



# **THIN FILM CHIP RESISTORS AUTOMOTIVE GRADE**

AT series 0.1% TO 1%, TC 15 TO TC50 sizes 0402/0603/0805/1206 **RoHS** compliant

YAGEO



1101

1271

221

2R20

## YAGEO Phícomp

Chip Resistor Surface Mount | AT | SERIES | 0402 to 1206

SCOPE

This specification describes AT0402 to AT1206 high precision-high stability chip resistors with lead-free terminations made by thin film process.

#### **APPLICATIONS**

- Automotive electronics
- Industrial and medical equipment
- Test and measuring equipment
- Telecommunications

#### FEATURES

- AEC-Q200 qualified
- Superior resistance against sulfur containing atmosphere
- Moisture sensitivity level: MSL I
- Products with lead free terminations meet RoHS requirements
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Non-forbidden materials used in products/production
- Halogen free epoxy

#### ORDERING INFORMATION - GLOBAL PART NUMBER

Part number is identified by the series name, size, tolerance, packaging type, temperature coefficient, taping reel and resistance value.

#### **GLOBAL PART NUMBER**

#### AT XXXX X X X XX XXXXX L

,	(I)		3) (4)		(6)	(7)		
(1) 9	SIZE							
(	0402 / 0603 / 0805 / 1206							
(2)	TOLERAN	NCE						

 $B = \pm 0.1\%$ C =  $\pm 0.25\%$ D =  $\pm 0.5\%$ 

 $F = \pm 1\%$ 

### (3) PACKAGING TYPE R = Paper taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

### $C = \pm 15 \text{ ppm/°C}$

- $D = \pm 25 \text{ ppm/°C}$
- $E = \pm 50 \text{ ppm/°C}$

#### (5) TAPING REEL

07 = 7 inch dia. Reel

#### (6) RESISTANCE VALUE

There are 2~4 digits indicated the resistor value.

Letter R/K/M is decimal point

Example:  $100R = 100\Omega$ 

IK = 1,000**Ω** 

#### (7) DEFAULT CODE

Letter L is the system default code for ordering only.  $^{(\mbox{NOTE})}$ 

#### **ORDERING EXAMPLE**

The ordering code of a AT0402 chip resistor, TC 25 value  $56\Omega$  with ± 0.5% tolerance, supplied in 7-inch tape reel is: AT0402DRD0756RL.

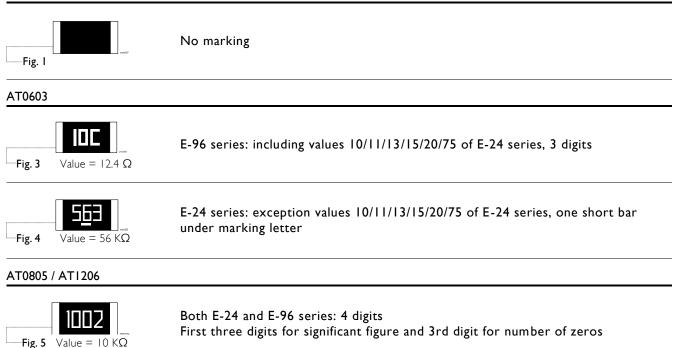
#### NOTE

- I. All our Rchip products meet RoHS compliant and Halogen Free. "LFP" of the internal 2D reel label mentions "Lead Free Process".
- 2. On customized label, "LFP" or specific symbol can be printed.

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#### MARKING





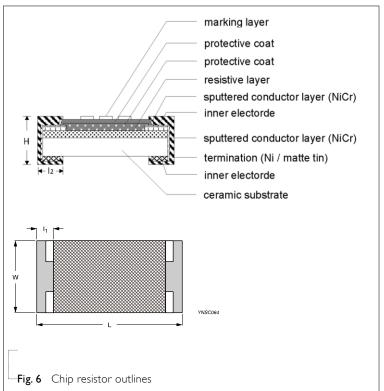
#### NOTE

For further marking information, please see special data sheet " Chip resistors marking" .

#### **CONSTRUCTION**

A metal film layer is deposited on a high grade ceramic body (aluminium oxide). This resistive layer is trimmed to its nominal value and on both ends a contact is made which will guarantee optimum solderability. This is achieved by applying several layers and for ease of soldering the outer layer consists of Ni/matte tin. The resistive layer is covered with a protective coating.

#### OUTLINES



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#### **DIMENSIONS**

Table I					
TYPE	L (mm)	W (mm)	H (mm)	I⊤ (mm)	l <sub>2</sub> (mm)
AT0402	1.00 ±0.10	0.50 ±0.05	0.30 ±0.05	0.20 ±0.10	0.25 ±0.10
AT0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
AT0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
AT1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20

#### ELECTRICAL CHARACTERISTICS

Table 2

	Operating	Davian	Max.	Max.		Resistance Range	(E-24/E-96 serie	s)(Ω ) & To	olerance
TYPE	Temperature Range	Rating	-		Withstanding Voltage	T.C.R. (ppm/°C)	±0.1% ±0.25%	±0.5%	±1%
AT0402		1/16W	50 V	100 V	100 V	±15		~  K	
						±25,±50	10-	~100K	
AT0603		1/10W	75V	150 V	100 V	±15	IC	~14K	
		1/10**	754	150 V	100 ¥	±25,±50	10-	~330K	
AT0805	–55 °C to +155 °C <sup>−</sup>		150.14	200.14	200.14	±15	10	~17K	
A10805		1/8W	150 V	300 V	300 V	±25,±50	IC	~ M	
AT1206		1/4W	200 1/	400 V		±15	10	~20K	
A11200		1/4VV	200 V	400 V	500 ∨	±25, ±50	IC	~ M	

#### FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please see the special data sheet "Chip resistors mounting".

#### PACKING STYLE AND PACKAGING QUANTITY

Table 3	Packing	style	and	packaging	quantity
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PRODUCT TYPE	PATKING STYLE	<b>REEL DIMENSION</b>	QUANTITY PER REEL
AT0402	Paper taping reel	7" (178 mm)	10,000 Units
AT0603	Paper taping reel	7" (178 mm)	5,000 Units
AT0805	Paper taping reel	7" (178 mm)	5,000 Units
AT1206	Paper taping reel	7" (178 mm)	5,000 Units

NOTE: for paper tape and reel specification/dimensions, please see the special data sheet "packing" document.

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#### FUNCTIONAL DESCRIPTION

#### **OPERATING TEMPERATURE RANGE**

Range: -55 °C to +155 °C

#### **POWER RATING**

Each type rated power at 70 °C: AT0402=1/16 W AT0603=1/10 W AT0805=1/8 W AT1206=1/4 W

#### **RATED VOLTAGE**

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

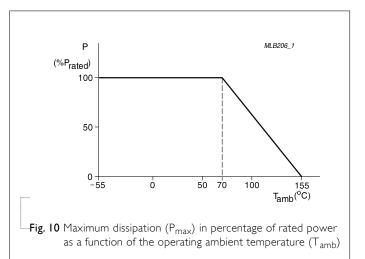
 $V = \sqrt{(P \times R)}$ 

Or max. working voltage whichever is less Where

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

P=Rated power

R=Resistance value (Ω)



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#### TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Short Time Overload	IEC60115-1 4.13	2.5 times of rated voltage or maximum overload voltage, the less of the above, for 5 sec at room temperature	±(0.05%+0.05 <b>Ω</b> )
High Temperature	AEC-Q200 Test 3 MIL-STD-202 Method 108	1,000 hours at Tamb = 125 °C, unpowered	±(0.1%+0.05 <b>Ω</b> )
Exposure		1,000 hours at Tamb = 155 °C, unpowered	±(0.3%+0.05 <b>Ω</b> )
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 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered	±(0.1%+0.05 <b>Ω</b> )
		Parts mounted on test-boards, without condensation on parts	
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	I,000 hours; 85 °C / 85% RH I 0% of operating power Measurement at 24±4 hours after test conclusion	±(0.1%+0.05 <b>Ω</b> )
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at 70±5 °C, RCWV applied for 1.5 hours on, 0.5 hour off, still air required	±(0.1%+0.05 <b>Ω</b> )
		1,000 hours at 125 °C, derated voltage applied for 1.5 hours on, 0.5 hour off, still air required	±(0.3%+0.05 <b>Ω</b> )
Resistance to Soldering Heat	AEC-Q200 Test 15 MIL-STD-202 Method 210	Condition B, no pre-heat of samples Lead-free solder, 260±5 °C, 10±1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(0.05%+0.05Ω)
Thermal	AEC-Q200 Test 16	-55/+125 °C	<b>±</b> (0.1%+0.05 <b>Ω</b> )
Shock	MIL-STD-202 Method 107	Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	No visible damage
Solderability - Wetting	AEC-Q200 Test 18 J-STD-002	<ul> <li>Electrical Test not required Magnification</li> <li>50X SMD conditions:</li> <li>(a) Method B, aging 4 hours at 155 °C dry heat, dipping at 235±3 °C for 5±0.5 seconds.</li> <li>(b) Method B, steam aging 8 hours, dipping at 215±3 °C for 5±0.5 seconds.</li> <li>(c) Method D, steam aging 8 hours, dipping at 260±3 °C for 7±0.5 seconds</li> </ul>	Well tinned (>95% covered) No visible damage

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Chip R	esistor	<b>Surface</b>	Mount	AT	SERIES	0402 to 1206
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Board Flex / Bending	AEC-Q200 Test 21 AEC-Q200-005	Chips mounted on a 90mm glass epoxy resin PCB (FR4) Bending for 0402: 5 mm 0603/0805: 3 mm I 206: 2mm Holding time: minimum 60 second	±(0.1%+0.05 <b>Ω</b> )
Temperature Coefficient of Resistance (T.C.R.)	IEC 60115-1 4.8	At +25/-55 °C and +25/+125°C Formula: R2-R1 T.C.R= $\frac{R2 - R1}{R1(t2 - t)}$ × 106(ppm/°C) Where t1=+25 °C or specified room temperature t2=-55 °C or +125 °C test temperature R1=resistance at reference temperature in ohms R2=resistance at test temperature in ohms	Refer to table 2
Flower of Sulfur	ASTM-B-809-95* * Modified	Sulfur 750 hours, 105°C, unpowered.	±(4.0%+0.05 <b>Ω</b> )

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#### <u>REVISION HISTORY</u>

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 5	Oct. 24, 2017		- Add resistance range for ±15 ppm/°C
Version 4	Mar. 16, 2016	-	- Remove FOS 90°C test
Version 3	Dec. 11, 2015	-	- Modify Outline
Version 2	May 11, 2015	-	- Modify FOS test
Version I	Jun. 18, 2014	-	- Modify FOS test
Version 0	May 07, 2014	-	- First issue of this specification

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