Innovative Service Around the Globe YAGEO

DATA SHEET

THICK FILM CHIP RESISTORS

Automotive Precision grade

AC series

0.1%, 0.5%, 1%, TC 50

sizes 0402/0603/0805/1206

RoHS compliant & Halogen Free

Product specification – August 02, 2022 V.2

YAGEO

SCOPE

This specification describes AC0402 to AC1206 ultra precision chip resistors with lead-free terminations made by thick film process.

APPLICATIONS

- All general purpose applications
- Car electronics
- Industrial applications

FEATURES

- AEC-Q200 qualified
- Halogen Free Epoxy
- RoHS compliant
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Moisture sensitivity level: MSL 1

ORDERING INFORMATION - GLOBAL PART NUMBER & 12NC

Both part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

YAGEO BRAND ordering code

GLOBAL PART NUMBER (PREFERRED)

AC	XXXX	X	X	X	XX	XXXX	L
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) SIZE

0402 / 0603 / 0805 / 1206

(2) TOLERANCE

B = ±0.1%

D = ±0.5%

F = ±1%

(3) PACKAGING TYPE

R = Paper/PE taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

E = 1MΩ to 7.5MΩ of 1206 : ± 60 ppm/°C Others: ± 50 ppm/°C

(5) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

(6) RESISTANCE VALUE

There are 2~4 digits indicated the resistor value. Letter R/K/M is decimal point, no need to mention the last zero after R/K/M, e.g.1K2, not 1K20.

Detailed resistance rules show in table of "Resistance rule of global part number".

(7) DEFAULT CODE

Letter L is system default code for order only (Note)

Resistance rule of global part number

Resistance code rule	Example
XXRX (10 to 97.6 Ω)	10R = 10 Ω 97R6 = 97.6 Ω
XXXR (100 to 976 Ω)	100R = 100 Ω
XKXX (1 to 9.76 KΩ)	1K = 1,000 Ω 9K76 = 9760 Ω
XMXX (1 MΩ)	1M = 1,000,000 Ω

ORDERING EXAMPLE

The ordering code of a AC0603 chip resistor, TC 50 value 56Ω with ±0.5% tolerance, supplied in 7-inch tape reel is: AC0603DRE0756RL.

NOTE

1. All our R-Chip 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

MARKING

AC0805 / AC1206

Fig. 1 Value = 10 kΩ

Either resistance in E-24 or E-96: 4 digits
First three digits for significant figure and 4th digit for number of zeros

AC0603

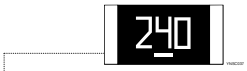

Fig. 2 Value = 24 Ω

1%, 0.5%, 0.1% E24 exception values 10/11/13/15/20/75 of E24 series

Fig. 3 Value = 12.4 kΩ

1%, 0.5%, 0.1% E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series

AC0402

Fig. 4

No marking

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

CONSTRUCTION

The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive layer. The resistive layer is adjusted to give the approximate required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the two external terminations (matte tin) are added. See fig. 5.

DIMENSION

Table 1 For outlines see fig. 5

TYPE	L (mm)	W (mm)	H (mm)	l_1 (mm)	l_2 (mm)
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	0.45 ±0.20

OUTLINES

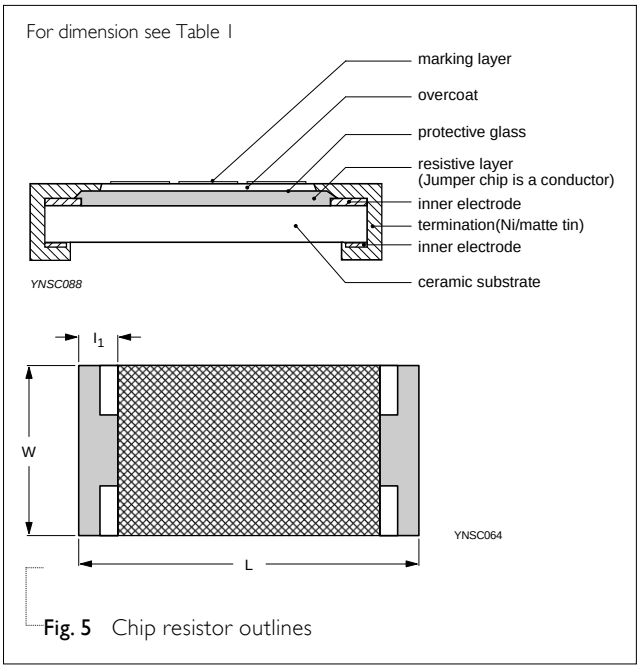

Fig. 5 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

TYPE	RESISTANCE RANGE (E24/E96)	OPERATING TEMPERATURE RANGE	POWER RATING	MAXIMUM WORKING VOLTAGE	DIELECTRIC WITHSTAND VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	TEMPERATURE COEFFICIENT OF RESISTANCE
AC0402	10 Ω to 1 MΩ	–55 °C to +155 °C	1/16 W	50 V	100 V	100 V	±50 ppm/°C
AC0603	10 Ω to 1 MΩ	–55 °C to +155 °C	1/10 W	75 V	150 V	150 V	±50 ppm/°C
AC0805	10 Ω to 1 MΩ	–55 °C to +155 °C	1/8 W	150 V	300 V	300 V	±50 ppm/°C
AC1206	10 Ω to 7.5 MΩ	–55 °C to +155 °C	1/4 W	200 V	500 V	400 V	10Ω to 1MΩ: ±50 ppm/°C 1MΩ to 7.5MΩ: ±60 ppm/°C

NOTE

The maximum working voltage that may be continuously applied to the resistor element, see "IEC publication 60115-8"

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

PACKING STYLE	REEL DIMENSION	AC0402	AC0603	AC0805	AC1206
Paper/PE taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000
	13" (330 mm)	50,000	20,000	20,000	20,000

NOTE

1. For Paper/PE tape and reel specification/dimensions, please see the special data sheet "Chip resistors packing"

FUNCTIONAL DESCRIPTION

POWER RATING

Each type rated power at 70°C:
AC0402=1/16W, AC0603=1/10W,
AC0805=1/8 W, AC1206=1/4W

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 max. working voltage whichever is less

Where

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

P=Rated power (W)

R=Resistance value (Ω)

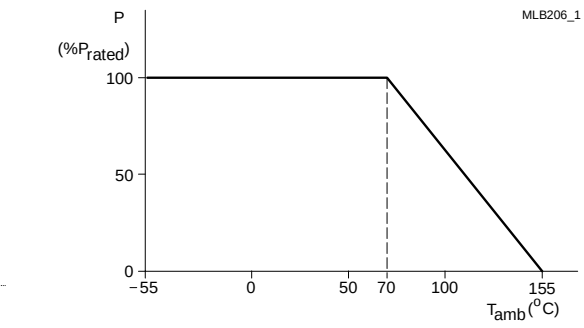

Fig. 6 Maximum dissipation (P) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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 °C, unpowered	±(1.0%+0.05Ω)
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 Parts mounted on test-boards, without condensation on parts	±(0.5%+0.05Ω)
Biased Humidity	AEC-Q200 Test 7 MIL-STD-202 Method 103	1,000 hours; 85 °C / 85% RH 10% of operating power Measurement at 24±4 hours after test conclusion.	±(1.0%+0.05Ω)
Operational Life	AEC-Q200 Test 8 MIL-STD-202 Method 108	1,000 hours at 125 °C, derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required	±(1.0%+0.05Ω)
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	±(0.5%+0.05Ω) No visible damage
Thermal Shock	AEC-Q200 Test 16 MIL-STD-202 Method 107	-55/+125 °C Number of cycles is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(0.5%+0.05Ω)
ESD	AEC-Q200 Test 17 AEC-Q200-002	Human Body Model, $1_{pos.}$ + $1_{neg.}$ discharges 0402/0603: 1KV 0805 and above: 2KV	±(3.0%+0.05Ω)

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 30±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 0402: 5 mm 0603/0805: 3 mm 1206 and above: 2 mm Holding time: minimum 60 seconds	±(1.0%+0.05Ω)
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/–55 °C and +25/+125 °C Formula: $T.C.R=\frac{R_2-R_1}{R_1(t_2-t_1)}\times 10^6$ (ppm/°C) Where t_1=+25 °C or specified room temperature t_2=–55 °C or +125 °C test temperature R_1=resistance at reference temperature in ohms R_2=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)
FOS	ASTM-B-809-95	Sulfur (saturated vapor) 500 hours, 60±2℃, unpowered	±(1.0%+0.05Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	Aug. 02, 2022	-	- l2 dimension updated, for size 1206
Version 1	Dec. 05, 2017	-	- Extend resistance value from 1Mohm to 7.5Mohm for AC1206
Version 0	Feb. 23, 2016	-	- New datasheet for Automotive thick film ultra precision chip resistors sizes of 0402/0603/0805/1206, 0.1%, 0.5%, 1%, TC50 with lead-free terminations

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