Innovative Service Around the Globe YAGEO

# DATA SHEET

## LEAD FREE CHIP RESISTORS

RC_P series

±0.5%, ±1%, ±5%

**Sizes 0100/0201/0402/0603/0805/**
**1206/1210/1218/2010/2512**

YAGEO

Product specification – May 11, 2022 V.4

## SCOPE

This specification describes RC series chip resistors with made by thick film process.

## APPLICATIONS

- All general purpose application

## FEATURES

- Total lead free without RoHS exemption
- Halogen Free Epoxy
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Saving of PCB space

## ORDERING INFORMATION - GLOBAL PART NUMBER

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

### GLOBAL PART NUMBER

| RC | XXXX | X | X | X | XX | XXXX | P |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |

#### (1) SIZE

0100/0201/0402/0603/0805/1206/1210/1218/2010/2512

#### (2) TOLERANCE

D = ±0.5%
F = ±1.0%
J = ±5.0% ( for jumper ordering, use code of J)

#### (3) PACKAGING TYPE

R = Paper taping reel
K = Embossed taping reel
S = ESD safe reel (0100 only)

#### (4) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Based on spec.

#### (5) TAPING REEL

07= 7 inch dia. Reel
13=13 inch dia. Reel
7N = 7 inch dia. Reel, ESD safe reel (0100 only)
7W = 7 inch dia. Reel & 2 x standard power

#### (6) RESISTANCE VALUE

There are 2~4 digits indicated the resistance value.
Letter R/K/M is decimal point.
Example:
97R6 = 97.6Ω
9K76 = 9760Ω
1M = 1,000,000Ω

#### (7) DEFAULT CODE

Letter P is lead free (without RoHS exemption)

### ORDERING EXAMPLE

The ordering code for a RC0402 0.0625W chip resistor value 100KΩ with ±5% tolerance, supplied in 7-inch tape reel of 10,000 units per reel is: RC0402JR-07100KP.

## MARKING

### RC0100 / RC0201 / RC0402

Fig. 1

No Marking

### RC0603

Fig. 2 Value = 10 KΩ

E24 series: 3 digits, 5%

First two digits for significant figure and 3rd digit for number of zeros

### RC0805 / RC1206 / RC1210 / RC1218 / RC2010 / RC2512

Fig. 3 Value = 10 KΩ

E24/E96 series: 4 digits, 1%, 0.5%

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 resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added on each end to make the contacts to the thick film resistive element. The composition of the resistive element is a noble metal imbedded into a glass and covered by a second glass to prevent environmental influences. The resistor is laser trimmed to the rated resistance value. The resistor is covered with a protective epoxy coat, finally the two external terminations (matte tin on Nibarrier) are added, as shown in Fig.4.

**Outlines**

For dimensions, please refer to Table 1

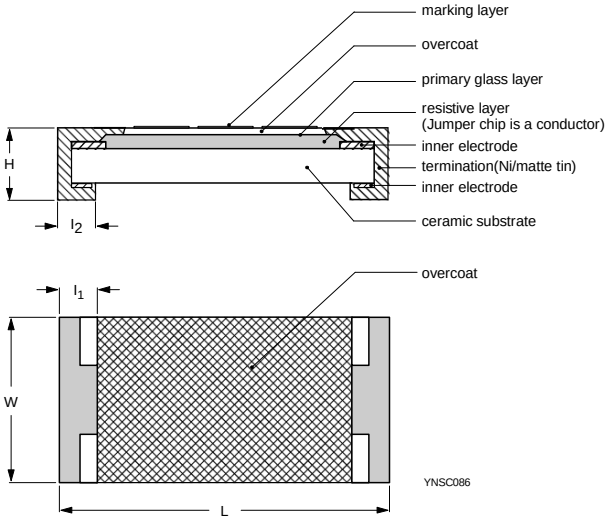


Fig. 4 Chip resistor outlines

## DIMENSION

Table 1

| TYPE | L (mm) | W (mm) | H (mm) | $I_1$ (mm) | $I_2$ (mm) |
|---|---|---|---|---|---|
| RC0100 | 0.40±0.02 | 0.20±0.02 | 0.13±0.02 | 0.10±0.03 | 0.10±0.03 |
| RC0201 | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.10±0.05 | 0.15±0.05 |
| RC0402 | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10 | 0.25±0.10 |
| RC0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.25±0.15 | 0.25±0.15 |
| RC0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20 | 0.35±0.20 |
| RC1206 | 3.10±0.10 | 1.60±0.10 | 0.55±0.10 | 0.45±0.20 | 0.45±0.20 |
| RC1210 | 3.10±0.10 | 2.60±0.15 | 0.55±0.10 | 0.45±0.15 | 0.50±0.20 |
| RC1218 | 3.10±0.10 | 4.60±0.10 | 0.55±0.10 | 0.45±0.20 | 0.40±0.20 |
| RC2010 | 5.00±0.10 | 2.50±0.15 | 0.55±0.10 | 0.45±0.15 | 0.55±0.20 |
| RC2512 | 6.35±0.10 | 3.10±0.15 | 0.55±0.10 | 0.60±0.20 | 0.60±0.20 |

## ELECTRICAL CHARACTERISTICS

Table 2

| TYPE | POWER | CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | RESISTANCE RANGE | Temperature Coefficient of Resistance | Jumper Criteria |
| RC0100 | 1/32W | -55℃ to +125℃ | 15V | 30V | 30V | E24 ±5%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>Jumper< 50mΩ | 1Ω≤R<10Ω:-200~+600ppm℃<br>10Ω≤ R<100Ω: ±300ppm/℃<br>100Ω≤R≤10MΩ: ±200ppm/℃ | Rated Current 0.5A<br>Max. Current 1.0A |
| RC0201 | 1/20W | -55℃ to +125℃ | 25V | 50V | 50V | E24 ±5%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: -100~+350ppm℃<br>10Ω<R≤10MΩ: ±200ppm℃ | Rated Current 0.5A<br>Max. Current 1.0A |
| RC0402 | 1/16W | -55℃ to +155℃ | 50V | 100V | 100V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃<br>10MΩ<R≤22MΩ: ±200ppm℃ | Rated Current 1.0A<br>Max. Current 2.0A |
| | 1/8W | -55℃ to +155℃ | 50V | 100V | 100V | E24 ±5%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃ | – |

| TYPE | POWER | CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | RESISTANCE RANGE | Temperature Coefficient of Resistance | Jumper Criteria |
| RC0603 | 1/10W | -55℃ to +155℃ | 75V | 150V | 150V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃<br>10MΩ<R≤22MΩ: ±200ppm℃ | Rated Current 1.0A<br>Max. Current 2.0A |
| | 1/5W | -55℃ to +155℃ | 75V | 150V | 150V | E24 ±5%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃ | -- |
| RC0805 | 1/8W | -55℃ to +155℃ | 150V | 300V | 300V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃<br>10MΩ<R≤22MΩ: ±200ppm℃ | Rated Current 2.0A<br>Max. Current 5.0A |
| | 1/4W | -55℃ to +155℃ | 150V | 300V | 300V | E24 ±5%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃ | -- |
| RC1206 | 1/4W | -55℃ to +155℃ | 200V | 400V | 500V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃<br>10MΩ<R≤22MΩ: ±200ppm℃ | Rated Current 2.0A<br>Max. Current 10.0A |
| | 1/2W | -55℃ to +155℃ | 200V | 400V | 500V | E24 ±5%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃ | -- |
| RC1210 | 1/2W | -55℃ to +155℃ | 200V | 500V | 500V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤10MΩ: ±100ppm℃<br>10MΩ<R≤22MΩ: ±200ppm℃ | Rated Current 2.0A<br>Max. Current 10.0A |
| RC1218 | 1W | -55℃ to +155℃ | 200V | 500V | 500V | E24 ±5%<br>1Ω ≤ R ≤ 1MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 1MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm℃<br>10Ω<R≤1MΩ: ±100ppm℃ | Rated Current 6.0A<br>Max. Current 10.0A |

| TYPE | POWER | CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | RESISTANCE RANGE | Temperature Coefficient of Resistance | Jumper Criteria |
| RC2010 | 3/4W | -55℃ to +155℃ | 200V | 500V | 500V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω ≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm/℃<br>10Ω<R≤10MΩ: ±100ppm/℃<br>10MΩ<R≤22MΩ: ±200ppm/℃ | Rated Current 2.0A<br>Max. Current 10.0A |
| RC2512 | 1W | -55℃ to +155℃ | 200V | 500V | 500V | E24 ±5%<br>1Ω ≤ R ≤ 22MΩ<br>E24/E96 ±1%<br>1Ω≤ R ≤ 10MΩ<br>E24/E96 ±0.5%<br>10Ω ≤ R ≤ 1MΩ<br>Jumper< 50mΩ | 1Ω≤R≤10Ω: ±200ppm/℃<br>10Ω<R≤10MΩ: ±100ppm/℃<br>10MΩ<R≤22MΩ: ±200ppm/℃ | Rated Current 2.0A<br>Max. Current 10.0A |

## FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please refer to data sheet "Chip resistors mounting"

## PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

| PACKING STYLE | REEL DIMENSION | RC0100 | RC0201 | RC0402 | RC0603 | RC0805 | RC1206 | RC1210 | RC1218 | RC2010 | RC2512 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Paper taping reel (R) | 7" (178 mm) | 20,000 | 10,000 | 10,000 | 5,000 | 5,000 | 5,000 | 5,000 | --- | --- | --- |
| | 13" (330 mm) | 80,000 | 50000 | 50000 | 20000 | 20000 | 20000 | 20000 | --- | --- | --- |
| ESD safe reel (S) | 7" (178 mm) | 40,000 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Embossed taping reel | 7" (178 mm) | | --- | --- | --- | --- | --- | --- | 4,000 | 4,000 | 4,000 |

**NOTE**

For tape and reel specification/dimensions, please refer to data sheet "Chip resistors packing".

## FUNCTIONAL DESCRIPTION

### OPERATING TEMPERATURE RANGE

RC0402 to RC2512 Range: -55℃ to +155℃ (Fig. 5-1)

RC0100 to RC0201 Range: -55℃ to +125℃ (Fig. 5-2)

### POWER RATING

Each type rated power at 70 ℃:

RC0100=1/32W
RC0201=1/20 W
RC0402=1/16 W, 1/8W
RC0603=1/10W, 1/5W
RC0805=1/8W, 1/4W
RC1206=1/4W, 1/2W
RC1210=1/2W
RC1218=1W
RC2010=3/4W
RC2512=1W

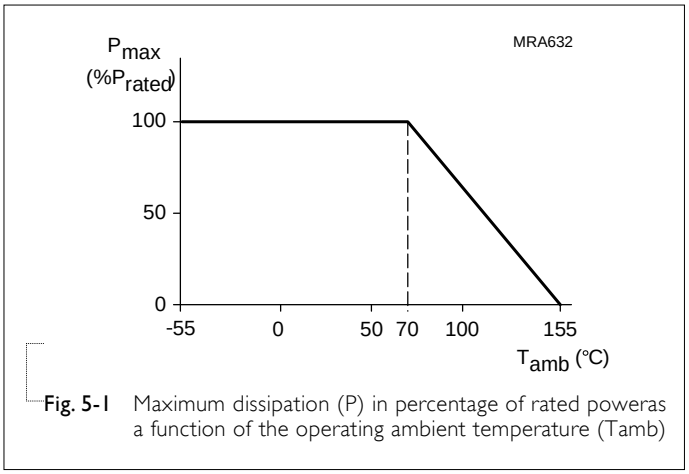


Fig. 5-1 Maximum dissipation (P) in percentage of rated poweras a function of the operating ambient temperature (Tamb)

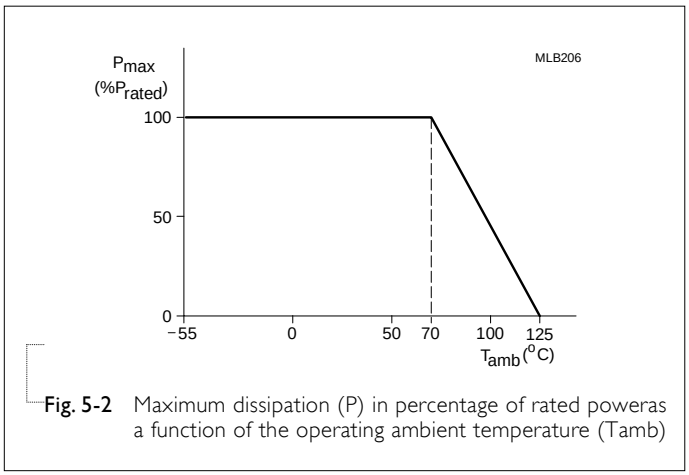


Fig. 5-2 Maximum dissipation (P) in percentage of rated poweras a function of the operating ambient temperature (Tamb)

### RATED VOLTAGE

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

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

Where

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

P = Rated power (W)

R = Resistance value (Ω)

## TESTS AND REQUIREMENTS

Table 8 Test condition, procedure and requirements

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---|---|---|
| Temperature Coefficient of Resistance (T.C.R.) | IEC 60115-1 4.8 | At +25/–55 °C and +25/+125 °C<br>Formula:<br>$T.C.R=\frac{R_2-R_1}{R_1(t_2-t_1)}\times 10^6$ (ppm/°C)<br>Where<br>$t_1$=+25 °C or specified room temperature<br>$t_2$=–55 °C or +125 °C test temperature<br>$R_1$=resistance at reference temperature in ohms<br>$R_2$=resistance at test temperature in ohms | Refer to table 2 |
| Life/ Endurance | MIL-STD-202G Method 108A<br>IEC 60115-1 4.25.1 | At 70±5℃ for 1,000 hours; RCWV applied for 1.5 hours on and 0.5 hour off, still air required | 0100: ±(3%+0.05Ω)<br>Others:<br>±(1%+0.05Ω ) for D/F tol<br>±(3%+0.05Ω) for J tol<br><100mR for jumper |
| High Temperature Exposure | MIL-STD-202G Method 108A<br>IEC 60115-1 4.25.3 | 1,000 hours at maximum operating temperature depending on specification, unpowered. | 0100: ±(1%+0.05Ω)<br>Others:<br>±(1%+0.05Ω) for D/F tol<br>±(2%+0.05Ω) for J tol<br><50mR for jumper |
| Moisture Resistance | MIL-STD-202G Method 106F<br>IEC 60115-1 4.24.2 | 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<br>Parts mounted on test-boards, without condensation on parts | 0100: ±(2%+0.05Ω)<br>Others:<br>±(0.5%+0.05Ω) for D/F tol<br>±(2%+0.05Ω) for J tol<br><100mR for jumper |
| Humidity | IEC 60115-1 4.37 | Steady state for 1000 hours at 40 °C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off | 0100: ±(3%+0.05Ω)<br>Others:<br>±(1%+0.05Ω) for D/F tol<br>±(2%+0.05Ω) for J tol<br><100mR for jumper |
| Thermal Shock | MIL-STD-202G Method 107G | -55/+125℃<br>Note Number of cycles required is 300 Devices mounted<br>Maximum transfer time is 20 seconds Dwell time is 15 minutes. Air - Air | 0100: ±(1%+0.05Ω)<br>Others:<br>±(0.5%+0.05Ω) for D/F tol<br>±(1%+0.05Ω) for J tol<br><50mR for jumper |
| Short Time Overload | IEC 60115-1 4.13 | 2.5 times RCWV or maximum overload voltage which is less for 5 seconds at room temperature | 0100: ±(2%+0.05Ω)<br>Others:<br>±(1%+0.05Ω) for D/F tol<br>±(2%+0.05Ω) for J tol<br><50mR for jumper |

| TEST | TEST METHOD | PROCEDURE | REQUIREMENTS |
|---|---|---|---|
| Board Flex/ Bending | IEC 60115-1 4.33 | Device mounted or as described only 1 board bending required<br>bending time: 60±5 seconds<br>0100/0201/0402:5mm;<br>0603/0805:3mm;<br>1206 and above:2mm | ±(1%+0.05Ω) for D/F/J Tol<br><50mR for jumper<br>No visible damage |
| Solderability - Wetting | IPC/JEDECJ-STD-002B test B<br>IEC 60068-2-58 | Electrical Test not required Magnification 50X<br>SMD conditions:<br>1st step: method B, aging 4 hours at 155 °C dry heat<br>2nd step: leadfree solder bath at 245±3 °C<br>Dipping time: 3±0.5 seconds | Well tinned (>95% covered)<br>No visible damage |
| -Leaching | IPC/JEDECJ-STD-002B test D<br>IEC 60068-2-58 | Leadfree solder ,260°C, 30 seconds immersion time | No visible damage |
| -Resistance to Soldering Heat | MIL-STD-202F Method 210F<br>IEC 60068-2-58 | Condition B, no pre-heat of samples<br>Leadfree solder, 260 °C ±5℃, 10 ±1 seconds immersion time<br>Procedure 2 for SMD: devices fluxed and cleaned with isopropanol | 0100: ±(1%+0.05Ω)<br>Others:<br>±(0.5%+0.05Ω) for D/F tol<br>±(1%+0.05Ω) for J tol<br><50mR for jumper<br>No visible damage |

## REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|---|---|---|---|
| Version 4 | MAY. 10, 2022 | - | - Extend the range of size 01005 to 10Mohm |
| Version 3 | Oct. 12, 2021 | - | - Upgrade Temperature Coefficient of Resistance |
| Version 2 | Mar. 25, 2021 | - | - Add size 01005 and Double Power for size 0402~1206 |
| Version 1 | Sep. 05, 2018 | - | - Remove size 01005 of this specification |
| Version 0 | Aug. 22, 2014 | - | - First issue of this specification |

*" YAGEO reserves all the rights for revising the content of this datasheet without further notification, as long as the products itself are unchanged. Any product change will be announced by PCN."*