DATA SHEET

RNA310
1%; 2%; 5%
Resistor network

Product specification
File under Discrete Ceramics, ACM2

2000 Mar 23

Philips
Components

PHILIPS

Resistor network

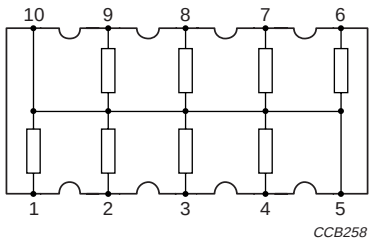
RNA310
1%; 2%; 5%

FEATURES

- Reduced size of final equipment
- Low assembly costs
- Higher component and equipment reliability.

APPLICATIONS

- Camcorders
- Hand-held measuring equipment
- Notebook computers
- Car telephones
- Computers
- Portable radio, CD and cassette players.



For dimensions see Fig.3 and Table 3.

Fig.1 Equivalent circuit diagram.

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.

The resistive layer is covered with a protective coating and printed with the resistance value. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a lead-tin alloy.

QUICK REFERENCE DATA

DESCRIPTION	VALUE
Resistance range	10 Ω to 100 kΩ; E24/E96 series
Resistance tolerance	±1%; ±2%; ±5%
Temperature coefficient:	
≤10 Ω	≤250 ±250 × 10^{-6}/K
10 Ω < R ≤ 100 kΩ	≤±200 × 10^{-6}/K
Absolute maximum dissipation at T_{amb} = 70 °C	0.031 W
Maximum permissible voltage	25 V (DC or RMS)
Climatic category (IEC 60068)	55/125/56
Basic specification	IEC 60115-8

ORDERING INFORMATION

Table 1 Ordering code indicating resistor type and packaging

TYPE	RESISTANCE VALUE	TOL. (%)	ORDERING CODE 2350 230 .....
			PAPER TAPE ON REEL
			5000 units
RNA310	10 Ω to 100 kΩ	±1	2....
		±2	11...
		±5	10...
Jumper 0 Ω			
RNA310	–	–	91001

Ordering code (12NC)

- The resistors have a 12-digit ordering code starting with 2350 230
- The subsequent 1 or 2 digits indicate the resistor type and packaging; 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	LAST DIGIT
1 to 9.1 Ω	8
10 to 91 Ω	9
100 to 910 Ω	1
1 to 9.1 kΩ	2
10 to 91 kΩ	3
100 to 910 kΩ	4
1 to 9.1 kΩ	5
10 MΩ	6

ORDERING EXAMPLE

The ordering code of an RNA310 chip resistor, value 562 Ω, supplied on paper tape of 5000 units per reel is: 2350 230 25624.

FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24/E96 series for resistors with a tolerance of ±1%, ±2%, ±5%. The values of the E24/E96 series are in accordance with *"IEC publication 60063"*.

Limiting values

TYPE	LIMITING VOLTAGE(1) (V)	LIMITING POWER (W)
RNA310	25	0.031

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.

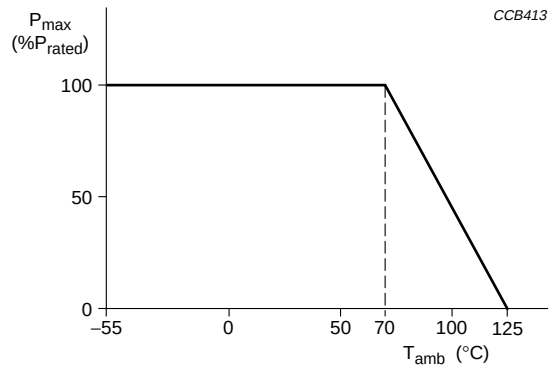


Fig.2 Maximum dissipation (P_{max}) in percentage of rated power as a function of the ambient temperature (T_{amb}).

MECHANICAL DATA

Mass per 100 units

TYPE	MASS (g)
RNA310	0.859

Marking

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

4-DIGIT MARKING

For values up to 910 Ω the R is used as a decimal point. For values of 1 kΩ or greater the first 3 digits apply to the resistance value and the fourth indicates the number of zeros to follow.

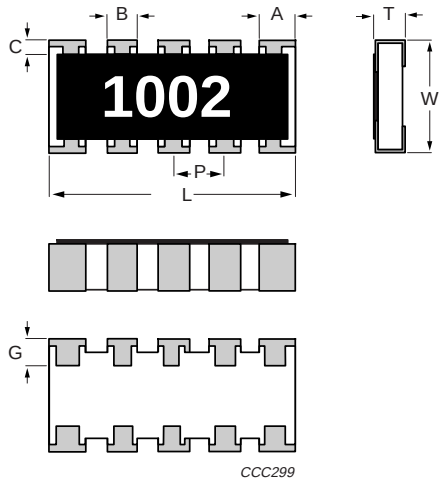
Example

MARKING	RESISTANCE
10R0	10 Ω
120R	120 Ω
1002	10 kΩ

PACKAGE MARKING

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

Outlines



For dimensions see Table 3.

Fig.3 Outlines.

Table 3 Physical dimensions; see Fig.3

SYMBOL	VALUE	TOL.	UNIT
L	3.30	±0.20	mm
W	1.60	±0.15	mm
T	0.55	±0.10	mm
A	0.50	±0.10	mm
C	0.40	±0.05	mm
P	0.64	±0.05	mm
G	0.40	±0.15	mm
B	0.35	±0.05	mm

TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with the schedule of *"IEC publication 60115-8"*, category **LCT/UCT/56** (rated temperature range: **L**ower **C**ategory **T**emperature, **U**pper **C**ategory **T**emperature; 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 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
Tests in accordance with the schedule of IEC publication 60115-8				
4.4.1		visual examination		no holes; clean surface; no 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	$R - R_{nom}$: max. ±5%
4.18	20 (Tb)	resistance to soldering heat	unmounted chips; 10 ±1 s; 260 ±5 °C	no visible damage ΔR/R max.: ±(1% +0.05 Ω)
4.29	45 (Xa)	component solvent resistance	isopropyl alcohol or H_2O 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
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 ($V \leq 2 \times V_{max}$)	ΔR/R max.: ±(2% +0.1 Ω)
4.33		bending	resistors mounted on a 90 mm glass epoxy resin PCB (FR4), bending: 5 mm	no visible damage ΔR/R max.: ±(1% +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 ΔR/R max.: ±(1% +0.05 Ω)
4.24.2	3 (Ca)	damp heat (steady state)	56 days; 40 ±2 °C; 93 +2/–3% RH; loaded with 0.01 P_n	ΔR/R max.: ±(2% +0.1 Ω)

IEC 60115-8 CLAUSE	IEC 60068-2 TEST METHOD	TEST	PROCEDURE	REQUIREMENTS
4.25.1		endurance	1000 +48/–0 hours; 70 ±2 °C; loaded with P_n or V_{max}; 1.5 hours on and 0.5 hours off	ΔR/R max.: ±(2% +0.1 Ω)
4.23.2	27 (Ba)	endurance at upper category temperature	1000 +48/–0 hours; 125 °C; no load	ΔR/R max.: ±(2% +0.1 Ω)
4.8.4.2		temperature coefficient	at 20/LCT/20 °C and 20/UCT/20 °C: R ≤ 10 Ω 10 Ω < R ≤ 100 kΩ	 250 ±250 × 10^{-6}/K ≤±200 × 10^{-6}/K
Other tests in accordance with IEC 60115 clauses and IEC 60068 test method				
4.17	20 (Ta)	solderability (after ageing)	8 hours steam or 16 hours 155 °C; unmounted chips completely immersed for 2 ±0.5 s in a solder bath at 235 ±2 °C	good tinning (≥95% covered); no visible damage
4.6.1.1		insulation resistance	50 V (DC) after 1 minute, metal block method	R_{ins} min.: 10^3 MΩ
4.12		noise	IEC publication 60195 (measured with Quantech-equipment) R ≤ 100 Ω 100 Ω < R ≤ 1 kΩ 1 kΩ < R ≤ 10 kΩ 10 kΩ < R ≤ 100 kΩ 100 kΩ < R ≤ 1 MΩ	 max. 0.316 μV/V (–10 dB) max. 1 μV/V (0 dB) max. 3 μV/V (9.54 dB) max. 6 μV/V (15.56 dB) max. 10 μV/V (20 dB
Other applicable tests				
(JIS) C 5202 7.9		endurance (under damp and load)	1000 +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	ΔR/R max.: ±(2% +0.1 Ω)
EIA 575 3.13		leaching	unmounted chips; 60 ±1 s; 260 ±5 °C	good tinning; no leaching
EIA/IS 703 4.5		load humidity	1000 +48/–0 hours; 85 ±2 °C; 85 ±5% RH; loaded with 0.01 P_n or V_{max}	ΔR/R max.: ±(2% +0.1 Ω)