Innovative Service Around the Globe YAGEO

DATA SHEET

LOW OHMIC CHIP RESISTORS

RL series (Pb Free)

5%, 1%

sizes 0402/0603/0805/1206/ 1210/1218/2010/2512

Phycomp

Product specification – Apr 15, 2005 V.1



SCOPE

This specification describes RL0402 to RL2512 low ohmic 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

2350 / 2390 / 2322 XXX XXXXX L
(1) (2) (3) (4)

SIZE	TYPE	START IN (1)	TOL. (%)	RESISTANCE RANGE	EMBOSSED (2) TAPE ON REEL	PAPER/PE (2) TAPE ON REEL (units)	
					4,000	5,000	10,000
0402	LRC31	2350	±5%	0.1 to 1 Ω	-	-	513 20xxx
	LRC32	2350	±1%	0.1 to 1 Ω	-	-	513 22xxx
0603	LRC21	2350	±5%	0.01 to 1 Ω	-	512 10xxx	-
	LRC22	2350	±1%	0.01 to 1 Ω	-	512 12xxx	-
0805	LRC11	2350	±5%	0.01 to 1 Ω	-	511 10xxx	-
	LRC12	2350	±1%	0.01 to 1 Ω	-	511 12xxx	-
1206	LRC01	2350	±5%	0.01 to 1 Ω	-	510 10xxx	-
	LRC02	2350	±1%	0.01 to 1 Ω	-	510 12xxx	-
1210	LPRC101	2390	±5%	0.01 to 0.0976 Ω	-	735 90xxx	-
	LPRC101	2390	±5%	0.1 to 1 Ω	-	735 60xxx	-
	LPRC102	2390	±1%	0.01 to 1 Ω	-	735 3xxxx	-
1218	LPRC201	2322	±5%	0.01 to 1 Ω	735 64xxx	-	-
	LPRC201	2322	±1%	0.01 to 1 Ω	735 7xxxx	-	-
2010	LPRC111	2322	±5%	0.01 to 0.0976 Ω	760 90xxx	-	-
	LPRC111	2322	±5%	0.1 to 1 Ω	760 60xxx	-	-
	LPRC111	2322	±1%	0.01 to 0.0976 Ω	761 90xxx	-	-
	LPRC111	2322	±1%	0.1 to 1 Ω	761 6xxxx	-	-
2512	LPRC221	2322	±5%	0.01 to 0.0976 Ω	762 90xxx	-	-
	LPRC221	2322	±5%	0.1 to 1 Ω	762 60xxx	-	-
	LPRC221	2322	±1%	0.01 to 0.0976 Ω	763 90xxx	-	-
	LPRC221	2322	±1%	0.1 to 1 Ω	763 6xxxx	-	-

(1) The resistors have a 12-digit ordering code starting with 2350/2390/2322.

(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.

ORDERING EXAMPLE

The ordering code of a RL0805 resistor, value 0.56 Ω with ±1% tolerance, supplied in tape of 5,000 units per reel is: 235051112567L.

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

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)

CTC CODE

RL XXXX X X X XX XXXX L
(1) (2) (3) (4) (5) (6) (7)

(1) SIZE

0402
0603
0805
1206
1210
1218
2010
2512

(2) TOLERANCE

F = ±1%
J = ±5%

(3) PACKAGING TYPE

R = Paper/PE taping reel
K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

(5) TAPING REEL

07 = 7 inch dia. Reel

(6) RESISTANCE VALUE

0R01, 0R056, 0R56, 0R91 of E24 series (E48/96 on request).

(7) RESISTOR TERMINATIONS

L = Lead free terminations (matte tin)

ORDERING EXAMPLE

The ordering code of a RL0805 chip resistor, value 0.56 Ω with ±1% tolerance, supplied in 7-inch tape reel is: RL0805FR-070R56L.

NOTE

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

RL0805 / RL1206 / RL1210 /RL1218 / RL2010 / RL2512



Fig. 1 Value = 20 mΩ

E-24 series: 4 digits

The "R" is used as a decimal point; the other 3 digits are significant.

RL0603: R≥100 mΩ IN E-24 SERIES, R = 10/20/30/40/50/60 mΩ



Fig. 2 Value = 22 mΩ

3 digits

The "R" is used as a decimal point; the other 2 digits are significant.

RL0402 / SPECIALITY / RL0603: R<100 mΩ EXCEPT 10/20/30/40/50/60 mΩ



Fig. 3

No marking

For marking codes, please see EIA-marking code rules in data sheet "Chip resistors marking".

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 (matte tin) are added. See fig. 4.

CONSTRUCTION

Table 1 For outlines see fig. 4

TYPE	L (mm)	W (mm)	H (mm)	I_1 (mm)	I_2 (mm)
RL0402	1.00 ±0.10	0.50 ±0.05	0.35 ±0.05	0.20 ±0.10	0.25 ±0.10
RL0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.25 ±0.15	0.25 ±0.15
RL0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.35 ±0.20	0.35 ±0.20
RL1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.45 ±0.20	0.40 ±0.20
RL1210	3.10 ±0.10	2.60 ±0.15	0.55 ±0.10	0.50 ±0.20	0.50 ±0.20
RL1218	3.05 ±0.15	4.60 ±0.20	0.55 ±0.10	0.45 ±0.25	0.50 ±0.25
RL2010	5.00 ±0.10	2.50 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20
RL2512	6.35 ±0.10	3.20 ±0.15	0.55 ±0.10	0.60 ±0.20	0.50 ±0.20

OUTLINES

For dimension see Table 1

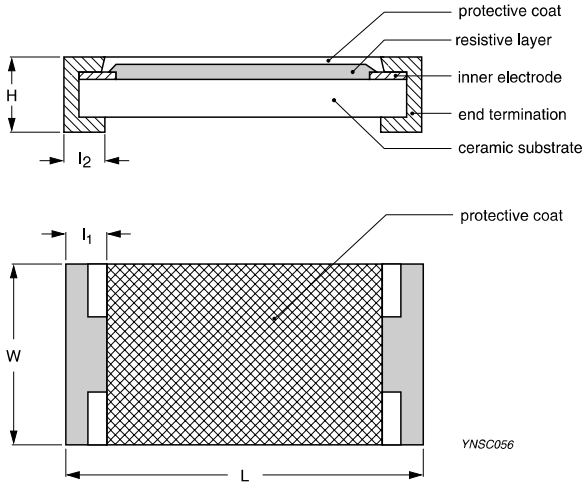

Fig. 4 Chip resistor outlines

ELECTRICAL CHARACTERISTICS

Table 2

TYPE / RESISTANCE RANGE		TEMPERATURE COEFFICIENT OF RESISTANCE					
RL0402	100mΩ≤R<1Ω	100mΩ≤R<1Ω					
		±800 ppm/°C					
RL0603	10mΩ≤R<1Ω	10mΩ≤R≤36mΩ	36mΩ<R≤91mΩ	91mΩ<R≤500mΩ	500mΩ<R<1Ω		
		±1,500 ppm/°C	±1,200 ppm/°C	±800 ppm/°C	±300 ppm/°C		
		10mΩ≤R≤18mΩ	18mΩ<R≤47mΩ	47mΩ<R≤91mΩ	91mΩ<R≤360mΩ	360mΩ<R≤500mΩ	500mΩ<R<1Ω
RL0805	10mΩ≤R<1Ω	±1,500 ppm/°C	±1,200 ppm/°C	±1,000 ppm/°C	±600 ppm/°C	±300 ppm/°C	±200 ppm/°C
RL1206		±1,500 ppm/°C	±1,200 ppm/°C	±1,000 ppm/°C	±600 ppm/°C	±300 ppm/°C	±200 ppm/°C
RL1210		±1,500 ppm/°C	±1,000 ppm/°C	±800 ppm/°C	±600 ppm/°C	±300 ppm/°C	±200 ppm/°C
RL2010		±1,500 ppm/°C	±1,200 ppm/°C	±1,000 ppm/°C	±600 ppm/°C	±300 ppm/°C	±200 ppm/°C
RL2512		±1,500 ppm/°C	±1,200 ppm/°C	±800 ppm/°C	±600 ppm/°C	±300 ppm/°C	±200 ppm/°C
RL1218	10mΩ≤R<1Ω	10mΩ≤R≤30mΩ	30mΩ<R≤56mΩ	56mΩ<R≤180mΩ	180mΩ<R<1Ω		
		±2,000 ppm/°C	±1,000 ppm/°C	±700 ppm/°C	±250 ppm/°C		

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

PACKING STYLE	REEL DIMENSION	RL0402	RL0603	RL0805	RL1206	RL1210	RL1218	RL2010	RL2512
Paper/PE taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000	5,000	---	---	---
Embossed taping reel (K)	7" (178 mm)	---	---	---	---	---	4,000	4,000	4,000

NOTE

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

FUNCTIONAL DESCRIPTION

OPERATINGTEMPERATURE RANGE

Range: –55°C to +125°C

POWER RATING

Each type rated power at 70°C:
RL0402=1/16 W; RL0603=1/10 W; RL0805=1/8 W; RL1206=1/4 W; RL1210=1/2 W; RL1218=1 W; RL2010=3/4 W; RL2512=1 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)

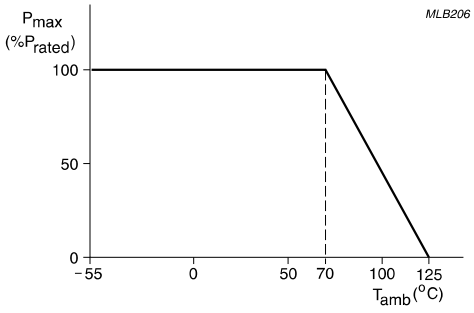

Fig. 5 Maximum dissipation (P_{max}) in percentage of rated power as a function of the operating ambient temperature (T_{amb})

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 +125 (+10/–0) °C for 2 minutes; 25 cycles	±1.0%
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	±1.0% 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% for 1% tol. ±2.0% for 5% tol. No visible damage
Insulation Resistance	MIL-STD-202F-method 302; IEC 60115-1 4.6.1.1	One DC voltage (V) applied for 1 minute Details see below table 5	≥10 GΩ
Dielectric Withstand Voltage	MIL-STD-202F-method 301; IEC 60115-1 4.6.1.1	One AC voltage (V_{rms}) applied for 1 minute Details see below table 5	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	±1.0% 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	±2% for 1% tol. ±3% for 5% tol.

Table 4 Test condition, procedure and requirements (continued)

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
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
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	±2.0%
Leaching	EIA/IS 4.13B; IEC 60115-8 4.18	Solder bath at 260±5 °C Dipping time: 30±1 seconds	No visible damage

Table 5 Criteria of rated continued working voltage and overload voltage

TYPE	RL0402	RL0603	RL0805	RL1206	RL1210	RL1218	RL2010	RL2512
Voltage (DC/unit: V); (AC/ unit: V_{rms})	100	100	300	500	500	500	500	500

REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 1	Apr 15, 2005	-	- New datasheet for low ohmic chip resistors sizes of 0402/0603/0805/1206/1210/1218/2010/2512 1% and 5% with lead-free terminations - Replace the 0603 to 2512 parts of pdf files: LRC01_5_12, LRC02_1_4, LRC11_5_4, LRC12_1_3, LRC21_22_51_4, LPRC111_1_6, LPRC111_5_7, LPRC221_1_PbFree_L_0, LPRC221_5_6, P_RL1218_51_PbFree_L_0, and combine into a document. - Test method and procedure updated - PE tape added (paper tape will be replaced by PE tape)