

APPROVAL SHEET

WR12, WR08, WR06, WR04

±1%, ±5%

Thick Film General Purpose Chip Resistors Size 1206, 0805, 0603, 0402

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



FEATURE

- 1. High reliability and stability
- 2. Reduced size of final equipment
- 3. Lower assembly costs
- 4. Higher component and equipment reliability
- 5. RoHS compliant and Lead free products

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 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 Tin (lead free) alloy.

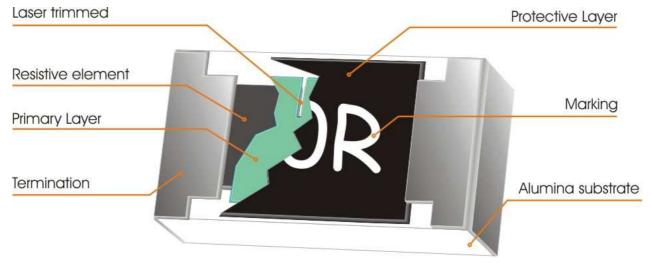


Fig 1. Construction of Chip-R



QUICK REFERENCE DATA

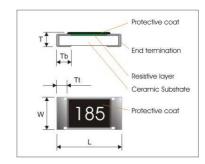
Item		General Specification							
Series No.	WF	R12	WF	WR08		WR06		WR04	
Size code	1206(3216)	0805(2012)	0603(1608)	0402	(1005)	
Resistance Range			1Ω~	10MΩ (±5%	tolerance), J	umper			
			1	IΩ~10MΩ (±	:1% tolerance	∍),			
Resistance Tolerance	±1%	±5%	±1%	±5%	±1%	±5%	±1%	±5%	
	E96/E24	E24	E96/E24	E24	E96/E24	E24	E96/E24	E24	
TCR (ppm/°C)									
10MΩ ≥R > 10Ω				≤ ±	100				
R≤10Ω				-200	~+400				
Max. dissipation @ T _{amb} =70°C	1/4	W	1/8	s W	1/10) W	1/1	6 W	
Max. Operation Voltage (DC or RMS)	200V 150V 75V 50V					0V			
Max. Overload Voltage (DC or RMS)	400V 300V 150V 100V					00V			
Climatic category		·	·	55/1	55/56	·	·		

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 $RCWV = \sqrt{RatedPower \times Resistance Value} \text{ or Max. RCWV listed above, whichever is lower.}$
- 3. The resistance of Jumper is defined $<0.05\Omega$.

DIMENSIONS (unit: mm)

	WR12	WR08	WR06	WR04
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
Т	0.60 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tb	0.45 ± 0.20	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10
Tt	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10





MARKING

Size \ Nr. Of digit of code\tolerance	±5%	±1%	
1206 (3216)	3-digits marking	4-digits marking	
0805 (2012)	3-digits marking	4-digits marking	
0603 (1608)	3-digits marking	3-digits marking	
0402(1005)	N0 MARKING		

3-digits marking (±5%: 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 (\pm 1%:0603)

Nomina	l resistan	се			Description										
1.E-24 s	series			As <i>0603</i>	0603 WR06X ±5%.										
2.E-96 s	series			The 1st t	wo digit o	codes ar	e referrin	g to the	CODE or	the tab	le, the 3rd	d code is	s the inde	x of resi	stance
				Y=10 ⁻² ,	X=10 ⁻¹ ,	A=10 ⁰ ,	B=10 ¹ ,	C=10 ² ,	D=10 ³ ,	E=10 ⁴ ,	F=10 ⁵				
						EX:	17.8 Ω=	25X,17	'8Ω=25A	,1K78	=25B				
							17K8=2	25C · 17	'8K=25D	, 1M78	=25E				
3. Rema	ark			There is	no marki	ng for th	e items a	re not u	nder E-24	and E-	96 series				
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	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%: 1206/0805)

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

Example

RESISTANCE	10Ω	12Ω	100Ω	6800Ω	47000Ω
3-digits marking(1206 & 0805 & 0603 ±5%)	100	120	101	682	473
4-digits marking	10R0	12R0	1000	6801	4702



FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of $\pm 5\%$, and E96 series for resistors with a tolerance of $\pm 1\%$. 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

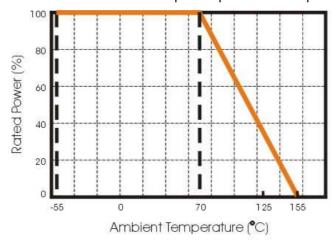


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature for WR12, WR08, WR06, WR04

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 one year 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.

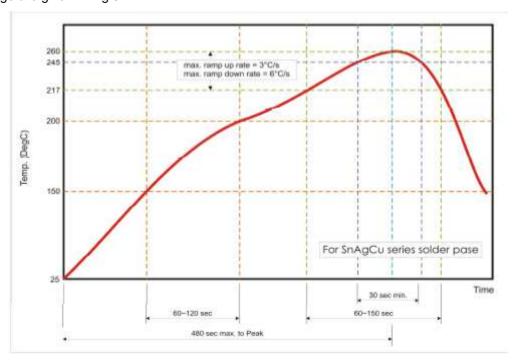


Fig 3. Infrared soldering profile for Chip Resistors

CATALOGUE NUMBERS

The resistors have a catalogue number starting with

WR12	X	472_	J	Т	L
Size code	Type code	Resistance code	Tolerance	Packaging code	Termination code
WR12: 1206 WR08: 0805 WR06: 0603 WR04: 0402	X: Jumper $\pm 5\%$, $1\Omega \sim 10 M\Omega$ $\pm 1\%$, $10\Omega \sim 1 M\Omega$ W: $\pm 1\%$, < 10Ω ; >1 MΩ	\pm 5%, E24: 2 significant digits followed by no. of zeros and a blank 4.7Ω =4R7_ 10Ω =100_ 220Ω =221_ Jumper =000_ ("_" means a blank) \pm 1%, E24+E96: 3 significant digits followed by no. of zeros 102Ω =1020 $37.4K\Omega$ =3742	F:±1% J:±5% P:Jumper	T: 7" Reeled taping Q: 10" Reeled taping G: 13" Reeled taping H: 13" reel 50Kpcs only for 0402 B: Bulk D: 7" reel 20Kpcs only for 0402 A: 7" reel 15Kpcs only for 0402	L= Sn base (lead free)

WR12, WR08, WR06:

1. Reeled tape packaging: 8mm width paper taping 5000pcs per 7" reel, 10kpcs per 10" reel, 20kpcs per 13" reel.

2. Bulk packaging : 5000pcs per poly-bag



WR04:

1. Reeled tape packaging: 8mm width paper taping 10,000pcs per 7" reel, 20,000pcs per 10" reel. 70,000pcs per 13" reel.

2. Bulk packaging : 10,000pcs per poly-bag



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: 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 midly activated flux.

TECT	DDOCEDURE / TEST METUS	REQUIREMENT	
TEST	PROCEDURE / TEST METHOD	Resistor	0Ω
Electrical Characteristics	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R)	Within the specified tolerance Refer to "QUICK REFERENCE	
	Natural resistance change per change in degree centigrade.	DATA"	
JISC5201-1: 1998 Clause 4.8	$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)} t_1 : 20\text{°C} + 5\text{°C} - 1\text{°C}; t_2 : -55\text{°C or } + 155\text{°C}$		<50mΩ
	R₁: Resistance at reference temperature (20℃+5℃/-1 ℃)		
	R_2 : Resistance at test temperature (-55°C or +155°C)		
Resistance to soldering heat(R.S.H) JISC5201-1:1998 Clause 4.18	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260 $^{\circ}\text{C}$ ±5 $^{\circ}\text{C}$	$\pm 5\%:\Delta R/Rmax.\pm(1\%+0.05\Omega)$ $\pm 1\%:\Delta R/Rmax.\pm(0.5\%+0.05\Omega)$ no visible damage	<50mΩ
Solderability	Un-mounted chips completely immersed for 2±0.5 second in a SAC	95% coverage min., good tinnin	g and no
JISC5201-1: 1998	solder bath at 235℃ ±5℃	visible damage	9
Clause 4.17		9	
Temperature cycling	30 minutes at -55°C±3°C, 2~3 minutes at 20°C+5°C-1°C, 30 minutes at	\pm 5%: Δ R/R max. \pm (1%+0.05 Ω)	
JISC5201-1: 1998	+155°C±3°C, 2~3 minutes at 20℃+5℃-1℃, total 5 continuous cycles	±1%:ΔR/Rmax.±(0.5%+0.05Ω)	<50m Ω
Clause 4.19		No visible damage	
High Temperature	1000+48/-0 hours; without load in a temperature chamber	±5%:ΔR/Rmax.±(2%+0.1Ω)	
Exposure	controlled 155±3°C	±1%:ΔR/Rmax.±(1%+0.1Ω)	<50mΩ
MIL-STD-202		No visible damage	<5011122
method 108			
Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending	±5%:ΔR/Rmax.±(1%+0.05Ω)	
JISC5201-1: 1998	once 3mm for 10sec, 5mm for WR04	±1%:ΔR/Rmax.±(1%+0.05Ω)	$<$ 50m Ω
Clause 4.33		No visual damaged	
Adhesion	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or remo	val of the
JISC5201-1: 1998		terminations	
Clause 4.32			T
Short Time Overload	2.5 times RCWV or max. overload voltage, for 5seconds	\pm 5%: ΔR/R max. \pm (2%+0.05Ω)	
(STOL)		\pm 1%: ΔR/R max. \pm (1%+0.05Ω)	<50mΩ
JISC5201-1: 1998		No visible damage	30011122
Clause 4.13			



TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
IESI	PROCEDURE/ 1E31 METHOD	Resistor	0Ω
Load life in Humidity	1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber	\pm 5%: Δ R/R max. \pm (2%+0.1 Ω)	
JISC5201-1: 1998	controller at 40°C±2°C and 90~95% relative humidity, 1.5hours on and 0.5 hours off	\pm 1%: Δ R/R max. \pm (1%+0.1 Ω)	$<$ 50m Ω
Clause 4.24	olo flodio di	No visible damage	
Load life (endurance)	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller	\pm 5%: Δ R/R max. \pm (3%+0.1 Ω)	
JISC5201-1: 1998	70±2°C, 1.5 hours on and 0.5 hours off	\pm 1%: Δ R/R max. \pm (1%+0.1 Ω)	$<$ 50m Ω
Clause 4.25		No visible damage	
Insulation Resistance	Apply the maximum overload voltage (DC) for 1minute	R≧10GΩ	
JISC5201-1: 1998 Clause 4.6			
Dielectric Withstand	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover	
Voltage	, , , , , , , , , , , , , , , , , , ,		
JISC5201-1: 1998			
Clause 4.7			

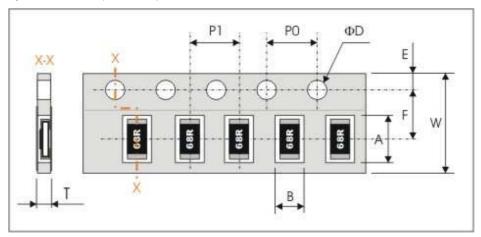
TEST CONDITION FOR JUMPER (0 Ω)

Item	WR12	WR08	WR06	WR04		
Power Rating At 70°C	1/4W	1/8W	1/10W	1/16W		
Resistance	MAX.50m $Ω$					
Rated Current	2A	1.5A	1A	1A		
Peak Current	5A	3.5A	ЗА	2A		
Operating Temperature	-55 ~ +155°C					



PACKAGING

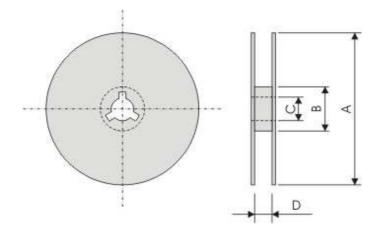
Paper Tape specifications (unit :mm)



Series No.	Α	В	W	F	E
WR12	3.60±0.20	2.00±0.20			
WR08	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.20	1.75±0.10
WR06	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.20	1.73±0.10
WR04	1.20±0.10	0.70±0.10			

Series No.	P1	P0	ΦD	Т
WR12 / WR08	4.00±0.10			Max. 1.0
WR06	4.00±0.10	4.00±0.10	Φ 1.50 $^{+0.1}_{-0.0}$	0.65±0.05
WR04	2.00±0.10			0.40±0.05

7" Reel dimensions



Symbol	Α	В	С	D
7" reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
10" reel	Ф254.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5
13" reel	Ф330.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5

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RC1005F471CS RC1005F4751CS RCP0603W100RGED ERJ-1GMF1R00C ERJ-1GMF1R20C ERJ-1GMF2R55C ERJ-1GMF8R66C

25121WF1003T4E 25.501.3653.0 290-1.0M-RC 292-1.0M-RC 292-2.2K-RC 292-4.7K-RC 25121WF4700T4E 292-470K-RC 302-1.0M-RC CPG1206F10KC CRCW02011R00FXED CRCW060315K0FKEE CRCW060320K5FKEE CRG0201F10K RCP2512B100RGWB

RCWP12061K00FKS2 3520510RJT 352075KJT M55342K11B9E53RUL RMC16-102JT RMC1JPTE TR0603MR-075K1L 5-2176094-4

35202K7JT WF06Q1000FTL ERJ-S14J4R7U CHP2512L4R30GNT WR12X1621FTL RCWP11001K00FKS3 LRC-LRF3W-01-R050-FTR1800 9-2176088-6 NRC06F1002TR20F CRCW02013M30FNED CRCW060343K0FKEE WR04X5360FTL RCA060345K3FKEA LTR100JZPF33R0