

# DATA SHEET

**RC04H/RC14H/RC24H**  
**0.25%**

High-precision chip resistors  
sizes 1206, 0805 and 0603

Product specification  
Supersedes data of 2nd December 1999

2001 Apr 27 Rev.2

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# RC04H/RC14H/RC24H 0.25%

## FEATURES

- Reduced size of final equipment
- Low assembly costs
- Higher component and equipment reliability
- Complete high precision SMD family.

## APPLICATIONS

- Measuring instruments
- Power supplies
- EDP
- Telecom.

## DESCRIPTION

The resistors are constructed on a high grade ceramic body (aluminium oxide). Internal metal electrodes are added at each end and connected by a high voltage resistive paste which is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to within tolerance, by laser cutting of this resistive layer.

The resistive layer is covered with a protective coating and printed with the resistance value. Finally, the two external end terminations are added. To guarantee optimum solderability the outer layer consists of a lead-tin alloy.

## QUICK REFERENCE DATA

| DESCRIPTION                                                            | VALUE                                            |                |                |
|------------------------------------------------------------------------|--------------------------------------------------|----------------|----------------|
|                                                                        | RC04H                                            | RC14H          | RC24H          |
| Size code                                                              | 1206<br>(3216)                                   | 0805<br>(2012) | 0603<br>(1608) |
| Resistance range                                                       | 100 $\Omega$ to 1 M $\Omega$ ;<br>E24/E96 series |                |                |
| Resistance tolerance                                                   | $\pm 0.25\%$                                     |                |                |
| Temperature coefficient:<br>100 $\Omega \leq R \leq 1 \text{ M}\Omega$ | $\leq \pm 100 \times 10^{-6}/\text{K}$           |                |                |
| Absolute maximum dissipation<br>at $T_{\text{amb}} = 70^\circ\text{C}$ | 0.125 W                                          | 0.10 W         | 0.063 W        |
| Maximum permissible voltage<br>(DC or RMS)                             | 200 V                                            | 150 V          | 50 V           |
| Climatic category (IEC 60068)                                          | 55/125/56                                        |                |                |
| Basic specification                                                    | IEC 60115-8                                      |                |                |

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## ORDERING INFORMATION

**Table 1** Ordering code indicating resistor type and packing

| TYPE         | TOL.<br>(%) | RESISTANCE<br>VALUE<br>( $\Omega$ ) | SERIES  | ORDERING CODE 2350 54. .... |
|--------------|-------------|-------------------------------------|---------|-----------------------------|
|              |             |                                     |         | PAPER TAPE ON REEL          |
|              |             |                                     |         | 5000 units                  |
|              |             |                                     |         | 1 0....                     |
| RC04H (1206) | $\pm 0.25$  | 100 $\Omega$ to 1 M $\Omega$        | E24/E96 | 4 0....                     |
| RC14H (0805) |             |                                     |         | 7 0....                     |
| RC24H (0603) |             |                                     |         |                             |

### Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2350 54; see Table 1.
- The subsequent 2 digits indicates the resistor type and packing.
- The remaining digits indicate the resistance value:
  - The first 3 digits indicate the resistance value.
  - The last digit indicates the resistance decade in accordance with Table 2.

**Table 2** Last digit of 12NC

| RESISTANCE<br>DECADE             | LAST DIGIT |
|----------------------------------|------------|
| 100 $\Omega$ to 976 $\Omega$     | 1          |
| 1 k $\Omega$ to 9.76 k $\Omega$  | 2          |
| 10 k $\Omega$ to 97.6 k $\Omega$ | 3          |
| 100 k $\Omega$ to 976 k $\Omega$ | 4          |
| 1 M $\Omega$                     | 5          |

### ORDERING EXAMPLE

The ordering code of a RC04H resistor, value 100  $\Omega$  with 0.25% tolerance, supplied on paper tape of 5 000 units per reel is: 2350 541 01001.

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FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24/E96 series for resistors with a tolerance of  $\pm 0.25\%$ . The values of the E24/E96 series are in accordance with “IEC publication 60063”.

Limiting values

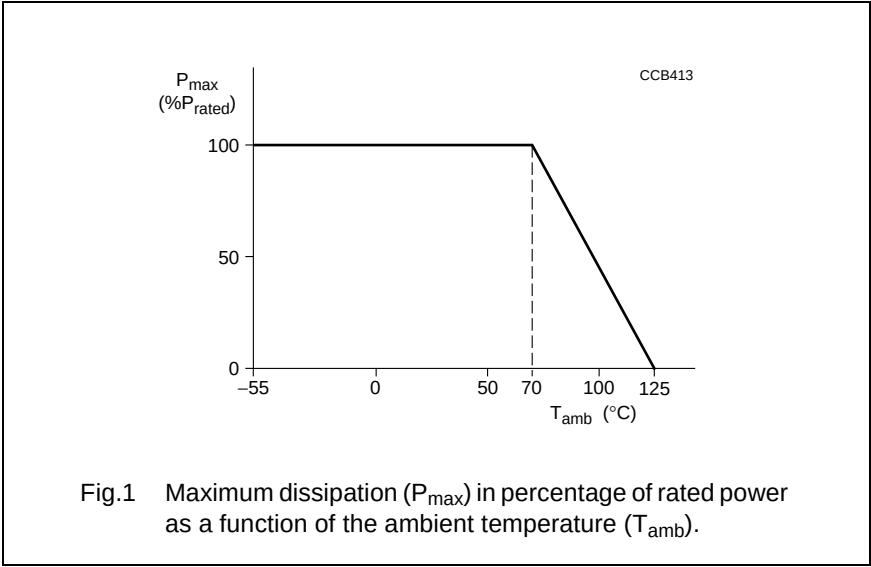
| TYPE  | LIMITING VOLTAGE <sup>(1)</sup><br>(V) | LIMITING POWER<br>(W) |
|-------|----------------------------------------|-----------------------|
| RC04H | 200                                    | 0.125                 |
| RC14H | 150                                    | 0.10                  |
| RC24H | 50                                     | 0.063                 |

Note

1. The maximum voltage that may be continuously applied to the resistor element, see “IEC publication 60115-8” and “IEC publication 60115-2”.

DERATING

The rated power that the resistor can dissipate depends on the operating temperature; see Fig.1.



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## MECHANICAL DATA

### Mass per 100 units

| TYPE  | MASS (g) |
|-------|----------|
| RC04H | 1.0      |
| RC14H | 0.55     |
| RC24H | 0.25     |

### Marking<sup>(1)</sup>

Each resistor is marked with a 4 digit code on the protective coating to designate the nominal resistance value.

The first 3 digits are significant and the fourth indicates the number of zeros to follow.

### Example

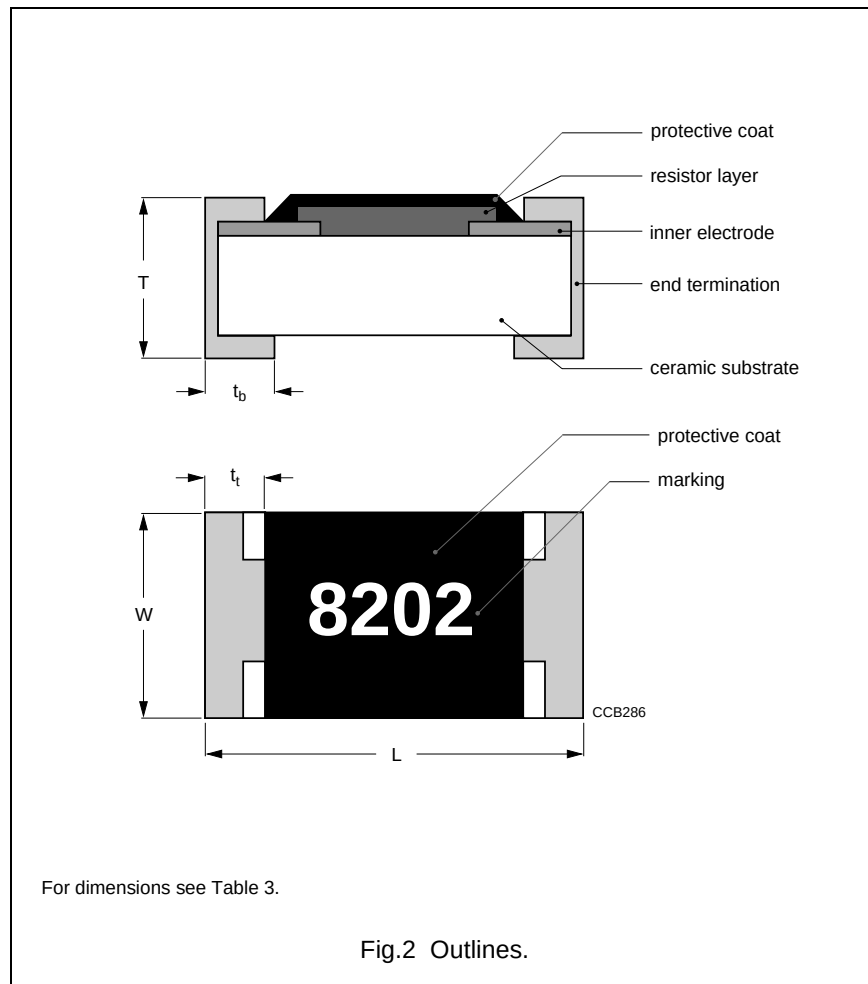
| MARKING | RESISTANCE    |
|---------|---------------|
| 120R    | 120 $\Omega$  |
| 8202    | 82 k $\Omega$ |

### PACKAGE MARKING

The packing is also marked and includes resistance value, tolerance, catalogue number, quantity, production period, batch number and source code.

(1) RC24H has no marking.

## Outlines



**Table 3** Chip resistor type and relevant physical dimensions; see Fig.2

| TYPE  | L (mm)           | W (mm)              | T (mm)     | t <sub>t</sub> (mm) | t <sub>b</sub> (mm) |
|-------|------------------|---------------------|------------|---------------------|---------------------|
| RC04H | 3.2<br>+0.1/-0.2 | 1.6 ±0.15           | 0.55 ±0.10 | 0.45 ±0.25          | 0.50 ±0.25          |
| RC14H | 2.00 ±0.15       | 1.25 ±0.15          | 0.55 ±0.10 | 0.40 ±0.20          | 0.40 ±0.20          |
| RC24H | 1.60 ±0.10       | 0.80<br>+0.15/-0.05 | 0.45 ±0.10 | 0.30 ±0.20          | 0.30 ±0.20          |

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## TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the schedule of "IEC publication 60115-8", category 55/125/56 (rated temperature range -55 to +125 °C; damp heat, long term, 56 days).

The testing also covers the requirements specified by EIA and EIAJ.

The tests are carried out in accordance with IEC publication 60068, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions in accordance with "IEC 60068-1", subclause 5.3.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 45% to 75%

Air pressure: 86 kPa to 106 kPa  
(860 mbar to 1060 mbar).

In Table 4 the tests and requirements are listed with reference to the relevant clauses of "IEC publications 60115-8 and 60068"; a short description of the test procedure is also given. In some instances deviations from the IEC recommendations were necessary for our method of specifying.

All soldering tests are performed with mildly activated flux.

**Table 4** Test procedures and requirements

| IEC 60115-8 CLAUSE                                                      | IEC 60068-2 TEST METHOD | TEST                         | PROCEDURE                                                                                                                                               | REQUIREMENTS                                      |
|-------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>Tests in accordance with the schedule of IEC publication 60115-8</b> |                         |                              |                                                                                                                                                         |                                                   |
| 4.4.1                                                                   |                         | visual examination           |                                                                                                                                                         | no holes; clean surface; no visible damage        |
| 4.5                                                                     |                         | resistance                   | applied voltage (0 to -10%):<br>100 Ω ≤ R < 1 kΩ: 1 V<br>1 kΩ ≤ R < 10 kΩ: 3 V<br>10 kΩ ≤ R < 100 kΩ: 10 V<br>100 kΩ ≤ R < 1 MΩ: 25 V<br>R ≥ 1 MΩ: 50 V | R - R <sub>nom</sub> : max. ±0.25%                |
| 4.17                                                                    | 20 (Ta)                 | solderability                | unmounted chips completely immersed for 2 ±0.5 s in a solder bath at 235 ±2 °C                                                                          | good tinning (≥95% covered); no visible damage    |
| 4.18                                                                    | 20 (Tb)                 | resistance to soldering heat | unmounted chips; 10 ±1 s; 260 ±5 °C                                                                                                                     | no visible damage<br>ΔR/R max.: ±(0.25% + 0.05 Ω) |
| 4.13                                                                    |                         | short time overload          | room temperature; dissipation = 6.25 × P <sub>n</sub> ; 5 s (voltage not more than 2 × V <sub>max</sub> )                                               | ΔR/R max.: ±(0.5% + 0.05 Ω)                       |
| 4.33                                                                    |                         | bending                      | resistors mounted on a 90 mm glass epoxy resin PCB (FR4), bending:<br>3 mm for 1206; 5 mm for 0805 and 0603                                             | no visible damage<br>ΔR/R max.: ±(0.25% + 0.05 Ω) |
| 4.19                                                                    | 14 (Na)                 | rapid change of temperature  | 30 minutes at LCT and 30 minutes at UCT; 5 cycles                                                                                                       | no visible damage<br>ΔR/R max.: ±(0.25% + 0.05 Ω) |
| 4.6.1.1                                                                 |                         | insulation resistance        | voltage (DC) after 1 minute, metal block method; 100 V                                                                                                  | R <sub>ins</sub> min.: 1000 MΩ                    |
| 4.24.2                                                                  | 3 (Ca)                  | damp heat (steady state)     | 56 days; 40 ±2 °C; 93 +2/-3% RH; loaded with 0.01 P <sub>n</sub> :<br>R ≤ 1 MΩ                                                                          | ΔR/R max.: ±(1.0% + 0.1 Ω)                        |

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| IEC 60115-8<br>CLAUSE                                                             | IEC 60068-2<br>TEST<br>METHOD | TEST                                          | PROCEDURE                                                                                                                                       | REQUIREMENTS                                                                                  |
|-----------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 4.25.1                                                                            |                               | endurance                                     | 1000 +48/-0 hours; 70 ±2 °C;<br>loaded with P <sub>n</sub> or V <sub>max</sub> ;<br>1.5 hours on, 0.5 hour off                                  | ΔR/R max.: ±(1% + 0.1 Ω)                                                                      |
| 4.25.1                                                                            |                               | endurance at<br>upper category<br>temperature | 1000 +48/-0 hours, no load                                                                                                                      | ΔR/R max.: ±(1% + 0.1 Ω)                                                                      |
| 4.8.4.2                                                                           |                               | temperature<br>coefficient                    | at 20/LCT/20 °C and 20/UCT/20 °C                                                                                                                | ΔR/R max.: ±100 × 10 <sup>-6</sup> /K                                                         |
| <b>Other tests in accordance with IEC 60115 clauses and IEC 60068 test method</b> |                               |                                               |                                                                                                                                                 |                                                                                               |
| 4.17                                                                              | 20 (Ta)                       | solderability<br>(after ageing)               | 8 hours steam or 16 hours at 155 °C;<br>unmounted chips completely immersed for<br>2 ±0.5 s in a solder bath at 235 ±2 °C                       | good tinning (≥95% covered);<br>no visible damage                                             |
| 4.12                                                                              |                               | noise                                         | IEC publication 60195<br>(measured with Quantech-equipment):<br>100 Ω < R ≤ 1 kΩ<br>1 kΩ < R ≤ 10 kΩ<br>10 kΩ < R ≤ 100 kΩ<br>100 kΩ < R ≤ 1 MΩ | max. 1 μV/V (0 dB)<br>max. 3 μV/V (9.54 dB)<br>max. 6 μV/V (15.56 dB)<br>max. 10 μV/V (20 dB) |
| <b>Other applicable tests</b>                                                     |                               |                                               |                                                                                                                                                 |                                                                                               |
|                                                                                   |                               | leaching                                      | unmounted chips 60 ±1 s; 260 ±5 °C                                                                                                              | good tinning; no leaching                                                                     |
|                                                                                   | (JIS) C<br>5202 7.5           | resistance to<br>damp heat<br>(steady state)  | 1000 +48/-0 hours; 40 ±2 °C;<br>93 +2/-3% RH; loaded with P <sub>n</sub> or V <sub>max</sub> ;<br>1.5 hours on, 0.5 hour off                    | ΔR/R max.: ±(2% + 0.1 Ω)                                                                      |

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**REVISION HISTORY**

| Revision | Date        | Change Notification | Description                  |
|----------|-------------|---------------------|------------------------------|
| Rev.2    | 2001 Apr 27 | –                   | - Converted to Phycomp brand |
|          |             |                     |                              |