

# DATA SHEET

## TRIMMABLE CHIP RESISTORS

TR series (Pb Free)

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

sizes 0402/0603/0805/1206



SCOPE

This specification describes TR0402/0603/0805/1206 trimmable chip resistors with lead-free terminations made by thick film process.

ORDERING INFORMATION

Part number is identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

**YAGEO ORDERING CODE**

**CTC CODE**

**TR XXXX X X X XX XXXX L**  
 (1) (2) (3) (4) (5) (6) (7)

**(1) SIZE**

0402/0603/0805/1206

**(2) TOLERANCE**

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

**(3) PACKAGING TYPE**

R = Paper/PE taping reel

**(4) TEMPERATURE COEFFICIENT OF RESISTANCE**

- = Base on spec

**(5) TAPING REEL**

07 = 7 inch dia. Reel  
 7T = European type <sup>(d)</sup>

**(6) RESISTANCE VALUE**

5R6, 56R, 560R, 56K, 1M, 10M.

**(7) RESISTOR TERMINATIONS <sup>(a)</sup>**

L = Lead-free terminations (matte tin)

APPLICATIONS

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

**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-07330RL.

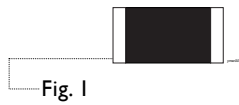
For size 1206 of European type resistor, value 330 Ω with 0/-30% tolerance, supplied in 7-inch tape reel, the ordering code is: TR1206NR-7T330RL.

**NOTE**

- a. The "L" at the end of the code is only for ordering. On the reel label, the standard CTC or I2NC will be mentioned an additional stamp "LFP"= lead free production.
- b. Products with lead in terminations fulfil the same requirements as mentioned in this datasheet.
- c. Products with lead in terminations will be phased out in the coming months (before July 1st, 2006)
- d. European type products are covered with transparent lacquer in stead of transparent glass layer.

**MARKING**

TR0402/0603/0805/1206



No marking

For marking codes, please see EIA-marking code rules in 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.

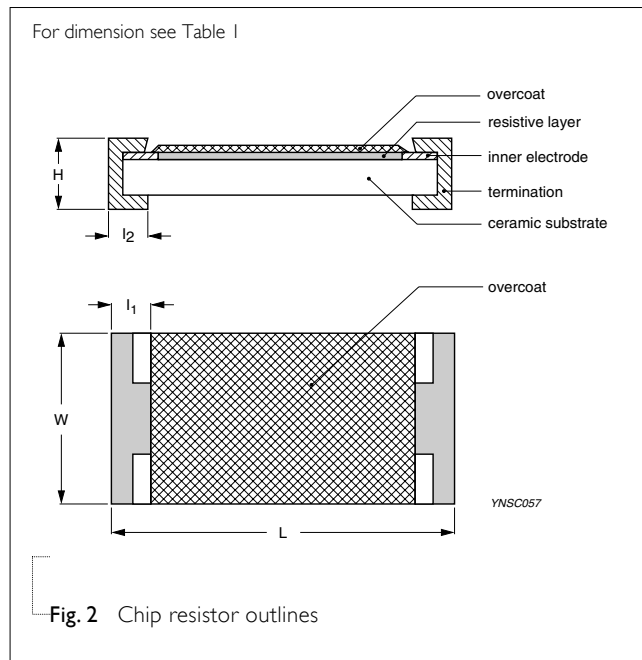
The resistive layer is covered with a translucent protective coat. Finally, two end electrodes are added, the composition of which has been designed to provide ease of soldering. See fig. 2.

**DIMENSIONS**

Table I 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**



**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                   | 50 V                 | 100 V                 | 100 V                           |                                       |
| TR0603 | 0/-10%, 0/-20%, 0/-30%:<br>1 Ω to 10 MΩ | 1/16 W          | +125 °C                     | 50 V                 | 100 V                 | 100 V                           | 1 Ω ≤ R ≤ 10 Ω: ±200 ppm/°C           |
| TR0805 | (E-24)                                  | 1/8 W           | -55 °C to                   | 150 V                | 300 V                 | 500 V                           | 10 Ω < R ≤ 1 MΩ: ±100 ppm/°C          |
| TR1206 |   | 1/4 W           | +155 °C                     | 200 V                | 500 V                 | 500 V                           | 1 MΩ < R ≤ 10 MΩ: ±200 ppm/°C         |

**FOOTPRINT AND SOLDERING PROFILES**

For recommended footprint and soldering profiles, please see the special data sheet “Chip resistors mounting”.

**ENVIRONMENTAL DATA**

For material declaration information (IMDS-data) of the products, please see the separated info “Environmental data” conformed to EU RoHS.

**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

| PACKING STYLE            | REEL DIMENSION | TR0402 | TR0603 | TR0805 | TR1206 |
|--------------------------|----------------|--------|--------|--------|--------|
| Paper/PE taping reel (R) | 7" (178 mm)    | 10,000 | 5,000  | 5,000  | 5,000  |

**NOTE**

1. For Paper/PE tape and reel specification/dimensions, please see the special data sheet “Packing” document.

**FUNCTIONAL DESCRIPTION**

**PRODUCT CHARACTERIZATION**

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of 0/-10%, 0/-20% and 0/-30%. The values of the E24 series are in accordance with "IEC publication 60063".

**OPERATING TEMPERATURE RANGE**

Each type range:

TR0402/0603: -55°C to +125°C;  
TR0805/1206: -55°C to +155°C.

**LIMITING VALUES**

Table 4

| TYPE   | LIMITING VOLTAGE (V) <sup>(1)</sup> | LIMITING POWER (W) |
|--------|-------------------------------------|--------------------|
| TR0402 | 50                                  | 1/16               |
| TR0603 | 50                                  | 1/16               |
| TR0805 | 150                                 | 1/8                |
| TR1206 | 200                                 | 1/4                |

**NOTES**

- The maximum voltage that may be continuously applied to the resistor element, see "IEC publication 60115-8".

**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:

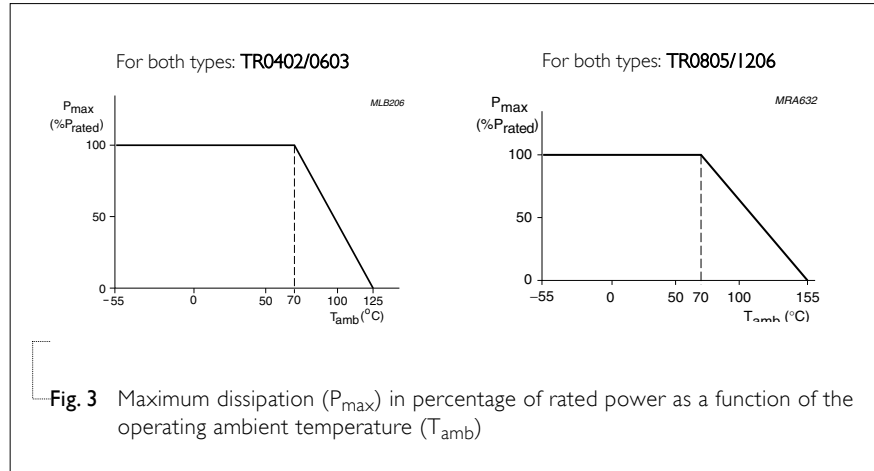
$$V = \sqrt{P \times R}$$

Where

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

P = Rated power (W)

R = Resistance value ( $\Omega$ )



**APPLICATION INFORMATION**

**TRIMMING INSTRUCTIONS WITH YAG-LASER**

Typical values for:

Cutting speed = 10 to 300 mm/s

Laser power = 1 to 6 W

Maximum trimming length = 60% of resistor film width

Minimum distance between end termination and trimming cut =

TR0402/0603: 0.20 mm

TR0805/1206: 0.50 mm

**PROTECTION OF LASER CUT**

With epoxy-phenol lacquers, epoxy resins or silicon alkyd-resins.

This is necessary for humidity tests and stability at load.

TESTS AND REQUIREMENTS

Table 5 Test condition, procedure and requirements

| TEST   | TEST METHOD                                     | PROCEDURE  | REQUIREMENTS                        |
|--|---|--|-------------------------------------|
| Temperature Coefficient of Resistance (T.C.R.) | MIL-STD-202F-method 304;                        | At +25/-55 °C and +25/+125 °C  | Refer to table 2                    |
|  | JIS C 5202-4.8                                  | <p><b>Formula:</b></p> $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ <p>Where<br/> <math>t_1 = +25 \text{ °C}</math> or specified room temperature<br/> <math>t_2 = -55 \text{ °C}</math> or +125 °C test temperature<br/> <math>R_1 =</math>resistance at reference temperature in ohms<br/> <math>R_2 =</math>resistance at test temperature in ohms</p> |                                     |
| Thermal Shock                                  | MIL-STD-202F-method 107G;<br>IEC 60115-1 4.19   | At -65 (+0/-10) °C for 2 minutes and at UCT (+10/-0) °C for 2 minutes; 25 cycles<br><br>UCT: 0402/0603: 125 °C<br>0805/1206: 155 °C  | ±(1.0%+0.05 Ω)                      |
| Low Temperature Operation                      | MIL-R-55342D-Para 4.7.4                         | At -65 (+0/-5) °C for 1 hour; RCWV applied for 45 (+5/-0) minutes  | ±(1.0%+0.05 Ω)<br>No visible damage |
| Short Time Overload                            | MIL-R-55342D-Para 4.7.5;<br>IEC 60115-1 4.13    | 2.5 × RCWV applied for 5 seconds at room temperature   | ±(1.0%+0.05 Ω)<br>No visible damage |
| Insulation Resistance                          | MIL-STD-202F-method 302;<br>IEC 60115-1 4.6.1.1 | One DC voltage (V) applied for 1 minute<br>Details see below table 6   | ≥10 GΩ                              |
| Dielectric Withstand Voltage                   | MIL-STD-202F-method 301;<br>IEC 60115-1 4.6.1.1 | One AC voltage (V <sub>rms</sub> ) applied for 1 minute<br>Details see below table 6   | No breakdown or flashover           |
| Resistance to Soldering Heat                   | MIL-STD-202F-method 210C;<br>IEC 60115-1 4.18   | Unmounted chips; 260 ±5 °C for 10 ±1 seconds   | ±(1.0%+0.05 Ω)<br>No visible damage |
| Life   | MIL-STD-202F-method 108A;<br>IEC 60115-1 4.25.1 | At 70±2 °C for 1,000 hours; RCWV applied for 1.5 hours on and 0.5 hour off   | ±(1.0%+0.05 Ω)                      |

Table 5 Test condition, procedure and requirements (continued)

| TEST                     | TEST METHOD                                  | PROCEDURE  | REQUIREMENTS               |              |
|--------------------------|--|--|----------------------------|--------------|
| Solderability            | MIL-STD-202F-method 208A;                    | Solder bath at 245±3 °C  | Well tinned (≥95% covered) |              |
|                          | IEC 60115-1 4.17                             | Dipping time: 2±0.5 seconds  | No visible damage          |              |
| Bending Strength         | JIS C 5202.6.14;                             | Resistors mounted on a 90 mm glass epoxy resin PCB (FR4)<br>Bending: 5 mm  | ±(1.0%+0.05 Ω)             |              |
|                          | IEC 60115-1 4.15                             |  | No visible damage          |              |
| Resistance to Solvent    | MIL-STD-202F-method 215;<br>IEC 60115-1 4.29 | Isopropylalcohol (C <sub>3</sub> H <sub>7</sub> OH) or dichloromethane (CH <sub>2</sub> Cl <sub>2</sub> ) followed by brushing | No smeared                 |              |
| Noise                    | JIS C 5202 5.9;<br>IEC 60115-1 4.12          | Maximum voltage (V <sub>rms</sub> ) applied  | <b>Resistors range</b>     | <b>Value</b> |
|                          |  |  | R < 100 Ω                  | 10 dB        |
|                          |  |  | 100 Ω ≤ R < 1 KΩ           | 20 dB        |
|                          |  |  | 1 KΩ ≤ R < 10 KΩ           | 30 dB        |
|                          |  |  | 10 KΩ ≤ R < 100 KΩ         | 40 dB        |
|                          |  |  | 100 KΩ ≤ R < 1 MΩ          | 46 dB        |
|                          |  |  | 1 MΩ ≤ R ≤ 22 MΩ           | 48 dB        |
| Humidity (steady state)  | JIS C 5202 7.5;<br>IEC 60115-8 4.24.8        | 1,000 hours; 40±2 °C; 93(+2/-3)% RH<br>RCWV applied for 1.5 hours on and 0.5 hour off  | R < 1 MΩ: ±(1.0%+0.05 Ω)   |              |
|                          |  |  | R ≥ 1 MΩ: ±(1.5%+0.05 Ω)   |              |
| Leaching                 | EIA/IS 4.13B;<br>IEC 60115-8 4.18            | Solder bath at 260±5 °C<br>Dipping time: 30±1 seconds  | No visible damage          |              |
| Intermittent Overload    | JIS C 5202 5.8                               | At room temperature; 2.5 × RCWV applied for 1 second on and 25 seconds off; total 10,000 cycles                                | ±(1.0%+0.05 Ω)             |              |
| Resistance to Vibration  | On request                                   | On request   |                            |              |
| Moisture Resistance Heat | MIL-STD-202F-method 106F;                    | 42 cycles; total 1,000 hours   | ±(2.0%+0.05Ω)              |              |
|                          | IEC 60115-1 4.24.2                           | Shown as Fig. 4  | No visible damage          |              |

Table 6 Criteria of rated continued working voltage and overload voltage

| TYPE  | TR0402 | TR0603 | TR0805 | TR1206 |
|---|--------|--------|--------|--------|
| Voltage (DC/unit: V); (AC/ unit: V <sub>rms</sub> ) | 100    | 100    | 300    | 500    |

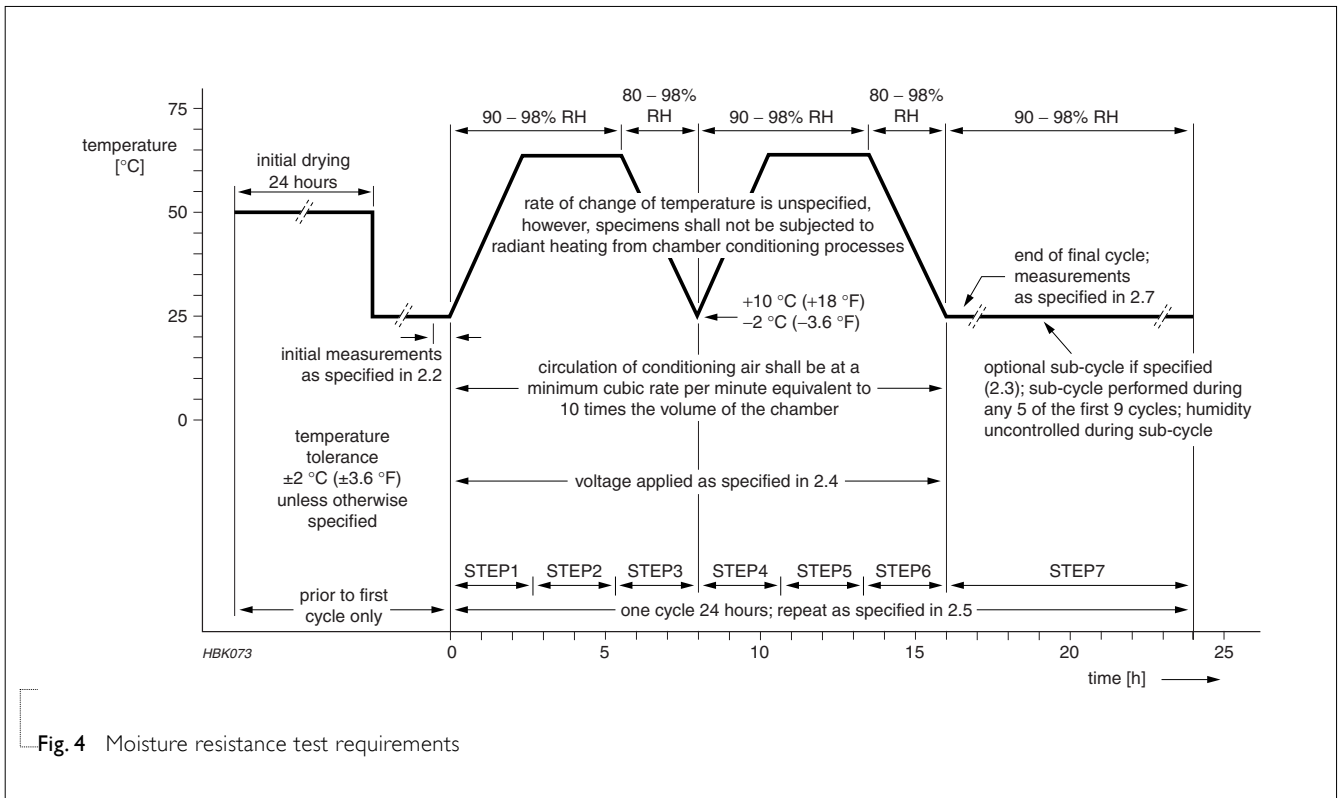


Fig. 4 Moisture resistance test requirements



REVISION HISTORY

| REVISION | DATE | CHANGE NOTIFICATION | DESCRIPTION |
|----------|------|---------------------|-------------|
|----------|------|---------------------|-------------|

|           |              |   |                                     |
|-----------|--------------|---|-------------------------------------|
| Version 0 | Oct 18, 2005 | - | - First issue of this specification |
|-----------|--------------|---|-------------------------------------|