

# DATA SHEET

## THICK FILM CHIP RESISTORS AUTOMOTIVE GRADE

AC series  
 $\pm 5\%$ ,  $\pm 1\%$ ,  $\pm 0.5\%$

Sizes 0201/0402/0603/0805/1206/  
1210/1218/2010/2512

RoHS compliant & Halogen free



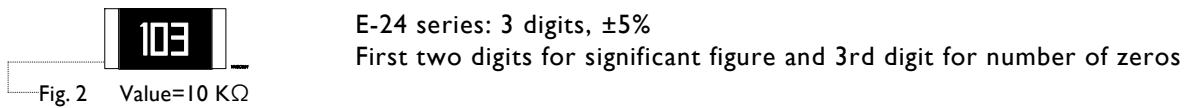


**MARKING**

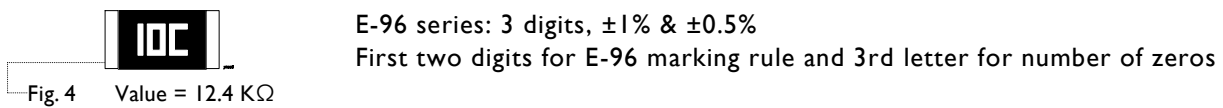
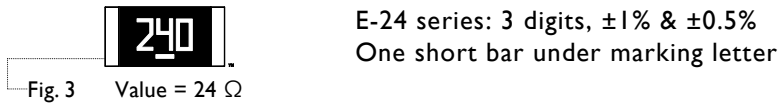
AC0201 / AC0402



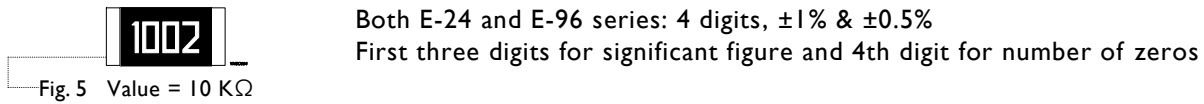
AC0603 / AC0805 / AC1206 / AC1210 / AC2010 / AC2512



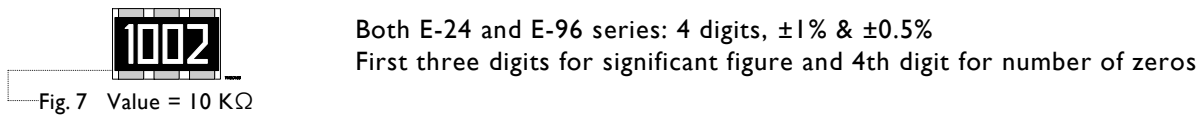
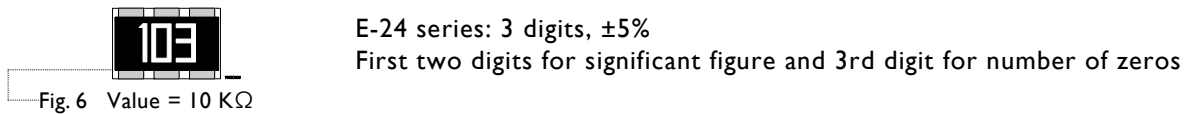
AC0603



AC0805 / AC1206 / AC1210 / AC2010 / AC2512



AC1218



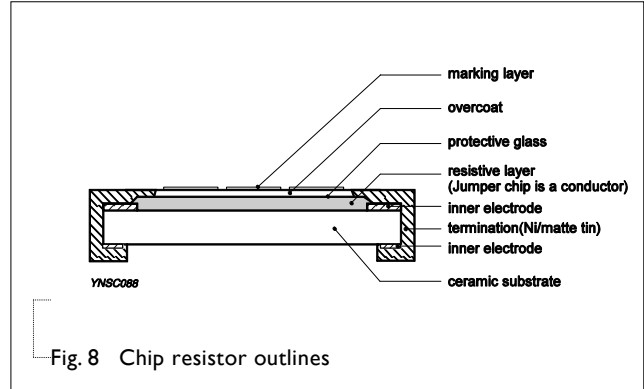
**NOTE**

For further marking information, please refer to data sheet “Chip resistors marking”. Marking of AC series is the same as RC series.

**CONSTRUCTION**

The resistors are constructed on top of an automotive grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a lead-free glass. The composition of the glaze is adjusted to give the approximately required resistance value and laser trimming of this resistive glaze achieves the value within tolerance. The whole element is covered by a protective overcoat. Size 0603 and bigger is marked with the resistance value on top. Finally, the two external terminations (Ni / matte tin) are added, as shown in Fig.8.

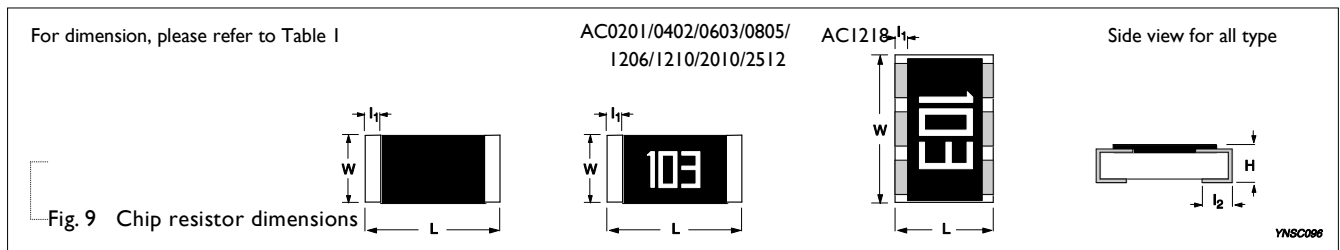
**OUTLINES**



**DIMENSIONS**

Table I For outlines, please refer to Fig. 9

TYPE	L (mm)	W (mm)	H (mm)	l <sub>1</sub> (mm)	l <sub>2</sub> (mm)
AC0201	0.60±0.03	0.30±0.03	0.23±0.03	0.12±0.05	0.15±0.05
AC0402	1.00 ±0.05	0.50 ±0.05	0.32 ±0.05	0.20 ±0.10	0.25 ±0.10
AC0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
AC0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
AC1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
AC1210	3.10 ±0.10	2.60 ±0.15	0.50 ±0.10	0.45 ±0.15	0.50 ±0.20
AC1218	3.10 ±0.10	4.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
AC2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.55 ±0.15	0.50 ±0.20
AC2512	6.35 ±0.10	3.10 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20



**ELECTRICAL CHARACTERISTICS**

Table 2

TYPE	RESISTANCE RANGE	CHARACTERISTICS					
		Operating Temperature Range	Max. Working Voltage	Max. Overload Voltage	Dielectric Withstanding Voltage	Temperature Coefficient of Resistance	Jumper Criteria
AC0201		-55 °C to +155 °C	25V	50V	50V	$1\Omega \leq R \leq 10\Omega$ , -100/+350ppm/°C $10\Omega < R \leq 10M\Omega$ , ±200ppm/°C	Rated Current 0.5A Max. Current 1.0A
AC0402			50 V	100 V	100 V		Rated Current 1A Max. Current 2A
AC0603			75V	150 V	150 V		Rated Current 1A Max. Current 2A
AC0805	5% (E24) $1\Omega \leq R \leq 22M\Omega$ (0201: Max. 10MΩ) (1218: Max. 1MΩ) 1% (E24/E96)		150 V	300 V	300 V		Rated Current 2A Max. Current 5A
AC1206	$1\Omega \leq R \leq 10M\Omega$ (1218: Max. 1MΩ) 0.5% (E24/E96)		200 V	400 V	500 V	$1\Omega \leq R \leq 10\Omega$ , ±200 ppm/°C	Rated Current 2A Max. Current 10A
AC1210	$10\Omega \leq R \leq 1M\Omega$ Jumper < 50mΩ		200 V	500 V	500 V	$10\Omega < R \leq 10M\Omega$ , ±100 ppm/°C	Rated Current 2A Max. Current 10A
AC1218			200 V	500 V	500 V		Rated Current 6A Max. Current 10A
AC2010			200 V	500 V	500 V		Rated Current 2A Max. Current 10A
AC2512			200 V	500 V	500 V		Rated Current 2A Max. Current 10A

**FOOTPRINT AND SOLDERING PROFILES**

Recommended footprint and soldering profiles of AC-series is the same as RC-series. Please refer to data sheet “Chip resistors mounting”.

**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

PACKING STYLE	REEL	AC0201	AC0402	AC0603	AC0805	AC1206	AC1210	AC1218	AC2010
	DIMENSION								
Paper taping reel (R)	7" (178 mm)	10,000	10,000	5,000	5,000	5,000	5,000	---	---
	13" (330 mm)	50,000	50,000	20,000	20,000	20,000	20,000	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	---	---	---	4,000	4,000

**NOTE**

I. For paper/embossed tape and reel specifications/dimensions, please refer to data sheet “Chip resistors packing”.

**FUNCTIONAL DESCRIPTION**

**OPERATING TEMPERATURE RANGE**

Range: -55 °C to +155 °C

**POWER RATING**

Each type rated power at 70 °C:

- AC0201=1/20W (0.05W)
- AC0402=1/16W (0.0625W)
- AC0603=1/10W (0.1W)
- AC0805=1/8W (0.125W)
- AC1206=1/4W (0.25W)
- AC1210=1/2W (0.5W)
- AC1218=1W
- AC2010=3/4W (0.75W)
- AC2512=1 W

**RATED VOLTAGE**

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$$V = \sqrt{P \times R}$$

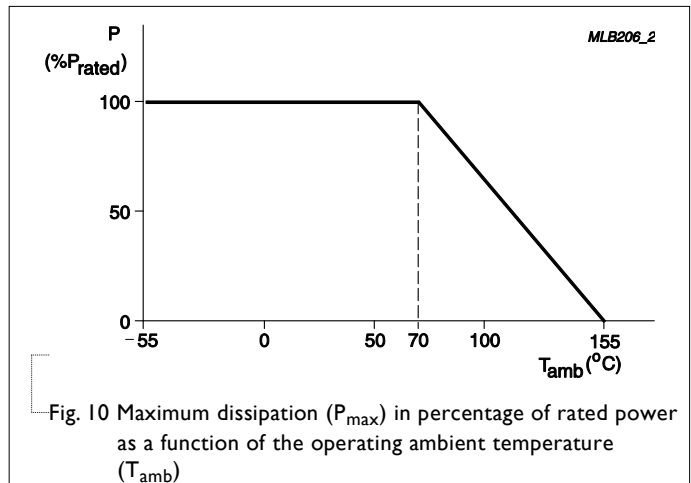
Or Maximum working voltage whichever is less

Where

V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value (Ω)



**TESTS AND REQUIREMENTS**

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
High Temperature Exposure	AEC-Q200 Test 3 MIL-STD-202 Method 108	1,000 hours at $T_A = 155\text{ }^\circ\text{C}$ , unpowered	$\pm(1.0\%+0.05\Omega)$ for D/F tol $\pm(2.0\%+0.05\Omega)$ for J tol <50 m $\Omega$ for Jumper
Moisture Resistance	AEC-Q200 Test 6 MIL-STD-202 Method 106	Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d. with $25\text{ }^\circ\text{C} / 65\text{ }^\circ\text{C}$ 95% R.H, without steps 7a & 7b, unpowered  Parts mounted on test-boards, without condensation on parts	$\pm(0.5\%+0.05\Omega)$ for D/F tol $\pm(2.0\%+0.05\Omega)$ for J tol <100 m $\Omega$ for Jumper
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	1,000 hours; $85\text{ }^\circ\text{C} / 85\%$ RH 10% of operating power  Measurement at $24\pm 4$ hours after test conclusion.	$\pm(1.0\%+0.05\Omega)$ for D/F tol $\pm(3.0\%+0.05\Omega)$ for J tol <100 m $\Omega$ for Jumper
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at $125\text{ }^\circ\text{C}$ , derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	$\pm(1.0\%+0.05\Omega)$ for D/F tol $\pm(3.0\%+0.05\Omega)$ for J tol <100 m $\Omega$ for Jumper
Resistance to Soldering Heat	AEC-Q200 Test 15 MIL-STD-202 Method 210	Condition B, no pre-heat of samples Lead-free solder, $260\pm 5\text{ }^\circ\text{C}$ , $10\pm 1$ seconds immersion time  Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	$\pm(0.5\%+0.05\Omega)$ for D/F tol $\pm(1.0\%+0.05\Omega)$ for J tol <50 m $\Omega$ for Jumper No visible damage
Thermal Shock	AEC-Q200 Test 16 MIL-STD-202 Method 107	$-55/+125\text{ }^\circ\text{C}$  Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	$\pm(0.5\%+0.05\Omega)$ for D/F tol $\pm(1.0\%+0.05\Omega)$ for J tol <50 m $\Omega$ for Jumper
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, $I_{\text{pos.}} + I_{\text{neg.}}$ discharges 0201: 500V 0402/0603: 1KV 0805 and above: 2KV	$\pm(3.0\%+0.05\Omega)$ <50 m $\Omega$ for Jumper

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	AEC-Q200 Test 18 J-STD-002	Electrical Test not required Magnification 50X SMD conditions: (a) Method B, aging 4 hours at 155 °C dry heat, dipping at 235±3 °C for 5±0.5 seconds. (b) Method B, steam aging 8 hours, dipping at 215±3 °C for 5±0.5 seconds. (c) Method D, steam aging 8 hours, dipping at 260±3 °C for 7±0.5 seconds.	Well tinned (≥95% covered) No visible damage
Board Flex	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4) Bending for 0201/0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm Holding time: minimum 60 seconds	±(1.0%+0.05Ω) <50 mΩ for Jumper
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/-55 °C and +25/+125 °C  Formula: $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ Where t <sub>1</sub> =+25 °C or specified room temperature t <sub>2</sub> =-55 °C or +125 °C test temperature R <sub>1</sub> =resistance at reference temperature in ohms R <sub>2</sub> =resistance at test temperature in ohms	Refer to table 2
Short Time Overload	IEC60115-1 4.13	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature	±(1.0%+0.05Ω) for D/F tol ±(2.0%+0.05Ω) for J tol <50 mΩ for Jumper
FOS	ASTM-B-809-95	Sulfur (saturated vapor) 500 hours, 60±2°C, unpowered	±( 1.0%+0.05Ω)



**REVISION HISTORY**

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 4	May 25, 2015	-	<ul style="list-style-type: none"> <li>- Remove 7D packing</li> <li>- Extend resistance range</li> <li>- Add in AC0201</li> <li>- Update FOS test and requirements</li> </ul>
Version 3	Feb 13, 2014	-	<ul style="list-style-type: none"> <li>- Feature description updated</li> <li>- add <math>\pm 0.5\%</math></li> <li>- delete 10" taping reel</li> </ul>
Version 2	Feb. 10, 2012	-	<ul style="list-style-type: none"> <li>- Jumper criteria added</li> <li>- AC1218 marking and outline figure updated</li> </ul>
Version 1	Feb. 01, 2011	-	<ul style="list-style-type: none"> <li>- Case size 1210, 1218, 2010, 2512 extended</li> <li>- Test method and procedure updated</li> <li>- Packing style of 7D added</li> </ul>
Version 0	Nov. 10, 2010	-	<ul style="list-style-type: none"> <li>- First issue of this specification</li> </ul>

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