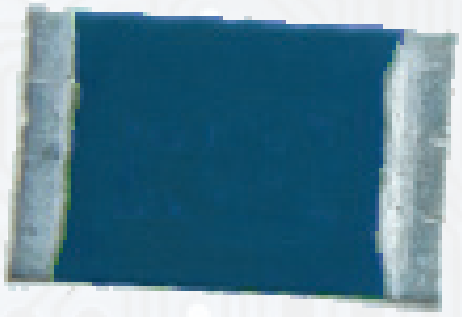
THICK FILM CHIP RESISTOR
- RL SERIES -

FEATURES

- High reliability and stability
- Reduced size of final equipment
- Lower assembly costs
- Higher component and equipment reliability
- RoHS exemption free and Lead free products



APPLICATIONS

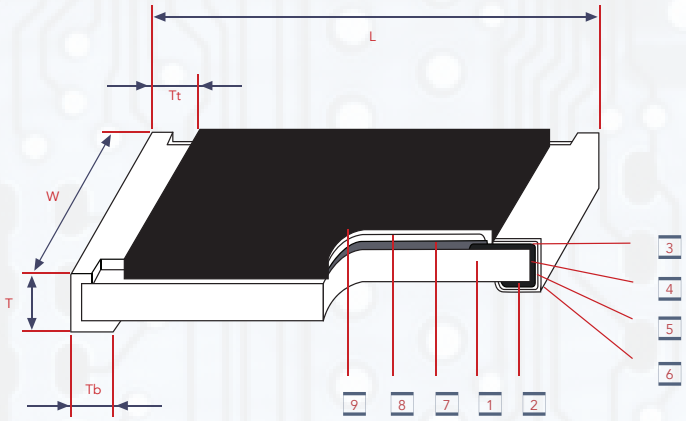
- Consumer electrical equipment
- Automotive application
- EDP, Computer application
- Telecom application

DESCRIPTION

The LEAD FREE resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal elctrodes are added at each end and connected by a LEAD FREE resistive paste that 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 coat. For all series, Overcoat is water blue color. Finally, these two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (LEAD FREE) alloy.

CONSTRUCTION & DIMENSIONS



1 Alumina Substrate
2 Bottom Electrode (Ag)
3 Top Elctrode (Ag-pd)
4 Edge Electrode (NiCr)
5 Barrier Layer (Ni)
6 External Electrode (Sn)
7 Resistor Layer (RuO_2/Ag)
8 Primary Overcoat (Glass)
9 Marking

	RL14	RL12	RL10	RL06	RL04
L	3.10 ± 0.10	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	2.60 ± 0.10	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.55 ± 0.10	0.60 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tb	0.50 ± 0.20	0.45 ± 0.20	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10
Tt	0.50 ± 0.20	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10

PART NUMBERING

RL	06	J	104	CT
SERIES CODE	SIZE CODE	TOLERANCE	RESISTANCE CODE	PACKAGING CODE
RL SERIES	04: 0402 06: 0603 10: 0805 12: 1206 14: 1210 20: 2010 25: 2512	F: ±1% J: ±5%	5%, E24: Signigicant digits followed by no. of zeros and a blank. 4.7Ω - 4R7_ 10Ω - 100_ 220Ω - 221_ Jumper - 000_ 1%, E24/E96: 3 Significant digits followed by no. of zeros 102Ω - 1020 37.4KΩ - 3742	CT: 7" Reeled taping CTD: 10" Reeled taping CTG: 13" Reeled taping

- LEAD content: below 100ppm with reference to IEC62321, determination of LEAD by ICP-AES
RL04, RL06, RL10, RL12, RL14, RL20, RL25

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STANDARD ELECTRICAL SPECIFICATIONS

ITEM	GENERAL SPECIFICATION									
SERIES NO.	RL14		RL12		RL10		RL06		RL04	
SIZE CODE	1210 (3225)		1206 (3216)		0805 (2012)		0603 (1608)		0402 (1005)	
RESISTANCE RANGE	1Ω ~ 10MΩ (±5% Tolerance) 1Ω ~ 10MΩ (±1% Tolerance), Jumper									
RESISTANCE TOLERANCE	±1% E24 / E96	±5% E24	±1% E24 / E96	±5% E24	±1% E24 / E96	±5% E24	±1% E24 / E96	±5% E24	±1% E24 / E96	±5% E24
TCR (ppm/°C) R≥1MΩ 1MΩ > R > 10Ω R≤10Ω	≤±200 ≤±100 -300 / +500	≤±200 ≤±200 -300 / +500	≤±200 ≤±100 -300 / +500	≤±200 ≤±200 -300 / +500	≤±200 ≤±100 -300 / +500	≤±200 ≤±200 -300 / +500	≤±200 ≤±100 -300 / +500	≤±200 ≤±200 -300 / +500	≤±300 ≤±100 -300 / +500	≤±300 ≤±200 -300 / +500
MAX. DISSIPATION @T_{amb} - 70°C	1/3 W		1/4 W		1/8 W		1/10 W		1/16 W	
MAX OPERATION VOLTAGE (DC OR RMS)	200V		200V		150V		50V		50V	
MAX OVERLOAD VOLTAGE (DC OR RMS)	400V		400V		300V		100V		100V	
CLIMATIC CATEGORY (IEC 60068)	55 / 155 / 56									

NOTE:
1) This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
2) Max. Operation Voltage: So called RCWV (Rated Continuous Working Voltage) is determined by
3) RCWV = $\sqrt{\text{RatedPower x Resistance Value}}$ or Max. RCWV listed above, whichever is lower.
4) The resistance of Jumper is defined as max. 0.05Ω

MARKING

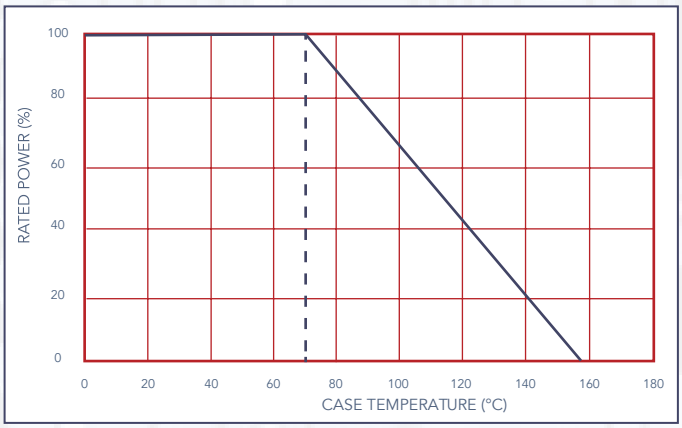
All series are defined as no marking!

PRODUCT CHARACTERIZATION

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

DERATING CURVE

The power that the resistor can dissipate depends on the operating temperatrure.



Maximum dissipation in percentage of rated power as a function of the ambient temperature for RL14, RL12, RL10, RL04

MOUNTING

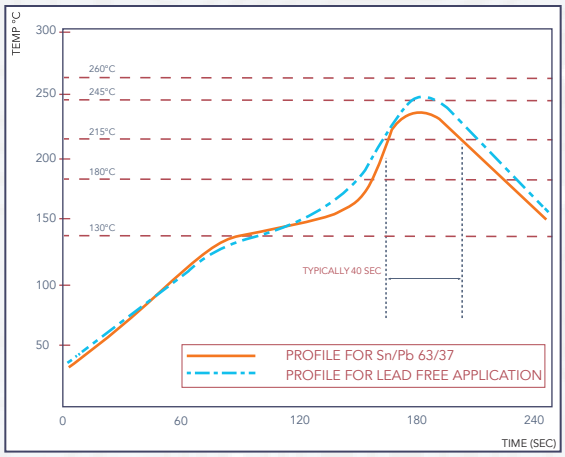
Due to their rectangular shapes and small tolerances, SUrface Mountables Resistors are suitable for handling by automatic placement systems.
Chip placement can be on ceramic substrates and printed- circuit boards (PCBs)
Electrical connection to the circuit is by individual soldering condition.
The end terminations guarantee a reliable contact.

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SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed ina solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Reisistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.



TEST AND REQUIREMENTS (JIS C 5201-1 : 1998)

Essentially all tests are carried out according tot he schedule of IEC publication 115-8, category LCT/UCT/56 (rated temperature range: Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ, and JIS.

The tests are carreid out in accordance with IEC publication 68, "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 value supplied:

Temperature: 15°C to 35°C
Relative Humidity: 45% to 75%
Air Pressure: 86kPa to 106kPa (860 mbar to 1060 mbar)
All soldering tests are performed with mildly activated flux.

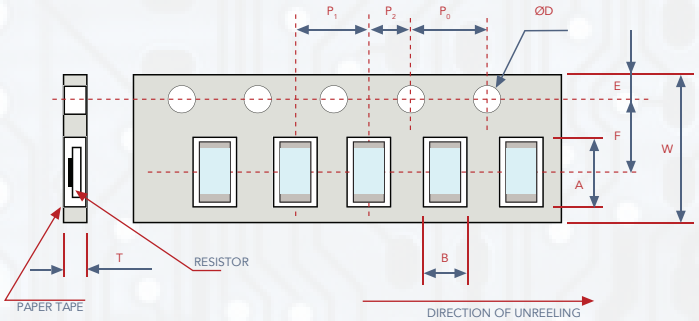
TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		RESISTOR	0Ω
DC Resistance Clause 4.5	DC resistance values measured at the test voltages specified below: <Ω@0.1V, <100Ω@0.3V, <1KΩ@1.0V, <10KΩ@3V, <100KΩ@10V, <1MΩ@25V, <10MΩ@30V	Within the specified tolerance	<50mΩ
Temperature Coefficient of Resistance (T.C.R.) Clause 4.8	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6$ (ppm / °C) t_1: 20°C + 5°C - 1°C R_1: Resistance at reference temperature R_2: Resistance at test temperature	Refer to "QUICK REFERENCE DATA"	n/a
Short Time Overload (S.T.O.L.) Clause 4.13	Permanent resistance change after a 5 second application of a voltage 2.5 times RCWV or the maximum overload voltage specified int eh above list, whichever is less	1% tol.: ΔR/R max. ±(1% + 0.10Ω) 5% tol.: ΔR/R max. ±(2% + 0.10Ω)	<50mΩ
Ressitance to Soldering Heat (R.S.H) Clause 4.18	Un-mounted chips completely immersed for 10 ± 1 second in a SAC solder bath at 260°C ± 5°C	1% tol.: ΔR/R max. ±(0.5% + 0.10Ω) 5% tol.: ΔR/R max. ±(1% + 0.10Ω)	<50mΩ
Solderability Clause 4.17	Un-mounted chips completely immersed for 2 ± 0.5 second in a SAC solder bath at 235°C ± 5°C	95% coverage min., good tinning and no visible damage	
Temperature Cycling Clause 4.19	30 minutes at -55°C ± 3°C, 2~3 minutes at 20°C + 5°C - 1°C, 30 minutes at +155°C ± 3°C, 2`3 minutes at 20°C + 5°C - 1°C, total 5 continuous cycles	1% tol.: ΔR/R max. ±(0.5% + 0.10Ω) 5% tol.: ΔR/R max. ±(1% + 0.10Ω)	<50mΩ
Damp Heat (Load Life in Humidity) Clause 4.24	1000 +48/-0 hours, loaded with RCWV or V_{max} in humidity chamber controller at 40°C ± 2°C and 90~95% relative humidity, 1.5 hours on and 0.5 hours off	1% tol.: ΔR/R max. ±(1% + 0.10Ω) 5% tol.: ΔR/R max. ±(2% + 0.10Ω)	<50mΩ
Load Life (Endurance) Clause 4.25	1000 +48/-0 hours; loaded with RCWV or V_{max} in chamber controller 70 ± 2°C, 1.5 hours on and 0.5 hours off	1% tol.: ΔR/R max. ±(1% + 0.10Ω) 5% tol.: ΔR/R max. ±(2% + 0.10Ω)	<50mΩ
Bending Strength Clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 3mm for 10sec, 5mm for WR04	1% tol.: ΔR/R max. ±(0.5% + 0.10Ω) 5% tol.: ΔR/R max. ±(1% + 0.10Ω)	<50mΩ
Adhesion Clause 4.32	Pressurizing force: 5N, Test Time: 10 ± 1sec.	No remarkable amage or removal of the terminations	

TEST CONDITION FOR JUMPER (0Ω)

ITEM	RL14	RL12	RL10	RL06	RL04
POWER RATING AT 70°C	1/3W	1/4W	1/8W	1/10W	1/16W
RESISTANCE	MAX. 50MΩ				
RATED CURRENT	2.5A	2A	1.5A	1A	1A
PEAK CURRENT	6A	5A	3.5A	3A	1.5S
OPERATING TEMPERATURE	-55 ~ 155°C				

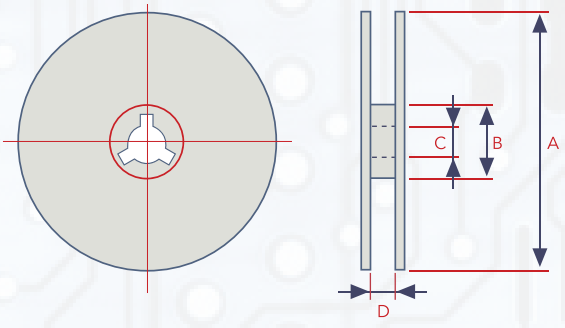
PACKAGING

Paper Tape Specifications



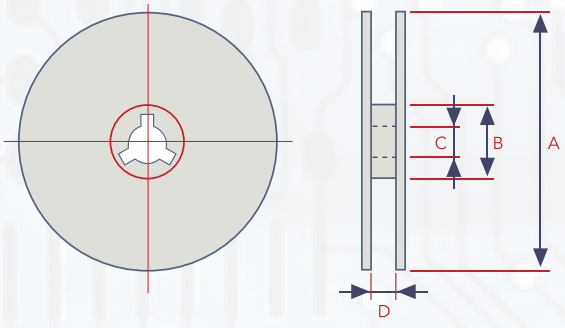
SIZE	B	A	W	F	E	P1	P2	P0	D
0201	0.37 ± 0.05	0.67 ± 0.05	8.00 ± 0.20	3.50 ± 0.05	1.75 ± 0.10	2.00 ± 0.05	2.00 ± 0.05	4.00 ± 0.10	1.50+0.10/-0
0402	0.70 ± 0.10	1.20 ± 0.10				2.00 ± 0.10			
0603	1.10 ± 0.20	1.90 ± 0.20							
0805	1.65 ± 0.20	2.40 ± 0.20	8.00 ± 0.30						
1206	2.00 ± 0.20	3.60 ± 0.20				4.00 ± 0.10			
1210	3.00 ± 0.20								
2010	2.80 ± 0.20	5.50 ± 0.20	12.00 ± 0.30	5.50 ± 0.05					
2512	3.50 ± 0.20	6.70 ± 0.20							

7" Reel Dimensions



SYMBOL	A	B	C	D
(UNIT : MM)	Ø178.0 ± 2.0	Ø60.0 ± 1.0	13.0 ± 0.2	9.0 ± 0.5

7" Reel Dimensions - 12mm Tape



SYMBOL	A	B	C	D
(UNIT : MM)	Ø178.0 ± 2.0	Ø60.0 ± 1.0	13.0 ± 0.2	9.0 ± 0.5