

APPROVAL SHEET

WR02X

±5%, ±1%

General purpose chip resistors

Size 0201

Customer : _____
Approval No : _____
Issue Date : _____

Customer Approval :



FEATURE

1. Small size and light weight
2. High reliability and stability
3. Reduced size of final equipment
4. Suitable for high density print circuit board assembly
5. Higher component and equipment reliability
6. Lead free product

APPLICATION

- Mobile phone
- PDA
- Camcorders
- Palmtop computers
- Hybrid module

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 pure Tin.

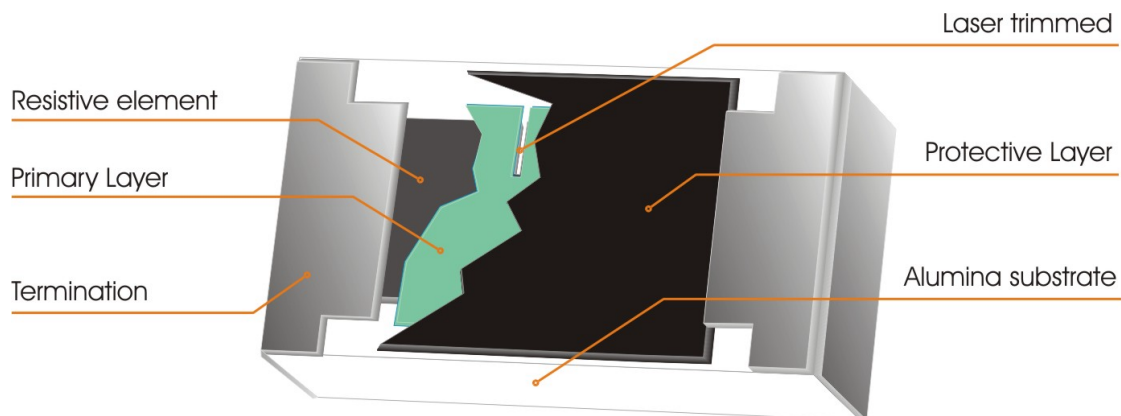


Fig 1. Construction of Chip-R WR02X

QUICK REFERENCE DATA

Item	General Specification
Series No.	WR02X
Size code	0201 (0603)
Resistance Tolerance	±5%, ±1% E24
Resistance Range (E24 series)	10Ω ~ 1MΩ, Jumper (0Ω)
TCR (ppm/°C)	≥1MΩ, ≤±500ppm/°C 51Ω - 910K, ≤±400ppm/°C 10Ω - 50Ω, ≤±500ppm/°C
Max. dissipation at T _{amb} =70°C	1/20 W
Max. Operation Voltage (DC or RMS)	15V
Max. Overload Voltage (DC or RMS)	30V
Climatic category (IEC 60068)	55/125/56

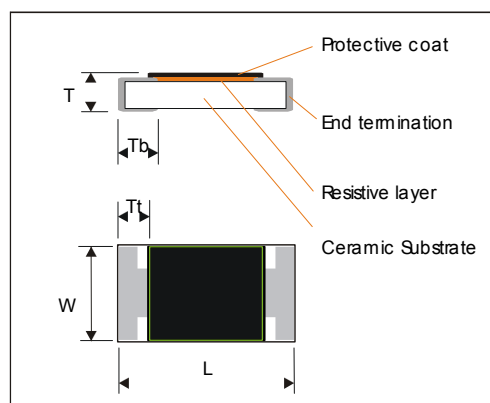
Note :

- This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
- Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}} \text{ or Max. RCWV listed above, whichever is lower.}$$

Dimensions:

	WR02X
L	0.60 ± 0.03
W	0.30 ± 0.03
T	0.23 ± 0.03
T_b	0.15 ± 0.05
T_t	0.15 ± 0.05



Marking

WR02X has no marking.

FUNCTIONAL DESCRIPTION

Product characterization

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

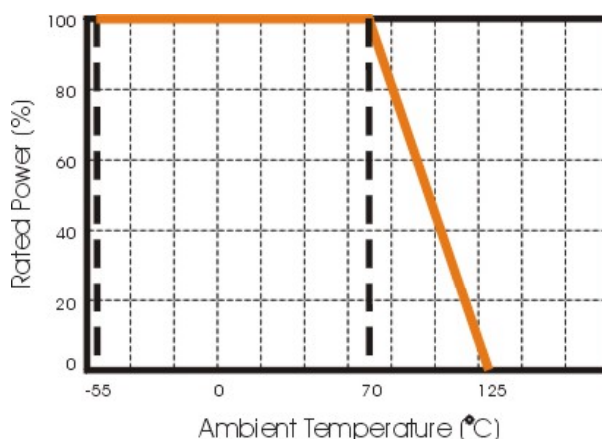


Figure 2. Maximum dissipation in percentage of rated power
As a function of the ambient temperature

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 one minute. 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 60 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.

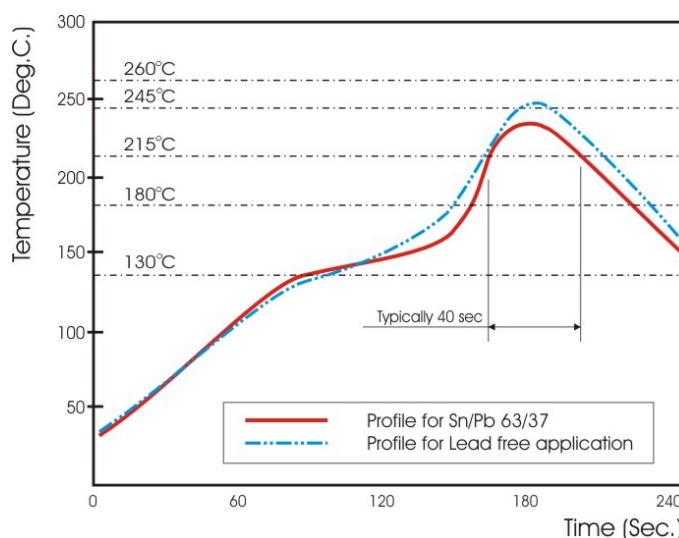


Fig 3. Infrared soldering profile for Chip Resistors WR02X

**CATALOGUE NUMBERS**

The resistors have a catalogue number starting with :

WR02	X	472_	J	T	L
Size code WR02 : 0201	Type code X : Normal	Resistance code E24 : 2 significant digits followed by no. of zeros and a blank 4.7Ω =4R7_ 10Ω =100_ 220Ω =221_ Jumper =000_ ("_" means a blank)	Tolerance J : ±5% F : ±1% P : Jumper	Packaging code T : 7" Reeled taping	Termination code _ = SnPb base ("_" means a blank) L = Sn base (lead free)

- Reeled tape packaging : 8mm width paper taping 10,000pcs per reel.

Resistance code: +/-5%, E24

OHM	Code	OHM	Code	OHM	Code	OHM	Code	OHM	Code
10R	10R	100R	101	1K0	102	10K	103	100K	104
11R	11R	110R	111	1K1	112	11K	113	110K	114
12R	12R	120R	121	1K2	122	12K	123	120K	124
13R	13R	130R	131	1K3	132	13K	133	130K	134
15R	15R	150R	151	1K5	152	15K	153	150K	154
16R	16R	160R	161	1K6	162	16K	163	160K	164
18R	18R	180R	181	1K8	182	18K	183	180K	184
20R	20R	200R	201	2K0	202	20K	203	200K	204
22R	22R	220R	221	2K2	222	22K	223	220K	224
24R	24R	240R	241	2K4	242	24K	243	240K	244
27R	27R	270R	271	2K7	272	27K	273	270K	274
30R	30R	300R	301	3K0	302	30K	303	300K	304
33R	33R	330R	331	3K3	332	33K	333	330K	334
36R	36R	360R	361	3K6	362	36K	363	360K	364
39R	39R	390R	391	3K9	392	39K	393	390K	394
43R	43R	430R	431	4K3	432	43K	433	430K	434
47R	47R	470R	471	4K7	472	47K	473	470K	474
51R	51R	510R	511	5K1	512	51K	513	510K	514
56R	56R	560R	561	5K6	562	56K	563	560K	564
62R	62R	620R	621	6K2	622	62K	623	620K	624
68R	68R	680R	681	6K8	682	68K	683	680K	684
75R	75R	750R	751	7K5	752	75K	753	750K	754
82R	82R	820R	821	8K2	822	82K	823	820K	824
91R	91R	910R	911	9K1	912	91K	913	910K	914



1M0 = 105; JUMPER=000

Resistance code: +/-1%, E24

OHM	Code	OHM	Code	OHM	Code	OHM	Code	OHM	Code
10R	10R0	100R	1000	1K0	1001	10K	1002	100K	1003
11R	11R0	110R	110	1K1	1101	11K	1102	110K	1103
12R	12R0	120R	1200	1K2	1201	12K	1202	120K	1203
13R	13R0	130R	1300	1K3	1301	13K	1302	130K	1303
15R	15R0	150R	1500	1K5	1501	15K	1502	150K	1503
16R	16R0	160R	1600	1K6	1601	16K	1602	160K	1603
18R	18R0	180R	1800	1K8	1801	18K	1802	180K	1803
20R	20R0	200R	2000	2K0	2001	20K	2002	200K	2003
22R	22R0	220R	2200	2K2	2201	22K	2202	220K	2203
24R	24R0	240R	2400	2K4	2401	24K	2402	240K	2403
27R	27R0	270R	2700	2K7	2701	27K	2702	270K	2703
30R	30R0	300R	3000	3K0	3001	30K	3002	300K	3003
33R	33R0	330R	3300	3K3	3301	33K	3302	330K	3303
36R	36R0	360R	3600	3K6	3601	36K	3602	360K	3603
39R	39R0	390R	3900	3K9	3901	39K	3902	390K	3903
43R	43R0	430R	4300	4K3	4301	43K	4302	430K	4303
47R	47R0	470R	4700	4K7	4701	47K	4702	470K	4703
51R	51R0	510R	5100	5K1	5101	51K	5102	510K	5103
56R	56R0	560R	5600	5K6	5601	56K	5602	560K	5603
62R	62R0	620R	6200	6K2	6201	62K	6202	620K	6203
68R	68R0	680R	6800	6K8	6801	68K	6802	680K	6803
75R	75R0	750R	7500	7K5	7501	75K	7502	750K	7503
82R	82R0	820R	8200	8K2	8201	82K	8202	820K	8203
91R	91R0	910R	9100	9K1	9101	91K	9102	910K	9103

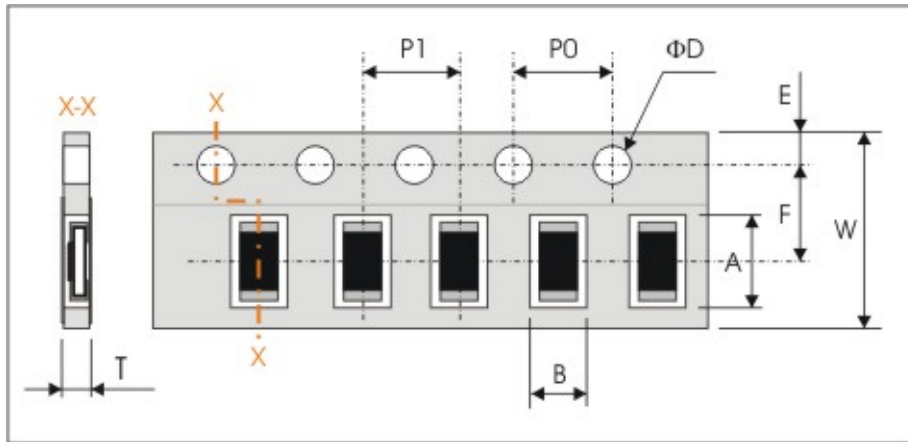
1M0=1004

**TEST AND REQUIREMENTS**

TEST	PROCEDURE	REQUIREMENT	
		Resistor	Jumper
DC resistance	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	< 50mΩ by 0.5A rated current
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 ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature t ₁ : 25°C	Test temperature -55~+125°C ≥1MΩ, ≤±500ppm/°C 51Ω - 910K, ≤±400ppm/°C 10Ω - 50R, ≤±500ppm/°C	N/a
Short time overload (STOL)	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.	ΔR/R max. ±(2%+0.10Ω)	< 50mΩ
Resistance to soldering heat	Unmounted chips 10±1 seconds, 270±5°C	no visible damage Δ R/R max. ±(1%+0.05Ω)	no visible damage, < 50mΩ
Solderability	Termination SnPb base : Unmounted chips completely immersed for 2±0.5 sec. in a solder bath at 230±5°C Termination Sn base (lead free) : Unmounted chip completely immersed in a lead free solder bath, 245°C±5°C, 3±1 sec	good tinning (>95% covered) no visible damage	
Temperature cycling	1. 30 minutes at -55°C±3°C, 2. 2~3 minutes at room temperature, 3. 30 minutes at +125°C±3°C, 4. 2~3 minutes at room temperature, Total 5 continuous cycles	no visible damage ΔR/R max. ±(1%+0.05Ω)	no visible damage, < 50mΩ
Load life (endurance)	70±2°C, 1000 hours, loaded with RCWV or Vmax, 1.5 hours on and 0.5 hours off	ΔR/R max. ±(3%+0.1Ω)	< 50mΩ
Load life in Humidity	1000 hours, at rated continuous working voltage 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. ±(3%+0.1Ω)	< 50mΩ
Bending	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 5 mm, once for 10seconds	no visible damage ΔR/R max. ±(1%+0.05Ω)	no visible damage, < 50mΩ

PACKAGING

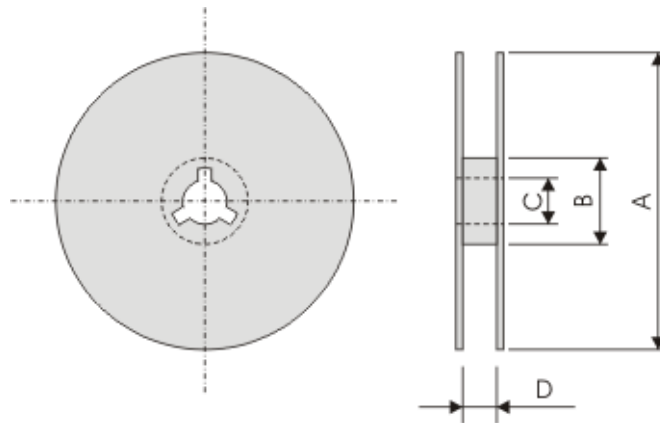
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WR02X	0.68±0.03	0.38±0.03	8.00±0.20	3.50±0.05	1.75±0.10

Series No.	P1	P0	ΦD	T
WR02X	2.00±0.05	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.35±0.03

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 and Tape material

- Chip resistors 10,000 pcs/reel, Paper tape.