

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 meet RoHS 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.








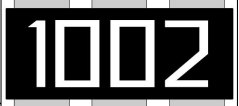
PART NUMBER

| |
|---|
| RI <u>XXXX</u> <u>L</u> <u>XXXX</u> <u>F</u> <u>T</u> (1) (2) (3) (4) (5) |
| (1) SIZE 0075/0100/0201/0402/0603/0805/1206/1210/1218/2010/2512 |
| (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 |

ORDERING EXAMPLE

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

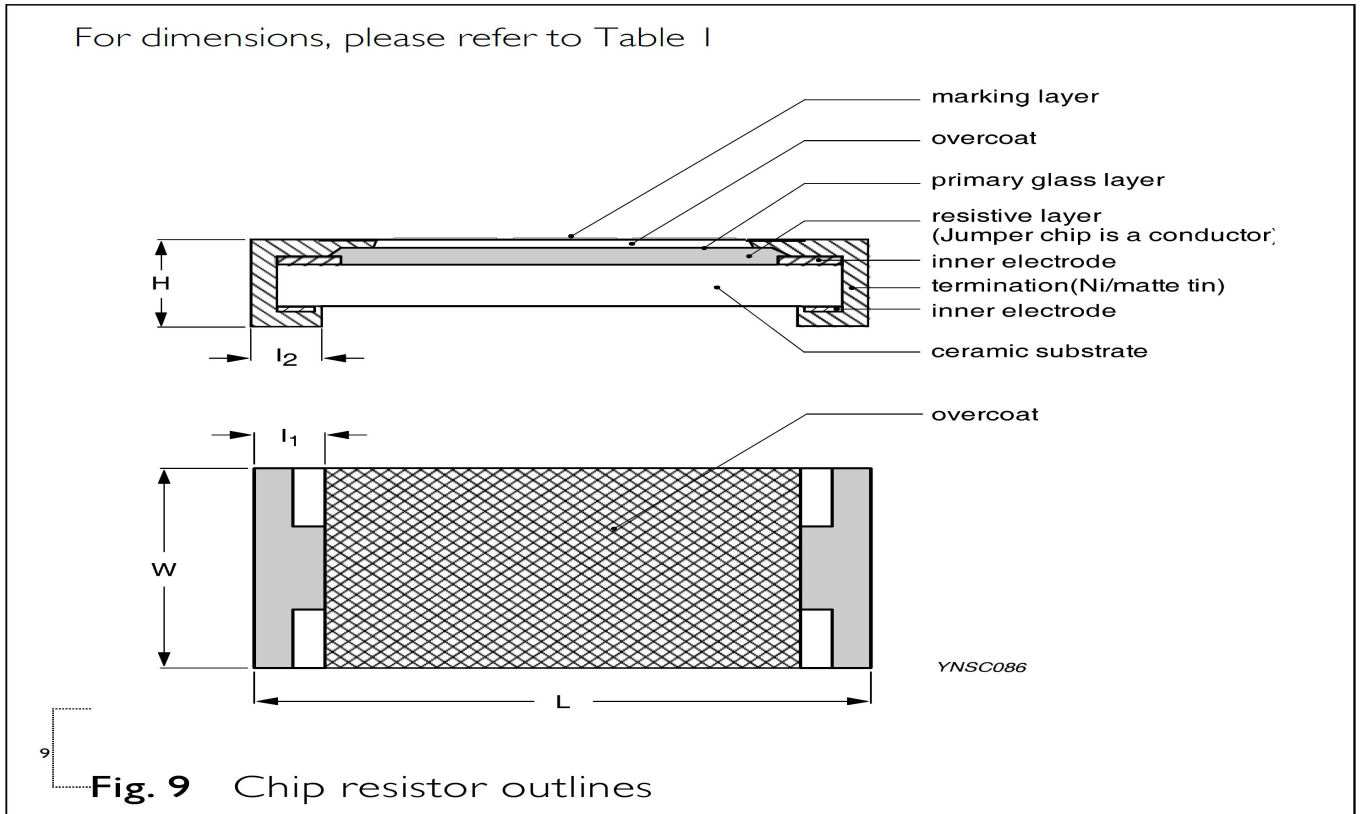
MARKING

| | |
|--|---|
| RI0075 / RI0100 / RI0201 / RI0402 | |
|  <p>FIG.1</p> | No Marking |
| RI0603 | |
|  <p>240 = 24 × 10⁰ = 24 FIG.2</p> | 1%, 0.5%, E24 exception values 10/11/13/15/20/75 of E24 series |
|  <p>88A = 806 × 10⁰ = 806 Ω FIG.3</p> | 1%, 0.5%, E96 refer to EIA-96 marking method, including values 10/11/13/15/20/75 of E24 series |
|  <p>Value = 10 KΩ FIG.4</p> | 5%, E24 series : 3 digits First two digits for significant figure and 3rd digit for number of zeros |
| RI0805 / RI1206 / RI1210 / RI2010 / RI2512 | |
|  <p>Value = 10 KΩ FIG.5</p> | 1%, 0.5%, E24/E96 series : 4 digits First three digits for significant figure and 4th digit for number of zeros |
|  <p>Value = 10 KΩ FIG.6</p> | 5%, E24 series : 3 digits First two digits for significant figure and 3rd digit for number of zeros |
| RI1218 | |
|  <p>Value = 10 KΩ FIG.7</p> | E-24 series: 3 digits, ±5% First two digits for significant figure and 3rd digit for number of zeros |
|  <p>Value = 10 KΩ FIG.8</p> | 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



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 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 |

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°C to 125°C | 10V | 25V | 25V | 5% (E24) 10Ω ≤ R ≤ 1MΩ 1% (E24/E96) 10Ω ≤ R ≤ 1MΩ Jumper < 50mΩ | 10Ω ≤ R < 100Ω - 200~+600ppm/°C 100Ω ≤ R ≤ 1MΩ ±200ppm/°C | Rated Current 0.5A Maximum Current 1.0A |
| RI0100 | 1/32 W | -55°C to 125°C | 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/°C 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°C to 125°C | 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/°C 10Ω ≤ R ≤ 10MΩ: ±200ppm/°C | Rated Current 0.5A Maximum Current 1.0A |
| RI0402 | 1/16W | -55°C to 155°C | 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/°C 10Ω ≤ R ≤ 10MΩ: ±100ppm/°C 10MΩ < R ≤ 22MΩ: ±200ppm/°C | Rated Current 1.0A Maximum Current 2.0A |
| | 1/8W | -55°C to 155°C | 50V | 100V | 100V | 5% (E24) 1Ω ≤ R ≤ 1MΩ 1% (E24/E96) 1Ω ≤ R ≤ 1MΩ | 1Ω ≤ R < 1MΩ ±200ppm/°C | |
| RI0603 | 1/10W | -55°C to 155°C | 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/°C 1Ω ≤ R ≤ 10Ω: ±200ppm/°C 10Ω < R ≤ 10MΩ: ±100ppm/°C 10MΩ < R ≤ 22MΩ: ±200ppm/°C | Rated Current 1.0A Maximum Current 2.0A |
| | 1/5W | -55°C to 155°C | 75V | 150V | 150V | 5% (E24) 1Ω ≤ R ≤ 1MΩ 1% (E24/E96) 1Ω ≤ R ≤ 1MΩ | 1Ω ≤ R ≤ 1MΩ: ±200ppm/°C | |
| RI0805 | 1/8W | -55°C to 155°C | 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/°C 1Ω ≤ R ≤ 10Ω: ±200ppm/°C 10Ω < R ≤ 10MΩ: ±100ppm/°C 10MΩ < R ≤ 22MΩ: ±200ppm/°C 24MΩ < R ≤ 100MΩ: ±300ppm/°C | Rated Current 2.0A Maximum Current 5.0A |

| 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°C to 155°C | 150V | 300V | 300V | 5% (E24) 1Ω ≤ R ≤ 1MΩ 1% (E24/E96) 1Ω ≤ R ≤ 1MΩ | 1Ω ≤ R ≤ 1MΩ: ±200ppm/°C | |
| RI1206 | 1/4W | -55°C to 155°C | 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/°C 1Ω ≤ R ≤ 10Ω: ±200ppm/°C 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°C to 155°C | 200V | 400V | 500V | 5% (E24) 1Ω ≤ R ≤ 1MΩ 1% (E24/E96) 1Ω ≤ R ≤ 1MΩ | 1Ω ≤ R ≤ 1MΩ: ±200ppm/°C | |
| RI1210 | 1/2W | -55°C to 155°C | 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/°C 1Ω ≤ R ≤ 10Ω: ±200ppm/°C 10Ω < R ≤ 10MΩ: ±100ppm/°C 10MΩ < R ≤ 22MΩ: ±200ppm/°C | Rated Current 2.0A Maximum Current 10.0A |
| RI1218 | 1W | -55°C to 155°C | 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/°C 10Ω < R ≤ 1MΩ: ±100ppm/°C | Rated Current 6.0A Maximum Current 10.0A |
| RI2010 | 3/4W | -55°C to 155°C | 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/°C 1Ω ≤ R ≤ 10Ω: ±200ppm/°C 10Ω < R ≤ 10MΩ: ±100ppm/°C 10MΩ < R ≤ 22MΩ: ±200ppm/°C | Rated Current 2.0A Maximum Current 10.0A |
| RI2512 | 1W | -55°C to 155°C | 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/°C 1Ω ≤ R ≤ 10Ω: ±200ppm/°C 10Ω < R ≤ 10MΩ: ±100ppm/°C 10MΩ < R ≤ 22MΩ: ±200ppm/°C | Rated Current 2.0A Maximum Current 10.0A |
| | 2W | -55°C to 155°C | 200V | 400V | 500V | 5% (E24) 1Ω ≤ R ≤ 1MΩ 1% (E24/E96) 1Ω ≤ R ≤ 1MΩ | 1Ω ≤ R ≤ 1MΩ: ±200ppm/°C | |

PACKING STYLE AND PACKAGING QUANTITY

| PACKING STYLE | PAPER TAPING REEL(R) | | | ESD SAFE REEL(S) (4MM WIDTH, 1MM PITCH PLASTIC EMBOSS) | EMBOSS TAPING REEL |
|----------------|----------------------|------------|------------|--|--------------------|
| | 7"(178mm) | 10"(254mm) | 13"(330mm) | | |
| REEL DIMENSION | 7"(178mm) | 10"(254mm) | 13"(330mm) | 7"(178mm) | 7"(178mm) |
| RI0075 | | | | 20000 | |
| RI0100 | 20000 | | 80000 | 40000 | |
| RI0201 | 10000 | 20000 | 50000 | | |
| RI0402 | 10000 | 20000 | 50000 | | |
| RI0603 | 5000 | 10000 | 20000 | | |
| RI0805 | 5000 | 10000 | 20000 | | |
| RI1206 | 5000 | 10000 | 20000 | | |
| RI1210 | 5000 | 10000 | 20000 | | |
| RI1218 | | | | | 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°C to +155°C (Fig. 10-1)

RI 0075 to RI 0201 Range: -55°C to +125°C (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 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:

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

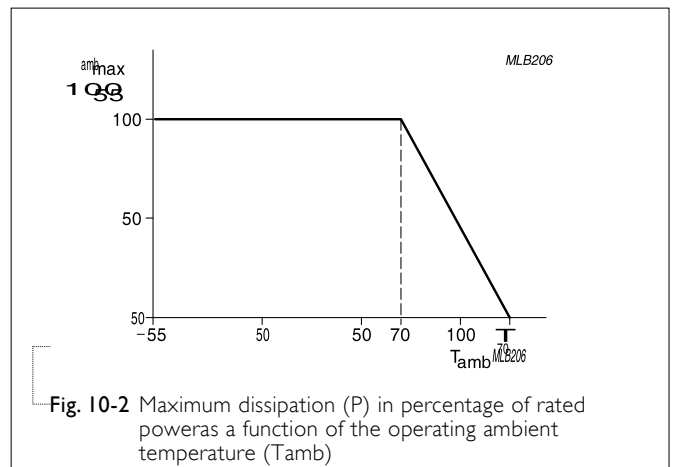
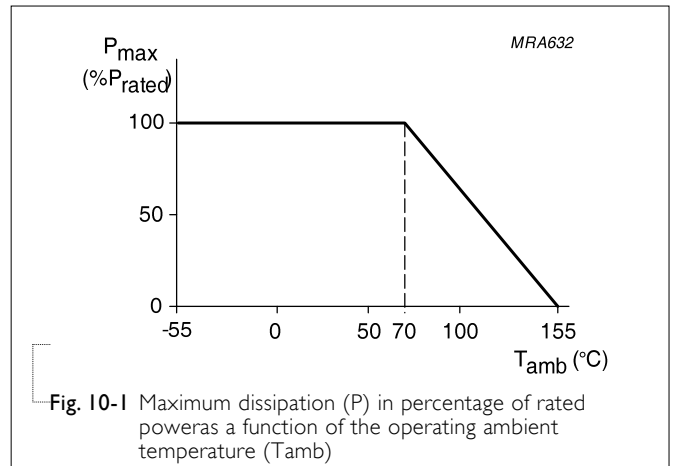
or max. working voltage whichever is less

Where

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

P = Rated power (W)

R = Resistance value (Ω)



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: $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ 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: $\pm(1\% +50m\Omega)$ < 50m Ω f or jumper Others: $\pm(0.5\%+50m\Omega)$ for B/D/F tol $\pm(1\%+50m\Omega)$ for J tol < 50mR for jumper |
| Short Time Overload | IEC 60115-1 4.13 | 2.5 times RCVV or maximum overload voltage which is less for 5 seconds at room temperature | 0075/01005: $\pm(2\% +50m\Omega)$ < 50m Ω f or jumper Others: $\pm(1\%+50m\Omega)$ for B/D/F tol $\pm(2\%+50m\Omega)$ 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 \pm 5 seconds 0075/0100/0201/0402:5mm; 0603/0805:3mm; 1206 and above:2mm | 0075/01005: $\pm(1\% +50m\Omega)$ < 50m Ω f or jumper Others: $\pm(1\%+50m\Omega)$ 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 \pm 3°C Dipping time: 3 \pm 0.5 seconds | Well 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 \pm 5°C, 10 \pm 1 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol | 0075: $\pm(3\%+50m\Omega)$ <50m Ω for jumper 01005: $\pm(1\% +50m\Omega)$ < 50m Ω f or jumper Others: $\pm(0.5\% +50m\Omega)$ for B/D/F tol. $\pm(1\% +50m\Omega)$ for J tol. <50mR for jumper No visible damage |