

# APPROVAL SHEET

**WA04X, WA06X**

**±1%, ±5%, Convex Type**

General purpose chip resistors array

Size 0402x4, 0603x4 (8p4R)

(Automotive )

## FEATURE

1. Small size and light weight
2. Reduced size of final equipment
3. Lower surface mounted assembly costs
4. Automotive grade AEC Q-200 compliant
5. RoHS compliant and Lead (Pb) free terminations.

## APPLICATION

- Consumer electrical equipment
- EDP, Computer application
- Telecom
- Automotive application ( non-safety part )

## DESCRIPTION

The resistors array is 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 (Pb free) solder alloy.

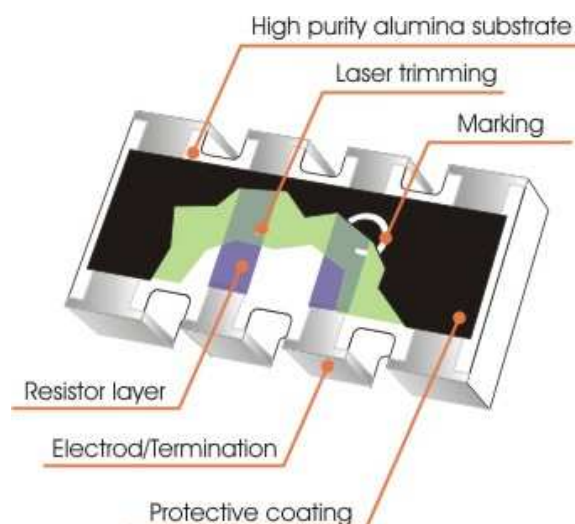


Fig 1. Construction of a Chip-R array (convex type)

**QUICK REFERENCE DATA**

Item	General Specification	
Series No.	WA04X	WA06X
Size	0402x4 (1005x4)	0603x4 (1608x4)
Termination construction	Convex	Convex
Resistance Tolerance	±5%, ±1%	±5%, ±1%
Resistance Range	±5%: 3Ω ~ 1MΩ, Jumper ±1%: 10Ω ~ 1MΩ	±5%: 1Ω ~ 1MΩ, Jumper ±1%: 10Ω ~ 1MΩ
TCR (ppm/°C) 10Ω<R<1MΩ R≤10Ω, R≥1MΩ	≤ ± 200 -300~+500	≤ ± 200 -300~+500
Max. dissipation at T <sub>amb</sub> =70°C	1/16 W	1/10 W
Max. Operation Voltage (DC or RMS)	50V	50V
Max. overload voltage	100V	100V
Climatic category	55/155/56	

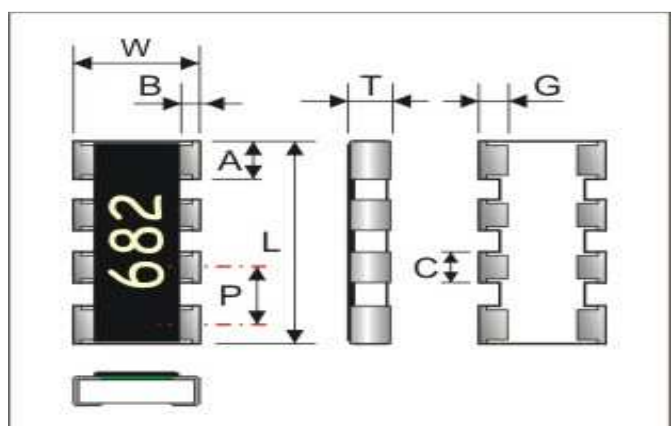
Note :

1. Climatic category refer to IEC 60068
2. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
3. 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 (unit : mm)**

	WA04X	WA06X
<b>L</b>	2.00 ± 0.10	3.20 ± 0.10
<b>W</b>	1.00 ± 0.10	1.60 ± 0.10
<b>T</b>	0.45 ± 0.10	0.50 ± 0.10
<b>P</b>	0.50 ± 0.05	0.80 ± 0.10
<b>A</b>	0.40 ± 0.10	0.60 ± 0.10
<b>B</b>	0.20 ± 0.10	0.30 ± 0.10
<b>C</b>	0.30 ± 0.05	0.40 ± 0.10
<b>G</b>	0.25 ± 0.10	0.30 ± 0.10



## MARKING

3-digits marking for E24 series +/-1% , +/-5% products.

No marking for E96 series +/-1% , +/-5% products.

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value. For values of 10.0 or greater the first 2 digits apply to the resistance value and third digit indicates the zeros of multiple to follow.

### Example

RESISTANCE	10Ω	100Ω	6800Ω	47000Ω
3-digits marking	100	101	682	473

## FUNCTIONAL DESCRIPTION

### Product characterization

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of  $\pm 5\%$ , The values of the E24 series are in accordance with "IEC publication 60063"

Standard values of nominal resistance are taken from the E24/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.3.

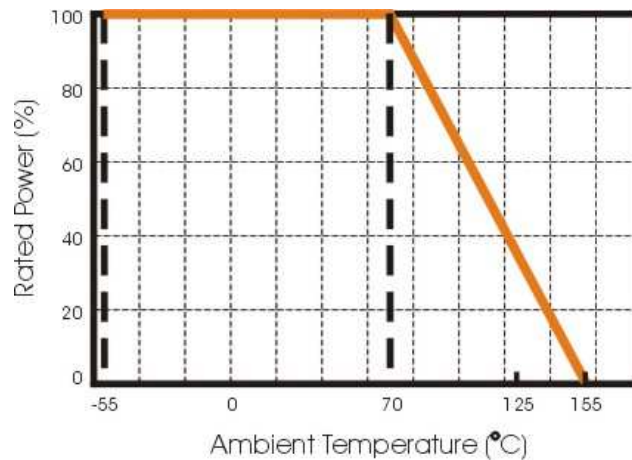
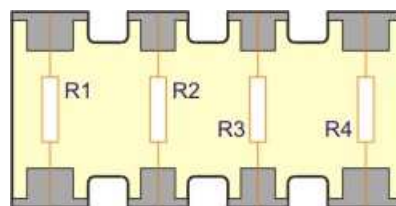


Figure 3 Maximum dissipation in percentage of rated power as a function of the ambient temperature

## CONSTRUCTION



$$R1=R2=R3=R4$$

## 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 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 4.

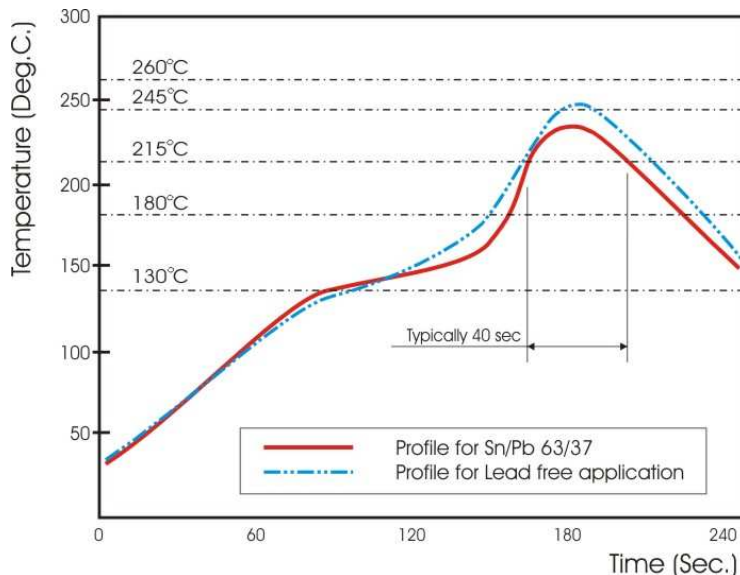


Fig 4. Infrared soldering profile for Chip Resistors array

## 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 mildly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
Electrical Characteristics  <b>JISC5201-1: 1998</b> Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ $t_1 : 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$ $R_1$ : Resistance at reference temperature $R_2$ : Resistance at test temperature	Within the specified tolerance Refer to "QUICK REFERENCE DATA"	<50mΩ
Resistance to soldering heat (R.S.H) <b>MIL-STD-202 method 210</b>	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270°C ±5°C	ΔR/R max. ±(1%+0.05Ω)	<50mΩ
Solderability <b>J-STD-202</b>	a) Bake the sample for 155°C dwell time 4hrs/ solder dipping 235°C/ 5sec. b) Steam the sample dwell time 1 hour/ solder dipping 260°C/ 7sec.	95% coverage min., good tinning and no visible damage	
Temperature cycling <b>JESD22 method JA-104</b>	1000 cycles, -55C ~ +155C, dwell time 5~10min	ΔR/R max. ±(1%+0.05Ω)	< 50mΩ
Moisture Resistance <b>MIL-STD-202 method 106</b>	65C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(1%+0.05Ω)	< 50mΩ
Bias Humidity <b>MIL-STD-202 method 103</b>	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(2%+0.1Ω) No visible damage	<50mΩ
Operational Life <b>MIL-STD-202 method 108</b>	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(2%+0.1Ω) No visible damage	< 50mΩ
High Temperature Exposure <b>MIL-STD-202G 108</b>	1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C	ΔR/R max. ±(2%+0.1Ω) No visible damage	<50mΩ
Board Flex <b>AEC-Q200-005</b>	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	<50mΩ
Terminal strength <b>AEC-Q200-006</b>	Pressurizing force: 1Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations	
Thermal shock <b>MIL-STD-202G 107G</b>	Test -55 to 155°C/ dwell time 15min/ Max transfer time 20sec/ 300cycles	ΔR/R max. ±(1%+0.05Ω) No visible damage	<50mΩ
ESD <b>AEC-Q200-002</b>	Test contact 1.0KV	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Short Time Overload	Permanent resistance change after a 5sec application of a voltage 2.5xUR or max. overload voltage, whichever is less.	ΔR/R max. ±(2%+0.10Ω)	<50mΩ

**TEST CONDITION FOR JUMPER (0 Ω)**

Item	WA04X	WA06X
Power Rating At 70°C	1/16W	1/10W
Resistance	MAX.50mΩ	MAX.50mΩ
Rated Current	1A	1A
Peak Current	1.5A	3A
Operating Temperature	-55~155°C	-55~155°C

**CATALOGUE NUMBERS**

The resistors have a catalogue number starting with .

WA	X	XXXX	J	T	L	J
<b>Size code</b> 06: 0603 (1608) 04:0402 (1005)	<b>Type code</b> X : x 4, Convex	<b>Resistance code</b> 5%,E24 : 2 significant digits followed by no. of zeros and a blank 10Ω =100_ 220Ω =221_ Jumper =000_ ("_" means a blank) 1%,E24+E96: 3 significant digits followed by no. of zeros . 10Ω =10R0 220Ω =2200	<b>Tolerance</b> F : ±1% J : ±5% P : Jumper	<b>Packaging code</b> T : 7" Reel taping B : Bulk	<b>Termination code</b> L = Sn base (lead free)	<b>Visual code</b> J = Automotive grade

WA06X,

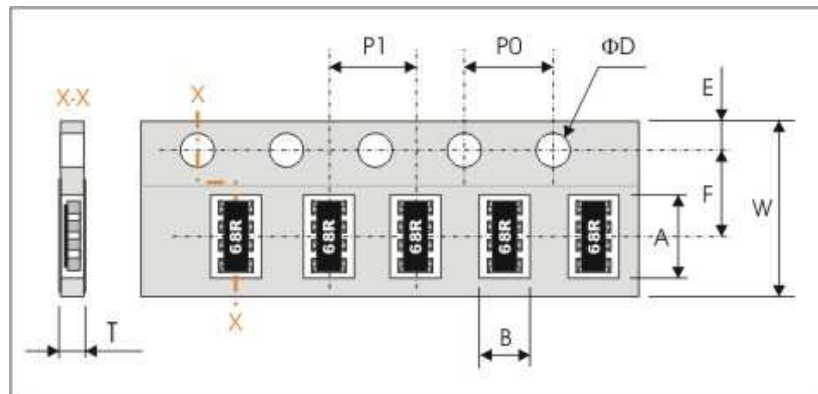
1. Reeled tape packaging : 8mm width paper taping 5000pcs per reel.

WA04X,

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

**PACKAGING**

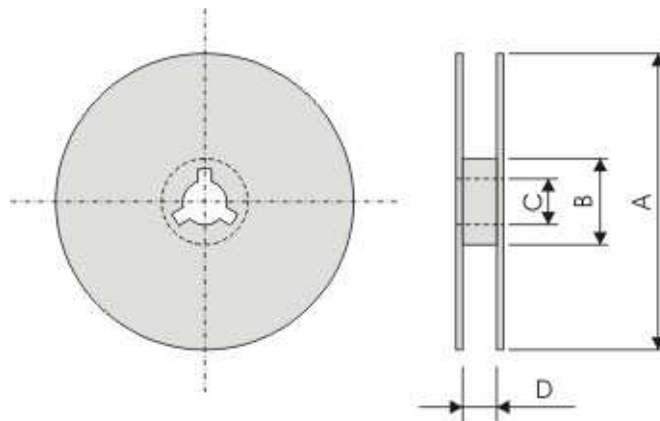
Paper Tape specifications (unit :mm)



Symbol	A	B	W	F	E
WA06X,	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
WA04X	2.20±0.20	1.20±0.20			

Symbol	P1	P0	ΦD	T
WA06X,	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.0
WA04X	2.00±0.05			Max. 0.6

**Reel dimensions**



Symbol	A	B	C	D
WA06X,WA04X,	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5