

## General Purpose Chip Resistors ( 1Ω~10MΩ)

### Feature

1. High reliability and stability
2. Reduced size of final equipment
3. Lower assembly costs
4. Higher component and equipment reliability
5. RoHs compliant and lead free products

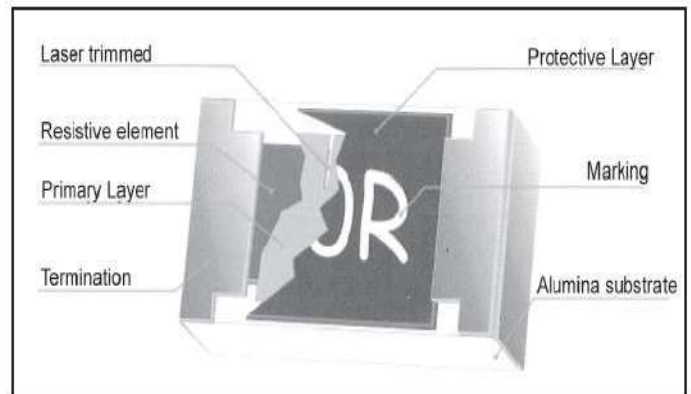
### Application

1. Consumer electrical equipment, PDA digital Camcorder.
2. EDP, Computer application
3. Mobile phone ,Telecom
4. Power supply , Battery charger ,DC-DC power converter
5. Digital meter
6. Automotive.

### Description

The resistors are constructed in a high grade ceramic body(aluminum oxide). Internal metal electrodes are added at each end and connected by a 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. Finally, the two external and terminations are added. For ease of soldering the outer layer of these end terminations is a Lead-tin or Tin solder alloy.



### General Purpose Chip-R

Series	Size	Rated Power	TCR(ppm°C)	Tolerance	Resistance
RP25X	2512 (6432)	1 W	±100	±1%	1 ~ 10MΩ
			±200	±5%	
RP18X	1218 (3248)	1 W	±100	±1%	
			±200	±5%	
RP20X	2010 (5025)	1/2 W	±100	±1%	
			±200	±5%	
RP10X	1210 (3225)	1/3 W	±100	±1%	
			±200	±5%	
RP12X	1206 (3216)	1/4 W	±100	±1%	
				±5%	
RP08X	0805 (2012)	1/8 W	±100	±1%	
				±5%	
RP06X	0603 (1608)	1/10 W	±100	±1%	
				±5%	
RP04X	0402 (1005)	1/16 W	±100	±1%	
				±5%	
RP02X	0201 (0603)	1/20 W	±200	±1%	
			±200	±5%	
RP01X	01005 (0402)	1/32 W	±200	±1%	4.7 ~ 1MΩ
			±200	±5%	

Remark :

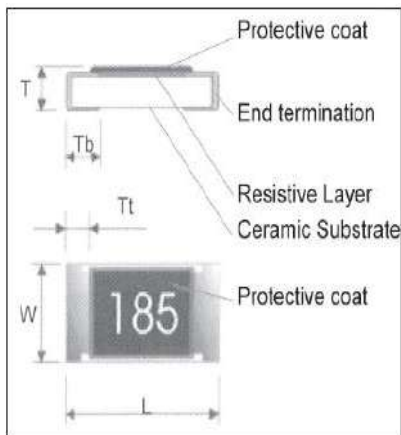
- 1 . Detailed resistance vs. TCR and ordering code please refer to specific specifications.
- 2 . Jumper resistor is not designed for fusing applications, designers shall apply dedicate fusible resistor or standard fuse in application circuits.
- 3 . WRxxW defines for ±1% < 10ohm or > 1Mohm.

## Quick Reference Data

Series No.	RP25	RP20	RP18	RP12	RP12	RP08	RP06	RP04	RP02	RP01
Size code	2512 (6432)	2010 (5025)	1218 (3248)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)	0201 (0603)	01005 (0402)
Resistance Range	±5% (E24) : 1Ω ~ 10MΩ : Jumper ±1% (E24+E964) : 1Ω ~ 10MΩ									
±5% Tolerance (E24)										
±1% Tolerance (E24+E96)										
TCR (ppm/°C)										
R > 1MΩ	≤ ±200		≤ ±200		≤ ±100			≤ ±200		≤ ±200
1MΩ ≥ R > 10Ω	≤ ±100		≤ ±100		≤ ±100			≤ ±300		≤ ±300
R ≤ 10Ω	≤ ±200		≤ ±200		-200 ~ +400					
Max. dissipation @ Tamb=70°C	1.0 W	1/2 W	1.0 W	1/3 W	1/4 W	1/8 W	1/10 W	1/16 W	1/20 W	1/32W
Max. Operation Voltage	250V	200V	200V	200V	200V	150V	50V	50V	25V	20V
(DC or RMS)										
Operation Temperature	-55 ~ +155°C								-55 ~ +125°C	
Basic specification	JIS C 5201-1 / IEC 60115-1									

## Physical Dimensions

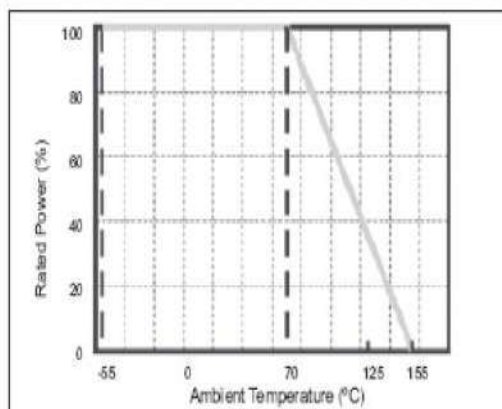
Unit:mm



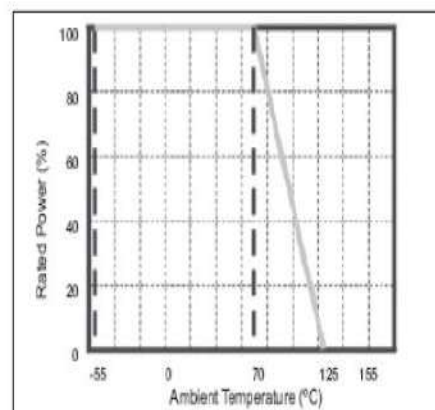
Size	2512 (6432)	2010 (5025)	1208 (3248)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)	0201 (0603)	01005 (0402)
L	6.40±0.20	5.00±0.20	3.05±0.15	3.10±0.10	3.10±0.10	2.00±0.10	1.60±0.10	1.00±0.05	0.60±0.03	0.40±0.02
W	3.20±0.20	2.50±0.20	4.60±0.20	2.60±0.10	1.60±0.10	1.25±0.10	0.80±0.10	0.50±0.05	0.30±0.03	0.20±0.02
T	0.60±0.10	0.55±0.10	0.55±0.10	0.55±0.10	0.60±0.15	0.50±0.15	0.45±0.15	0.35±0.05	0.23±0.03	0.13±0.02
Tb	0.90±0.25	0.60±0.25	0.50±0.25	0.50±0.20	0.45±0.20	0.40±0.20	0.30±0.15	0.25±0.10	0.15±0.05	0.10±0.03
Tt	0.65±0.25	0.65±0.25	0.45±0.25	0.50±0.20	0.50±0.20	0.40±0.20	0.30±0.10	0.20±0.10	0.10±0.05	0.08±0.03

## Power Deration Curve

For resistors operated in ambient temperature over 70°C, power rating should be derated in accordance with the following figures.



For Climatic category (IEC 60068) 55/155/56



For Climatic category (IEC 60068) 55/125/56 (for 0201 type)

# Thick Film Low Ohm/Power Low Ohm Chip Resistors

## Function For Low Ohm Chip Resistors

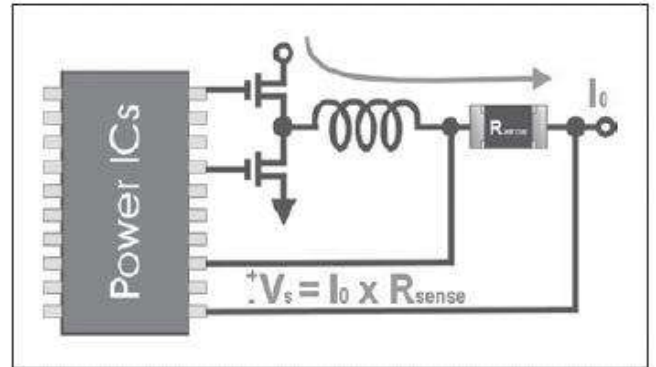
The low ohmic resistors are used to sense output current in power supply, automotive and engine control management system, and other power sensing application. As shows in figure below, the typical function of low ohmic (power) chip resistor is to be a current sensor ( $R_{sense}$ ) to generate the sensing voltage ( $V_s$ ) for the purpose of feedback control when output current ( $I_o$ ) passed on it . The sensing voltage be treated as a signal to trigger the switches (CMOS) ON/OFF duration so that to monitor and/or adjust the output current from inductor.

Simplify to say,  $V_s = I_o \times R_{sense}$ .

In general case, this feedback voltage is setting around 100mV for considering both on power saving and noise robustness. To sense a 5 ampere average output current, the  $R_{sense}$  resistance value therefore be required as  $100mV / 5A = 20 m\Omega$ , the power dissipation will be :

$$P = I^2 \times R = 5A^2 \times 20m\Omega = 0.5Watt$$

A low ohmic chip resistor with a power rating of 1.0 watt is recommended on this application in case the power safety margin is taken into account.



## Quick Reference Data of Low Ohm Chip Resistor

Size code	2512 (6432)	2010 (5025)	1208 (3248)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±5%, ±1%							
Resistance Range	0.020Ω ~ 0.976Ω						0.100Ω ~ 0.976Ω	
TCR (ppm/°C)	Detailed TCR please refer to specific data sheets							
Max. dissipation @ Tamb=70°C	1 Watt	0.5 Watt	1 Watt	1/3 Watt	1/4 Watt	1/8 Watt	1/10 Watt	1/16 Watt
Max. Operation Voltage (DC or RMS)	250V	200V	200V	200V	200V	100V	50V	50V
Operation Temperature	-55 ~ +155°C							
Basic Specification	JIS C 5201-1 / IEC 60115-1							

Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-9".
2. Power derating curve, and detail specification please refer to specific data sheets.
3. Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of change of resistance value.

## Quick Reference Data of Power Low Ohm Chip Resistor

Series No.	RP25P	RP20P	RP12P	RP08P	RP06P	RP04P
Size code	2512 (6432)	2010 (5025)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±5%, ±1%					
Resistance Range	0.047Ω ~ 0.976Ω					0.1Ω ~ 0.976Ω
TCR (ppm/°C) <0.100Ω	±150ppm/°C	±150ppm/°C	±200ppm/°C	±200ppm/°C	±250ppm/°C	-
≥0.100Ω	±100ppm/°C	±100ppm/°C	±100ppm/°C	±150ppm/°C	±200ppm/°C	0 ~ +300ppm/°C
Max. dissipation @ Tamb=70°C	2 W	1 W	1/2 W	1/3 W	1/4 W	1/8 W
Max. Operation Voltage (DC or RMS)	300V	200V	200V	150V	50V	50V
Operation Temperature	-55 ~ +155°C					

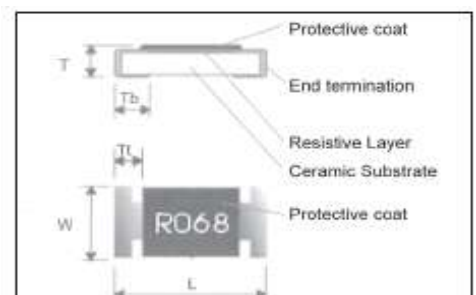
Note :

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 RCWW (Rated Continuous Working Voltage) is determined by  $RCWW = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$  or Max. RCWW listed above, whichever is lower.
3. 2W loading with total solder-pad and trace size of 300mm<sup>2</sup>

## Physical Dimensions

Unit:mm

Size	2512	2010	1210	0805	0603	
L	6.30±0.20	5.00±0.20	3.10±0.15	2.00±0.15	1.60±0.10	1.00±0.05
W	3.10±0.20	2.50±0.20	1.60±0.15	1.20±0.15	0.80±0.10	0.50±0.05
T	0.60±0.15	0.60±0.10	0.55±0.10	0.50±0.10	0.45±0.10	0.35±0.05
Tt	0.60±0.25	0.60±0.25	0.50±0.25	0.40±0.20	0.30±0.20	0.20±0.10
Tb	1.80±0.25	0.65±0.25	0.50±0.25	0.40±0.20	0.30±0.20	0.25±0.05/-0.1



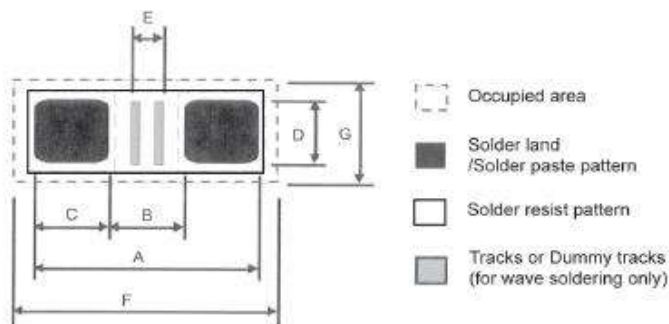
## How To Order

RP	12	1000	F	T	L
Type code	Size code	Resistance	Tolerance	Packaging code	Termination code
RP : General 1~10MR	25 : 2512 (6432)	E24(J tol.) : 2 significant digits	J : $\pm 5\%$	R : 7" reel taping	L : Sn base (Lead free)
	20 : 2010 (5025)	followed by No. of zeros and	F : $\pm 1\%$	G : 13" reel taping	
	18 : 1218 (3248)	a blank	D : $\pm 0.5\%$		
	12 : 1206 (3216)	e.g. : 3ohm = 3R0_	B : $\pm 0.1\%$		
	10 : 1210 (3225)	10ohm = 100_			
	08 : 0805 (2012)	220ohm = 221_			
	06 : 0603 (1608)	56Kohm = 563_			
	04 : 0402 (1005)	("_" means blank)			
	02 : 0201 (0603)	E24+E96(F tol.): 3 significant digits followed by No. of zeros			
	01 : 01005 (0402)	e.g. : 3Ω = 3R00 10Ω = 10R0 220Ω = 2200 56KΩ = 5602			

## Reel Taping Quantity Specifications for RP.....Series

Component Size / Series	Reel Diameter
0603 , 0805 , 1206	4" reel
1210 , 1206 , 0805 , 0603	7" reel
0201 , 0402 ,	7" reel
2512 , 2010	7" reel
1218	10" reel

## Footprint Design



Unit: mm

Size	Reflow Soldering							Processing Remarks	Placement Accuracy
	A	B	C	D	E	F	G		
01005	0.58	0.18	0.20	0.20	0.10	0.90	0.40	IR or hot plate soldering	$\pm 0.03$
0201	0.75	0.30	0.30	0.30	0.20	1.10	0.50		$\pm 0.05$
0402	1.50	0.50	0.50	0.60	0.10	1.90	1.00		$\pm 0.15$
0603	2.10	0.90	0.60	0.90	0.50	2.35	1.45		$\pm 0.25$
0805	2.60	1.20	0.70	1.30	0.75	2.85	1.90		$\pm 0.25$
1206	3.80	2.00	0.90	1.60	1.60	4.05	2.25		$\pm 0.25$
1210	3.80	2.00	0.90	2.80	1.60	4.05	3.15		$\pm 0.25$
1218	3.80	2.00	0.90	4.80	1.40	4.20	5.50		$\pm 0.25$
2010	5.60	3.80	0.90	2.80	3.40	5.85	3.15		$\pm 0.25$
2512	7.00	3.80	1.60	3.50	3.40	7.25	3.85		$\pm 0.25$

## Test and Requirements For RP Series

Test	Procedure / Test Method	Requirements	
		Resistor	0Ω
Electrical Characteristics JISC5201-1: 1998 Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $[(R2-R1)/R1(T2-T1)] \times 10^6$ (ppm / °C ) T1:20°C+5°C-1°C R1:Resistance at reference temperature (20°C+5°C/-1°C) R2:Resistance at test temperature (-55°C or +155°C)	Within the specified tolerance Refer to "QUICK REFERENCE DATA"	< 50mΩ
Resistance to soldering heat(R.S.H) JISC5201-1:1998 Clause 4.18	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C	±5%: ΔR/Rmax. (1%+0.05Ω) ±1%: ΔR/Rmax. (0.5%+0.05Ω) no visible damage	< 50mΩ
Solder ability JISC5201-1:1998 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 JISC5201-1:1998 Clause 4.19	30minutes at -55°C±3°C, 2~3minutes at 20°C+5°C-1°C,30minutes at +155°C±3°C,2~3minutes at 20°C+5°C-1°C, total 5continuous cycles	±5%: ΔR/Rmax. (1%+0.05Ω) ±1%: ΔR/Rmax. (0.5%+0.05Ω) no visible damage	< 50mΩ
High Temperature Exposure MIL-STD-202 Mothod 108	1000+48/-0 hours; without load in a temperature chamber controlled 155°C±3°C	±5%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (1%+0.1Ω) no visible damage	< 50mΩ
Bending strength JISC5201-1:1998 Clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR-4), bending once 3mm for 10sec, 5mm for WR04	±5%: ΔR/Rmax. (1%+0.05Ω) ±1%: ΔR/Rmax. (1%+0.05Ω) no visible damage	< 50mΩ
Adhesion JISC5201-1:1998 Clause 4.32	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations	
Short Time Overload (STOL) JISC5201-1:1998 Clause 4.13	2.5 times RCWV or max. overload voltage, for 5seconds	±5%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (1%+0.1Ω) no visible damage	< 50mΩ
Load life in Humidity JISC5201-1:1998 Clause 4.24	1000+48/-0 hours, loaded with RCWV or Vmax In humidity chamber controller 40°C±2°C at and 90~95% relative humidity, 1.5 hours on and 0.5 hours off	±5%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (1%+0.1Ω) no visible damage	< 50mΩ
Load life (endurance) JISC5201-1:1998 Clause 4.25	1000+48/-0 hours, loaded with RCWV or Vmax In chamber controller 70°C±2°C 1.5 hours on and 0.5 hours off	±5%: ΔR/Rmax. (2%+0.1Ω) ±1%: ΔR/Rmax. (1%+0.1Ω) no visible damage	< 50mΩ
Insulation Resistance JISC5201-1:1998 Clause 4.6	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10GΩ	
Dielectric Withstand Voltage JISC5201-1:1998 Clause 4.7	Apply the maximum overload voltage (AC) for 1minute	No breakdown or flashover	