

# DATA SHEET

## THIN FILM CHIP RESISTORS

General purpose

RJ series

1%, TC50

sizes 0402/0603/0805/1206/  
1210/2010/2512

RoHS compliant



## SCOPE

This specification describes RJ0402 to RJ2512 general purpose chip resistors with lead-free terminations made by thin film process.

## APPLICATIONS

- Converters
- Printer equipment
- Server board
- Telecom
- Consumer

## 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
- Halogen Free Epoxy

## 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)

**RJ XXXX F X E XX XXXX L**  
 (1) (2) (3) (4) (5) (6) (7)

#### (1) SIZE

0402 / 0603 / 0805 / 1206 / 1210 / 2010 / 2512

#### (2) TOLERANCE

F =  $\pm 1\%$

#### (3) PACKAGING TYPE

R = Paper taping reel

K = Embossed taping reel

#### (4) TEMPERATURE COEFFICIENT OF RESISTANCE

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

#### (5) TAPING REEL

07 = 7 inch dia. Reel    10 = 10 inch dia. Reel    13 = 13 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 (1 to 9.76 $\Omega$ )	1R = 1 $\Omega$ 1R5 = 1.5 $\Omega$ 9R76 = 9.76 $\Omega$
XXRX (10 to 97.6 $\Omega$ )	10R = 10 $\Omega$ 97R6 = 97.6 $\Omega$
XXXR (100 to 976 $\Omega$ )	100R = 100 $\Omega$
XKXX (1 to 9.76 k $\Omega$ )	1K = 1,000 $\Omega$ 9K76 = 9760 $\Omega$
XMXX (1 to 9.76 M $\Omega$ )	1M = 1,000,000 $\Omega$ 9M76 = 9,760,000 $\Omega$

### ORDERING EXAMPLE

The ordering code of a RJ0603 chip resistor, TC50 value 56  $\Omega$  with  $\pm 1\%$  tolerance, supplied in 7-inch tape reel is:  
**RJ0603FRE0756R(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****2390      XXX XXXXX L**

(1)                      (2)                      (3)                      (4)

RJ SIZE	START IN <sup>(1)</sup>	TOL. (%)	RESISTANCE RANGE	EMBOSSED TAPE ON REEL <sup>(2)</sup>		PAPER TAPE ON REEL (units) <sup>(2)</sup>			
				4,000	5,000	10,000	20,000	50,000	
0402	2390	±1%	10 Ω to 121 kΩ	-	-	407 8xxxx	427 8xxxx	447 8xxxx	
0603	2390	±1%	5.1 Ω to 681 kΩ	-	404 8xxxx	424 8xxxx	444 8xxxx		-
0805	2390	±1%	5.1 Ω to 1.5 MΩ	-	401 8xxxx	421 8xxxx	441 8xxxx		-
1206	2390	±1%	5.1 Ω to 1.5 MΩ	-	411 8xxxx	431 8xxxx	451 8xxxx		-
1210	2390	±1%	5.1 Ω to 1 MΩ	-	412 0xxxx	432 8xxxx	412 8xxxx		-
2010	2390	±1%	10 Ω to 1 MΩ	415 8xxxx	-	-	-	-	-
2512	2390	±1%	10 Ω to 1 MΩ	418 8xxxx	-	-	-	-	-

(1) The resistors have a 12-digit ordering code starting with 2390.

(2) The subsequent 4 digits indicate the resistor tolerance and packaging.

(3) The remaining 4 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 <sup>(Note)</sup>

**ORDERING EXAMPLE**

The ordering code of a RJ0603 resistor, TC50 value 56 Ω, with ±1% tolerance, supplied in tape of 5,000 units per reel is: 239040485609(L) or RJ0603FRE0756R(L).

**NOTE**

- All our RSMD products are RoHS compliant. "LFP" of the internal 2D reel label mentions "Lead Free Process"
- 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)

□ 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

## MARKING

RJ0805 / RJ1206 / RJ1210 / RJ2010 / RJ2512

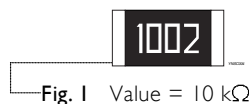


Fig. 1 Value = 10 k $\Omega$

Either resistance in E-24 or E-96: 4 digits

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

RJ0603



Fig. 2 Value = 12 k $\Omega$

E-24 series: 3 digits

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



Fig. 3 Value = 12.4 k $\Omega$

E-96 series: 3 digits for 0603 $\pm$ 1% EIA-96 marking method

RJ0402

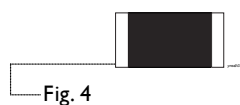


Fig. 4

No marking

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

## CONSTRUCTION

A metal film layer is deposited on a high-grade ceramic body (aluminium oxide). It is given the approximate resistance required and the value is trimmed to within tolerance by laser cutting of this resistive layer.

Internal metal electrodes are formed into several layers at each end as a contact. To guarantee optimum solderability, the outer layer consists of matte tin.

The resistive layer is covered with a protective coat and printed with the resistance value. See fig. 5.

Table 1 For outlines see fig. 5

TYPE	L (mm)	W (mm)	H (mm)	I <sub>1</sub> (mm)	I <sub>2</sub> (mm)
RJ0402	1.00 ±0.10	0.50 ±0.05	0.30 ±0.05	0.20 ±0.10	0.25 ±0.10
RJ0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
RJ0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
RJ1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
RJ1210	3.10 ±0.10	2.60 ±0.15	0.55 ±0.10	0.50 ±0.20	0.50 ±0.20
RJ2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20
RJ2512	6.35 ±0.10	3.20 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20

## OUTLINES

For dimension see Table 1

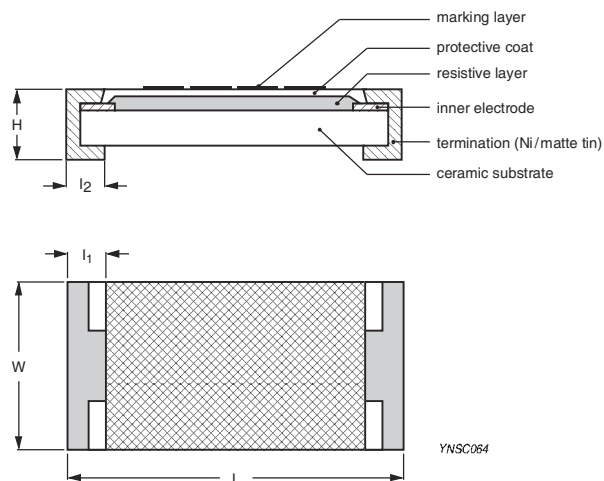


Fig. 5 Chip resistor outlines

## ELECTRICAL CHARACTERISTICS

Table 2

TYPE	RESISTANCE RANGE	OPERATING TEMPERATURE RANGE	POWER RATING	MAXIMUM WORKING VOLTAGE	DIELECTRIC WITHSTAND VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	TEMPERATURE COEFFICIENT OF RESISTANCE
RJ0402	10 Ω to 121 KΩ	-55 °C to +125 °C	1/16 W	25 V	100 V	100 V	±50 ppm/°C
RJ0603	5.1 Ω to 681 KΩ	-55 °C to +125 °C	1/16 W	50 V	100 V	100 V	±50 ppm/°C
RJ0805	5.1 Ω to 1.5 MΩ	-55 °C to +125 °C	1/10 W	100 V	250 V	200 V	±50 ppm/°C
RJ1206	5.1 Ω to 1.5 MΩ	-55 °C to +125 °C	1/8 W	150 V	250 V	250 V	±50 ppm/°C
RJ1210	5.1 Ω to 1 MΩ	-55 °C to +125 °C	1/4 W	150 V	400 V	300 V	±50 ppm/°C
RJ2010	10 Ω to 1 MΩ	-55 °C to +125 °C	1/2 W	150 V	400 V	300 V	±50 ppm/°C
RJ2512	10 Ω to 1 MΩ	-55 °C to +125 °C	3/4 W	150 V	400 V	300 V	±50 ppm/°C

## 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	RJ0402	RJ0603	RJ0805	RJ1206	RJ1210	RJ2010	RJ2512
Paper taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000	5,000	---	---
	10" (254 mm)	20,000	10,000	10,000	10,000	10,000	---	---
	13" (330 mm)	50,000	20,000	20,000	20,000	20,000	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	---	---	4,000	4,000

### NOTE

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

## FUNCTIONAL DESCRIPTION

### OPERATING TEMPERATURE RANGE

Range: -55°C to +125°C

### POWER RATING

Each type rated power at 70°C:

RJ0402=1/16 W, RJ0603=1/16 W, RJ0805=1/10 W,  
RJ1206=1/8 W, RJ1210=1/4 W, RJ2010=1/2 W,  
RJ2512=3/4 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 ( $\Omega$ )

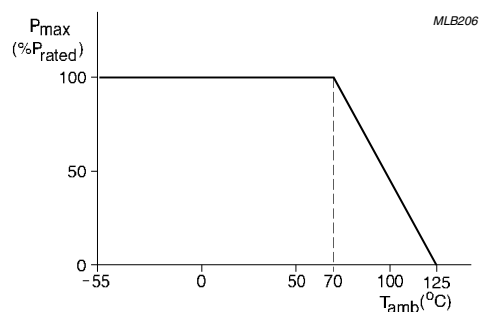


Fig. 6 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

**TESTS AND REQUIREMENTS****Table 4** Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Life/ Operational Life/ Endurance	MIL-STD-202F-method 108A IEC 60115- 4.25.1 JIS C 5202-7.10	1,000 hours at 70°C ±5°C applied RCWV 1.5h on, 0.5h off, still air required	±(1%+0.05 Ω)
High Temperature Exposure/ Endurance at upper category temperature	MIL-STD-202F-method 108A IEC 60115- 4.25.3 JIS C 5202-7.11	1,000 hours at maximum operating temperature depending on specification, unpowered No direct impingement of forced air to the parts Tolerances: 125±3 °C	±(0.5%+0.05 Ω)
Moisture Resistance	MIL-STD-202F-method 106F IEC 60115- 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  Parts mounted on test-boards, without condensation on parts  Measurement at 24±2 hours after test conclusion	±(0.5%+0.05 Ω)
Thermal Shock	MIL-STD-202 Method 107	-55/+125 °C Note: Number of cycles required is 300. Devices unmounted  Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	±(0.5%+0.05 Ω)
Short time overload	MIL-R-55342D-para 4.7.5 IEC60155-1 4.6.1.1	2.5 times RCWV or maximum overload voltage whichever is less for 5 sec at room temperature	±(1%+0.05 Ω)
Board Flex/ Bending	IEC60115-1 4.33 IEC60068-2-21 Ue1	Device mounted on PC board as described, only 1 board bending required  Bending : sizes ≤ 1206 : 3mm sizes > 1206 : 2mm  Bending time: 60±5 seconds Ohmic value checked during bending	±(1%+0.05 Ω)

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability - Wetting	J-STD-002	Electrical Test not required. Magnification 50X. SMD conditions: 1 <sup>st</sup> step: method B, aging 4 hours at 155°C dry heat 2 <sup>nd</sup> step: leadfree solder bath at 245±3°C Dipping time: 3±0.5 seconds	Well tinned (≥95% covered) No visible damage
- Leaching	EIA/IS 4.13B IEC 60115-8 4.18	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	MIL-STD-202 Method 210	Condition B, no pre-heat of samples Leadfree solder, 270 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	±(0.5%+0.05 Ω)



REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	Jul 11, 2008	-	<ul style="list-style-type: none"><li>- Change to dual brand datasheet that describe RJ0402 to RJ2512 with RoHS compliant</li><li>- Modify ordering information - global part number &amp; 12NC</li><li>- Modify electrical characteristic</li><li>- Tests and requirements update</li></ul>
Version 1	May 30, 2005	-	<ul style="list-style-type: none"><li>- New datasheet for thin film general purpose chip resistors sizes of 0201/0402/0603/0805/1206/1210/2010/2512 1%, TC50 with lead-free terminations</li></ul>