

# 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 I
- 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 =  $\pm 0.1\%$

C =  $\pm 0.25\%$

D =  $\pm 0.5\%$

F =  $\pm 1\%$

**(3) PACKAGING TYPE**

R = Paper taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

B =  $\pm 10 \text{ ppm}/^\circ\text{C}$

C =  $\pm 15 \text{ ppm}/^\circ\text{C}$

D =  $\pm 25 \text{ ppm}/^\circ\text{C}$

E =  $\pm 50 \text{ ppm}/^\circ\text{C}$

**(5) TAPING REEL**

07 / 7VV 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 = 100 $\Omega$

1K = 1,000 $\Omega$

**(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 56 $\Omega$  with  $\pm 0.5\%$  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



No marking

Fig. 1

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 / RPI206 / RPI210

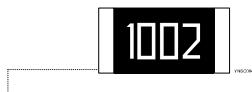


Fig. 4 Value = 10 KΩ

Both E-24 and E-96 series: 4 digits

First three digits for significant figure and 4th digit for number of zeros

**NOTE**

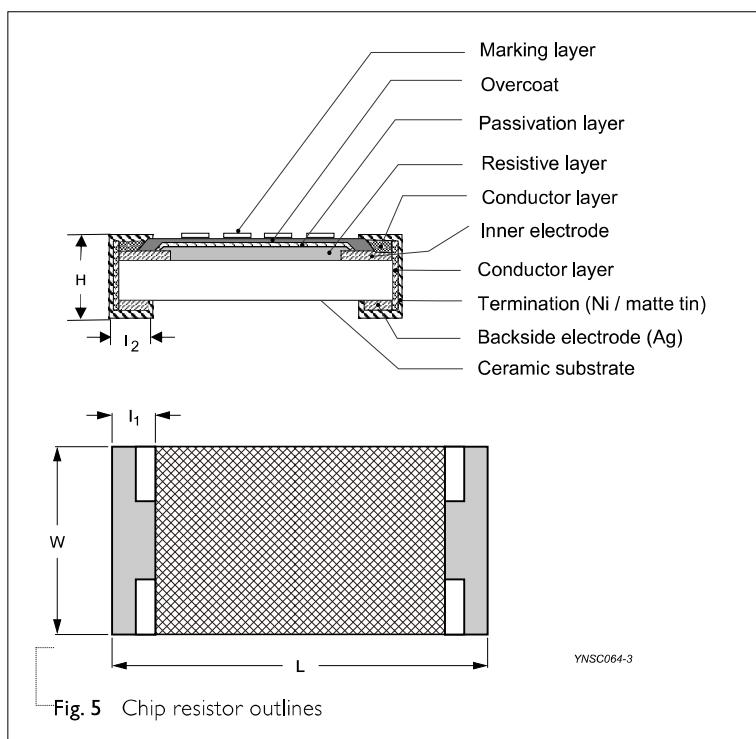
For further marking information, please see special data sheet "Chip resistors marking".

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

DIMENSIONS

Table 1

| TYPE   | L (mm)     | W (mm)     | H (mm)     | I <sub>1</sub> (mm) | I <sub>2</sub> (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          |
| RPI206 | 3.10 ±0.10 | 1.60 ±0.10 | 0.55 ±0.10 | 0.45 ±0.20          | 0.40 ±0.20          |
| RPI210 | 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 <sup>(3)</sup> |       | Max. Working Voltage | Max. Overload Voltage | T.C.R. (ppm/°C) <sup>(2)</sup>           | Resistance Range (E-24/E-96 series)(Ω) & Tolerance <sup>(1)</sup> |     |     |     | Unit weight (mg/pcs) |
|--------|-----------------------------|----------------------------------|-------|----------------------|-----------------------|--|---|-----|-----|-----|----------------------|
|        |                             | 07                               | 7W    |                      |                       |  | (B)   | (C) | (D) | (F) |                      |
| RP0402 | -55 °C to +155 °C           | 1/16 W                           | --    | 50 V                 | 100 V                 | ±50 (E)<br>±25 (D)<br>±15 (C)<br>±10 (B) | 10 ≤ R ≤ 300K   |     |     |     | 0.572                |
|        |                             | --                               | 1/8 W |                      |                       |  | 10 ≤ R ≤ 240K   |     |     |     |                      |
| RP0603 | -55 °C to +155 °C           | 1/10 W                           | 1/5 W | 75V                  | 150 V                 | ±50 (E)<br>±25 (D)<br>±15 (C)<br>±10 (B) | 10 ≤ R ≤ 1M   |     |     |     | 2.128                |
|        |                             | --                               | 1/8 W |                      |                       |  | 10 ≤ R ≤ 1M5  |     |     |     |                      |
| RP0805 | -55 °C to +155 °C           | 1/8 W                            | 1/4 W | 150 V                | 300 V                 | ±50 (E)<br>±25 (D)<br>±15 (C)<br>±10 (B) | 10 ≤ R ≤ 1M5  |     |     |     | 4.642                |
|        |                             | --                               | 1/4 W |                      |                       |  | 10 ≤ R ≤ 1M5  |     |     |     |                      |
| RPI206 | -55 °C to +155 °C           | 1/4 W                            | 2/5W  | 200 V                | 400 V                 | ±50 (E)<br>±25 (D)<br>±15 (C)<br>±10 (B) | 10 ≤ R ≤ 1M5  |     |     |     | 10.116               |
|        |                             | --                               | 1/4 W |                      |                       |  | 10 ≤ R ≤ 1M5  |     |     |     |                      |
| RPI210 | -55 °C to +155 °C           | 1/4 W                            | --    | 200 V                | 400 V                 | ±50 (E)<br>±25 (D)                       | 10 ≤ R ≤ 1M   |     |     |     | 15.805               |
|        |                             | --                               | 1/4 W |                      |                       |  | 10 ≤ R ≤ 1M   |     |     |     |                      |

**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 | PACKING 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       |
| RPI206       | Paper taping reel | 7" (178 mm)    | 5,000 Units       |
| RPI210       | 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:  $-55^{\circ}\text{C}$  to  $+155^{\circ}\text{C}$

**POWER RATING**

Each type rated power at  $70^{\circ}\text{C}$ :

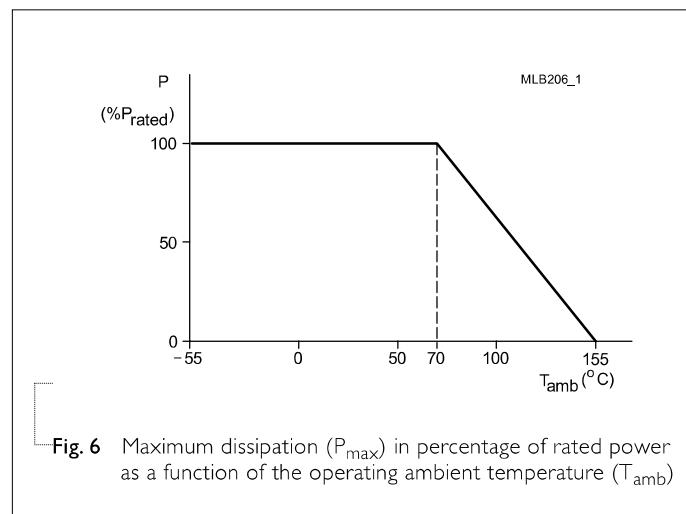
RP0402=1/16 W; 1/8 W

RP0603=1/10 W; 1/5 W

RP0805=1/8 W; 1/4 W

RPI206=1/4 W; 2/5W

RPI210=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

R=Resistance value ( $\Omega$ )

**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   | $\pm(0.05\%+0.05\Omega)$                               |
| High Temperature Exposure    | AEC-Q200 Test 3<br>MIL-STD-202 Method 108  | 1,000 hours at $T_{amb} = 155^{\circ}\text{C}$ , unpowered   | $\pm(0.3\%+0.05\Omega)$                                |
| Moisture Resistance          | AEC-Q200 Test 6<br>MIL-STD-202 Method 106  | Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d. with $25^{\circ}\text{C} / 65^{\circ}\text{C}$ 95% R.H, without steps 7a & 7b, unpowered<br>Parts mounted on test-boards, without condensation on parts  | $\pm(0.1\%+0.05\Omega)$                                |
| Biased Humidity              | AEC-Q200 Test 7<br>MIL-STD-202 Method 103  | 1,000 hours; $85^{\circ}\text{C} / 85\%$ RH<br>10% of operating power<br>Measurement at $24\pm4$ hours after test conclusion   | $\pm(0.1\%+0.05\Omega)$                                |
| Life                         | AEC-Q200 Test 8<br>MIL-STD-202 Method 108  | 1,000 hours at $70\pm5^{\circ}\text{C}$ , RCWV applied for 1.5 hours on, 0.5 hour off, still air required  | $\pm(0.1\%+0.05\Omega)$                                |
| Resistance to Soldering Heat | AEC-Q200 Test 15<br>MIL-STD-202 Method 210 | Condition B, no pre-heat of samples<br>Lead-free solder, $260\pm5^{\circ}\text{C}$ , $10\pm1$ seconds immersion time<br>Procedure 2 for SMD: devices fluxed and cleaned with isopropanol   | $\pm(0.05\%+0.05\Omega)$                               |
| Thermal Shock                | AEC-Q200 Test 16<br>MIL-STD-202 Method 107 | $-55/+125^{\circ}\text{C}$<br>Number of cycles is 300. Devices mounted<br>Maximum transfer time is 20 seconds.<br>Dwell time is 15 minutes. Air – Air  | $\pm(0.1\%+0.05\Omega)$<br>No visible damage           |
| Solderability - Wetting      | AEC-Q200 Test 18<br>J-STD-002              | Electrical Test not required Magnification 50X<br>SMD conditions:<br>(a) Method B, aging 4 hours at $155^{\circ}\text{C}$ dry heat, dipping at $235\pm3^{\circ}\text{C}$ for $5\pm0.5$ seconds.<br>(b) Method B, steam aging 8 hours, dipping at $215\pm3^{\circ}\text{C}$ for $5\pm0.5$ seconds.<br>(c) Method D, steam aging 8 hours, dipping at $260\pm3^{\circ}\text{C}$ for $7\pm0.5$ seconds | Well tinned<br>( $>95\%$ covered)<br>No visible damage |



| TEST   | TEST METHOD                      | PROCEDURE  | REQUIREMENTS            |
|--|----------------------------------|--|-------------------------|
| Board Flex / Bending                           | AEC-Q200 Test 21<br>AEC-Q200-005 | Chips mounted on a 90mm glass epoxy resin PCB (FR4)<br>Bending for 0402: 5 mm<br>0603/0805: 3 mm<br>1206/1210: 2mm<br>Holding time: minimum 60 second  | $\pm(0.1\%+0.05\Omega)$ |
| Temperature Coefficient of Resistance (T.C.R.) | IEC 60115-I 4.8                  | At $+25/-55$ °C and $+25/+125$ °C Formula:<br>$T.C.R = \frac{R2 - R1}{R1 (t2 - t1)} \times 10^6 (\text{ppm}/\text{°C})$ Where<br>$t1 = +25$ °C or specified room temperature<br>$t2 = -55$ °C or $+125$ °C test temperature<br>$R1$ = resistance at reference temperature in ohms<br>$R2$ = resistance at test temperature in ohms | Refer to table 2        |
| Flower of Sulfur                               | ASTM-B-809-95*<br>* Modified     | Sulfur 750 hours, 105°C, unpowered.  | $\pm(2.0\%+0.05\Omega)$ |

REVISION HISTORY

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION   |
|-----------|---------------|---------------------|---|
| Version 3 | May 10, 2024  | -                   | - Add RP1210 series<br>- Extend power rating  |
| Version 2 | Oct. 03, 2023 | -                   | - Extend double power rating  |
| Version 1 | Nov. 07, 2022 | -                   | - Extend temperature coefficient of resistance range ( $B=\pm 10\text{ppm}/^\circ\text{C}$ )<br>- Add unit weight |
| Version 0 | Jul. 25, 2022 | -                   | - First issue of this specification   |

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