Innovative Service Around the Globe YAGEO

DATA SHEET

GENERAL PURPOSE CHIP RESISTORS

RC2010 (Pb Free)

5%, 1%

Phycomp

Product specification – Sep 16, 2004 V.2

SCOPE

This specification describes RC2010 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

12NC CODE

2322 XXX XXXXX L
(1) (2) (3) (4)

TYPE/ 2010	START IN [1]	TOL. (%)	RESISTANCE RANGE	EMBOSSED TAPE ON REEL (units) [2] 4,000
PRC111	2322	±5%	1 to 22 MΩ	760 60xxx
PRC111	2322	±1%	1 to 10 MΩ	761 6xxxx
Jumper	2322	-	0 Ω	760 90003

(1) The resistors have a 12-digit ordering code starting with 2322.

(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 12NC".

(4) "L" means lead-free terminations.

Last digit of 12NC

Resistance decade [3]	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

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

ORDERING EXAMPLE

The ordering code of a PRC111 resistor, value 56 Ω with ±1% tolerance, supplied in tape of 4,000 units per reel is: 232276165609L.

CTC CODE

RC2010 X X X XX XXXX L
(1) (2) (3) (4) (5) (6)

(1) TOLERANCE

F = ±1%
J = ±5%

(2) PACKAGING TYPE

K = Embossed taping reel

(3) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(4) TAPING REEL

07 = 7 inch dia. Reel

(5) RESISTANCE VALUE

5R6, 56R, 560R, 5K6, 56K, 22M.

(6) RESISTOR TERMINATIONS

L = Lead free terminations (pure Tin)

ORDERING EXAMPLE

The ordering code of a RC2010 chip resistor, value 56 Ω with ±1% tolerance, supplied in 7-inch tape reel is: RC2010FK-0756RL.

NOTE

1. The "L" at the end of the code is only for ordering. On the reel label, the standard CTC or 12NC 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

RC2010

Fig. 1 Value=10 KΩ

E-24 series: 3 digits

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

Fig. 2 Value=10 KΩ

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.

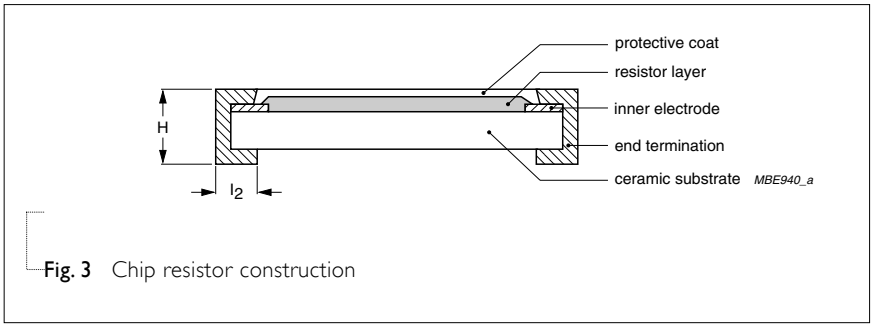

Fig. 3 Chip resistor construction

DIMENSIONS

Table 1

TYPE	RC2010
L (mm)	5.00 ±0.10
W (mm)	2.50 ±0.15
H (mm)	0.55 ±0.10
l_1 (mm)	0.45 ±0.15
l_2 (mm)	0.50 ±0.20

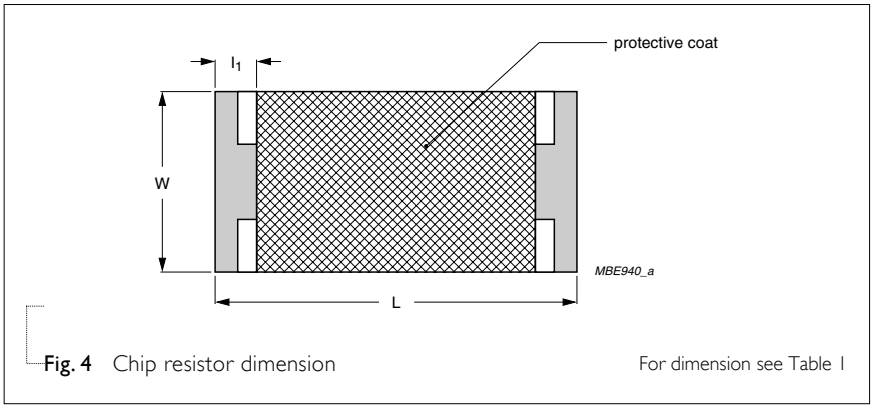

Fig. 4 Chip resistor dimension

For dimension see Table 1

ELECTRICAL CHARACTERISTICS

Table 2

CHARACTERISTICS		RC2010 3/4 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
RC2010	Embossed taping reel (K)	7" (178 mm)	4,000 units

NOTE

1. For embossed tape and reel specification/dimensions, please see the special data sheet "Packing" document.

FUNCTIONAL DESCRIPTION

POWER RATING

RC2010 rated power at 70°C is 3/4 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)

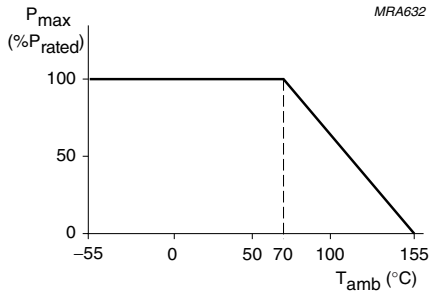

Fig. 5 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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 **Formula:** $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6$ (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
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. ±(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 . ±(1.0%+0.05 Ω) for 5% tol. 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. ±(2.0%+0.05 Ω) for 5% tol. No visible damage
Insulation Resistance	MIL-STD-202F-method 302; IEC 60115-1 4.6.1.1	RCOV for 1 minute Type: RC2010 Voltage (DC): 500 V	≥10 GΩ
Dielectric Withstand Voltage	MIL-STD-202F-method 301; IEC 60115-1 4.6.1.1	Maximum voltage (V_{rms}) applied for 1 minute Type: RC2010 Voltage (AC): 500 V_{rms}	No breakdown or flashover
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. ±(1.0%+0.05 Ω) for 5% tol. 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. ±(3%+0.05 Ω) for 5% tol.

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

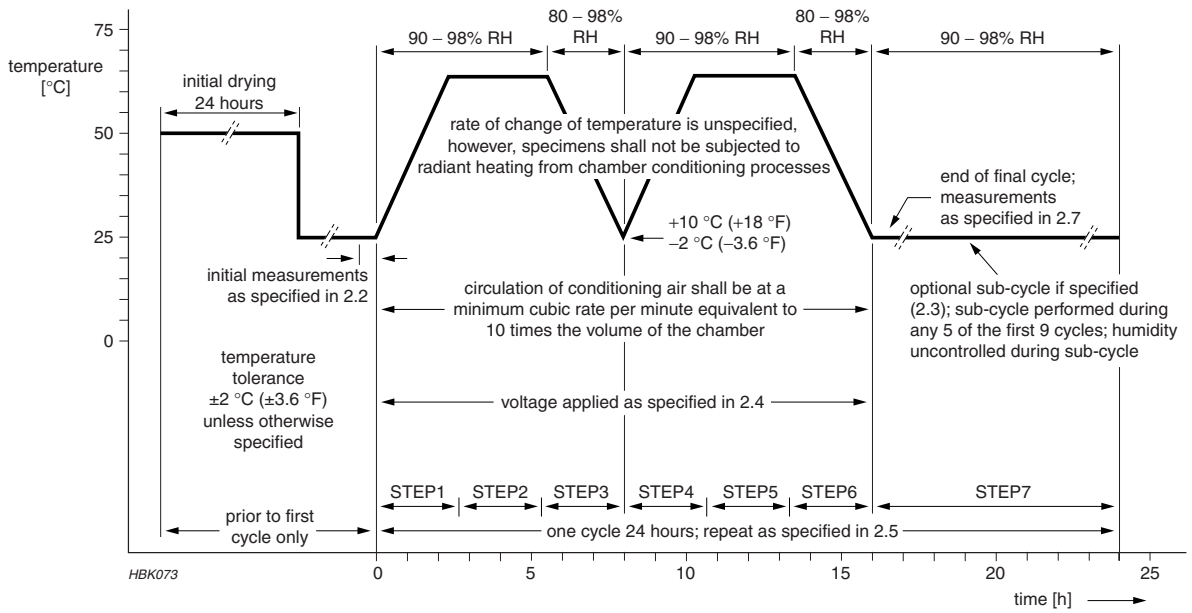

Fig. 6 Moisture resistance test requirements

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	Sep 16, 2004	-	- New datasheet for 2010 thick film 1% and 5% with lead-free terminations - Replace the 2010 part of pdf files: PRC111_1_5, PRC111_5_6 - Test method and procedure updated