, whichever is less.	ΔR/R max. ±(2%+0.10Ω)
Resistance to soldering heat(R.S.H) IEC 60068-2-58:2004	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 255°C±5°C	Δ R/R max. ±(1%+0.05Ω) no visible damage
Solderability IEC 60068-2-58:2004	Un-mounted chips completely immersed for 3±0.3 second in a SAC solder bath at 245°C±5°C	95% coverage min., good tinning and no visible damage
Temperature cycling Clause 4.19	30 minutes at -55°C±3°C, 2~3 minutes at 20°C+5°C-1°C, 30 minutes at +155°C±3°C, 2~3 minutes at 20°C+5°C-1°C, total 5 continuous cycles	ΔR/R max. ±(1%+0.05Ω)
Damp heat (Humidity loaded in steady state) Clause 4.24	1000 +48/-0 hours, loaded with RCWV or V _{max} in humidity chamber controller at 40°C±2°C and 90~95% relative humidity, 1.5hours on and 0.5 hours off	10Ω≤R : ΔR/R max. ±(3%+0.10Ω) R<10Ω, R≥1MΩ : ΔR/R max. ±(5%+0.10Ω)
Load Life (Endurance) Clause 4.25	1000+48/-0 hours; loaded with RCWV or V _{max} in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off	Ditto
Bending strength Clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once for 10sec : 3mm (only 0402: 5mm)	No visual damaged, ΔR/R max. ±(1%+0.05Ω)
Adhesion Clause 4.32	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations
Insulation Resistance JISC5201-1:1998 Clause 4.6	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10GΩ
Dielectric Withstand Voltage JISC5201-1:1998 Clause 4.7	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover



PACKAGING

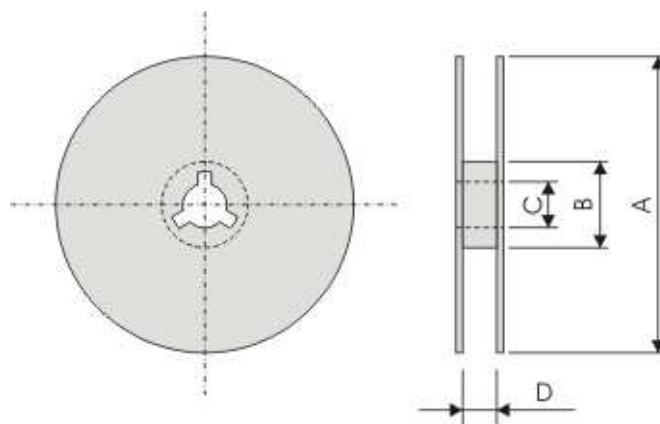
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WR12W	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
WR08W	2.40±0.20	1.65±0.20			
WR06W	1.90±0.20	1.10±0.20		3.50±0.05	
WR04W	1.20±0.10	0.70±0.10			

Series No.	P1	P0	ΦD	T
WR12W / WR08W	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.0
WR06W				0.65±0.05
WR04W	2.00±0.10			0.40±0.05

7" Reel dimensions



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	10.0±1.5