Innovative Service Around the Globe YAGEO

DATA SHEET

THIN FILM CHIP RESISTORS

High precision - high stability

RT_P series

0.1% TO 1%, TCR 25 TO 50

sizes 0402/ 0603/ 0805/ 1206

RoHS compliant



YAGEO

Product specification – October 6, 2023 V.1

SCOPE

This specification describes RT series high precision - high stability chip resistors.

APPLICATIONS

- Converters
- Printing equipment
- Server board
- Telecom
- Consumer

FEATURES

- Pb free without RoHS exemption
- Halogen Free Epoxy
- RoHS compliant
- Environmental hazards reduction
- Saving of PCB space
- None forbidden-materials used in products/production

ORDERING INFORMATION - GLOBAL PART NUMBER

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

GLOBAL PART NUMBER

RT	XXXX	F	X	X	XX	XXXX	P
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) SIZE

0402 / 0603 / 0805 / 1206

(2) TOLERANCE

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

(3) PACKAGING TYPE

R = Paper/PE taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

D = 25 ppm/°C
E = 50 ppm/°C

(5) TAPING REEL

07 = 7 inch dia. Reel
10 = 10 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.

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

(7) DEFAULT CODE

Letter P is lead free (without RoHS exemption)

Resistance rule of global part number

Resistance code rule	Example
XRXX (1 to 9.76 Ω)	1R = 1 Ω 1R5 = 1.5 Ω 9R76 = 9.76 Ω
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 to 9.76 MΩ)	1M = 1,000,000 Ω 9M76= 9,760,000 Ω

ORDERING EXAMPLE

The ordering code of a RT0603 chip resistor, TC 50 value 56 Ω with ±0.5% tolerance, supplied in 7-inch tape reel is: RT0603DRE0756RP.

MARKING

RT0402 / RESISTANCE VALUE IS NOT IN E-24 / E96 SERIES



Fig. 1

No marking

RT0603

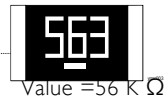


Fig. 2 Value =56 K Ω

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



Fig. 3 Value = 12.4 K Ω

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

RT0805 / RT1206



Fig. 4 Value =10 K Ω

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

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)	I_1 (mm)	I_2 (mm)
RT0402	1.00 ±0.10	0.50 ±0.05	0.30 ±0.05	0.20 ±0.10	0.25 ±0.10
RT0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
RT0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
RT1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20

OUTLINES

For dimension see Table 1

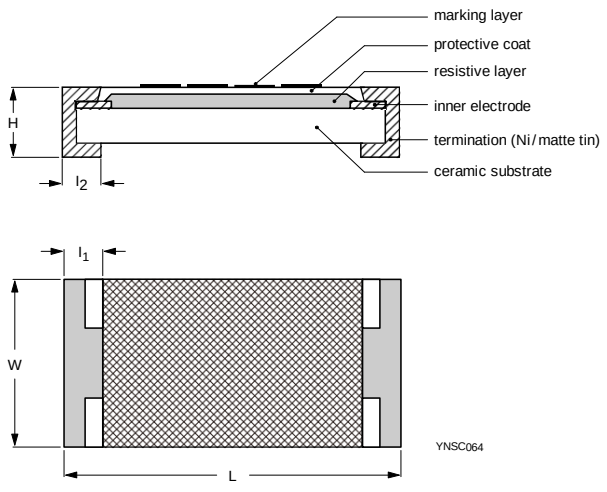


Fig. 5 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

Type	Operating Temperature Range	Power Rating	Max. Work Vol. (1)	Max. Overload Vol.	T.C.R. (ppm/°C)	Resistance Range (E-24/E-96 series)(2) & Tolerance				Unit weight (mg/pcs)
						±0.1% (B)	±0.25% (C)	±0.5% (D)	±1.0% (F)	
RT0402	–55°C to +155°C	1/16W	50V	100V	±50(E)	5.1~237K	5.1~237K	5.1~237K	5.1~237K	0.564
					±25(D)	5.1~237K	5.1~237K	5.1~237K	5.1~237K	
RT0603		1/10W	75V	150V	±50(E)	10~681K	10~681K	10~681K	10~681K	2.128
					±25(D)	10~681K	10~681K	10~681K	10~681K	
RT0805		1/8W	150V	300V	±50(E)	4.7~1.5M	4.7~1.5M	4.7~1.5M	4.7~1.5M	4.642
					±25(D)	4.7~1.5M	4.7~1.5M	4.7~1.5M	4.7~1.5M	
RT1206		1/4W	200V	400V	±50(E)	5.6~1.5M	5.6~1.5M	5.6~1.5M	5.6~1.5M	9.996
					±25(D)	5.6~1.5M	5.6~1.5M	5.6~1.5M	5.6~1.5M	

NOTE

1. The maximum working voltage that may be continuously applied to the resistor element, see "IEC publication 60115-8"
2. Value of E-192 series is on request

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	RT0402	RT0603	RT0805	RT1206
Paper/PE taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000
	10" (254 mm)	20,000	10,000	10,000	10,000
	13" (330 mm)	50,000	20,000	20,000	20,000

NOTE

1. For Paper/Embossed 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:
RT0402=1/16W, RT0603=1/10W
RT0805=1/8W, RT1206=1/4W

RATED VOLTAGE

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

$$V=\sqrt{(PxR)}$$

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)

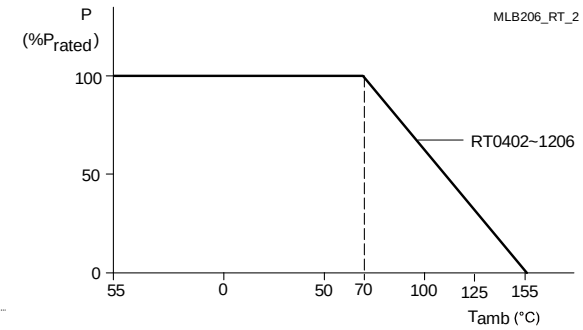


Fig. 6 Maximum dissipation (P) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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
Life/Endurance	IEC 60115-1 4.25.1 MIL-STD-202 Method 108A	At 70±5 °C for 1,000 hours, rated voltage applied for 1.5 hours on, 0.5 hour off, still air required	±(0.5%+0.05 Ω)
High Temperature Exposure	IEC 60068-2-2	1000 hours at maximum operating temperature depending on specification, unpowered	±(0.5%+0.05 Ω)
Moisture Resistance	MIL-STD-202 Method 106G	Each temperature / humidity cycle is defined at 8 hours, 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 Measurement at 24±2 hours after test conclusion	±(0.5%+0.05 Ω)
Thermal Shock	MIL-STD-202 Method 107G	-55/+125 °C Number of cycles required is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(0.5%+0.05 Ω)
Humidity (steady state)	IEC 60115-1 4.24.2	Steady state for 1000 hours at 40 °C / 95% R.H. rated voltage applied for 1.5 hours on and 0.5 hour off	±(0.5%+0.05 Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
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	±(0.5%+0.05 Ω) No visible damage
Board Flex/ Bending	IEC 60115-1 4.33	Chips mounted on a glass epoxy resin PCB (FR4) Bending time: 60±5 seconds RT0402: 5 mm RT0603: 3 mm RT0805: 3 mm RT1206: 2 mm	±(0.25%+0.05 Ω) No visible damage
Solderability - Wetting	J-STD-002 test B	Electrical Test not required Magnification 50X SMD conditions: 1st step: method B, aging 4 hours at 155°C dry heat 2nd step: leadfree solder bath at 245±3°C Dipping time: 3±0.5 seconds	Well tinned (≥95% covered) No visible damage
- Leaching	J-STD-002 test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	IEC 60115-1 4.18	Condition B, no pre-heat of samples. Leadfree solder, 260 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(0.5%+0.05 Ω) No visible damage

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 1	Oct. 06, 2023	-	- Extend case size RT0805_P & RT1206_P
Version 0	Nov. 10, 2022	-	- First issue of this specification

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