

# 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.

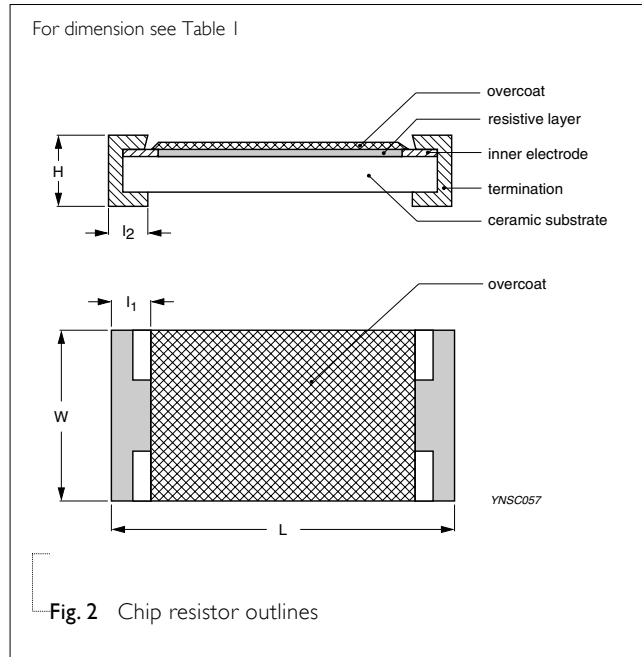
The resistive layer is covered with a translucent protective coat. Finally, two end electrodes are added, the composition of which has been designed to provide ease of soldering. See fig. 2.

**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%: 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:

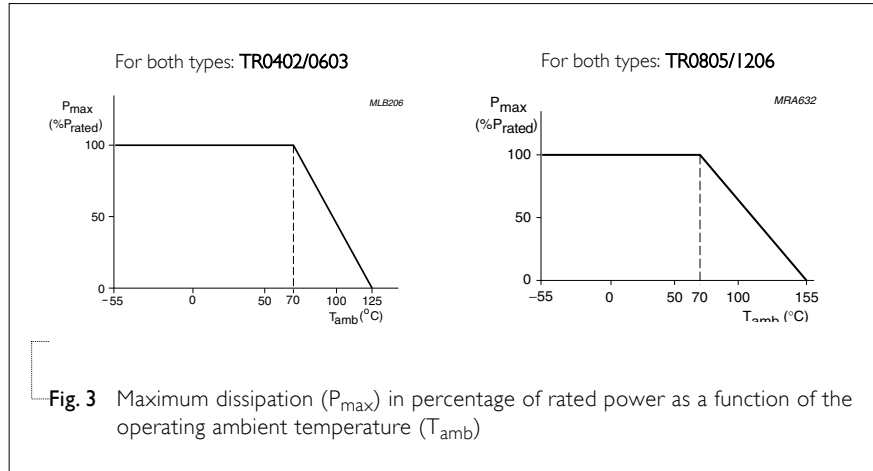
$$V = \sqrt{P \times R}$$

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  <math>t_1 = +25 \text{ °C}</math> or specified room temperature  <math>t_2 = -55 \text{ °C}</math> or +125 °C test temperature  <math>R_1 =</math>resistance at reference temperature in ohms  <math>R_2 =</math>resistance at test temperature in ohms</p>	
Thermal Shock	MIL-STD-202F-method 107G; IEC 60115-1 4.19	At -65 (+0/-10) °C for 2 minutes and at UCT (+10/-0) °C for 2 minutes; 25 cycles  UCT: 0402/0603: 125 °C 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) No visible damage
Short Time Overload	MIL-R-55342D-Para 4.7.5; IEC 60115-1 4.13	2.5 × RCWV applied for 5 seconds at room temperature	±(1.0%+0.05 Ω) No visible damage
Insulation Resistance	MIL-STD-202F-method 302; IEC 60115-1 4.6.1.1	One DC voltage (V) applied for 1 minute Details see below table 6	≥10 GΩ
Dielectric Withstand Voltage	MIL-STD-202F-method 301; IEC 60115-1 4.6.1.1	One AC voltage (V <sub>rms</sub> ) applied for 1 minute Details see below table 6	No breakdown or flashover
Resistance to Soldering Heat	MIL-STD-202F-method 210C; IEC 60115-1 4.18	Unmounted chips; 260 ±5 °C for 10 ±1 seconds	±(1.0%+0.05 Ω) No visible damage
Life	MIL-STD-202F-method 108A; 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) Bending: 5 mm	±(1.0%+0.05 Ω)	
	IEC 60115-1 4.15		No visible damage	
Resistance to Solvent	MIL-STD-202F-method 215; 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; 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; IEC 60115-8 4.24.8	1,000 hours; 40±2 °C; 93(+2/-3)% RH 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; IEC 60115-8 4.18	Solder bath at 260±5 °C 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

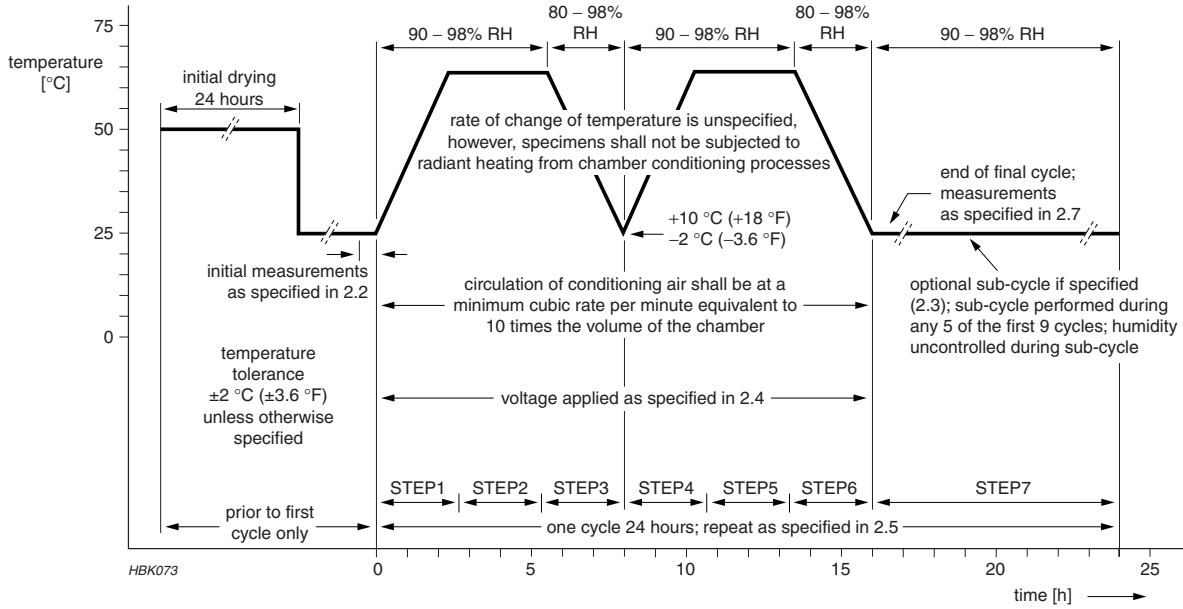


Fig. 4 Moisture resistance test requirements

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
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Version 0	Oct 18, 2005	-	- First issue of this specification
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