APPROVAL SHEET

MA04X, MA06X

±1%, ±5%, Convex Type

General purpose chip resistors array

Size 0402x4, 0603x4 (8p4R)
(Automotive & Anti-sulfur)

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

FEATURE

1. High reliability and stability
2. Sulfuration resistant
3. Automotive grade with AEC Q-200 compliant
4. Higher component and equipment reliability
5. EU RoHS compliant and Lead free products

APPLICATION

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

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.

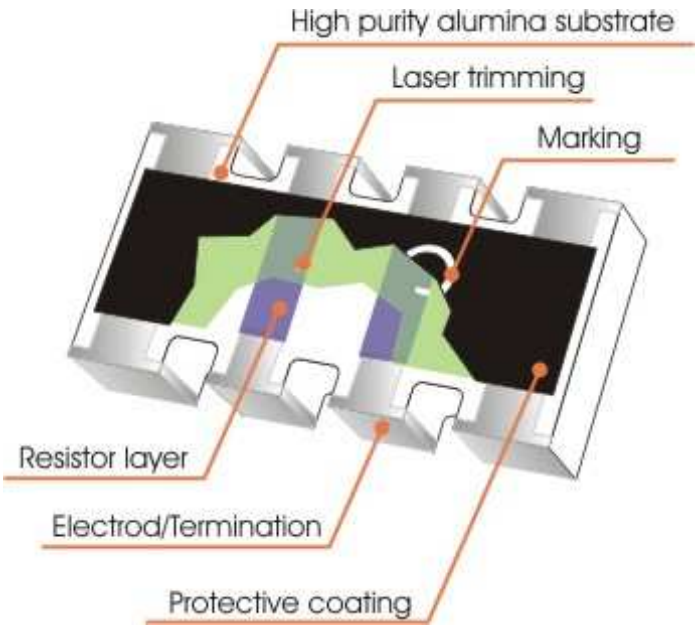


Fig 1. Consctruction of a Chip-R array(convex Type)

QUICK REFERENCE DATA

Item	General Specification	
Series No.	MA04X	MA06X
Size	0402x4 (1005x4)	0603x4 (1608x4)
Termination construction	Convex	Convex
Resistance Tolerance	±5%, ±1%	±5%, ±1%
Resistance Range	10Ω ~ 1MΩ, Jumper	10Ω ~ 1MΩ, Jumper,
TCR (ppm/°C)	≤ ± 300	≤ ± 200
Max. dissipation at T_{amb}=70°C	1/16 W	1/10 W
Max. Operation Voltage (DC or RMS)	50V	50V
Max. overload voltage	100V	100V
Climatic category	55/125/56	

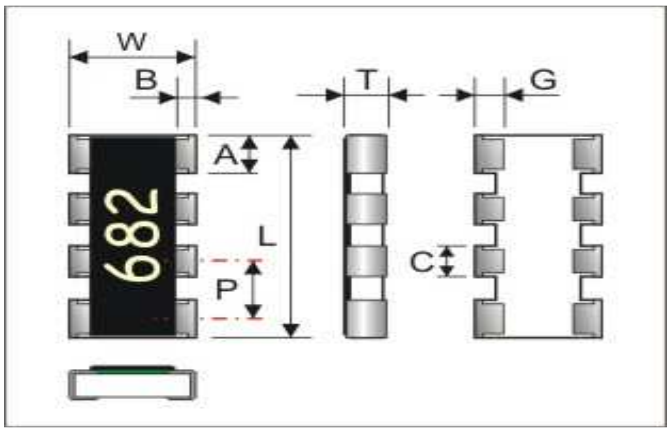
Note :

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

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

DIMENSIONS (unit : mm)

	MA04X	MA06X
L	2.00 ± 0.10	3.20 ± 0.10
W	1.00 ± 0.10	1.60 ± 0.10
T	0.45 ± 0.10	0.50 ± 0.10
P	0.50 ± 0.05	0.80 ± 0.10
A	0.40 ± 0.10	0.60 ± 0.10
B	0.20 ± 0.10	0.30 ± 0.10
C	0.30 ± 0.05	0.40 ± 0.10
G	0.25 ± 0.10	0.30 ± 0.20



MARKING

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

No marking for chip resistors array E96 series resistance.

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

Example

Resistance	10Ω	100Ω	6800Ω	47000Ω
Marking code	**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 ±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 ±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.

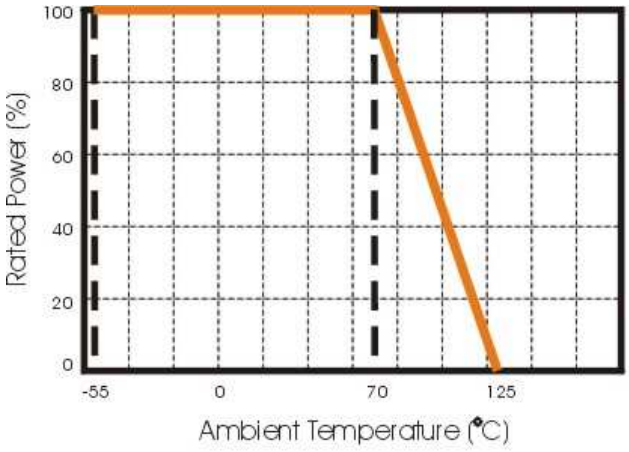
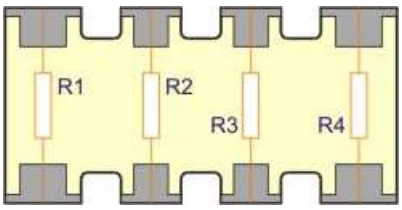


Figure 2. Maximum dissipation in percentage of rated power

As a function of the ambient temperature

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 3.

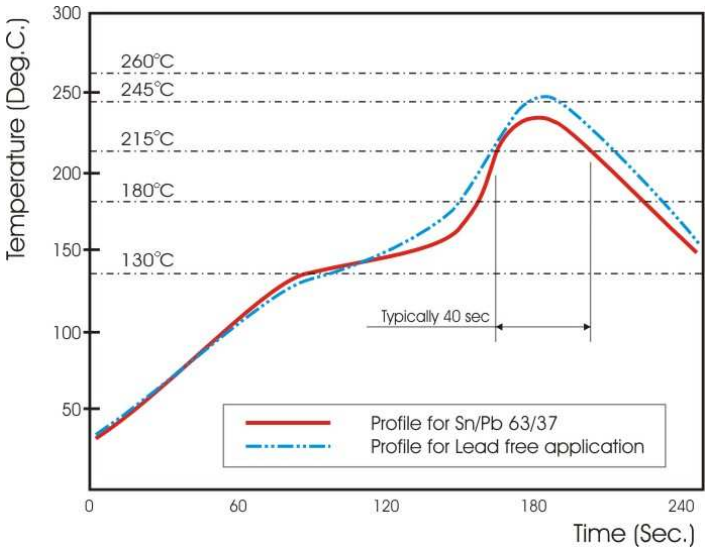


Fig 3. Infrared soldering profile for Chip Resistors array

CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

MA04	X	472_	J	T	L
Automotive code MA04 : 0402 x 4 MA06 : 0603 x 4	**Type code** X : Convex	**Resistance code** 5%, E24 : 2 significant digits followed by no. of zeros and a blank 220Ω =221_ ("_" means a blank) 1%, E24+E96: 3 significant digits followed by no. of zeros 102Ω =1020 37.4KΩ =3742	**Tolerance** F : ±1% J : ±5% P : Jumper	**Packaging code** T : 7" Reeled taping Q : 10" Reeled taping G : 13" Reeled taping B : Bulk	**Special code** L = Lead free

* Anti-sulfur test conditions: H2S 3ppm, 40'C, 90% RH, 1000 hrs, criteria: within ±1% !

* 100% CCD visual inspection to guarantee visual quality !

MA06X, Reeled tape packaging : 8mm width paper taping 5000pcs per reel.

MA04X, Reeled tape packaging : 8mm width paper taping 10,000pcs per reel.

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	**0Ω**
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 201**	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270℃±5°C	ΔR/R max. ±(0.5%+0.05Ω)	<50mΩ
Solderability **J-STD-202**	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. ±(0.5%+0.05Ω)	< 50mΩ
Moisture Resistance **MIL-STD-202** **method 106**	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(0.5%+0.10Ω)	< 50mΩ
Bias Humidity **MIL-STD-202** **method 103**	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Operational Life **MIL-STD-202** **method 108**	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	< 50mΩ
High Temperature Exposure **MIL-STD-202** **method 108**	1000+48/-0 hours; without load in a temperature chamber controlled 125±3°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ

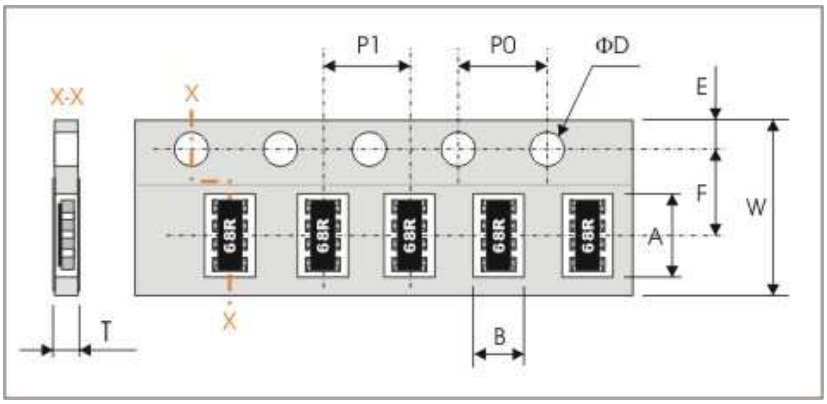
TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
Board Flex **AEC-Q200-005**	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 2mm for 10sec	ΔR/R max. ±(1.0%+0.05Ω). No visible damage	<50mΩ
Terminal strength **AEC-Q200-006**	Pressurizing force: 1Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations	
Vibration **MIL-STD-202** **method 204**	Test 5g's for 20min., 12 cycles each of 3 orientations	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Thermal shock **MIL-STD-202** **method 107**	Test –55 to 125℃/ dwell time 15min/ Max transfer time 20sec 300cycles	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
ESD **AEC-Q200-002**	Test contact 1.0KV	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ

TEST CONDITION FOR JUMPER (0 Ω)

Item	MA04X	MA06X
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	-55~125°C	-55~125°C

PACKAGING

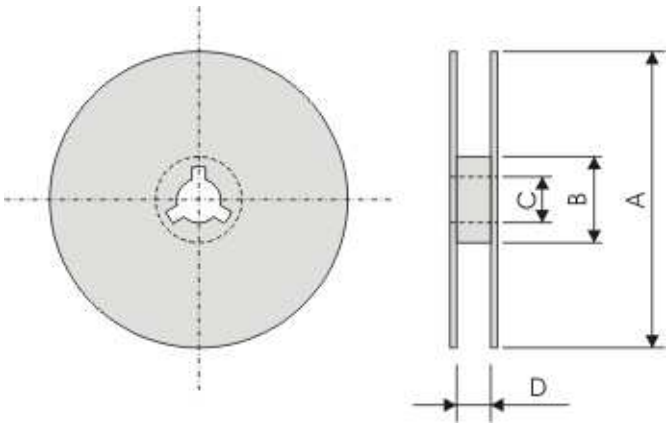
Paper Tape specifications (unit :mm)



Symbol	A	B	W	F	E
MA06X	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
MA04X	2.20±0.20	1.20±0.20			

Symbol	P1	P0	ΦD	T
MA06X	4.00±0.10	4.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.0
MA04X	2.00±0.05			Max. 0.6

Reel dimensions



Symbol	A	B	C	D
MA06X,MA04X	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5