

# DATA SHEET

## TRIMMABLE CHIP RESISTORS

TR series

0/-10%, 0/-20%, 0/-30%

sizes 0402/0603/0805/1206

RoHS compliant



## SCOPE

This specification describes TR0402 to TR1206 trimmable chip resistors with lead-free terminations made by thick film process.

## APPLICATIONS

- Hand-held measuring equipment
- Mobile phones
- Camcorders
- Portable radios, CD and cassette
- Tuners
- Photo sensors

## FEATURES

- RoHS compliant
  - Products with lead free terminations meet RoHS requirements
  - Pb-glass contained in electrodes, resistor element and glass are exempted by RoHS
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Saving of PCB space
- None forbidden-materials used in products/production

## ORDERING INFORMATION - GLOBAL PART NUMBER & I2NC

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)

TR XXXX X X X XX XXXX  
(1) (2) (3) (4) (5) (6)

#### (1) SIZE

0402  
0603  
0805  
1206

#### (2) TOLERANCE

K = 0/-10%  
M = 0/-20%  
N = 0/-30%

#### (3) PACKAGING TYPE

R = Paper taping reel

#### (4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

#### (5) TAPING REEL

07 = 7 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) OPTIONAL CODE

L = optional symbol (Note)

#### Resistance rule of global part number

| Resistance code rule   | Example                                  |
|------------------------|------------------------------------------|
| XXXX<br>(1 to 9.76 Ω)  | 1R = 1 Ω<br>1R5 = 1.5 Ω<br>9R76 = 9.76 Ω |
| XXRX<br>(10 to 97.6 Ω) | 10R = 10 Ω<br>97R6 = 97.6 Ω              |
| XXXX<br>(100 to 976 Ω) | 100R = 100 Ω                             |
| XKXX<br>(1 to 9.76 KΩ) | 1K = 1,000 Ω<br>9K76 = 9,760 Ω           |
| XMXX<br>(1 to 9.76 MΩ) | 1M = 1,000,000 Ω<br>9M76 = 9,760,000 Ω   |

### ORDERING EXAMPLE

The ordering code of a TR0603 chip resistor, value 330 Ω with 0/-30% tolerance, supplied in 7-inch tape reel is: TR0603NR-07330R(L).

### NOTE

1. All our RSMD products meet RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / I2NC can be added (both are on customer request)

**PHYCOMP BRAND ordering codes**

Both GLOBAL PART NUMBER (preferred) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

**GLOBAL PART NUMBER (PREFERRED)**

For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

**I2NC CODE**

| 2350 |        | XXX XXXXX L             |          |                  |                                              |              |           |
|------|--------|-------------------------|----------|------------------|----------------------------------------------|--------------|-----------|
| (1)  |        | (2)                     | (3)      | (4)              |                                              |              |           |
| SIZE | TYPE   | START IN <sup>(1)</sup> | TOL. (%) | RESISTANCE RANGE | PAPER/PE TAPE ON REEL (units) <sup>(2)</sup> |              |           |
|      |        |                         |          |                  | 10,000                                       | 5,000/10,000 | 5,000     |
| 0402 | RC32TR | 2350                    | 0/-10%   | 1 to 10 MΩ       | 503 22xxx                                    |              | -         |
|      |        |                         | 0/-20%   | 1 to 10 MΩ       | 503 21xxx                                    |              | -         |
|      |        |                         | 0/-30%   | 1 to 10 MΩ       | 503 20xxx                                    |              | -         |
| 0603 | RC22TR | 2350                    | 0/-10%   | 1 to 10 MΩ       | -                                            |              | 502 12xxx |
|      |        |                         | 0/-20%   | 1 to 10 MΩ       | -                                            |              | 502 11xxx |
|      |        |                         | 0/-30%   | 1 to 10 MΩ       | -                                            |              | 502 10xxx |
| 0805 | RC12TR | 2350                    | 0/-10%   | 1 to 10 MΩ       | -                                            |              | 501 12xxx |
|      |        |                         | 0/-20%   | 1 to 10 MΩ       | -                                            |              | 501 11xxx |
|      |        |                         | 0/-30%   | 1 to 10 MΩ       | -                                            |              | 501 10xxx |
| 1206 | RC02TR | 2350                    | 0/-10%   | 1 to 10 MΩ       | -                                            |              | 500 12xxx |
|      |        |                         | 0/-20%   | 1 to 10 MΩ       | -                                            |              | 500 11xxx |
|      |        |                         | 0/-30%   | 1 to 10 MΩ       | -                                            |              | 500 10xxx |

— Last digit of I2NC

Resistance decade <sup>(3)</sup> Last digit

|                  |   |
|------------------|---|
| 0.01 to 0.0976 Ω | 0 |
| 0.1 to 0.976 Ω   | 7 |
| 1 to 9.76 Ω      | 8 |
| 10 to 97.6 Ω     | 9 |
| 100 to 976 Ω     | 1 |
| 1 to 9.76 KΩ     | 2 |
| 10 to 97.6 KΩ    | 3 |
| 100 to 976 KΩ    | 4 |
| 1 to 9.76 MΩ     | 5 |
| 10 to 97.6 MΩ    | 6 |

|          |        |   |             |
|----------|--------|---|-------------|
| Example: | 0.02 Ω | = | 0200 or 200 |
|          | 0.3 Ω  | = | 3007 or 307 |
|          | 1 Ω    | = | 1008 or 108 |
|          | 33 KΩ  | = | 3303 or 333 |
|          | 10 MΩ  | = | 1006 or 106 |

- (1) The resistors have a 12-digit ordering code starting with 2350.
- (2) The subsequent 4 or 5 digits indicate the resistor tolerance and packaging.
- (3) The remaining 4 or 3 digits represent the resistance value with the last digit indicating the multiplier as shown in the table of "Last digit of I2NC".
- (4) "L" is optional symbol (Note).

**ORDERING EXAMPLE**

The ordering code of a RC22TR resistor with terminations, value 330 Ω with 0/-30% tolerance, supplied in tape of 5,000 units per reel is: 235050210331(L) or TR0603NR-07330R(L).

**NOTE**

1. All our RSMD products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol printed and the optional "L" at the end of GLOBAL PART NUMBER / I2NC can be added (both are on customer request)

## MARKING

TR0402/0603/0805/1206



No marking

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

## CONSTRUCTION

The resistors are constructed on a high-grade ceramic body (aluminium oxide). Internal metal electrodes are added at each end and a connection is made between them using a resistive metal glaze; the approximate resistor values are dependent on the composition of the glaze.

The resistive layer is covered with a translucent protective coat. Finally, two end electrodes are added, the composition of which has been designed to provide ease of soldering. See fig. 2.

## DIMENSIONS

Table 1 For outlines see fig. 2

| TYPE   | L (mm)     | W (mm)     | H (mm)     | l <sub>1</sub> (mm) | l <sub>2</sub> (mm) |
|--------|------------|------------|------------|---------------------|---------------------|
| TR0402 | 1.00 ±0.10 | 0.50 ±0.05 | 0.35 ±0.05 | 0.20 ±0.10          | 0.25 ±0.10          |
| TR0603 | 1.60 ±0.10 | 0.80 ±0.10 | 0.45 ±0.10 | 0.25 ±0.15          | 0.25 ±0.15          |
| TR0805 | 2.00 ±0.10 | 1.25 ±0.10 | 0.50 ±0.10 | 0.35 ±0.20          | 0.35 ±0.20          |
| TR1206 | 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

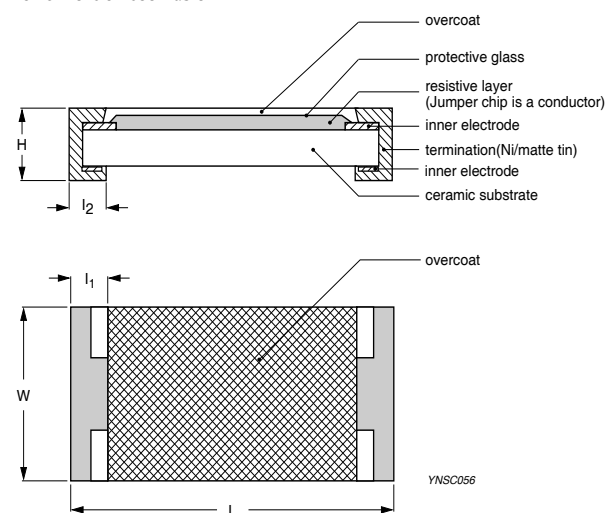


Fig. 2 Chip resistor outlines

## ELECTRICAL CHARACTERISTICS

Table 2

| TYPE   | RESISTANCE RANGE                        | CHARACTERISTICS |                             |                      |                       |                                 | Temperature Coefficient of Resistance                                                        |
|--------|-----------------------------------------|-----------------|-----------------------------|----------------------|-----------------------|---------------------------------|----------------------------------------------------------------------------------------------|
|        |                                         | Rated Power     | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage |                                                                                              |
| TR0402 |                                         | 1/16 W          | -55 °C to +125 °C           | 50 V                 | 100 V                 | 100 V                           |                                                                                              |
| TR0603 | 0/-10%, 0/-20%, 0/-30%:<br>1 Ω to 10 MΩ | 1/16 W          |                             | 50 V                 | 100 V                 | 100 V                           | 1 Ω ≤ R ≤ 10 Ω: ±200 ppm/°C<br>10 Ω < R ≤ 1 MΩ: ±100 ppm/°C<br>1 MΩ < R ≤ 10 MΩ: ±200 ppm/°C |
| TR0805 | (E-24)                                  | 1/8 W           | -55 °C to +155 °C           | 150 V                | 300 V                 | 500 V                           |                                                                                              |
| TR1206 |                                         | 1/4 W           |                             | 200 V                | 500 V                 | 500 V                           |                                                                                              |

## 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 | TR0402 | TR0603 | TR0805 | TR1206 |
|-----------------------|----------------|--------|--------|--------|--------|
| Paper taping reel (R) | 7" (178 mm)    | 10,000 | 5,000  | 5,000  | 5,000  |

### NOTE

I. For Paper tape and reel specification/dimensions, please see the special data sheet “Chip resistors packing”.

## FUNCTIONAL DESCRIPTION

### OPERATING TEMPERATURE RANGE

Each type range:

TR0402/0603: -55°C to +125°C;

TR0805/1206: -55°C to +155°C.

### POWER RATING

Each type rated power at 70°C:

TR0402=1/16 W; TR0603=1/16 W;

TR0805=1/8 W; TR1206=1/4 W.

### 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 ( $\Omega$ )

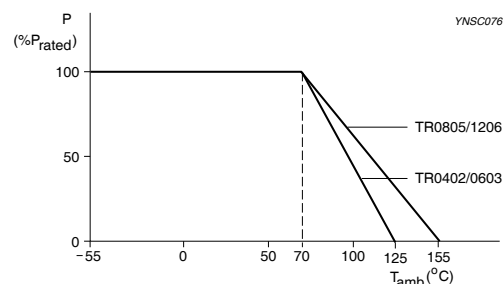


Fig. 3 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

## TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

| TEST                                                                              | TEST METHOD              | PROCEDURE                                                                                                                                                                               | REQUIREMENTS                                                    |
|-----------------------------------------------------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|
| Life/<br>Operational Life/<br>Endurance                                           | MIL-STD-202G-method 108A | 1,000 hours at 70±5 °C applied RCWV                                                                                                                                                     | ±(2%+0.05 Ω)                                                    |
|                                                                                   | IEC 60115-1 4.25.1       | 1.5 hours on, 0.5 hour off, still air required                                                                                                                                          |                                                                 |
|                                                                                   | JIS C 5202-7.10          |                                                                                                                                                                                         |                                                                 |
| High<br>Temperature<br>Exposure/<br>Endurance at<br>upper category<br>temperature | MIL-STD-202G-method 108A | 1,000 hours at maximum operating temperature                                                                                                                                            | ±(1%+0.05 Ω)                                                    |
|                                                                                   | IEC 60115-1 4.25.3       | depending on specification, unpowered                                                                                                                                                   |                                                                 |
|                                                                                   | JIS C 5202-7.11          | No direct impingement of forced air to the parts<br>Tolerances: 155±3 °C                                                                                                                |                                                                 |
| Moisture<br>Resistance                                                            | MIL-STD-202G-method 106F | Each temperature / humidity cycle is defined at 8                                                                                                                                       | ±(2%+0.05 Ω)                                                    |
|                                                                                   | IEC 60115-1 4.24.2       | hours (method 106F), 3 cycles / 24 hours for 10d                                                                                                                                        |                                                                 |
|                                                                                   |                          | with 25 °C / 65 °C 95% R.H, without steps 7a &<br>7b, unpowered<br>Parts mounted on test-boards, without<br>condensation on parts<br>Measurement at 24±2 hours after<br>test conclusion |                                                                 |
| Thermal Shock                                                                     | MIL-STD-202G-method 107G | AR0402/0603: -55/+155 °C                                                                                                                                                                | ±(0.5%+0.05 Ω) for 10 KΩ to<br>10 MΩ<br>±(1%+0.05 Ω) for others |
|                                                                                   |                          | AR0805/1206: -55/+125 °C                                                                                                                                                                |                                                                 |
|                                                                                   |                          | Note: Number of cycles required is 300. Devices<br>unmounted<br>Maximum transfer time is 20 seconds. Dwell time<br>is 15 minutes. Air – Air                                             |                                                                 |
| Short time<br>overload                                                            | MIL-R-55342D-para 4.7.5  | 2.5 times RCWV or maximum overload voltage                                                                                                                                              | ±(2%+0.05 Ω)<br>No visible damage                               |
|                                                                                   | IEC60115-1 4.13          | whichever is less for 5 sec at room temperature                                                                                                                                         |                                                                 |
| Board Flex/<br>Bending                                                            | IEC60115-1 4.33          | Device mounted on PCB test board as described,                                                                                                                                          | ±(1%+0.05 Ω)<br>No visible damage                               |
|                                                                                   |                          | only 1 board bending required                                                                                                                                                           |                                                                 |
|                                                                                   |                          | 3 mm bending<br>Bending time: 60±5 seconds<br>Ohmic value checked during bending                                                                                                        |                                                                 |

| TEST                              | TEST METHOD                                  | PROCEDURE                                                                                                                                                                                                                            | REQUIREMENTS                                    |
|-----------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Solderability                     |                                              |                                                                                                                                                                                                                                      |                                                 |
| - Wetting                         | IPC/JEDECJ-STD-002B test B<br>IEC 60068-2-58 | Electrical Test not required<br>Magnification 50X<br>SMD conditions:<br>1 <sup>st</sup> step: method B, aging 4 hours at 155 °C<br>dry heat<br>2 <sup>nd</sup> 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<br>immersion time                                                                                                                                                                                | No visible damage                               |
| - Resistance to<br>Soldering Heat | MIL-STD-202G-method 210F<br>IEC 60068-2-58   | Condition B, no pre-heat of samples<br>Leadfree solder, 270 °C, 10 seconds<br>immersion time<br>Procedure 2 for SMD: devices fluxed and<br>cleaned with isopropanol                                                                  | ±(1%+0.05 Ω)<br>No visible damage               |

**REVISION HISTORY**

| REVISION  | DATE         | CHANGE NOTIFICATION | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------|--------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version 1 | Jan 14, 2009 | -                   | <ul style="list-style-type: none"><li>- Change to dual brand datasheet that describes TR0402 to TR1206 with RoHS compliant</li><li>- Define global part number</li></ul>                                                                                                                                                                                                                                                        |
| Version 0 | Oct 18, 2005 | -                   | <ul style="list-style-type: none"><li>- New datasheet for trimmable chip resistors sizes of 0402/0603/0805/1206, 0/-10%, 0/-20, and 0/-30% tolerance with lead-free terminations</li><li>- Replace the 0603/0805/1206 parts of pdf files: RC02TR_12TR_9.pdf, RC22_TR_3.pdf, and combine into a document.</li><li>- Test method and procedure updated</li><li>- PE tape added (paper tape will be replaced by PE tape)</li></ul> |

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