

DATA SHEET

GENERAL PURPOSE CHIP RESISTORS

RC0402
5%, 1%
RoHS compliant



SCOPE

This specification describes RC0402 series chip resistors with lead-free terminations made by thick film process.

APPLICATIONS

- All general purpose application

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)**

RC0402 **X R - XX XXXX L**
 (1) (2) (3) (4) (5) (6)

(1) TOLERANCE

F = $\pm 1\%$

J = $\pm 5\%$ (for Jumper ordering, use code of J)

(2) PACKAGING TYPE

R = Paper / PE taping reel

(3) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Base on spec

(4) TAPING REEL

07 = 7 inch dia. Reel

10 = 10 inch dia. Reel

13 = 13 inch dia. Reel

(5) 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".

(6) OPTIONAL CODE

L = optional symbol (Note)

Resistance rule of global part number	
Resistance code rule	Example
D1	D1 = Dummy
0R	0R = Jumper
XRXX	1R = 1 Ω
(1 to 9.76 Ω)	1R5 = 1.5 Ω
	9R76 = 9.76 Ω
XXRX	10R = 10 Ω
(10 to 97.6 Ω)	97R6 = 97.6 Ω
XXXR	100R = 100 Ω
(100 to 976 Ω)	
XKXX	1K = 1,000 Ω
(1 to 9.76 K Ω)	9K76 = 9760 Ω
XMXX	1M = 1,000,000 Ω
(1 to 9.76 M Ω)	9M76 = 9,760,000 Ω

ORDERING EXAMPLE

The ordering code of a RC0402 chip resistor, value 56 Ω with $\pm 1\%$ tolerance, supplied in 7-inch tape reel is: RC0402FR-0756R(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

	2322		XXX XXXXX L			
	(1)		(2) (3) (4)			
TYPE/ 0402	START IN ⁽¹⁾	TOL. (%)	RESISTANCE RANGE	PAPER / PE TAPE ON REEL (units) ⁽²⁾		
				10,000	20,000/not preferred	50,000
RC31	2322	±5%	1 to 22 MΩ	705 70xxx	---	705 87xxx
RC32	2322	±1%	1 to 10 MΩ	706 7xxxx	---	706 8xxxx
Jumper	2322	-	0 Ω	705 91001	---	705 91007

- (1) The resistors have a 12-digit ordering code starting with 2322.
- (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 RC32 resistor, value 56 Ω with ±1% tolerance, supplied in tape of 10,000 units per reel is: 232270675609(L) or RC0402FR-0756R(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)

Resistance decade ⁽³⁾	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

RC0402



Fig. 1

No marking

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

CONSTRUCTION

The resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added on each end to make the contacts to the thick film resistive element. The composition of the resistive element is a noble metal imbedded into a glass and covered by a second glass to prevent environment influences. The resistor is laser trimmed to the rated resistance value. The resistor is covered with a protective epoxy coat, finally the two external terminations (matte tin on Ni-barrier) are added. See fig.2

DIMENSIONS

Table I

TYPE	RC0402
L (mm)	1.00 ±0.05
W (mm)	0.50 ±0.05
H (mm)	0.32 ±0.05
l ₁ (mm)	0.20 ±0.10
l ₂ (mm)	0.25 ±0.10

OUTLINES

For dimension see Table I

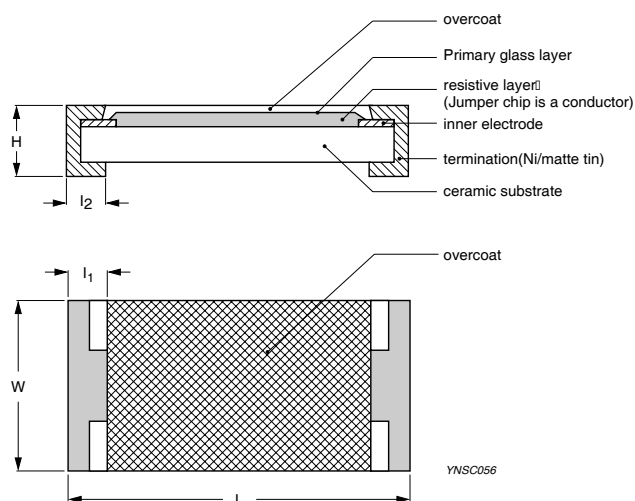


Fig. 2 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

CHARACTERISTICS	RC0402 1/16 W	
Operating Temperature Range	-55 °C to +155 °C	
Maximum Working Voltage	50 V	
Maximum Overload Voltage	100 V	
Dielectric Withstanding Voltage	100 V	
Resistance Range	5% (E24) 1 Ω to 22 MΩ	
	1% (E24/E96) 1 Ω to 10 MΩ	
	Zero Ohm Jumper < 0.05 Ω	
Temperature Coefficient	1 Ω ≤ R ≤ 10 Ω	±200 ppm/°C
	10 MΩ < R ≤ 22 MΩ	±200 ppm/°C
	10 Ω < R ≤ 10 MΩ	±100 ppm/°C
Jumper Criteria	Rated Current	1.0 A
	Maximum Current	2.0 A

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
RC0402	Paper Taping Reel (R)	7" (178 mm)	10,000 units
		10" (254 mm)	20,000 units
		13" (330 mm)	50,000 units

NOTE

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

FUNCTIONAL DESCRIPTION**POWER RATING**

RC0402 rated power at 70°C is 1/16 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 (Ω)

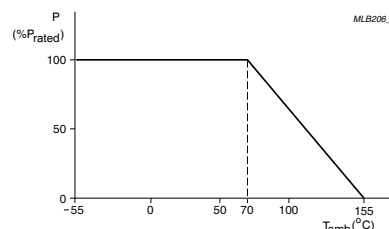


Fig. 3 Maximum dissipation (P) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Life/ Operational Life/ Endurance	MIL-STD-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	<100 mΩ for Jumper
	JIS C 5202-7.10		
High Temperature Exposure/ Endurance at upper category 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	<50 mΩ for Jumper
	JIS C 5202-7.11	No direct impingement of forced air to the parts Tolerances: 125±3 °C	
Moisture 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	<100 mΩ for Jumper
		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	
Thermal Shock	MIL-STD-202G-method 107G	-55/+125 °C	±(0.5%+0.05 Ω) for 10 KΩ to 10 MΩ
		Note: Number of cycles required is 300. Devices unmounted	±(1%+0.05 Ω) for others
		Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air – Air	<50 mΩ for Jumper
Short time overload	MIL-R-55342D-para 4.7.5	2.5 times RCWV or maximum overload voltage	±(2%+0.05 Ω)
	IEC60115-1 4.13	whichever is less for 5 sec at room temperature	<50 mΩ for Jumper No visible damage
Board Flex/ Bending	IEC60115-1 4.33	Device mounted on PCB test board as described,	±(1%+0.05 Ω)
		only 1 board bending required	<50 mΩ for Jumper
		3 mm bending Bending time: 60±5 seconds Ohmic value checked during bending	No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Solderability			
- Wetting	IPC/JEDECJ-STD-002B test B IEC 60068-2-58	Electrical Test not required Magnification 50X SMD conditions: 1 st step: method B, aging 4 hours at 155 °C dry heat 2 nd step: leadfree solder bath at 245±3 °C Dipping time: 3±0.5 seconds	Well tinned (≥95% covered) No visible damage
- Leaching	IPC/JEDECJ-STD-002B test D IEC 60068-2-58	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	MIL-STD-202G-method 210F IEC 60068-2-58	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	±(1%+0.05 Ω) <50 mΩ for Jumper No visible damage

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 3	Jul 15, 2008	-	- Change to dual brand datasheet that describe RC0402 with RoHS compliant - Description of "Halogen Free Epoxy" added - Define global part number
Version 2	Sep 03, 2004	-	- New datasheet for 0402 thick film 1% and 5% with lead-free terminations - Replace the 0402 part of pdf files: RC01_11_21_31_5, RC02_12_22_32_10 - Test method and procedure updated - PE tape added (paper tape will be replaced by PE tape)

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