Innovative Service Around the Globe YAGEO

DATA SHEET

THIN FILM CHIP RESISTORS AUTOMOTIVE GRADE

RP series

0.1% TO 1%, TC10 TO TC50

sizes 0402/0603/0805/1206/1210

RoHS compliant

YAGEO

Product specification – May 10, 2024 V.3



SCOPE

This specification describes RP0402 to RP1210 high precision-high stability chip resistors made by thin film process.

APPLICATIONS

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

FEATURES

- AEC-Q200 qualified
- Pb free without RoHS exemption
- Halogen free epoxy
- Superior resistance against sulfur containing surroundings
- Moisture sensitivity level: MSL 1
- Environmental hazards reduction
- Non-forbidden materials used in products/production

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

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

(1) SIZE

0402 / 0603 / 0805 / 1206 / 1210

(2) TOLERANCE

B = ± 0.1%
C = ± 0.25%
D = ± 0.5%
F = ± 1%

(3) PACKAGING TYPE

R = Paper taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

B = ± 10 ppm/°C
C = ± 15 ppm/°C
D = ± 25 ppm/°C
E = ± 50 ppm/°C

(5) TAPING REEL

07 / 7W inch dia. Reel and specific rated power

Detailed power rating are shown in the Table 2.

(6) RESISTANCE VALUE

There are 2~4 digits indicated the resistor value.

Letter R/K/M is decimal point

Example: 100R = 100Ω
1K = 1,000Ω

(7) DEFAULT CODE

Letter L is the system default code for ordering only. (NOTE)

ORDERING EXAMPLE

The ordering code of a RP0402 0.063W chip resistor, TCR 25 value 56Ω with ±0.5% tolerance, supplied in 7-inch tape reel is: RP0402DRD0756RL.

NOTE

1. 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.

MARKING

RP0402

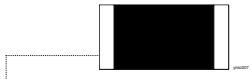


Fig. 1

No marking

RP0603



Fig. 2 Value = 12.4 KΩ

E-96 series: including values 10/11/13/15/20/75 of E-24 series, 3 digits



Fig. 3 Value = 56 KΩ

E-24 series: exception values 10/11/13/15/20/75 of E-24 series, one short bar under marking letter

RP0805 / RP1206 / RP1210



Fig. 4 Value = 10 KΩ

Both E-24 and E-96 series: 4 digits
First three digits for significant figure and 4th digit for number of zeros

NOTE

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 connected by a resistive layer.
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.
Adding a special protective layer, passivation coating, on this series to enhance moisture resistance of the environment.

OUTLINES

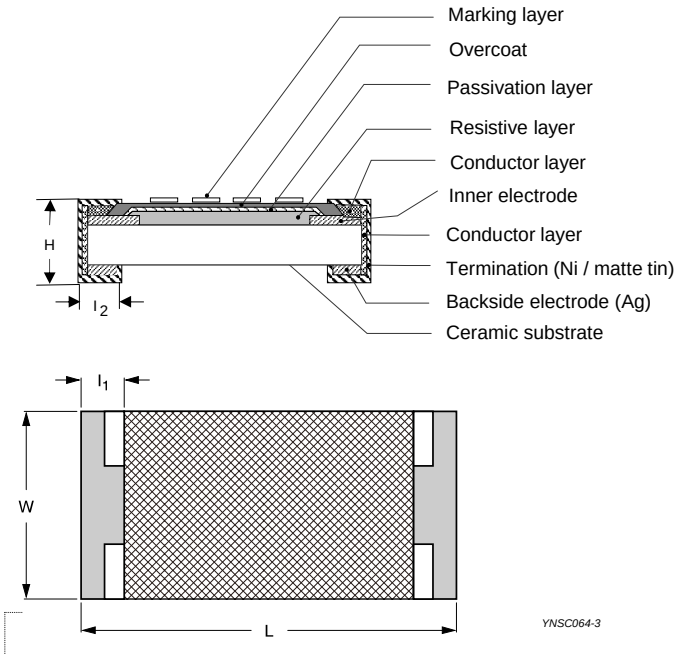


Fig. 5 Chip resistor outlines

DIMENSIONS

Table 1

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
RP0402	1.00 ±0.10	0.50 ±0.05	0.30 ±0.05	0.20 ±0.10	0.25 ±0.10
RP0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
RP0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
RP1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
RP1210	3.10 ±0.10	2.60 ±0.15	0.55 ±0.10	0.50 ±0.20	0.50 ±0.20

ELECTRICAL CHARACTERISTICS

Table 2

TYPE	Operating Temperature Range	Power Rating@70°C (3) 07	Power Rating@70°C (3) 7W	Max. Working Voltage	Max. Overload Voltage	Resistance Range (E-24/E-96 series)(Ω) & Tolerance(1) T.C.R. (ppm/°C)(2)	±0.1% (B)	±0.25% (C)	±0.5% (D)	±1% (F)	Unit weight (mg/pcs)
RP0402	–55 °C to +155 °C	1/16 W	--	50 V	100 V	±50 (E) ±25 (D) ±15 (C) ±10 (B)	10 ≤ R ≤ 300K				0.572
		--	1/8 W				10 ≤ R ≤ 240K				
RP0603		1/10 W	1/5 W	75V	150 V	±50 (E) ±25 (D) ±15 (C) ±10 (B)	10 ≤ R ≤ 1M				2.128
RP0805		1/8 W	1/4 W	150 V	300 V	±50 (E) ±25 (D) ±15 (C) ±10 (B)	10 ≤ R ≤ 1M5				4.642
RP1206		1/4 W	2/5W	200 V	400 V	±50 (E) ±25 (D) ±15 (C) ±10 (B)	10 ≤ R ≤ 1M5				10.116
RP1210		1/4 W	--	200 V	400 V	±50 (E) ±25 (D)	10 ≤ R ≤ 1M				15.805

NOTE : 1. Global part number (code 7)
2. Global part number (code 9)
3. Global part number (code 10-11)

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

PRODUCT TYPE	PATKING STYLE	REEL DIMENSION	QUANTITY PER REEL
RP0402	Paper taping reel	7" (178 mm)	10,000 Units
RP0603	Paper taping reel	7" (178 mm)	5,000 Units
RP0805	Paper taping reel	7" (178 mm)	5,000 Units
RP1206	Paper taping reel	7" (178 mm)	5,000 Units
RP1210	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.

FUNCTIONAL DESCRIPTION

OPERATING TEMPERATURE RANGE

Range: –55 °C to +155 °C

POWER RATING

Each type rated power at 70 °C:
RP0402=1/16 W; 1/8 W
RP0603=1/10 W; 1/5 W
RP0805=1/8 W; 1/4 W
RP1206=1/4 W; 2/5W
RP1210=1/4W

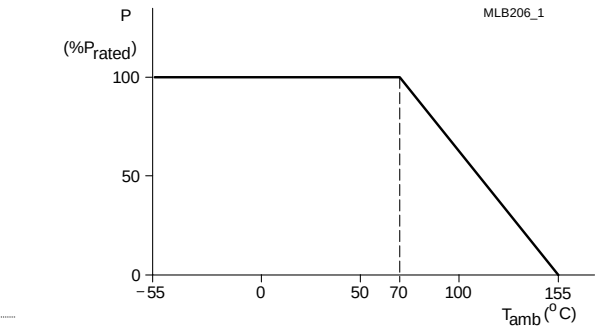


Fig. 6 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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

R=Resistance value (Ω)

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%+0.05Ω)
High Temperature Exposure	AEC-Q200 Test 3 MIL-STD-202 Method 108	1,000 hours at Tamb = 155 °C, unpowered	±(0.3%+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	±(0.1%+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	±(0.1%+0.05Ω)
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%+0.05Ω)
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	±(0.05%+0.05Ω)
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	±(0.1%+0.05Ω) No visible damage
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

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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 1206/1210: 2mm Holding time: minimum 60 second	±(0.1%+0.05Ω)
Temperature Coefficient of Resistance (T.C.R.)	IEC 60115-1 4.8	At +25/–55 °C and +25/+125°C Formula: $T.C.R=\frac{R2-R1}{R1(t2-t1)}\times 10^6(ppm/°C)$ 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.	±(2.0%+0.05Ω)

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 3	May 10, 2024	-	- Add RP1210 series - Extend power rating
Version 2	Oct. 03, 2023	-	- Extend double power rating
Version 1	Nov. 07, 2022	-	- Extend temperature coefficient of resistance range (B=±10ppm/°C) - Add unit weight
Version 0	Jul. 25, 2022	-	- First issue of this specification