

2R20 DATA SHEET 62R **LOW OHMIC CHIP RESISTORS RL** series 5%, 2%, 1% sizes 0402/0603/0805/1206/ 1210/1218/2010/2512 **RoHS compliant & Halogen Free** Cossk

1101

Product specification – June 01, 2017 V.2



YAGEO Phicomp

Chip Resistor Surface Mount RL SERIES 0402 to 2512

<u>SCOPE</u>

This specification describes RL0402 to RL2512 low ohmic chip resistors with lead-free terminations made by thick film process.

APPLICATIONS

- Converters
- Printer equipment
- Server board
- Telecom
- Consumer
- Car electronics

FEATURES

- AEC-Q200 qualified
- Halogen Free Epoxy
- RoHS compliant
- Hazardous wastes
- High component and equipment reliability
- Saving of PCB space
- Non-forbidden materials used in products/production
- Low resistances applied to current sensing
- MSL Class: MSL I

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)

RL XXXX X X X XX XXXX L

(1)	(2) (3) (4)	(5)	(6)	(7)
(.)				

(I) SIZE

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

(2) TOLERANCE

 $F = \pm 1\%$ $G = \pm 2\%$ $| = \pm 5\%$

"-" = Jumper ordering

(3) PACKAGING TYPE R = Paper taping reel

K = Embossed taping reel

(4) TEMPERATURE COEFFICIENT OF RESISTANCE

- = Based on spec

(5) TAPING REEL

- 07 = 7 inch dia. Reel and standard power
- 10 = 10 inch dia. Reel and standard power
- 13 = 13 inch dia. Reel and standard power
- 7W = 7 inch dia. Reel and 2 x standard power (0805 and 1206)

(6) RESISTANCE VALUE

There are $2\sim4$ digits indicated the resistor value. Letter R/K/M is decimal point. Detailed coding rules of resistance are shown in the table of "Resistance rule of global part number".

(7) DEFAULT CODE

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

Resistance rule	of global part
Resistance code rul	e Example
0RXXX (I to 976 mΩ)	0RI = 0.1 Ω 0RI2 = 0.12 Ω 0RI05 = 0.105 Ω
XRXX (Ι to 9.76 Ω)	R = Ω R5 = .5 Ω 9R76 = 9.76 Ω
XXRX (10 to 97.6 Ω)	lor = 10 Ω 97R6 = 97.6 Ω
XXXR (100 to 976 Ω)	100R = 100 Ω
XKXX (1 to 9.76 K Ω)	ικ = 1,000 Ω 9K76 = 9760 Ω
XMXX (1 to 9.76 MΩ)	IM = 1,000,000 Ω 9M76= 9,760,000 Ω

ORDERING EXAMPLE

The ordering code of a RL0603 chip resistor, value 0.56Ω with $\pm 1\%$ tolerance, supplied in 7-inch tape reel is: RL0603FR-070R56L.

NOTE

- All our R-Chip 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

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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.

12NC CODE

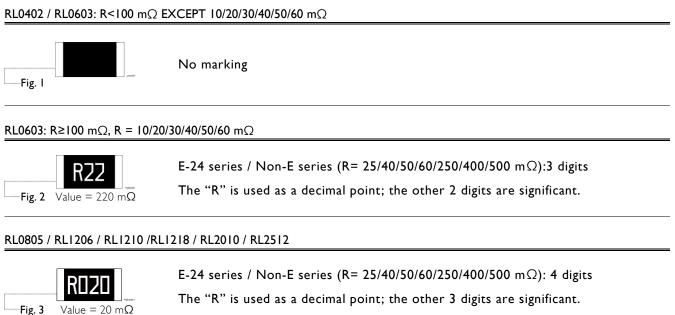
2350) / 2390 / (I)	2322		2) (3) (4)				Last dig Resistance	git of 12N decade ⁽³		Last digit
SIZE	TYPE	START		RESISTANCE	EMBOSSED ⁽²⁾ TAPE ON REEL	PAPER/PE (7 TAPE ON F		0.01 to 0.0	976 Ω		0
		IIN (1)	(%)	RANGE	4,000	5,000	10,000	l to 9.760			, 8
0402	LRC31	2350	±5%	0.05 to Ι Ω	-	-	513 20xxx	10 to 97.6	-		9
	LRC32	2350	±1%	0.05 to Ι Ω	-	-	513 22xxx	100 to 976			,
0603	LRC21	2350	±5%	0.01 to 1 Ω	-	512 10xxx	-	l to 9.76 k			2
	LRC22	2350	±1%	0.01 to 1 Ω	-	512 12xxx	-	10 to 97.6			2
0805	LRCII	2350	±5%	0.01 to 1 Ω	-	51110xxx	-	100 to 976			4
	LRC12	2350	±1%	0.01 to 1 Ω	-	51112xxx	-	l to 9.76 l			5
	LRCIIP	2350	±1%	0.01 to 1 Ω	-	51115xxx	-	10 to 97.6			6
	LRC12P	2350	±5%	0.01 to 1 Ω	-	511 17xxx	-				0
1206	LRC01	2350	±5%	0.01 to 1 Ω	-	510 10xxx	-	Example:	0.02 Ω	=	0200 or 200
	LRC02	2350	±1%	0.01 to 1 Ω	-	51012xxx	-		0.3 Ω	=	3007 or 307
	LRC01P	2350	±1%	0.01 to 1 Ω	-	51901xxx	-		IΩ	=	1008 or 108
	LRC02P	2350	±5%	0.01 to 1 Ω	-	519 1xxxx	-		33 kΩ	=	3303 or 333
1210	LPRC101	2390	±5%	0.01 to 0.0976 Ω	-	735 90xxx	-		Ι0 Μ Ω	=	1006 or 106
	LPRC101	2390	±5%	0. to Ω	-	735 60xxx	-	ORDERING	G EXAMP	LE	
	LPRC102	2390	±1%	0.01 to 1 Ω	-	735 3xxxx	-	The orderi	ng code c	of a R	L0603 chip
1218	LPRC201	2322	±5%	0.01 to 1 Ω	735 64xxx	-	-	resistor, va	lue 0.56 🛙	2 wi	ith ±1%
	LPRC201	2322	±1%	0.01 to 1 Ω	735 7xxxx	-	-	tolerance, s	••	•	
2010	LPRCIII	2322	±5%	0.01 to 0.0976 Ω	760 90xxx	-	-	units per re			212567L or
	LPRCIII	2322	±5%	0. to Ω	760 60xxx	-	-	RL0603FR-	070K56L.		
	LPRCIII	2322	±1%	0.01 to 0.0976 Ω	761 90xxx	-	-	NOTE			
	LPRCIII	2322	±1%	0. to Ω	761 6xxxx	-	-	I. All our R-0			
2512	LPRC221	2322	±5%	0.01 to 0.0976 Ω	762 90xxx	-	-	compliant and Halogen Free. "LFP" of the internal 2D reel label mentions			
	LPRC221	2322	±5%	0. to Ω	762 60xxx	-	-	"Lead Free		idei II	
	LPRC221	2322	±1%	0.01 to 0.0976 Ω	763 90xxx	-	-	2. On custon	nized label,	"LFP'	or specific
	LPRC221	2322	±1%	0.1 to 1 Ω	763 6xxxx	-	-	symbol car	n be printeo	ł	

(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. (In I2NC code, only 07" tape reel code is supplied. Supply of 10"/13" tape reel is requested in Global part number ordering code.)
- (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) Letter L is system default code for order only $^{({\sf Note})}.$

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<u>MARKING</u>



For further marking information, please see special data sheet "Chip resistors marking".

CONSTRUCTION

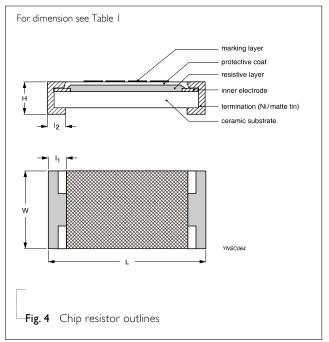
The resistors are constructed out of a high-grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive paste. The composition of the paste is adjusted to give the approximate required resistance and laser cutting of this resistive layer that achieves tolerance trims 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.

DIMENSIONS

Table I For outlines see fig. 4

ТҮРЕ	L (mm)	W (mm)	H (mm)	l₁ (mm)	l 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



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ELECTRICAL CHARACTERISTICS

Table 2

Туре	Power P ₇₀	Operating Temp. range	Resistance range & tolerance		T. C. R. (ppm/°C)	Jumper criteria
RL0402	1/16W			$50m\Omega \le R < \Omega $		Max. resistance 20m Ω Rated current 1.5A
RL0603	1/10W	-55°C to +155°C		$10m\Omega \le R < 1\Omega$		Max. resistance 20mΩ Rated current 2A
DI OOOF	1/8W	_		$10m\Omega \le R < 1\Omega$	See following table "T.C.R RL series"	Max. resistance 20mΩ Rated current 2.5A
RL0805	1/4W	-55°C to +125°C		$10m\Omega \le R < \Omega $		
DI 1207	1/4W	-55°C to +155°C		$10m\Omega \le R < 1\Omega$		Max. resistance 20mΩ Rated current 3.5A
RL1206	1/2W	-55°C to +125°C	E24 ±1%, ±2%, ±5%	$10m\Omega \le R < \Omega $		
RL1210	1/2W			$10m\Omega \le R < \Omega $		
RL1218	IW			$10m\Omega \le R < \Omega $		
RL2010	3/4W	55°C to +155°C		$10m\Omega \le R < \Omega $		
RL2512	IW	_		$10m\Omega \le R < \Omega $		

TYPE /	resistance Range	TEMPERATURE COEFFICIENT OF RESISTANCE								
RL0402		50m <u>Ω</u> ≤R	<100mΩ		- I00mΩ ≤	R<500m <u>Ω</u>	-	500mΩ :	≤R <iω< th=""></iω<>	
KL0 4 02	50mΩ≤R <iω< th=""><td>±1000</td><td colspan="3">±1000 ppm/°C</td><td>opm/°C</td><td></td><td>±300 p</td><td>pm/°C</td></iω<>	±1000	±1000 ppm/°C			opm/°C		±300 p	pm/°C	
RL0603		l0m <u>Ω</u> ≤R≤36r	mΩ	36r	m <u>Ω</u> <r≤9im<u>Ω</r≤9im<u>	91m <u>Ω</u> <r≤500< th=""><th>)mΩ</th><th colspan="3">mΩ 500m<u>Ω</u> <r<iω< th=""></r<iω<></th></r≤500<>)mΩ	mΩ 500m <u>Ω</u> <r<iω< th=""></r<iω<>		
KL0003	10mΩ≤R<1Ω	±1,500 ppm/	°C	±	l,200 ppm/°C	±800 ppm/'	°C	±300 ppm/°C		
RL0805		10m <u>Ω</u> ≤R≤18m <u>Ω</u>	I8mΩ <f< th=""><th>R≤47mΩ</th><th>47m<u>Ω</u> <r≤91m<u>Ω</r≤91m<u></th><th>91m<u>Ω</u> <r≤360m<u>Ω</r≤360m<u></th><th>360mΩ <i< th=""><th>R<500mΩ</th><th>500m<u>Ω</u> ≤R<i<u>Ω</i<u></th></i<></th></f<>	R≤47mΩ	47m <u>Ω</u> <r≤91m<u>Ω</r≤91m<u>	91m <u>Ω</u> <r≤360m<u>Ω</r≤360m<u>	360mΩ <i< th=""><th>R<500mΩ</th><th>500m<u>Ω</u> ≤R<i<u>Ω</i<u></th></i<>	R<500mΩ	500m <u>Ω</u> ≤R <i<u>Ω</i<u>	
	_	±1,500 ppm/°C	600 ppm/°C ±1,200 ppm/°		±1,000 ppm/°C	±600 ppm/°C	±300 ppm/°C		±200 ppm/°C	
		10m <u>Ω</u> ≤R≤18m <u>Ω</u>	I8mΩ <f< th=""><th>R≤47mΩ</th><th>47m<u>Ω</u> <r≤91m<u>Ω</r≤91m<u></th><th>91m<u>Ω</u> <r≤360m<u>Ω</r≤360m<u></th><th>360m<u>Ω</u> <i< th=""><th>R≤500mΩ</th><th>500mΩ <r<iω< th=""></r<iω<></th></i<></th></f<>	R≤47mΩ	47m <u>Ω</u> <r≤91m<u>Ω</r≤91m<u>	91m <u>Ω</u> <r≤360m<u>Ω</r≤360m<u>	360m <u>Ω</u> <i< th=""><th>R≤500mΩ</th><th>500mΩ <r<iω< th=""></r<iω<></th></i<>	R≤500mΩ	500mΩ <r<iω< th=""></r<iω<>	
RL1206	0mΩ≤R< Ω	±1,500 ppm/°C	±1,200	ppm/°C	±1,000 ppm/°C	±600 ppm/°C	±300 p	opm/°C	±200 ppm/°C	
RL1210	_	±1,500 ppm/°C	±1,000	ppm/°C	±800 ppm/°C	±600 ppm/°C	±300 p	opm/°C	±200 ppm/°C	
RL2010	_	±1,500 ppm/°C	±1,200	ppm/°C	±1,000 ppm/°C	±600 ppm/°C	±300 p	opm/°C	±200 ppm/°C	
RL2512		±1,500 ppm/°C	±1,200	ppm/°C	±800 ppm/°C	±600 ppm/°C	±300 p	opm/°C	±200 ppm/°C	
RL1218		I0m <u>Ω</u> ≤R≤30r	mΩ	30r	n <u>Ω</u> <r≤56m<u>Ω</r≤56m<u>	56m <u>Ω</u> <r≤180< th=""><th>)mΩ</th><th>180</th><th>)mΩ <r<iω< th=""></r<iω<></th></r≤180<>)mΩ	180)mΩ <r<iω< th=""></r<iω<>	
	l0mΩ≤R <lω< th=""><td>±2,000 ppm/</td><td>°C</td><td>±</td><td>1,000 ppm/°C</td><td colspan="2">±700 ppm/°C</td><td colspan="2">±250 ppm/°C</td></lω<>	±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".

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PACKING STYLE AND PACKAGING QUANTITY

PACKING STYLE	REEL DIMENSION	RL0402	RL0603	RL0805	RL1206	RL1210	RL1218	RL2010	RL2512
Paper taping reel (R)	7" (178 mm)	10,000	5,000	5,000	5,000	5,000			
	10" (254 mm)	20,000	10,000	10,000	10,000	10,000			
	13" (330 mm)	50,000	20,000	20,000	20,000	20,000			
Embossed taping reel (K)	7" (178 mm)						4,000	4,000	4,000

NOTE

I. For paper/embossed tape and reel specification/dimensions, please see the special data sheet "Chip resistors packing".

FUNCTIONAL DESCRIPTION

OPERATINGTEMPERATURE RANGE

Normal Power: Range: -55 °C to +155 °C (Fig. 5) Double Power: Range: -55 °C to +125 °C (Fig. 6)

POWER RATING

Each type rated power at 70 °C: RL0402=1/16 W; RL0603=1/10 W; RL0805=1/8 W, 1/4W; RL1206=1/4 W, 1/2W; 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:

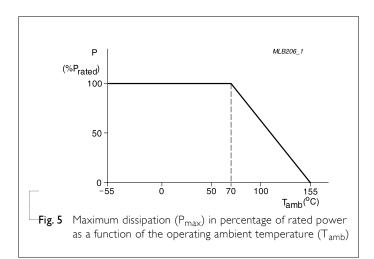
 $V = \sqrt{(P \times R)}$

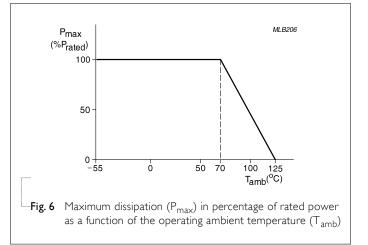
Where

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

P = Rated power (W)

 $R = Resistance value (\Omega)$





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TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

TEST	TEST METHOD	PROCEDURE	REQUIREMENTS
Life/	IEC 60115-1 4.25.1	I,000 hours at 70±2°C applied RCWV	±(2% +0.5m Ω)
Endurance	MIL-STD-202 Method 108A	1.5 hours on, 0.5 hour off, still air required	
High Temperature Exposure	IEC 60068-2-2	I ,000 hours at maximum operating temperature depending on specification, unpowered	±(1% +0.5m Ω)
		No direct impingement of forced air to the parts	
		Normal power : Tolerances: 155±5° C	
		Double power : Tolerances: 125±5° C	
Moisture Resistance	MIL-STD-202 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	±(2% +0.5m Ω)
		Parts mounted on test-boards, without condensation on parts	
Thermal Shock	MIL-STD-202 Method 107G	-55/+125 °C	±(1% +0.5m Ω)
		Number of cycles required is 300.	
		Devices mounted	
		Maximum transfer time is 20 seconds. Dwell time is 15 minutes.	
Short time overload	IEC60115-14.13	RL standard power: 2.5 times rated voltage for 5 sec at room temperature	±(2% +0.5m Ω) No visible damage
		RL high power: 5 times rated power for 5 sec at room temperature	
Board Flex/ Bending	IEC 60115-1 4.33	Device mounted on PCB test board as described, only I board bending required	±(1% +0.5m Ω) No visible damage
		3 mm bending	
		Bending time: 60±5 seconds	
		Ohmic value checked during bending	

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TEST	TEST METHOD	PROCEDURE	REQUIREMENTS		
Solderability					
- Wetting	J-STD-002 test B	Electrical Test not required	Well tinned (≥95% covered)		
		Magnification 50X	No visible damage		
		SMD conditions:			
		I st step: method B, aging 4 hours at 155 °C dry heat			
		2 nd step: leadfree solder bath at 245±3 °C			
		Dipping time: 3±0.5 seconds			
- Leaching	J-STD-002 test D	Leadfree solder, 260 °C, 30 seconds immersion time	No visible damage		
- Resistance to	IEC 60115-1 4.18	Condition B, no pre-heat of samples.	±(1% +0.5m Ω)		
Soldering Heat		Leadfree solder, 260 °C, 10 seconds immersion time	No visible damage		
		Procedure 2 for SMD: devices fluxed and cleaned with isopropanol			

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<u>REVISION HISTORY</u>

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 2	May 31, 2017	-	- Add 10" packing
Version I	Dec. 16, 2015	-	- Extend 0805 T.C.R. range
Version 0	Nov. 11, 2014	-	- First issue of this specification

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