

# DATA SHEET

## GENERAL PURPOSE CHIP RESISTORS

RC1210 (Pb Free)  
5%, 1%



## SCOPE

This specification describes RC1210 series 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.

### PHYCOMP ORDERING CODE

#### I2NC CODE

| 2390       | XXX                     | XXXXX    | L                |                                              |           |
|------------|-------------------------|----------|------------------|----------------------------------------------|-----------|
| (1)        | (2)                     | (3)      | (4)              |                                              |           |
| TYPE/ 1210 | START IN <sup>(1)</sup> | TOL. (%) | RESISTANCE RANGE | EMBOSSED TAPE ON REEL (units) <sup>(2)</sup> |           |
|            |                         |          |                  | 5,000                                        | 20,000    |
| PRC101     | 2390                    | ±5%      | 1 to 22 MΩ       | 735 70xxx                                    | 735 71xxx |
| PRC102     | 2390                    | ±1%      | 1 to 10 MΩ       | 735 3xxxx                                    | 735 5xxxx |
| Jumper     | 2390                    | -        | 0 Ω              | 735 90001                                    | -         |

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

(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" means lead-free terminations.

┐ 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          |

#### ORDERING EXAMPLE

The ordering code of a PRC102 resistor, value 56 Ω with ±1% tolerance, supplied in tape of 5,000 units per reel is: 239073535609L.

|          |        |   |             |
|----------|--------|---|-------------|
| 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 |

#### CTC CODE

| RC1210 | X   | X   | X   | XX  | XXXX | L |
|--------|-----|-----|-----|-----|------|---|
| (1)    | (2) | (3) | (4) | (5) | (6)  |   |

#### (1) TOLERANCE

F = ±1%

J = ±5%

#### (2) PACKAGING TYPE

R = Paper/PE taping reel

#### (3) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Base on spec

#### (4) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

#### (5) RESISTANCE VALUE

5R6, 56R, 560R, 56K, 22M.

#### (6) RESISTOR TERMINATIONS

L = Lead free terminations (pure Tin)

#### ORDERING EXAMPLE

The ordering code of a RC1210 chip resistor, value 56 Ω with ±1% tolerance, supplied in 7-inch tape reel is: RC1210FR-0756RL.

## NOTE

1. 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.
2. Products with lead in terminations fulfil the same requirements as mentioned in this datasheet.
3. Products with lead in terminations will be phased out in the coming months (before July 1st, 2006)

## MARKING

### RC1210



E-24 series: 3 digits

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



Both E-24 and E-96 series: 4 digits

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

For marking codes, please see EIA-marking code rules in data sheet “Chip resistors instruction”.

## CONSTRUCTION

The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive paste. The composition of the paste is adjusted to give the approximate required resistance and laser cutting of this resistive layer that achieves tolerance trims the value. The resistive layer is covered with a protective coat and printed with the resistance value. Finally, the two external terminations (pure Tin) are added. See fig. 3.

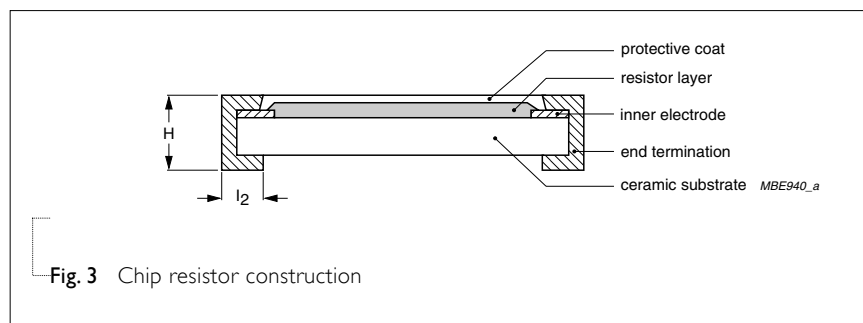


Fig. 3 Chip resistor construction

## DIMENSIONS

Table I

| TYPE                | RC1210     |
|---------------------|------------|
| L (mm)              | 3.10±0.10  |
| W (mm)              | 2.60 ±0.15 |
| H (mm)              | 0.50 ±0.10 |
| l <sub>1</sub> (mm) | 0.45 ±0.15 |
| l <sub>2</sub> (mm) | 0.50 ±0.20 |

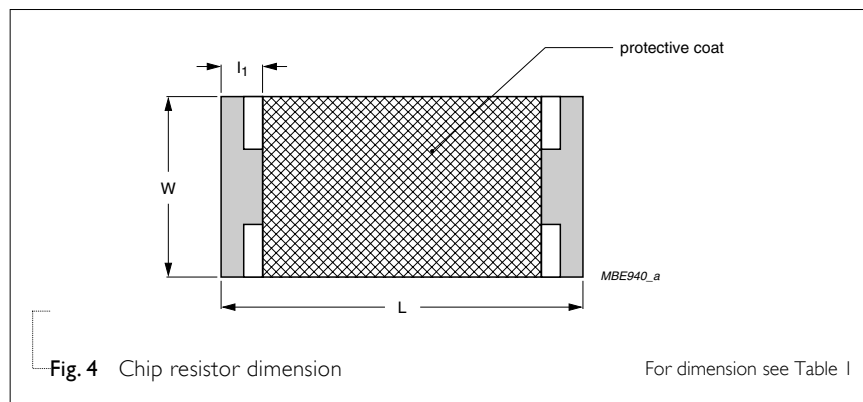


Fig. 4 Chip resistor dimension

For dimension see Table I

**ELECTRICAL CHARACTERISTICS**

Table 2

| CHARACTERISTICS                 | RC1210 1/2 W                    |
|---------------------------------|---------------------------------|
| Operating Temperature Range     | -55 °C to +155 °C               |
| Maximum Working Voltage         | 200 V                           |
| Maximum Overload Voltage        | 500 V                           |
| Dielectric Withstanding Voltage | 500 V                           |
| Resistance Range                | 5% (E24) 1 Ω to 22 MΩ           |
|                                 | 1% (E96) 1 Ω to 10 MΩ           |
|                                 | Zero Ohm Jumper < 0.05 Ω        |
| Temperature Coefficient         | 10 Ω < R ≤ 10 MΩ ±100 ppm/°C    |
|                                 | R ≤ 10 Ω; R > 10 MΩ ±200 ppm/°C |
| Jumper Criteria                 | Rated Current 2.0 A             |
|                                 | Maximum Current 10.0 A          |

**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”.

**PACKING STYLE AND PACKAGING QUANTITY**

Table 3 Packing style and packaging quantity

| PRODUCT TYPE | PACKING STYLE              | REEL DIMENSION | QUANTITY PER REEL |
|--------------|----------------------------|----------------|-------------------|
| RC1210       | Paper / PE Taping Reel (R) | 7" (178 mm)    | 5,000 units       |
|              |                            | 13" (330 mm)   | 20,000 units      |

**NOTE**

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

**FUNCTIONAL DESCRIPTION****POWER RATING**

RC1210 rated power at 70°C is 1/2 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 (Ω)

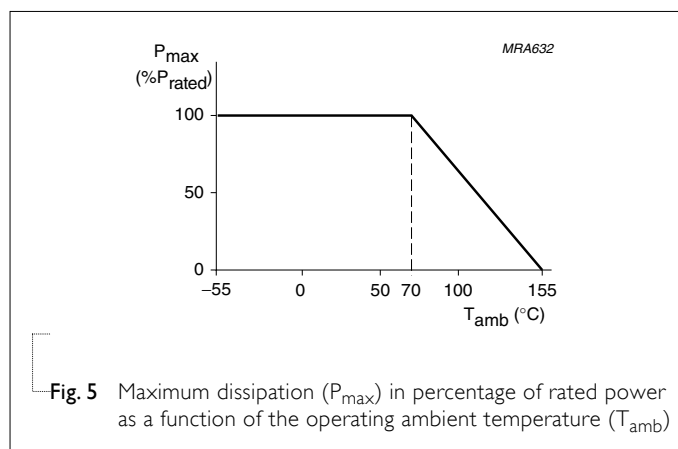


Fig. 5 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

## TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

| TEST                                           | TEST METHOD                                  | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                            | REQUIREMENTS                                                                   |        |              |                      |                           |
|------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|--------|--------------|----------------------|---------------------------|
| Temperature Coefficient of Resistance (T.C.R.) | MIL-STD-202F-method 304; JIS C 5202-4.8      | At +25/−55 °C and +25/+125 °C<br><br>Formula:<br><br>$T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$<br><br>Where<br>t <sub>1</sub> = +25 °C or specified room temperature<br>t <sub>2</sub> = −55 °C or +125 °C test temperature<br>R <sub>1</sub> = resistance at reference temperature in ohms<br>R <sub>2</sub> = resistance at test temperature in ohms | Refer to table 2                                                               |        |              |                      |                           |
| Thermal Shock                                  | MIL-STD-202F-method 107G; IEC 60115-1 4.19   | At −65 (+0/−10) °C for 2 minutes and at +155 (+10/−0) °C for 2 minutes; 25 cycles                                                                                                                                                                                                                                                                                                    | ±(0.5%+0.05 Ω) for 1% tol.<br>±(1.0%+0.05 Ω) for 5% tol.                       |        |              |                      |                           |
| 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                                                                                                                                                                                                                                                                                                                    | ±(0.5%+0.05 Ω) for 1% tol .<br>±(1.0%+0.05 Ω) for 5% tol.<br>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) for 1% tol.<br>±(2.0%+0.05 Ω) for 5% tol.<br>No visible damage  |        |              |                      |                           |
| Insulation Resistance                          | MIL-STD-202F-method 302; IEC 60115-1 4.6.1.1 | RCOV for 1 minute<br><table><tr><td>Type</td><td>RC1210</td></tr><tr><td>Voltage (DC)</td><td>500 V</td></tr></table>                                                                                                                                                                                                                                                                | Type                                                                           | RC1210 | Voltage (DC) | 500 V                | ≥10 GΩ                    |
| Type                                           | RC1210                                       |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                |        |              |                      |                           |
| Voltage (DC)                                   | 500 V                                        |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                |        |              |                      |                           |
| Dielectric Withstand Voltage                   | MIL-STD-202F-method 301; IEC 60115-1 4.6.1.1 | Maximum voltage (V <sub>rms</sub> ) applied for 1 minute<br><table><tr><td>Type</td><td>RC1210</td></tr><tr><td>Voltage (AC)</td><td>500 V<sub>rms</sub></td></tr></table>                                                                                                                                                                                                           | Type                                                                           | RC1210 | Voltage (AC) | 500 V <sub>rms</sub> | No breakdown or flashover |
| Type                                           | RC1210                                       |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                |        |              |                      |                           |
| Voltage (AC)                                   | 500 V <sub>rms</sub>                         |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                |        |              |                      |                           |
| Resistance to Soldering Heat                   | MIL-STD-202F-method 210C; IEC 60115-1 4.18   | Unmounted chips; 260 ±5 °C for 10 ±1 seconds                                                                                                                                                                                                                                                                                                                                         | ±(0.5%+0.05 Ω) for 1% tol.<br>±(1.0%+0.05 Ω) for 5% tol.<br>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%+0.05 Ω) for 1% tol.<br>±(3%+0.05 Ω) for 5% tol.                           |        |              |                      |                           |

| TEST                     | TEST METHOD                                     | PROCEDURE                                                                                              | REQUIREMENTS                                                                                    |              |
|--------------------------|-------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------|
| Solderability            | MIL-STD-202F-method 208A;                       | Solder bath at $245 \pm 3$ °C                                                                          | Well tinned ( $\geq 95\%$ covered)                                                              |              |
|                          | IEC 60115-1 4.17                                | Dipping time: $2 \pm 0.5$ seconds                                                                      | No visible damage                                                                               |              |
| Bending Strength         | JIS C 5202.6.14;                                | Resistors mounted on a 90 mm glass epoxy resin PCB (FR4)<br>Bending: 2 mm                              | $\pm(1.0\%+0.05 \Omega)$ for 1% tol.                                                            |              |
|                          | IEC 60115-1 4.15                                |                                                                                                        | $\pm(1.0\%+0.05 \Omega)$ for 5% tol.<br>No visible damage                                       |              |
| Resistance to Solvent    | MIL-STD-202F-method 215;<br>IEC 60115-1 4.29    | Isopropylalcohol ( $C_3H_7OH$ ) or dichloromethane ( $CH_2Cl_2$ ) followed by brushing                 | No smeared                                                                                      |              |
| Noise                    | JIS C 5202 5.9;<br>IEC 60115-1 4.12             | Maximum voltage ( $V_{rms}$ ) applied.                                                                 | <b>Resistors range</b>                                                                          | <b>Value</b> |
|                          |                                                 |                                                                                                        | $R < 100 \Omega$                                                                                | 10 dB        |
|                          |                                                 |                                                                                                        | $100 \Omega \leq R < 1 K\Omega$                                                                 | 24 dB        |
|                          |                                                 |                                                                                                        | $1 K\Omega \leq R < 10 K\Omega$                                                                 | 34 dB        |
|                          |                                                 |                                                                                                        | $10 K\Omega \leq R < 100 K\Omega$                                                               | 44 dB        |
|                          |                                                 |                                                                                                        | $100 K\Omega \leq R < 1 M\Omega$                                                                | 46 dB        |
|                          |                                                 |                                                                                                        | $1 M\Omega \leq R \leq 22 M\Omega$                                                              | 48 dB        |
| Humidity (steady state)  | JIS C 5202 7.5;<br>IEC 60115-8 4.24.8           | 1,000 hours; $40 \pm 2$ °C; $93(+2/-3)\%$ RH<br>RCWV applied for 1.5 hours on and 0.5 hour off         | $\pm(0.5\%+0.05 \Omega)$ for 1% tol.<br>$\pm(2.0\%+0.05 \Omega)$ for 5% tol.                    |              |
| Leaching                 | EIA/IS 4.13B;<br>IEC 60115-8 4.18               | Solder bath at $260 \pm 5$ °C<br>Dipping time: $30 \pm 1$ seconds                                      | No visible damage                                                                               |              |
| Intermittent Overload    | JIS C 5202 5.8                                  | At room temperature; $2.5 \times$ RCWV applied for 1 second on and 25 seconds off; total 10,000 cycles | $\pm(1.0\%+0.05 \Omega)$ for 1% tol.<br>$\pm(2.0\%+0.05 \Omega)$ for 5% tol.                    |              |
| Resistance to Vibration  | On request                                      | On request                                                                                             |                                                                                                 |              |
| Moisture Resistance Heat | MIL-STD-202F-method 106F;<br>IEC 60115-1 4.24.2 | 42 cycles; total 1,000 hours<br>Shown as Fig. 6                                                        | $\pm(0.5\%+0.05\Omega)$ for 1% tol.<br>$\pm(2.0\%+0.05\Omega)$ for 5% tol.<br>No visible damage |              |

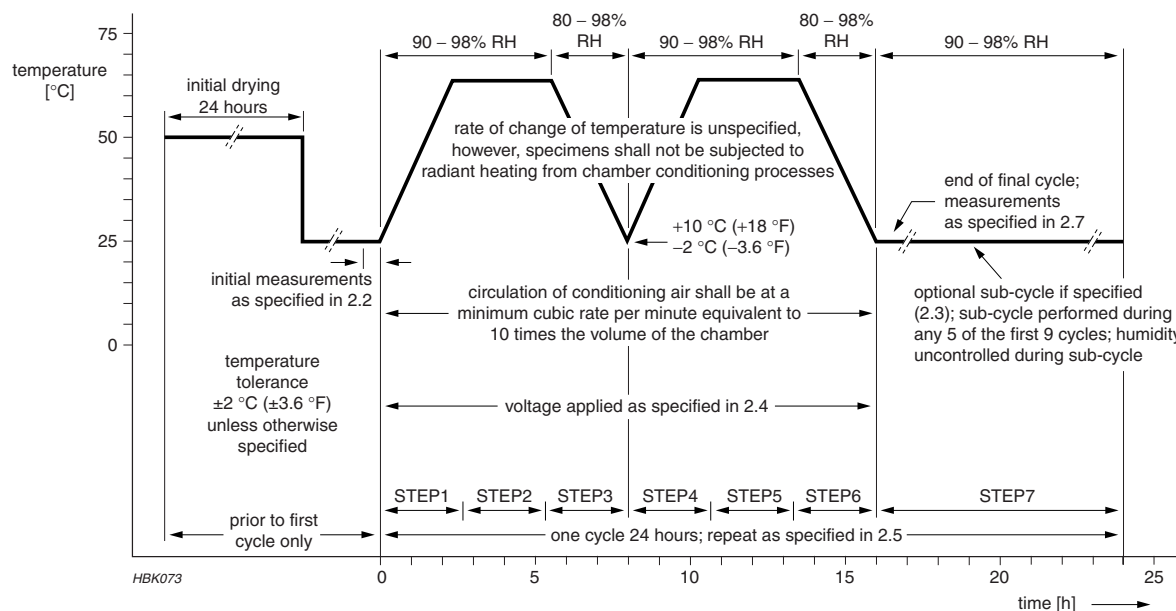


Fig. 6 Moisture resistance test requirements

REVISION HISTORY

| REVISION  | DATE         | CHANGE NOTIFICATION | DESCRIPTION                                                                                                                                                                                                                                |
|-----------|--------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Version 2 | Oct 13, 2004 | -                   | <ul style="list-style-type: none"><li>- New datasheet for 1210 thick film 1% and 5% with lead-free terminations</li><li>- Replace the 1210 part of pdf files: PRC101_5_1, PRC102_1_1</li><li>- Test method and procedure updated</li></ul> |