SCOPE

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

APPLICATIONS

- All general purpose application

FEATURES

- Halogen Free Epoxy
- RoHS compliant
  - Products with lead free terminations meetRoHS requirements
  - Pb-glass contained in electrodes, resistors 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

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

PART NUMBER

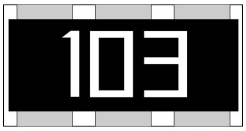
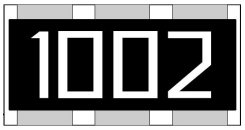
RI XXXX L XXXX F T (1) (2) (3) (4) (5)
(1) SIZE
0075/0100/0201/0402/0603/0805/1206/1210/1218/1812/2010/2512
(2) TEMPERATURE COEFFICIENT OF RESISTANCE
1%=100PPM 5%=200PPM
(3) RESISTANCE VALUE
There are 2~4 digits indicated the resistance value. Letter R/K/M is decimal point. Example: 97R6 = 97.6Ω 9K76 = 9760Ω 1M = 1,000,000Ω
(4)TOLERANCE
B = ±0.1% D = ±0.5% F = ±1.0% J = ±5.0% (for jumper ordering, use code of J)
(5)PACKAGING TYPE AND TAPING REEL
T = Taping Reel TE = 15K Packaging Quantity Taping Reel(0201 SIZE)

ORDERING EXAMPLE

The ordering code for a RI0402 0.0625W chip resistor value 100KΩwith±5% tolerance, supplied in tape reel is: RI0402L104JT.

The ordering code for a RI0201 0.0625W chip resistor value 100KΩwith±5% tolerance, 15K/Reel. Supplied in tape reel is: RI0201L104JTE.

MARKING

RI0075 / RI0100 / RI0201 / RI0402	
 FIG.1	No Marking
RI0603	
 240 = 24 × 10^0 = 24 FIG.2	1%, 0.5%,E24 exception values 10/11/13/15/20/75 of E24 series
 88A = 806 × 10^0 = 806 Ω FIG.3	1%, 0.5%, E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series
 Value = 10 KΩ FIG.4	5%, E24 series : 3 digits First two digits for significant figure and 3rd digit for number of zeros
RI0805 / RI1206 / RI1210 / RI1812 / RI2010 / RI2512	
 Value = 10 KΩ FIG.5	1%, 0.5%, E24/E96 series : 4 digits First three digits for significant figure and 4th digit for number of zeros
 Value = 10 KΩ FIG.6	5%, E24 series : 3 digits First two digits for significant figure and 3rd digit for number of zeros
RI1218	
 Value = 10 KΩ FIG.7	E-24 series: 3 digits, ±5% First two digits for significant figure and 3rd digit for number of zeros
 Value = 10 KΩ FIG.8	Both E-24 and E-96 series: 4 digits, ±1% & ±0.5% First three digits for significant figure and 4th digit for number of zeros

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 environmental 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, as shown in Fig.9.

Outlines

For dimensions, please refer to Table 1

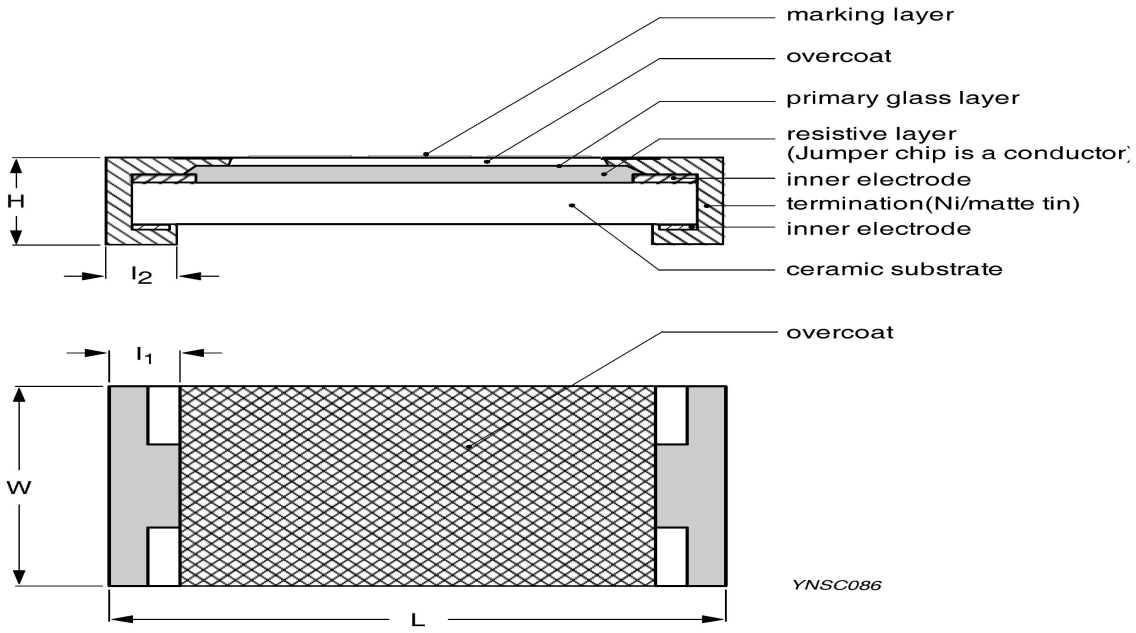


Fig. 9 Chip resistor outlines

DIMENSION

TYPE	L (mm)	W (mm)	H (mm)	l_1 (mm)	l_2 (mm)
RI 0075	0.30±0.01	0.15±0.01	0.10±0.01	0.08±0.03	0.08±0.03
RI 0100	0.40±0.02	0.20±0.02	0.13±0.02	0.10±0.03	0.10±0.03
RI 0201	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
RI 0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
RI 0603	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.25±0.15
RI 0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.35±0.20
RI 1206	3.10±0.10	1.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
RI 1210	3.10±0.10	2.60±0.15	0.55±0.10	0.45±0.15	0.50±0.20
RI 1218	3.10±0.10	4.60±0.10	0.55±0.10	0.45±0.20	0.40±0.20
RI 1812	4.60±0.10	3.10±0.10	0.55±0.10	0.45±0.20	0.50±0.20
RI 2010	5.00±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20
RI 2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.50±0.20

GENERAL PURPOSE CHIP RESISTORS DATA SHEET

ELECTRICAL CHARACTERISTICS

CHARACTERISTICS	POWER	OPERATING TEMPERATURE RANGE	MAXIMUM WORKING VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	DIELECTRIC WITH STANDING VOLTAGE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT	JUMPER CRITERIA
RI0075	1/50 W	-55℃ to 125℃	10V	25V	25V	5% (E24) 10Ω≦R≦1MΩ 1% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	10Ω≦R<100Ω - 200~+600ppm℃ 100Ω≦R≦1MΩ ±200ppm℃	Rated Current 0.5A Maximum Current 1.0A
RI0100	1/32 W	-55℃ to 125℃	15V	30V	30V	5%(E24) 1Ω≦R≦22MΩ 1% (E24/E96) 1Ω≦R≦10MΩ 0.5% (E24/E96) 33Ω≦R≦470KΩ Jumper<50mΩ	1Ω≦R<10Ω -200~+600ppm℃ 10Ω≤R＜100Ω: ±300ppm/°C 100Ω≤R≤10MΩ: ±200ppm/°C 10MΩ<R≤22MΩ: ±250ppm/°C	Rated Current 0.5A Maximum Current 1.0A
RI0201	1/20 W	-55℃ to 125℃	25V	50V	50V	5%(E24) 1Ω≦R≦10MΩ 1% (E24/E96) 1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω -100~+350ppm℃ 10Ω≤R≤10MΩ: ±200ppm/°C	Rated Current 0.5A Maximum Current 1.0A
RI0402	1/16W	-55℃ to 155℃	50V	100V	100V	5%(E24) 1Ω≦R≦22MΩ 1% (E24/E96) 1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R<10Ω ±200ppm℃ 10Ω≤R≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C	Rated Current 1.0A Maximum Current 2.0A
	1/8W	-55℃ to 155℃	50V	100V	100V	5%(E24) 1Ω≦R≦1MΩ 1% (E24/E96) 1Ω≦R≦1MΩ	1Ω≦R<1MΩ ±200ppm℃	
RI0603	1/10W	-55℃ to 155℃	75V	150V	150V	5%(E24) 0.1Ω≦R≦22MΩ 1% (E24/E96) 0.1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C	Rated Current 1.0A Maximum Current 2.0A
	1/5W	-55℃ to 155℃	75V	150V	150V	5%(E24) 1Ω≦R≦1MΩ 1% (E24/E96) 1Ω≦R≦1MΩ	1Ω≦R≦1MΩ: ±200ppm℃	
RI0805	1/8W	-55℃ to 155℃	150V	300V	300V	5%(E24) 0.1Ω≦R≦100MΩ 1% (E24/E96) 0.1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ 10%,20% (E24) 24MΩ≦R≦100MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C 24MΩ<R≤100MΩ: ±300ppm/°C	Rated Current 2.0A Maximum Current 5.0A

GENERAL PURPOSE CHIP RESISTORS DATA SHEET

CHARACTERISTICS	POWER	OPERATING TEMPERATURE RANGE	MAXIMUM WORKING VOLTAGE	MAXIMUM OVERLOAD VOLTAGE	DIELECTRIC WITH STANDING VOLTAGE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT	JUMPER CRITERIA
RI0805	1/4W	-55℃ to 155℃	150V	300V	300V	5% (E24) 1Ω≦R≦1MΩ 1% (E24/E96) 1Ω≦R≦1MΩ	1Ω≦R≦1MΩ: ±200ppm℃	
RI1206	1/4W	-55℃ to 155℃	200V	400V	500V	5% (E24) 0.1Ω≦R≦100MΩ 1% (E24/E96) 0.1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ 10%,20% (E24) 24MΩ≦R≦100MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω: ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R ≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C 24MΩ<R≤100MΩ: ±300ppm/°C	Rated Current 2.0A Maximum Current 10.0A
	1/2W	-55℃ to 155℃	200V	400V	500V	5% (E24) 1Ω≦R≦1MΩ 1% (E24/E96) 1Ω≦R≦1MΩ	1Ω≦R≦1MΩ: ±200ppm℃	
RI1210	1/2W	-55℃ to 155℃	200V	500V	500V	5% (E24) 0.1Ω≦R≦22MΩ 1% (E24/E96) 0.1Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω: ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R ≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C	Rated Current 2.0A Maximum Current 10.0A
RI1218	1W	-55℃ to 155℃	200V	500V	500V	5% (E24) 1Ω≦R≦1MΩ 1% (E24/E96) 1Ω≦R≦1MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R ≤1MΩ: ±100ppm/°C	Rated Current 6.0A Maximum Current 10.0A
RI1812	3/4W	-55℃ to 155℃	200V	500V	500V	5% E24 0.01Ω≦R≦10MΩ 1% 2% (E24/E96) 0.01Ω≦R≦10MΩ 0.1%,0.5%(E24/E96) 1Ω≦R≦10MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω: ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R ≤10MΩ: ±100ppm/°C	Rated Current 2.0A Maximum Current 10.0A
RI2010	3/4W	-55℃ to 155℃	200V	500V	500V	5% (E24) 0.1Ω≦R≦22MΩ 1% (E24/E96) 0.1 Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω: ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R ≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C	Rated Current 2.0A Maximum Current 10.0A
RI2512	1W	-55℃ to 155℃	200V	500V	500V	5% (E24) 0.1Ω≦R≦22MΩ 1% (E24/E96) 0.1 Ω≦R≦10MΩ 0.1%,0.5% (E24/E96) 10Ω≦R≦1MΩ Jumper<50mΩ	0.1Ω≦R≦0.99Ω: ±800ppm℃ 1Ω≦R≦10Ω: ±200ppm℃ 10Ω<R ≤10MΩ: ±100ppm/°C 10MΩ<R≤22MΩ: ±200ppm/°C	Rated Current 2.0A Maximum Current 10.0A
	2W	-55℃ to 155℃	200V	400V	500V	5% (E24) 1Ω≦R≦1MΩ 1% (E24/E96) 1Ω≦R≦1MΩ	1Ω≦R≦1MΩ: ±200ppm℃	

PACKING STYLE AND PACKAGING QUANTITY

PACKING STYLE	PAPER TAPING REEL(R)			ESD SAFE REEL(S) (4MM WIDTH,1MM PITCH PLASTIC EMBOSSED)	EMBOSSED TAPING REEL
REEL DIMENSION	7"(178mm)	10"(254mm)	13"(330mm)	7"(178mm)	7"(178mm)
RI0075				20000	
RI0100	20000		80000	40000	
RI0201	10000/15000	20000	50000		
RI0402	10000	20000	50000		
RI0603	5000	10000	20000		
RI0805	5000	10000	20000		
RI1206	5000	10000	20000		
RI1210	5000	10000	20000		
RI1218					4000
RI1812					4000
RI2010					4000
RI2512					4000

NOTE: For tape and reel specification, please refer to data sheet "Chip resistors packing".

FUNCTIONAL DESCRIPTION

OPERATING TEMPRETURE RANGE

RI 0402 to RI 2512 Range : -55℃ to +155℃ (Fig. 10-1)

RI 0075 to RI 0201 Range : -55℃ to +125℃ (Fig. 10-2)

POWER RATING

Each type rated power at 70 °C:
RI 0075=1/50W
RI 0100=1/32W
RI 0201=1/20W
RI 0402=1/16W, 1/8W
RI 0603=1/10W, 1/5W
RI 0805=1/8W , 1/4W
RI 1206=1/4W , 1/2W
RI 1210=1/2W
RI 1218=1W
RI 1812=3/4W
RI 2010=3/4W
RI 2512=1W , 2W

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)

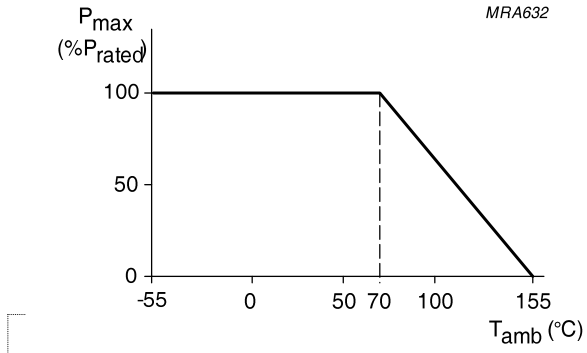


Fig. 10-1 Maximum dissipation (P) in percentage of rated poweras a function of the operating ambient temperature (Tamb)

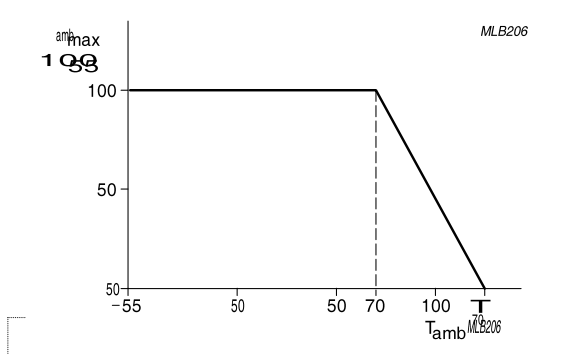


Fig. 10-2 Maximum dissipation (P) in percentage of rated poweras a function of the operating ambient temperature (Tamb)

TESTS AND REQUIREMENTS

Table 8 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance (T.C.R.)	MIL-STD-202 Method 304	At +25/–55°C and +25/+125°C **Formula:** $T.C.R=\frac{R_2-R_1}{R_1(t_2-t_1)}\times 10^6$ (ppm/°C) Where t_1=+25 °C or specified room temperature t_2=–55 °C or +125 °C test temperature R_1=resistance at reference temperature in ohms R_2=resistance at test temperature in ohms	Refer to table 2
Life/ Endurance	MIL-STD-202 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, still air required	0075: ± (5%+100mΩ) <100mΩ for jumper 01005: ±(3% +50mΩ) <100mΩf or jumper Others: ±(1%+50mΩ) for B/D/F tol ±(3%+50mΩ) for J tol <100mR for jumper
High Temperature Exposure	MIL-STD-202 Method 108A IEC 60068-2-2	1,000 hours at maximum operating temperature depending on specification, unpowered.	0075: ± (5%+100mΩ) <100mΩ for jumper 01005: ±(1% +50mΩ) < 50mΩf or jumper Others: ±(1%+50mΩ) for B/D/F tol ±(2%+50mΩ) for J tol <50mR for jumper
Moisture Resistance	MIL-STD-202 Method 106G	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	0075: ± (2%+100mΩ) <100mΩ for jumper 01005: ±(2% +50mΩ) < 100mΩf or jumper Others: ±(0.5%+50mΩ) for B/ D/F tol ±(2%+50mΩ) for J tol <100mR for jumper
Humidity	IEC 60115-1 4.24.2	Steady state for 1000 hours at 40°C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	0075: ± (5%+100mΩ) no visible damage 01005: ±(3% +50mΩ) < 100mΩf or jumper Others: ±(1%+50mΩ) for B/D/F tol ±(2%+50mΩ) for J tol <100mR for jumper

Thermal Shock	MIL-STD-202 Method 107G	-55/+125°C Note Number of cycles required is 300. Devices mounted Maximum transfer time is 20 seconds. Dwell time is 15 minutes. Air - Air	0075/01005: ±(1% +50mΩ) < 50mΩf or jumper Others: ±(0.5%+50mΩ) for B/D/F tol ±(1%+50mΩ) for J tol < 50mR for jumper
Short Time Overload	IEC 60115-1 4.13	2.5 times RCWV or maximum overload voltage which is less for 5 seconds at room temperature	0075/01005: ±(2% +50mΩ) < 50mΩf or jumper Others: ±(1%+50mΩ) for B/D/F tol ±(2%+50mΩ) for J tol <50mR for jumper No visible damage
Board Flex/ Bending	IEC 60115-1 4.33	Device mounted or as described only 1 board bending required bending time: 60±5 seconds 0075/0100/0201/0402:5mm; 0603/0805:3mm; 1206 and above:2mm	0075/01005: ±(1% +50mΩ) < 50mΩf or jumper Others: ±(1%+50mΩ) for B/D/F/J tol <50mR for jumper No visible damage
Solderability - Wetting	J-STD-002 test B	Electrical Test not required Magnification 50X SMD conditions: 1st step: method B, aging 4 hours at 155°C dry heat 2nd step: leadfree solder bath at 245±3°C Dipping time: 3±0.5 seconds	W ell tinned (>95% covered) No visible damage
-Leaching	J-STD-002 test D	Leadfree solder ,260°C, 30 seconds immersion time	No visible damage
-Resistance to Soldering Heat	MIL-STD-202 Method 210F IEC 60115-1 4.18	Condition B, no pre-heat of samples Leadfree solder, 260°C ±5°C, 10 ±1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	0075: ± (3%+50mΩ) <50mΩ for jumper 01005: ±(1% +50mΩ) < 50mΩf or jumper Others: ±(0.5% +50mΩ) for B/D/F tol. ±(1% +50mΩ) for J tol. <50mR for jumper No visible damage