

DATA SHEET

GENERAL PURPOSE CHIP RESISTORS

RC2010
5%, 1%
RoHS compliant



SCOPE

This specification describes RC2010 series chip resistors with lead-free terminations made by thick film process.

APPLICATIONS

- All general purpose application

FEATURES

- Halogen Free Epoxy
- RoHS compliant
 - Products with lead free terminations meet RoHS requirements
 - Pb-glass contained in electrodes, resistor element and glass are exempted by RoHS
- Reducing environmentally hazardous wastes
- High component and equipment reliability
- Saving of PCB space
- None forbidden-materials used in products/production

ORDERING INFORMATION - GLOBAL PART NUMBER & 12NC

Both part numbers are identified by the series, size, tolerance, packing type, temperature coefficient, taping reel and resistance value.

YAGEO BRAND ordering code**GLOBAL PART NUMBER (PREFERRED)**

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

(1) TOLERANCE

F = $\pm 1\%$

J = $\pm 5\%$ (for Jumper ordering, use code of J)

(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

There are 2~4 digits indicated the resistor value. Letter R/K/M is decimal point, no need to mention the last zero after R/K/M, e.g. 1K2, not 1K20.

Detailed resistance rules show in table of "Resistance rule of global part number".

(6) DEFAULT CODE

Letter L is system default code for order only (Note)

Resistance rule of global part number	
Resistance code rule	Example
0R	0R = Jumper
XXXX (1 to 9.76 Ω)	1R = 1 Ω 1R5 = 1.5 Ω 9R76 = 9.76 Ω
XXRX (10 to 97.6 Ω)	10R = 10 Ω 97R6 = 97.6 Ω
XXXR (100 to 976 Ω)	100R = 100 Ω
XKXX (1 to 9.76 K Ω)	1K = 1,000 Ω 9K76 = 9760 Ω
XMXX (1 to 9.76 M Ω)	1M = 1,000,000 Ω 9M76 = 9,760,000 Ω

ORDERING EXAMPLE

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

NOTE

1. All our RSMD products meet RoHS compliant and Halogen Free. "LFP" of the internal 2D reel label mentions "Lead Free Process"
2. On customized label, "LFP" or specific symbol can be printed

PHYCOMP BRAND ordering codes

Both GLOBAL PART NUMBER (preferred) and I2NC (traditional) codes are acceptable to order Phycomp brand products.

GLOBAL PART NUMBER (PREFERRED)

For detailed information of GLOBAL PART NUMBER and ordering example, please refer to page 2.

I2NC CODE

2322	XXX XXXXX L			
(1)	(2)	(3)	(4)	
TYPE/ START	TOL.	RESISTANCE	EMBOSSED TAPE ON REEL (units) ⁽²⁾	
2010 IN ⁽¹⁾	(%)	RANGE	4,000	
PRCIII 2322	±5%	1 to 22 MΩ	760 60xxx	
PRCIII 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 I2NC".
- (4) Letter L is system default code for order only ^(Note)

ORDERING EXAMPLE

The ordering code of a PRCIII resistor, value 56 Ω with ±1% tolerance, supplied in tape of 4,000 units per reel is: 232276165609L or RC2010FK-0756RL.

NOTE

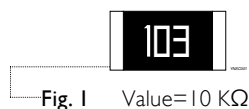
- All our RSMD products meet RoHS compliant and Halogen Free. "LFP" of the internal 2D reel label mentions "Lead Free Process"
- On customized label, "LFP" or specific symbol can be printed

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

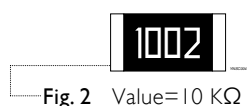
MARKING

RC2010



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 further marking information, please see special data sheet “Chip resistors marking”.

CONSTRUCTION

The resistor is constructed on top of a high-grade ceramic body. Internal metal electrodes are added on each end to make the contacts to the thick film resistive element. The composition of the resistive element is a noble metal imbedded into a glass and covered by a second glass to prevent environment influences. The resistor is laser trimmed to the rated resistance value. The resistor is covered with a protective epoxy coat, finally the two external terminations (matte tin on Ni-barrier) are added. See fig.3

DIMENSIONS

Table I	
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

OUTLINES

For dimension see Table I

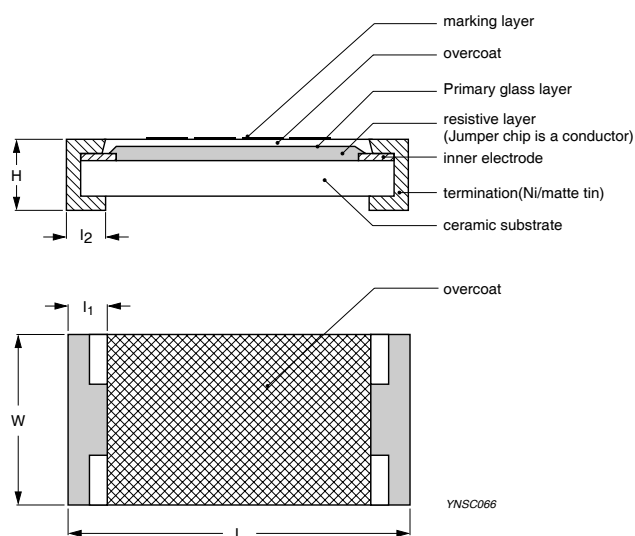


Fig. 3 Chip resistor outlines

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% (E24/E96)	1 Ω to 10 MΩ
	Zero Ohm Jumper	< 0.05 Ω
Temperature Coefficient	1 Ω ≤ R ≤ 10 Ω	±200 ppm/°C
	10 MΩ ≤ R ≤ 22 MΩ	±200 ppm/°C
	10 Ω < R ≤ 10 MΩ	±100 ppm/°C
Jumper Criteria	Rated Current	2 A
	Maximum Current	10 A

FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles, please see the special data sheet “Chip resistors mounting”.

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:

$$V = \sqrt{P \times R}$$

or max. working voltage whichever is less

Where

V=Continuous rated DC or
AC (rms) working voltage (V)

P=Rated power (W)

R=Resistance value (Ω)

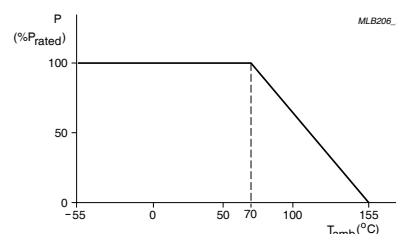


Fig. 4 Maximum dissipation (P) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

TESTS AND REQUIREMENTS**Table 4** Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Temperature Coefficient of Resistance (T.C.R.)	IEC 60115-1 4.8	At +25/-55 °C and +25/+125 °C Formula: $T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$ 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
Life/Endurance	IEC 60115-1 4.25.1	At 70±5 °C for 1,000 hours, RCWV applied for 1.5 hours on, 0.5 hour off, still air required	±(1.0%+0.05 Ω) for 1% tol. ±(3.0%+0.05 Ω) for 5% tol. <100 mΩ for Jumper
High Temperature Exposure/Endurance at Upper Category Temperature	IEC 60068-2-2	1,000 hours at 155±5 °C, unpowered	±(1.0%+0.05 Ω) for 1% tol. ±(2.0%+0.05 Ω) for 5% tol. <50 mΩ for Jumper
Moisture Resistance	MIL-STD-202G Method-106G	Each temperature / humidity cycle is defined at 8 hours, 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H, without steps 7a & 7b, unpowered Parts mounted on test-boards, without condensation on parts Measurement at 24±2 hours after test conclusion	±(0.5%+0.05 Ω) for 1% tol. ±(2.0%+0.05 Ω) for 5% tol. <100 mΩ for Jumper
Thermal Shock	MIL-STD-202G Method-107G	-55/+125 °C Number of cycles required is 300. Devices unmounted Maximum transfer time is 20 seconds, Dwell time is 15 minutes. Air – Air	±(0.5%+0.05 Ω) for 1% tol. ±(1%+0.05 Ω) for 5% tol. <50 mΩ for Jumper
Short Time Overload	IEC60115-1 4.13	2.5 times of rated voltage or maximum overload voltage whichever is less for 5 sec at room temperature	±(1.0%+0.05 Ω) for 1% tol. ±(2.0%+0.05 Ω) for 5% tol. <50 mΩ for Jumper No visible damage

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS															
Board Flex/ Bending	IEC 60068-2-21	Chips mounted on a 90mm glass epoxy resin PCB (FR4) 2 mm bending Bending time: 60±5 seconds	±(1.0%+0.05 Ω) for 1%, 5% tol. <50 mΩ for Jumper No visible damage															
Low Temperature Operation	IEC 60068-2-1	The resistor shall be subjected to a DC rated voltage for 1.5 h-on, 0.5 h-off, at -55±3 °C This constitutes shall be repeated for 96 hours However the applied voltage shall not exceed the maximum operating voltage	±(0.5%+0.05 Ω) for 1% tol . ±(1.0%+0.05 Ω) for 5% tol. No visible damage															
Insulation Resistance	IEC 60115-1 4.6	Rated continuous overload voltage (RCOV) for 1 minute <table><tr><td>Type</td><td>RC2010</td></tr><tr><td>Voltage (DC)</td><td>100 V</td></tr></table>	Type	RC2010	Voltage (DC)	100 V	≥10 GΩ											
Type	RC2010																	
Voltage (DC)	100 V																	
Dielectric Withstand Voltage	IEC 60115-1 4.7	Maximum voltage (V _{rms}) applied for 1 minute <table><tr><td>Type</td><td>RC2010</td></tr><tr><td>Voltage (AC)</td><td>500 V_{rms}</td></tr></table>	Type	RC2010	Voltage (AC)	500 V _{rms}	No breakdown or flashover											
Type	RC2010																	
Voltage (AC)	500 V _{rms}																	
Resistance to Solvent	IPC/JEDEC J-STD-020D	Isopropylalcohol (C ₃ H ₇ OH) followed by brushing	No smeared															
Noise	IEC 60115-1 4.12	Maximum voltage (V _{rms}) applied	<table><tr><th>Resistors range</th><th>Value</th></tr><tr><td>R < 100 Ω</td><td>10 dB</td></tr><tr><td>100 Ω ≤ R < 1 KΩ</td><td>20 dB</td></tr><tr><td>1 KΩ ≤ R < 10 KΩ</td><td>30 dB</td></tr><tr><td>10 KΩ ≤ R < 100 KΩ</td><td>40 dB</td></tr><tr><td>100 KΩ ≤ R < 1 MΩ</td><td>46 dB</td></tr><tr><td>1 MΩ ≤ R ≤ 22 MΩ</td><td>48 dB</td></tr></table>	Resistors range	Value	R < 100 Ω	10 dB	100 Ω ≤ R < 1 KΩ	20 dB	1 KΩ ≤ R < 10 KΩ	30 dB	10 KΩ ≤ R < 100 KΩ	40 dB	100 KΩ ≤ R < 1 MΩ	46 dB	1 MΩ ≤ R ≤ 22 MΩ	48 dB	
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100 KΩ ≤ R < 1 MΩ	46 dB																	
1 MΩ ≤ R ≤ 22 MΩ	48 dB																	
Biased Humidity (steady state)	IEC 60115-1 4.37	Steady state for 1000 hours at 40 °C / 95% R.H. RCWV applied for 1.5 hours on and 0.5 hour off	±(1.0%+0.05 Ω) for 1% tol. ±(2.0%+0.05 Ω) for 5% tol. <100 mΩ for Jumper															

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Intermittent Overload	IEC 60115-1 4.39	2.5 times of rated voltage or maximum overload voltage whichever is less for 1 second on and 25 seconds off; total 10,000 cycles	$\pm(1.0\%+0.05\ \Omega)$ for 1% tol. $\pm(2.0\%+0.05\ \Omega)$ for 5% tol. <100 m Ω for Jumper
Solderability - Wetting	IPC/JEDEC J-STD-002B test B	Electrical Test not required Magnification 50X SMD conditions: 1 st step: method B, aging 4 hours at 155 °C dry heat 2 nd step: leadfree solder bath at 245 $\pm$ 3 °C Dipping time: 3 $\pm$ 0.5 seconds	Well tinned ($\geq$ 95% covered) No visible damage
- Leaching	IPC/JEDEC J-STD-002B test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage
- Resistance to Soldering Heat	IEC 60068-2-58	Condition B, no pre-heat of samples Leadfree solder, 260 °C, 10 seconds immersion time Procedure 2 for SMD: devices fluxed and cleaned with isopropanol	$\pm(0.5\%+0.05\ \Omega)$ for 1% tol. $\pm(1.0\%+0.05\ \Omega)$ for 5% tol. <50 m Ω for Jumper No visible damage

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 4	Sep 22, 2009	-	- Test Items and methods updated - Test requirements upgraded
Version 3	Jul 15, 2008	-	- Change to dual brand datasheet that describe RC2010 with RoHS compliant - Description of "Halogen Free Epoxy" added - Define global part number
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

“Yageo reserves all the rights for revising the content of this datasheet without further notification, as long as the products itself are unchanged. Any product change will be announced by PCN.”

Composition of The Clear Text Code (R-Chip)

Version: 17 01-21-02

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

PHYCOMP Code

9C	Phycomp Thick Film Chip Res
9T	Phycomp Thin Film Chip Res

Size

0201	0201 (0603)	
0402	0402 (1005)	
0603	0603 (1608)	
0805	0805 (2012)	
1210	1210 (3225)	
1206	1206 (3216)	
1218	1218 (3248)	
2010	2010 (5025)	
2512	2512 (6432)	
4527	4527 (11070)	
AC34	0603 (1608) x 4 concave array	ARC241 / 242
AV34	0603 (1608) x 4 convex array	ARV241 / 242
AV22	0402 (1005) x 2 convex array	ARV321 / 322
AV24	0402 (1005) x 4 convex array	ARV341
AC24	0402 (1005) x 4 concave array	ARC341
AV28	0402 (1005) x 8 convex array	ARV381 / 382
RN31	10P8R in 1206 convex network	RNA310
RC21	10P4C4R in 1608 concave network	RCB210
FR01	1206 (3216) Fusible	
FR21	0603 (1608) Fusible	
SR01	1206 (3216) Surge	
VR01	1206 (3216) High Voltage 5%	
VR02	1206 (3216) High Voltage 1%	

Power Rating

1A	1/16W	0.063 W	0402	Upgraded from 1/16W
1A	1/10W	0.1 W	0603	
2A	1/8 W	0.125 W	0805	
3A	1/4 W	0.25 W	1206	
4A	1/10 W	0.1 W	0603	
5A	1/3W	0.3W	1210	
7A	1/20 W	0.05 W	0201	
8A	1/32 W	0.03125 W	RNA310	
12	1/2 W	0.5 W	2010	
1W	1 W	1 W	1218 / 2512	
2W	2 W	2 W		

Resistance Value

0R00	Jumper	6
R0xx	< 1R	0
Rxxx	< 1R	7
xRxx	1R - 9.76R	8
xxRx	10R - 97.6R	9
xxx0	100R - 976R	1
xxx1	1K - 9.76K	2
xxx2	10K - 97.6K	3
xxx3	100K - 976K	4
xxx4	1M - 9.76M	5
xxx5	10M - 97.6M	6
xxx6	100M+	7
Nxxx	marking code for RCB210	

Example:

Rchip 0603 (RC22H), 10R0, 1%, 5K reel =
9C06031A10R0FKHFT

R-chip Array

A = Array	
V = Convex	C = Concave
3 = 0603	2 = 0402
4 = 4 Res.	2 = 2 Res.

Packaging

T	5K Paper
3	10K Paper
4	20K Paper
5	4K Blister
6	5K Blister
7	50K Paper
P	25K Bulk Case

Special Coding

HF	PPCK, Sn/Pb
PF	100% Sn 2372
AF	NiAu

TCR

A	25 ppm/°C
B	50 ppm/°C
K	100 ppm/°C
L	200 ppm/°C
E	250 ppm/°C
M	300 ppm/°C
G	500 ppm/°C
P	750 ppm/°C
H	1000 ppm/°C
I	1500 ppm/°C
J	2000 ppm/°C
N	3000 ppm/°C

Tolerance

A	±0.05%
B	±0.1%
C	±0.25%
D	±0.5 %
F	±1%
G	±2%
J	±5%
N	0 / 20%
R	0 / 30%