

DATA SHEET

RC01/02H/21/22H

1%; 5%

Chip resistors with Au-terminations
sizes 1206 and 0603

Product specification
Supersedes data of 27th April 2001

2001 Oct 14 Rev.4

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FEATURES

- Reduced size of final equipment
- Low assembly costs
- Higher component and equipment reliability
- New Ni/Au terminations provide special application for hybrid board gluing and can replace AgPd terminations.

APPLICATIONS

- Power supply in small equipment
- Digital multi-meter
- Telecommunication
- Computer
- Automotive industry.

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 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.

To ensure the product insulation and performance, the protective overcoat layer is printed upon the resistor layer. Finally, the two external end terminations are added. For ease of soldering the outlayer of these end terminations is of Ni-Au alloy.

QUICK REFERENCE DATA

DESCRIPTION	VALUE			
	RC01	RC02H	RC21	RC22H
Size code	1206		0603	
Resistance range	1 Ω to 10 MΩ			
Resistance tolerance and E-series	±5%; E24 series	±1%; E24/E96 series	±5%; E24 series	±1%; E96 series
Temperature coefficient: 1 Ω ≤ R ≤ 10 Ω 10 Ω < R ≤ 10 MΩ	250 ±250 ≤±200	250 ±250 ≤±100	250 ±250 ≤±200	250 ±250 ≤±100
Maximum dissipation at T _{amb} = 70 °C	0.25 W		0.063 W	
Maximum permissible voltage	200 V (DC or RMS)		50 V (DC or RMS)	
Climatic category (IEC 60068)	55/155/56			
Basic specification	IEC 60115-8			

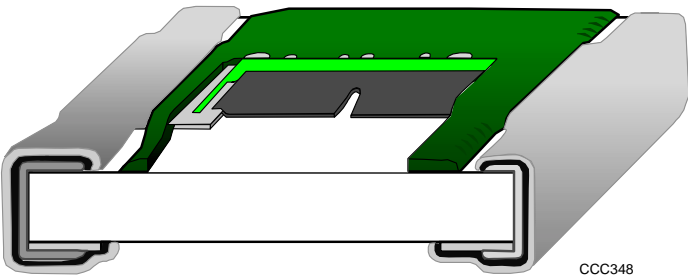


Fig.1 Outline.

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ORDERING INFORMATION

Table 1 Ordering code indicating type and packing

TYPE	RESISTANCE VALUE	TOLERANCE (%)	ORDERING CODE 2322	
			PAPER TAPE ON REEL	
			5000 units	10000 units
RC01	1 Ω to 10 M Ω	± 5	711 11...	–
RC02H	1 Ω to 10 M Ω	± 1	729 1....	–
RC21	1 Ω to 10 M Ω	± 5	702 11...	702 12...
RC22H	1 Ω to 10 M Ω	± 1	704 1....	–

Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2322.
- The subsequent 5 digits indicate the resistor type and packing; see Table 1.
- The remaining 3 or 4 digits indicate the resistance value:
 - The first 2 or 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 DECADE	LAST DIGIT
1 to 9.76 Ω	8
10 to 97.6 Ω	9
100 to 976 Ω	1
1 to 976 k Ω	2
10 to 97.6 k Ω	3
100 to 976 k Ω	4
1 to 9.76 M Ω	5
10 M Ω	6

ORDERING EXAMPLE

The ordering code of a RC01 resistor, Au-termination, value 1000 Ω , 5%, supplied on paper tape of 5000 units per reel is: 2322 711 11102.

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FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24 series or E96 series for resistors with a tolerance of $\pm 5\%$ or $\pm 1\%$. The values of the E24/96 series are in accordance with “IEC publication 60063”.

Limiting values

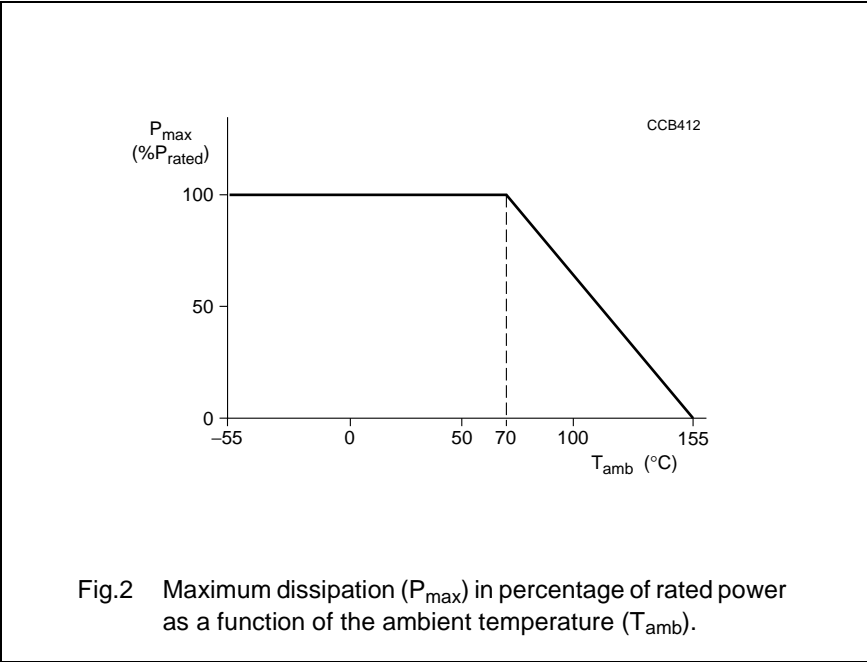
TYPE	LIMITING VOLTAGE ⁽¹⁾ (V)	LIMITING POWER (W)
RC01	200	0.25
RC02H	200	0.25
RC21	50	0.063
RC22H	50	0.063

Note

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

DERATING

The power that the resistor can dissipate depends on the operating temperature; see Fig.2.



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MECHANICAL DATA

Mass per 100 units

TYPE	MASS (g)
RC01	1.0
RC02H	1.0
RC21	0.25
RC22H	0.25

Marking

There is no marking on all the products with gold terminations.

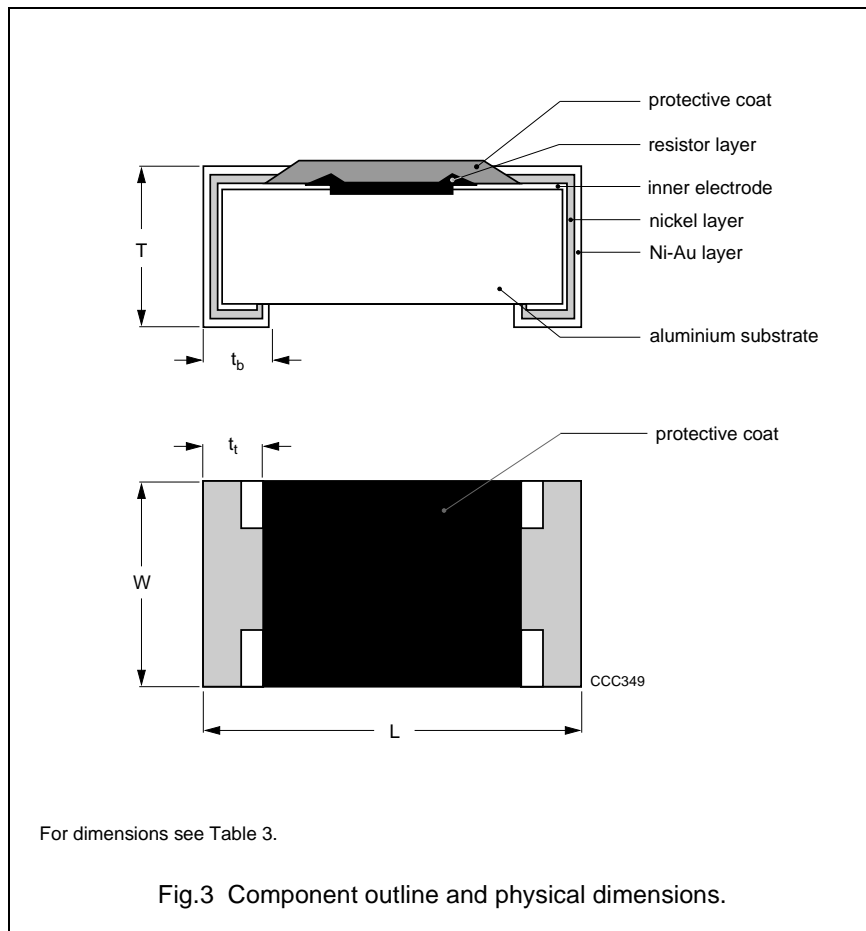


Table 3 Chip resistor types and relevant physical dimensions; see Fig.3

TYPE	L (mm)	W (mm)	T (mm)	t _t (mm)	t _b (mm)
RC01	3.20 +0.10/-0.20	1.60 ±0.15	0.55 ±0.10	0.45 ±0.25	0.50 ±0.25
RC02H	3.20 +0.10/-0.20	1.60 ±0.15	0.55 ±0.10	0.45 ±0.25	0.50 ±0.25
RC21	1.60 ±0.10	0.80 +0.15/-0.05	0.45 ±0.10	0.30 ±0.20	0.30 ±0.20
RC22H	1.60 ±0.10	0.80 +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 60 115-8”, category **LCT/UCT/56** (rated temperature range: **Lower Category Temperature**, **Upper Category Temperature**; 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 according to “IEC 60068-1”, subclause 5.3.

Unless otherwise specified the following values apply:

Temperature: 15 °C to 35 °C

Relative humidity: 25% 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 60 115-8 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			
				RC01	RC02H	RC21	RC22H
Tests in accordance with the schedule of IEC publication 60115-8							
4.4.1		visual examination		no holes; clean surface; no visible damage			
4.5		resistance	applied voltage (+0/−10%): R < 10 Ω: 0.1 V 10 Ω ≤ R < 100 Ω: 0.3 V 100 Ω ≤ R < 1 kΩ: 1 V 1 kΩ ≤ R < 10 kΩ: 3 V 10 kΩ ≤ R < 100 kΩ: 10 V 100 kΩ ≤ R < 1 MΩ: 25 V R ≥ 1 MΩ: 50 V	R – R _{nom} : max. ±5%	R – R _{nom} : max. ±1%	R – R _{nom} : max. ±5%	R – R _{nom} : max. ±1%
4.18	20 (Tb)	resistance to soldering heat	unmounted chips; 10 ±1 s; 260 ±5 °C	no visible damage ΔR/R max.: ±(0.5% +0.05 Ω)			
4.29	45 (Xa)	component solvent resistance	isopropyl alcohol or H ₂ O followed by brushing in accordance with “MIL 202 F”	no visible damage			
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			

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IEC 60115-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS			
				RC01	RC02H	RC21	RC22H
4.7		voltage proof on insulation	maximum voltage (RMS) during 1 minute, metal block method	no breakdown or flashover			
4.13		short time overload	room temperature; $P = 6.25 \times P_n$; 5 s ($V \leq 2 \times V_{max}$)	$\Delta R/R \text{ max.: } \pm(1\% + 0.05 \Omega)$			
4.33		bending	resistors mounted on a 90 mm glass epoxy resin PCB (FR4), bending RC01/02: 2 mm bending RC21/22: 3 mm.	no visible damage			
				$\Delta R/R \text{ max.: } \pm(1\% + 0.05 \Omega)$	$\Delta R/R \text{ max.: } \pm(0.5\% + 0.05 \Omega)$	$\Delta R/R \text{ max.: } \pm(1\% + 0.05 \Omega)$	$\Delta R/R \text{ max.: } \pm(0.5\% + 0.05 \Omega)$
4.19	14 (Na)	rapid change of temperature	30 minutes at LCT and 30 minutes at UCT; 5 cycles	no visible damage $\Delta R/R \text{ max.: } \pm(0.5\% + 0.05 \Omega)$			
4.24.2	3 (Ca)	damp heat (steady state)	56 days; $40 \pm 2 \text{ }^\circ\text{C}$; 93 +2/-3% RH; loaded with $0.01 P_n$: $R \leq 1 \text{ M}\Omega$ $R > 1 \text{ M}\Omega$	$\Delta R/R \text{ max.: } \pm(1.5\% + 0.1 \Omega)$ $\Delta R/R \text{ max.: } \pm(3.0\% + 0.1 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.0\% + 0.05 \Omega)$ $\Delta R/R \text{ max.: } \pm(1.5\% + 0.05 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.5\% + 0.1 \Omega)$ $\Delta R/R \text{ max.: } \pm(3.0\% + 0.1 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.0\% + 0.05 \Omega)$ $\Delta R/R \text{ max.: } \pm(1.5\% + 0.05 \Omega)$
4.25.1		endurance	1000 +48/-0 hours; $70 \pm 2 \text{ }^\circ\text{C}$; loaded with P_n or V_{max} ; 1.5 hours on and 0.5 hours off: $R \leq 1 \text{ M}\Omega$ $R > 1 \text{ M}\Omega$	$\Delta R/R \text{ max.: } \pm(1.5\% + 0.1 \Omega)$ $\Delta R/R \text{ max.: } \pm(3.0\% + 0.1 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.0\% + 0.05 \Omega)$ $\Delta R/R \text{ max.: } \pm(1.5\% + 0.05 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.5\% + 0.1 \Omega)$ $\Delta R/R \text{ max.: } \pm(3.0\% + 0.1 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.0\% + 0.05 \Omega)$ $\Delta R/R \text{ max.: } \pm(1.5\% + 0.05 \Omega)$
4.23.2	27 (Ba)	endurance at upper category temperature	1000 +48/-0 hours; no load: $R \leq 1 \text{ M}\Omega$ $R > 1 \text{ M}\Omega$	$\Delta R/R \text{ max.: } \pm(1.5\% + 0.1 \Omega)$ $\Delta R/R \text{ max.: } \pm(3.0\% + 0.1 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.0\% + 0.05 \Omega)$ $\Delta R/R \text{ max.: } \pm(1.5\% + 0.05 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.5\% + 0.1 \Omega)$ $\Delta R/R \text{ max.: } \pm(3.0\% + 0.1 \Omega)$	$\Delta R/R \text{ max.: } \pm(1.0\% + 0.05 \Omega)$ $\Delta R/R \text{ max.: } \pm(1.5\% + 0.05 \Omega)$

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IEC 60115-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS			
				RC01	RC02H	RC21	RC22H
4.8.4.2		temperature coefficient	at 20/LCT/20 °C and 20/UCT/20 °C: $1\ \Omega \leq R \leq 10\ \Omega$ $10\ \Omega < R \leq 10\ M\Omega$	$\leq 250 \pm 250$ $\leq \pm 200$	$\leq 250 \pm 250$ $\leq \pm 100$	$\leq 250 \pm 250$ $\leq \pm 200$	$\leq 250 \pm 250$ $\leq \pm 100$
Other tests in accordance with IEC 60115 clauses and IEC 60068 test method							
4.6.1.1		insulation resistance	voltage (DC) after 1 minute, metal block method	$R_{ins} \text{ min.: } 10^3\ M\Omega$			
4.12		noise	IEC publication 60195 (measured with Quantech - equipment): $R \leq 100\ \Omega$ $100\ \Omega < R \leq 1\ k\Omega$ $1\ k\Omega < R \leq 10\ k\Omega$ $10\ k\Omega < R \leq 100\ k\Omega$ $100\ k\Omega < R \leq 1\ M\Omega$ $1\ M\Omega < R \leq 10\ M\Omega$	max. $0.316\ \mu V/V$ (–10 dB) max. $1\ \mu V/V$ (0 dB) max. $3\ \mu V/V$ (9.54 dB) max. $6\ \mu V/V$ (15.56 dB) max. $10\ \mu V/V$ (20 dB) max. $32\ \mu V/V$ (30.10 dB)			

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IEC 60115-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS			
				RC01	RC02H	RC21	RC22H
Other applicable tests							
(JIS) C 5202 7.9		resistance to damp heat (steady state)	1 000 +48/−0 hours; 40 ±2 °C; 93 +2/−3% RH; loaded with P _n or V _{max} ; 1.5 hours on and 0.5 hours off: R ≤ 1 MΩ R > 1 MΩ	 ΔR/R max.: ±(3% +0.1 Ω) ΔR/R max.: ±(5% +0.1 Ω)	 ΔR/R max.: ±(2% +0.1 Ω) ΔR/R max.: ±(3% +0.1 Ω)	 ΔR/R max.: ±(3% +0.1 Ω) ΔR/R max.: ±(5% +0.1 Ω)	 ΔR/R max.: ±(2% +0.1 Ω) ΔR/R max.: ±(3% +0.1 Ω)
EIA/IS 703 4.5		load humidity	1 000 +48/−0 hours; 85 ±2 °C; 85 ±5% RH; loaded with 0.01 P _n or V _{max} : R ≤ 1 MΩ R > 1 MΩ	 ΔR/R max.: ±(3% +0.1 Ω) ΔR/R max.: ±(5% +0.1 Ω)	 ΔR/R max.: ±(2% +0.1 Ω) ΔR/R max.: ±(3% +0.1 Ω)	 ΔR/R max.: ±(3% +0.1 Ω) ΔR/R max.: ±(5% +0.1 Ω)	 ΔR/R max.: ±(2% +0.1 Ω) ΔR/R max.: ±(3% +0.1 Ω)
		shock termination test	−40 °C/+150 °C; 30 s on/30 s off; 500 cycles	no visual damage			

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REVISION HISTORY

Revision	Date	Change Notification	Description
Rev.3	2001 Apr 27	–	- Converted to Phycomp brand
Rev.4	2001 Oct 14	–	- Table 3: 'length' and 'width' changed; Table 4: 'bending' changed