SUSUMU

Thin Film Specialist and Innovator

英語版

English Version

Thin film surface mount resistors

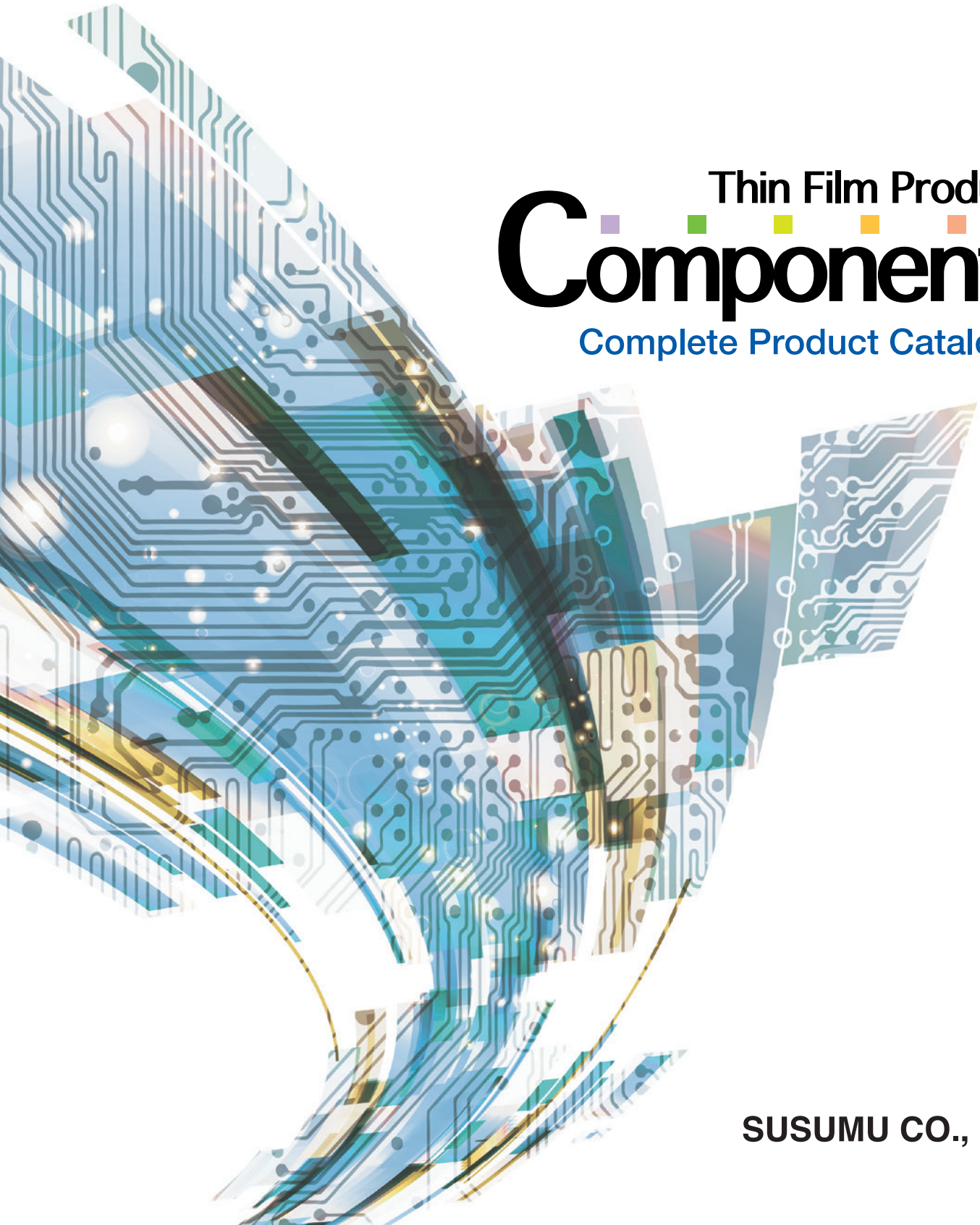
Current sensing surface mount resistors

Power choke coils

High frequency surface mount components

Sample kits

Standard specification



Thin Film Products

Components

Complete Product Catalogue

SUSUMU CO., LTD.

On Environment

You are making "Ecologically Sound" decisions by using Susumu products!

- The Thin Film deposition process requires minimal amounts of raw materials.
  Thin Film resistors are manufactured by processes that utilize minimal amounts of raw materials.
- Our processes use less electricity and emit less CO2.
  Number of heating, curing and sintering process are minimized. When heat is required,
  We use temperature as low as possible.
- Our products are extremely small :using fewer of the earth's natural resources.
  Even though they are small, their precision performance is unmatched.
- Using Susumu's products means reducing your products' environmental load.
  By using Susumu's products, you are contributing to a healthy environment.

Susumu's thin film products are environmentally friendly.

- All Susumu's products are RoHS compliant.
- Almost all products are halogen-free correspondence products.

■ The following logos designate "greenness" of the products.



■ About REACH

REACH was established by the European Chemical Agency (ECHA) in 2007 in order to manage the risk that chemicals pose to health and the environment. REACH stands for

Registration, Evaluation, and Authorization of Chemicals.

For the latest information on the SVHC list under REACH regulations, please visit our website.



Weight ratio (%) for each structural part of typical thin film chip resistors

Product series (Structural part)		RG1005	RG1608 URG1608	RG2012 URG2012	RG3216 URG3216	PRG3216	PRG6432	RM2012	RM3216	RoHS compliance *1
Ceramic substrate		83.18	86.95	87.63	89.51	89.36	92.26	87.78	92.86	●
Resistive element		0.02	0.02	0.02	0.02	0.02	0.11	0.02	0.02	●
Terminal: bottom layer		0.16	0.13	0.11	0.15	0.15	0.11	0.15	0.10	●
Terminal: middle layer		8.33	5.82	5.58	4.83	4.82	3.49	5.87	2.96	●
Terminal: outer layer		5.45	3.81	3.65	3.16	3.15	2.28	3.84	1.94	●
Protective coating	A									●
	B	2.87	2.93	2.67	2.06	2.22	1.79	1.99	1.88	●
	C									●
Marking ink			0.34	0.36	0.28	0.28	0.07	0.37	0.25	●
Total weight (mg)		0.72	2.07	4.12	8.26	8.27	30.81	4.11	7.96	●

*1 Contact our sales office regarding the composition of restricted or hazardous materials.

The long life of Susumu products means effective usage of natural resources.

■URG series P.11

■RG series P.15

The RG series, with its inorganic passivation, realizes less than +/-0.25% drift after 10000 hour stress tests. The ultra reliable URG series also uses inorganic passivation technology and attains less than +/-0.02% drift after similar stress tests.

Small sizes and high power handling capability also mean effective usage of natural resources.

■PRG series P.25

Size	Rated power (W)		Power ratio
	RG series	PRG series	
2012 / 2010	1/8	1/2	4 times
3216	1/4	1	4 times

■HRG series P.29

Size	Rated power (W)		Power ratio
	RG series	HRG series	
3216	1/4	1	4 times

Susumu, together with its group companies, is striving to manufacture environmentally friendly and high quality products.

Susumu group companies' ISO14001 certification status

Company names	facility location	Certification date	Valid date	Certification body	Certification No.
Susumu Co. Ltd	Obama, Japan	2000.12.15	2024.12.14	JQA	EM1184
	Kyoto Headquarters, and other sales offices				
	Niigata, Japan	2001.03.09	2024.12.14	JQA	EM1184
Susumu(Suzhou) Co., Ltd.	Suzhou (China)	2015.09.23	2024.09.21	TIRT	04818E40280R1M
Cyntec	Hsin-Chu (Taiwan)	2002.08.26	2023.06.20	DQS	20000618 UM15
	Suzhou (China)	2003.10.22	2023.06.20	DQS	20000617 UM15

Susumu group companies' ISO9001 certification status

Company names	facility location	Certification date	Valid date	Certification body	Certification No.
Susumu Co. Ltd	Obama, Japan	1998.11.06	2024.03.13	JQA	JQA2755
	Kyoto Headquarters, and other sales offices				
	Niigata, Japan	1988.07.23	2024.03.13	JQA	JQA2755
Susumu(Suzhou) Co., Ltd.	Suzhou (China)	2011.05.01	2024.04.30	BUREAU VERITAS	CNBJ312728-UK
Cyntec	Hsin-Chu (Taiwan)	1997.03.06	2024.03.23	DQS	20000618 QM15
	Suzhou (China)	1997.03.06	2024.03.23	DQS	20000617 QM15

Susumu group companies' IATF 16949 certification status

Company names	facility location	Certification date	Valid date	Certification body	Certification No.
Susumu Co. Ltd	Obama, Japan	2004.11.12	2024.03.18	JQA	JQA-AU0068-1(IATF:0291268)
	Kyoto Headquarters, and other sales offices				
	Niigata, Japan	2015.10.01	2024.03.18	JQA	JQA-AU0068-2(IATF:0335802)
Susumu(Suzhou) Co., Ltd.	Suzhou (China)	2011.05.02	2024.03.27	BUREAU VERITAS	CHN-19878/TS(IATF:301653)
Cyntec	Hsin-Chu (Taiwan)	2007.04.24	2024.03.23	DQS	0297408
	Suzhou (China)	2007.04.24	2024.03.23	DQS	0297419

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In order for customers to choose the best parts for their requirements, the following pages contain tables that provide an outline for each product series. For details, please refer to the specification pages or contact our sales office.

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Products categories

Product group	Product category	Series	Power ratings (W)														Resistance tolerance (%)							*2 Environmental compliance	Specification pages
			3	2	1.5	1	3/4	1/2	1/3	1/4	1/5	1/8	1/10	1/16	1/20	1/32	± 0.01	± 0.02	± 0.05	± 0.1	± 0.5	± 1	± 20		
Thin film surface mount resistors	Metal thin film chip resistors (the highest reliability and precision)	URG					●	●		●			●	●			●	●	●	●	●			●	11-14
	Metal thin firm chip resistors (the highest precision)	RG								●		●	●	●	●	●			●	●	●			●	15-16
	Metal thin firm chip resistors (wide temperature range)	RGT										●	●	●		●				●	●			●	17-18
	Metal thin film chip resistors (high voltage operation)	RGV							●	●										●	●			●	19-20
	Non-magnetic thin film chip resistors	NRG								●		●	●	●					●	●	●			●	21-22
	Audio thin film chip resistors (high precision)	RS												●		●				●	●			●	23-24
	High power thin film chip resistors (long side terminal)	PRG	●	●	●	●														●	●			●	25-28
	High power thin film chip resistors (short side terminal)	HRG				●														●	●			●	29-30
	Anti-surge thin film chip resistors	MRG						●		●		●	●							●	●			●	31-32
	High temperature thin film chip resistors	RGA											●	●		●				●	●			●	33-34
	Metal thin film chip resistors (precision)	RR											●	●	●					●	●	●		●	35
	Metal thin film trimmable chip resistors	RT											●	●	●								●	●	36
	Metal thin film chip resistor networks	RM										●	●				●*1	●*1	●	●	●			●	37-44
	High temperature metal thin film resistor networks	RMA									●	●	●				●*1	●*1	●	●	●			●	45-46

Product group	Product category	Series	Power ratings (W)																Resistance tolerance (%)				*2 Environmental compliance	Specification pages
			10	8	6	5	4	3	2	1.5	1	3/4	2/3	1/2	1/3	1/4	1/5	1/6	1/8	±0.5	±1	±2	±5		
Current sensing surface mount resistors	Metal foil low resistance chip resistors (long-side terminal)	KRL	●		●	●	●	●	●	●	●			●							●	●	●	●	49-50
	Metal foil low resistance chip resistors (short-side terminal)	KRL				●			●	●		●		●	●	●			●		●	●	●	●	51-52
	Metal foil low resistance chip resistors (4 terminal type)	KRL				●	●	●	●		●										●	●	●	●	53-54
	Low resistance chip resistors (long-side terminal)	PRL/ RL							●		●		●		●					●	●	●	●	●*3	55-56
	Low resistance chip resistors (short-side terminal)	RL												●	●	●	●	●	●		●	●	●	●*3	57-58
	High Current chip jumpers	YJP																						●	59

Product group	Product category	Series	Inductance (μH)						Rated current (A)						*2 Environmental compliance	Specification pages
			0.1 ~ 0.49	0.5 ~ 0.99	1.0 ~ 2.9	3.0 ~ 4.9	5.0 ~ 9.9	10 ~	0.45 ~ 0.9	1.0 ~ 4.9	5.0 ~ 9.9	10 ~ 19.9	20.0 ~ 34.9	35.0 ~		
Power choke coils	Power choke coils	PCMB	●	●	●	●	●	●	●	●	●	●	●	●	●	63
	Small power choke coils	PCMB /PS	●	●	●	●	●	●	●	●	●	●			●	64

Product group	Product category	Series	Power ratings (mW)					Frequency range (DC ~ X GHz)					*2 Environmental compliance	Specification pages
			500	250	125	100	50	67	20	10	6	3		
High frequency surface mount components	High Frequency Resistors	RFD					●	●					●	67-68

Product group	Product category	Series	Attenuation (dB)													Attenuation tolerance (dB)					*2 Environmental compliance	Specification pages
			0	1	2	3	4	5	6	7	8	9	10	16	20	55	30	10	6	3		
High frequency surface mount components	High Precision Chip Attenuators (up to 55GHz)	ATS-FD	●	●	●	●	●	●	●	●	●	●	●			●					●	69-72
	High Precision Chip Attenuators (up to 30GHz)	ATF	●	●	●	●	●	●	●	●	●	●	●				●				●	73-74
	Precision chip attenuators	PAT	●	●	●	●	●	●	●	●	●	●	●	●	●			●		●	●	75-78
	Precision chip attenuators (W type)	PAT-W	●	●	●	●	●	●	●	●	●	●	●	●				●	●		●	80-82
	Thermo-variable chip attenuators	P*V		●	●	●	●	●	●	●	●	●	●	●					●	●	●	83-86

Product group	Product category	Series	Input power ratings (mW)				Frequency range (DC ~ X GHz)				*2 Environmental compliance	Specification pages
			500	250	125	100	20	17.5	15	10		
High frequency surface mount components	Chip power splitters	PS	●	●	●	●	●	●	●	●	●	87-88

Product group	Product category	Series	Power ratings (W)										Frequency range (DC ~ X GHz)						*2 Environmental compliance	Specification pages
			100	60	30	20	10	5	2.5	2	1	0.5	0.2	15	12.5	10	7.5	5	3	
High frequency surface mount components	High power chip terminators	PCS					●	●		●	●	●	●	●	●	●	●	●	●	●	89-90
	Super High power chip terminators	HPT	●	●	●	●	●	●	●					●	●	●	●	●	●	●	91-92

*1 Relative tolerance

*2 Environmental compliance: EU-RoHS, REACH SVHCxx, Completely Pb free, Halogen free

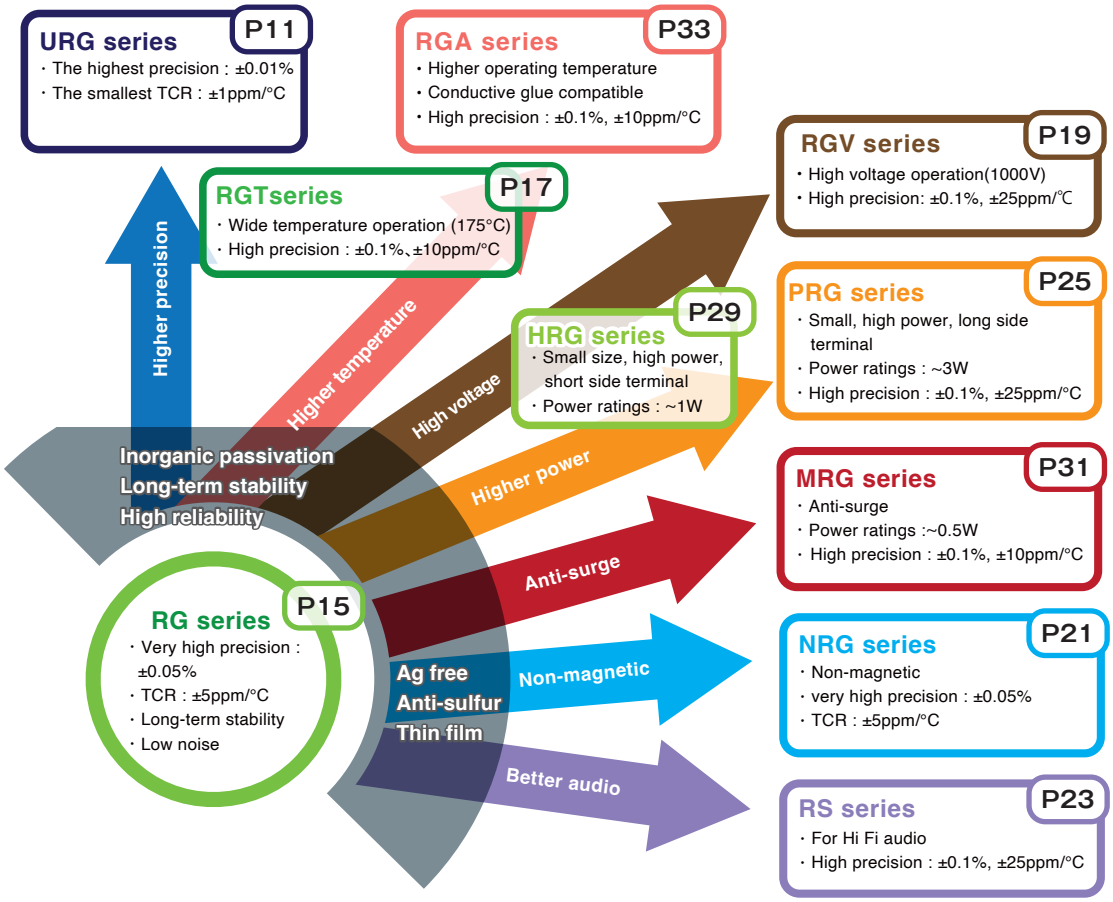
*3 RoHS compliant but resistive element contains few ppm level lead. Not completely lead free.

Selection Guide

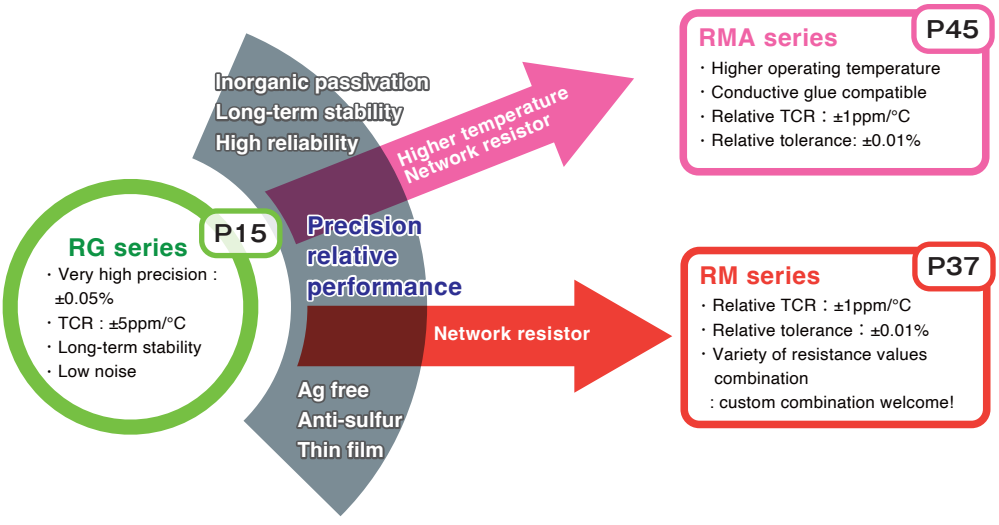
The RG series, the most popular metal thin film chip resistors because of their high precision, high reliability and long-term stability, is the base of our line-up of new innovative products: a higher precision, higher operating temperature, higher power handling capability, higher anti-surge capability version of the RG series and so on.
All of these products employ the inorganic passivation technology that enables high precision and high reliability.
In addition, our thin film based terminal technology does not involve any Ag (silver) and they are sulfur impervious.
The following diagram shows distinctive characteristics of these products and their relationships.

Higher precision : URG series
Higher operating temperature : RGT series, RGA series, RMA series (resistive networks)
High voltage: RGV series
High power : PRG series (long side terminal), HRG series (short side terminal)
Anti-surge : MRG series
Non-magnetic : NRG series
Audio grade : RS series

Relation map of thin film chip resistors

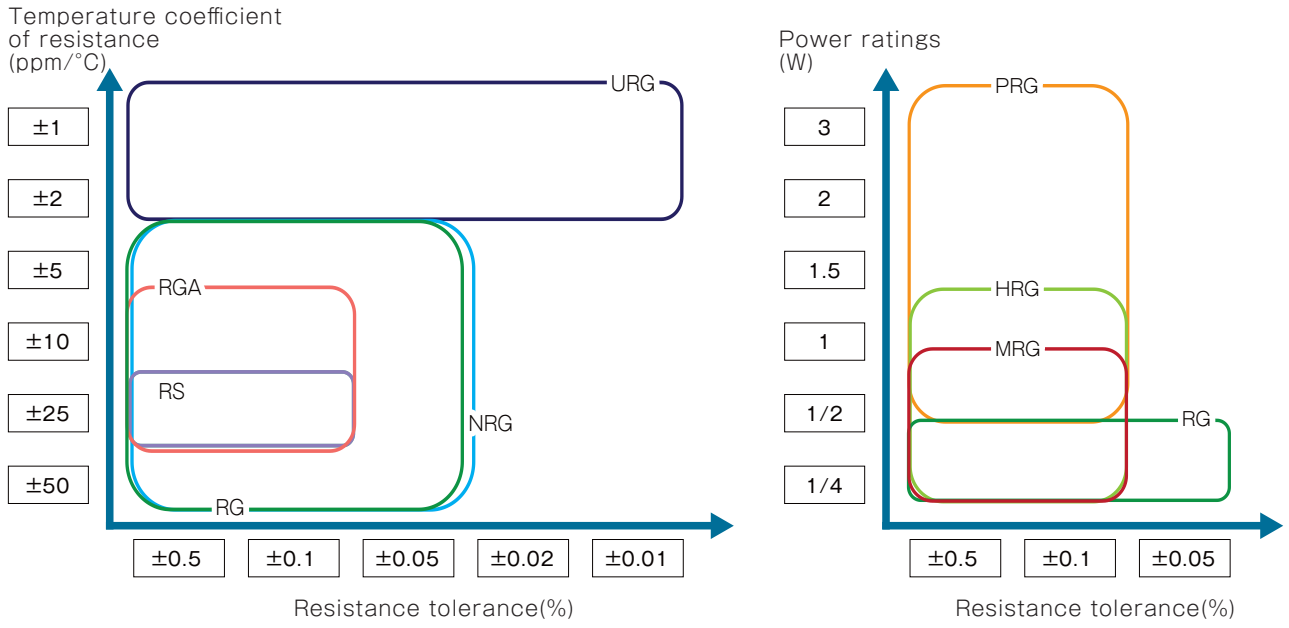


Map from discrete RG series to resistor networks



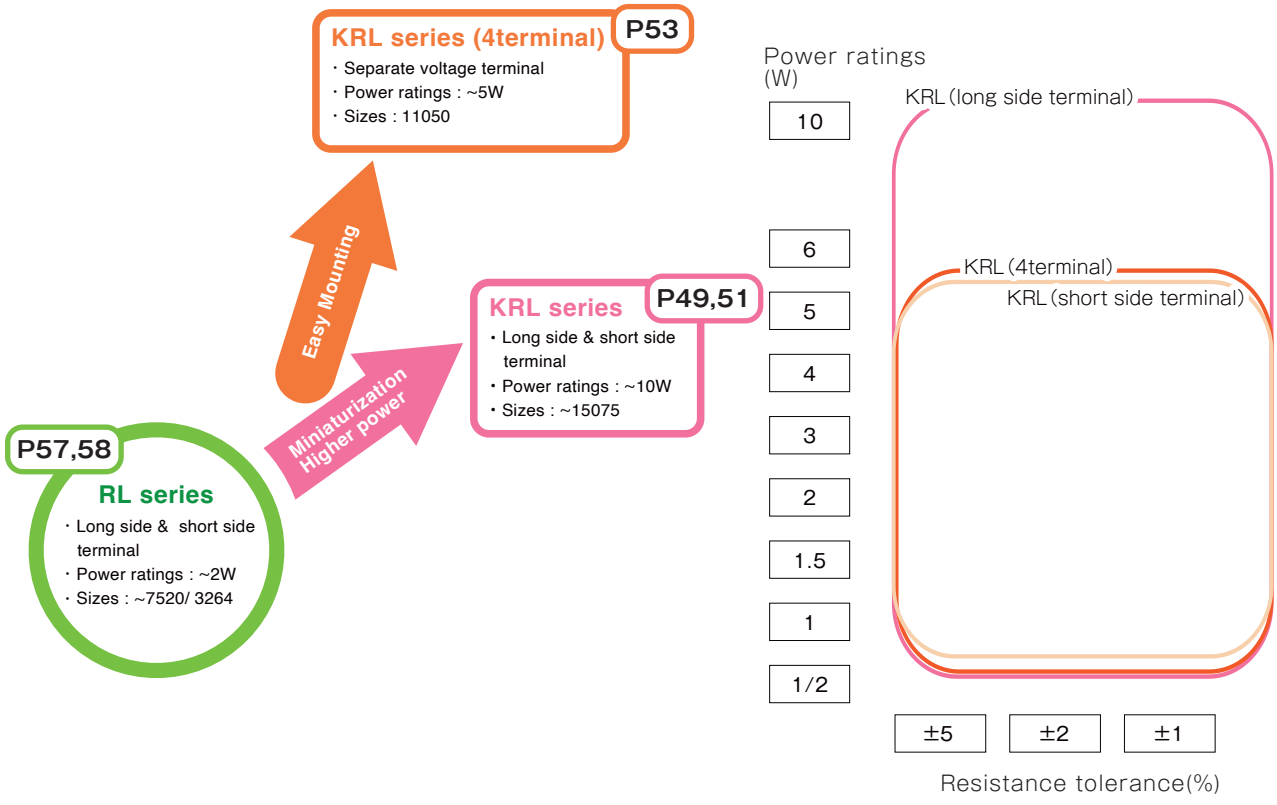
Thin film resistor map by performance

Thin film resistors are highly reliable and stable over long periods of time. The diagrams below show the matrix of Susumu's thin film resistors based on tolerance with TCR , and tolerance with power ratings.
The high power resistors are offered in two different terminal configurations; PRG series -long side terminal and HRG series - short side terminal, to meet your need for miniaturization using same power.



Current sensing chip resistors' relation map

The diagram below illustrates how we expanded our current sensing chip resistors in order to meet the need for miniaturization and high power ratings.
We also offer 4 terminal current sensor isolating voltage terminals, making it easier to mount on the board.
We will continue to expand current sensing chip resistor series corresponding the needs of the market.



E series resistance values (IEC designated series of resistance values)

series	Values														
E-6	1.0		1.5		2.2		3.3		4.7		6.8				
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2			
E-24	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0	3.3	3.6	3.9
	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1						
E-96	1.00	1.02	1.05	1.07	1.10	1.13	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.37	1.40
	1.43	1.47	1.50	1.54	1.58	1.62	1.65	1.69	1.74	1.78	1.82	1.87	1.91	1.96	2.00
	2.05	2.10	2.15	2.21	2.26	2.32	2.37	2.43	2.49	2.55	2.61	2.67	2.74	2.80	2.87
	2.94	3.01	3.09	3.16	3.24	3.32	3.40	3.48	3.57	3.65	3.74	3.83	3.92	4.02	4.12
	4.22	4.32	4.42	4.53	4.64	4.75	4.87	4.99	5.11	5.23	5.36	5.49	5.62	5.76	5.90
	6.04	6.19	6.34	6.49	6.65	6.81	6.98	7.15	7.32	7.50	7.68	7.87	8.06	8.25	8.45
	8.66	8.87	9.09	9.31	9.53	9.76									

Three-letter codes for resistance value (Codes for Marking in E96 series)

(1) A manufacturing date code: Refer to JIS C 5201-1.
(2) Three digits of number shall be marked on the protective coating. In this case, the three digits of code number shall be added at the end of type designation.

(Example) 4.99KΩ = 499 × 10^1

Marking: 68H
Type designation: RR0816P-4991-D-68H

code	E96 value	code	E96 value	code	E96 value	code	E96 value	code	E96 value	code	E96 value	code	E96 value	code	E96 value
01	100*	13	133	25	178	37	237	49	316	61	422	73	562	85	750*
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110*	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150*	30	200*	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	221	46	294	58	392	70	523	82	698	94	931
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130*	24	174	36	232	48	309	60	412	72	549	84	732	96	976

code for power of 10

code	power
A	10^0
H	10^1
C	10^2
D	10^3
E	10^4
F	10^5
R	10^{-1}
S	10^{-2}

* The resistance value duplicated in E24 series and in E96 series shall be manufactured in E24 series only.

Disclaimer and handling care of our products

Disclaimer

1. The contents of this catalogue are only for reference purposes and its contents may be changed without prior notification. Official specifications will be submitted to each customer. For ordering, please contact our sales representatives

2. The products listed in this catalogue are for general purpose electronic equipment. Please consult with us if you require specific qualities or reliability as in nuclear or aerospace applications.

3. When you incorporate our products in your design, please utilize them within their specified operating conditions such as rated power and recommended operating temperature. We cannot guarantee our products and cannot take responsibility for the failure of our products if they are used under improper conditions or outside of the parameters of our specified conditions.

4. No part of this publication may be reproduced by any means without the permission of Susumu Co. ltd.

Handling and care

< Consideration during mounting >

(1) Before, during and after mounting, take care not to damage the protective coating of the products. Damage to the protective coating may result in weakening the humidity tolerance.

(2) When using a soldering iron, the heat should be applied to the land pattern not directly to the component. The tip of the soldering iron should not touch the resistors directly. In addition, when the tip of the soldering iron is hot, please do soldering as quick as possible(Below 350℃ within 3 seconds).

(3) Flux residue can cause corrosion and electro-migration resulting in the deterioration of humidity tolerance. If you utilize highly activated flux, such as flux containing chlorine, please consult with us prior to usage.

(4) Ionized foreign material contamination or residue can also cause corrosion and electro-migration resulting in the deterioration of humidity tolerance. Do not touch the components with bare hands prior to or after mounting.

(5) If the soldering operation takes place at very high temperatures and for a prolonged period of time, the terminal may dissolve into the solder.

(6) Coating, sealing and embedding with resin or polymer
When mounted components are coated ,sealed with resin or polymer, or embedded into resin or polymer, the resin/polymer selection must consider heat tolerance, humidity tolerance, mechanical properties, and chemical or ion compositions. Certain resin materials may cause resistance drift during the curing process. Please get in touch with us in advance if you are using resin.

< Storage >

(1)Storage condition

When resistors are stored under sealed conditions with oxygen-depleting packing material, it is rare, but depending on the environment, the gas generated by the oxygen-depleting chemical may cause resistance change.

< Operating environment; condition>

(1)If these components are utilized for unusual conditions, the reliability and characteristics should be verified in advance. Such conditions include:

①Exposure of the component to water, salt water, oils, acids, alkaline, or solvents

②Exposure of the component to direct sunlight, outdoor weather conditions, or heavy dust

③Exposure to frost

④Possible exposure to corrosive air or gas such as a marine atmosphere, HCl, Cl_2, H_2S, NH_3, SO_2, and NOx.

(2)Usage under high temperatures and high humidity

①When components are used under high temperature conditions, assess the potential temperatures surrounding the components considering the other heat-producing neighboring components, and regulate your power usage following the specified derating curve.

②If the components are used under high humidity conditions or at temperatures below the dew point, the products can experience positive resistance drift or even an open circuit.

(3)Use our products under the rated power when the pulse current or voltage is applied. The peak voltage of the pulse should remain under the rated voltage.

MEMO

Thin film surface mount resistors

Metal thin film chip resistors
(the highest reliability and precision)
URG series

Metal thin firm chip resistors
(the highest precision)
RG series

Metal thin film chip resistors
(wide temperature range)
RGT series

Metal thin film chip resistors
(high voltage operation)
RGV series

Non-magnetic metal thin film chip resistors
NRG series

Audio thin film chip resistors
(high precision)
RS series

High power thin film chip resistors
(long side terminal)
PRG series

High power thin film chip resistors
(short side terminal)
HRG series

Anti-surge thin film chip resistors
MRG series

High temperature thin film chip resistors
RGA series

Metal thin film chip resistors
(precision)
RR series

Metal thin film trimmable chip resistors
RT series

Metal thin film chip resistor networks
RM series

High temperature metal thin film resistor networks
RMA series



Metal thin film chip resistors
(the highest reliability and precision)

■URG series **AEC-Q200 Compliant**

Features

- The tightest resistance tolerance: +/-0.01%
- The smallest temperature coefficient of resistance: ±1ppm/℃
- Long term stability with inorganic passivation
- Thin film structure enabling low noise and anti-sulfur

Applications

- Industrial measurement instrumentaion, electrical scales
- High precision sensors, medical electronics

◆Part numbering system

URG 2012 L - 102 - L - T1

- URG: Series code
- 2012: Size: URG1608, URG2012, URG3216, URG5025, URG6432
- L: Temperature coefficient of resistance
- 102: Nominal resistance value (E-24: 3 digit, E-96: 4 digit, URG3216, URG5025, URG6432: all 4 digit)
- L: Resistance tolerance
- T1: Packaging quantity: T1(1,000pcs), T05(500pcs), T01(100pcs)

◆Electrical Specification

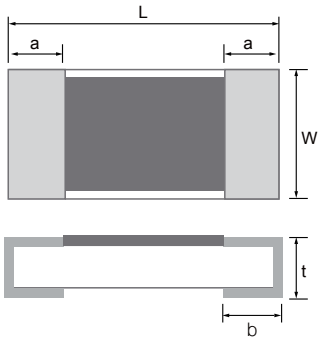
Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) Resistance tolerance					Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
			±0.01% (L)	±0.02% (P)	±0.05% (W)	±0.1% (B)	±0.5% (D)				
URG1608	1/16W	±1(K) *1 ±2(L) *2	250 ≦R ≦7.5K	100≦R≦7.5k				100V	E24, E96	-55℃ ~ 155℃	T1 T05 T01
URG2012	1/10W	±1(K) *1 ±2(L) *2	250 ≦R ≦36K	100≦R≦36k				150V			
URG3216	1/4W	±1(K) *1 ±2(L) *2	250 ≦R ≦68K	100≦R≦68k				200V			
URG5025	1/2W	±1(K) *1 ±2(L) *2	250 ≦R ≦100K	100≦R≦150k				300V			
URG6432	3/4W	±1(K) *1 ±2(L) *2	250 ≦R ≦100K	100≦R≦200k				300V			

*1: Applicable TCR K (±1.0) at temperature range 25℃~ 65℃
Applicable TCR K (±1.5) at temperature range -20℃~ 25℃, 65℃~125℃

*2: Applicable TCR L at temperature range -20℃~ 125℃

***Contact us for requirements not listed in above table.**

◆Dimensions



Type	Size (inch)	L	W	a	b	t
URG1608	0603	1.60±0.20	0.80+0.25/−0.20	0.30±0.20	0.30±0.20	0.40+0.15/−0.10
URG2012	0805	2.00±0.20	1.25+0.25/−0.20	0.40±0.20	0.40±0.20	0.40+0.15/−0.10
URG3216	1206	3.20±0.20	1.60±0.25	0.50±0.25	0.50±0.20	0.40+0.15/−0.10
URG5025	2010	5.00±0.20	2.50±0.25	0.60±0.25	0.60±0.25	0.45±0.10
URG6432	2512	6.40+0.20/−0.40	3.20±0.25	0.75±0.25	0.80±0.20	0.45±0.20

(unit : mm)

◆Reliability specification

Test items	Condition (test methods (MIL-PRF-55342/JIS C5201-1)	Standard
Short time overload	2.5 x rated voltage,*1 5seconds	±(0.02%+0.01Ω)
Life (biased)	70℃, rated voltage,*1 90min on 30min off, 2000hours	±(0.02%+0.01Ω)(R≧250Ω)
		±(0.05%+0.01Ω)(R<250Ω)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.05%+0.01Ω)
Temperature shock	-65℃ (15min) ~ 150℃ (15min) 100cycles	±(0.02%+0.01Ω)
High temperature exposure	155℃, no bias, 1000hours	±(0.05%+0.01Ω)
Resistance to soldering heat	235±5℃, 30 seconds (reflow), (by MIL-PRF-55342)	±(0.01%+0.01Ω)

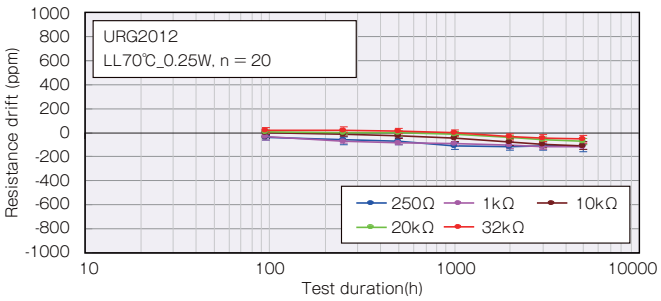
*1 Rated voltage is given by E= $\sqrt{R \times P}$
E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

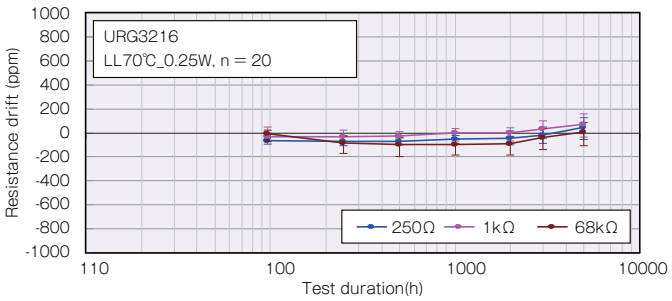
Metal thin film chip resistors
(the highest reliability and precision)

■URG series

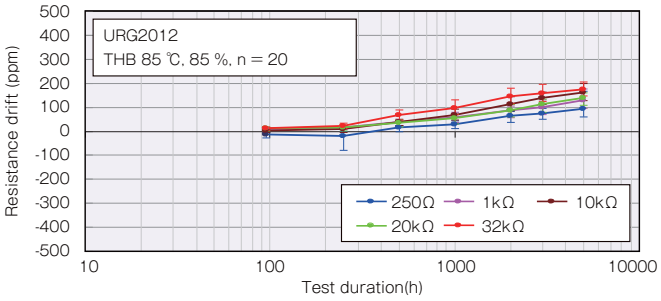
◆Reliability test data

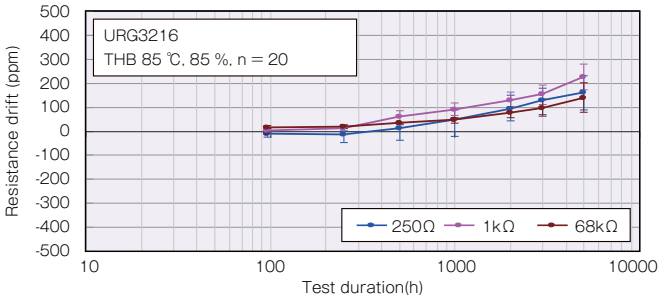
○Biased life test



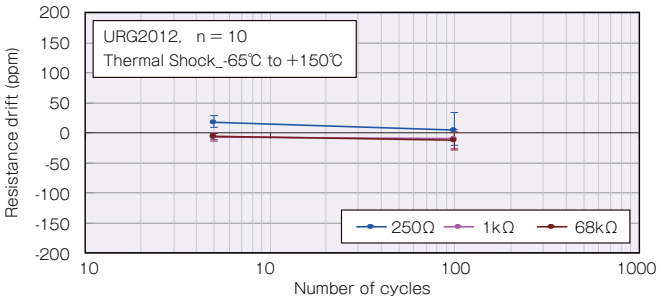


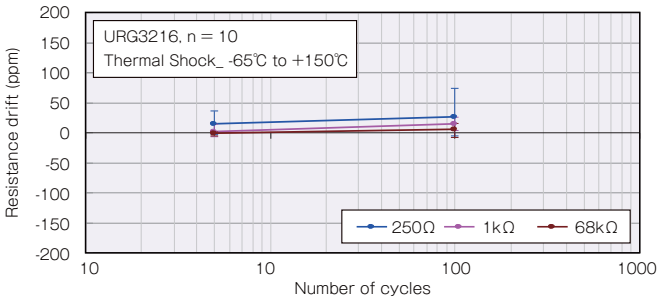
○High temperature high humidity (biased)



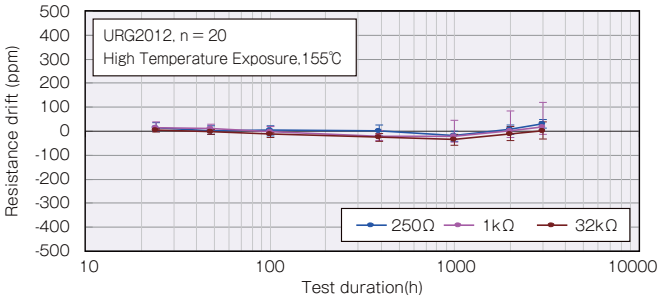


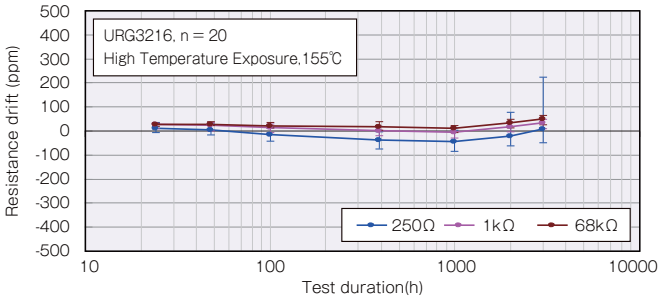
○Temperature shock





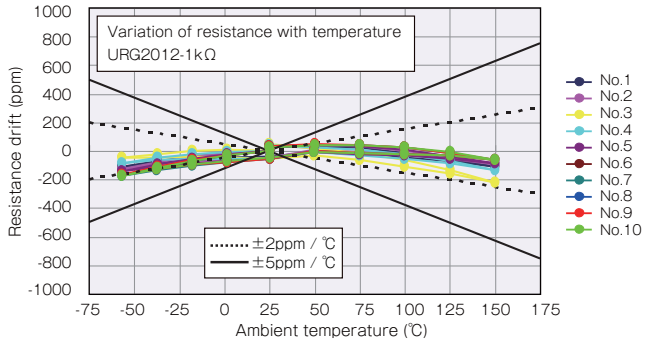
○High temperature exposure

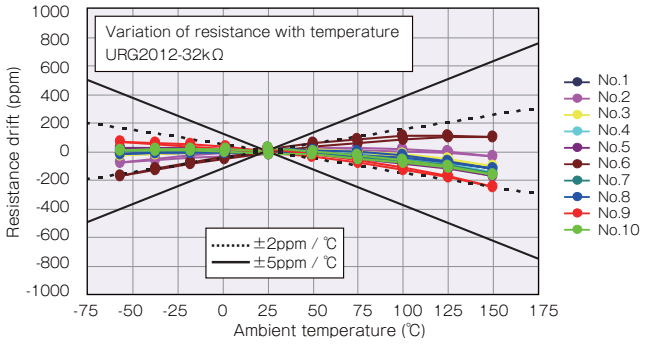




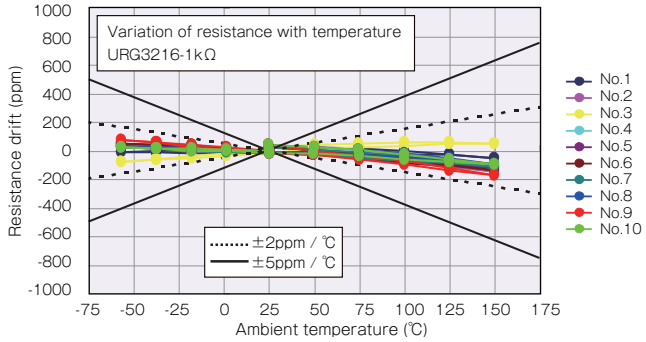
◆Temperature coefficient of Resistance

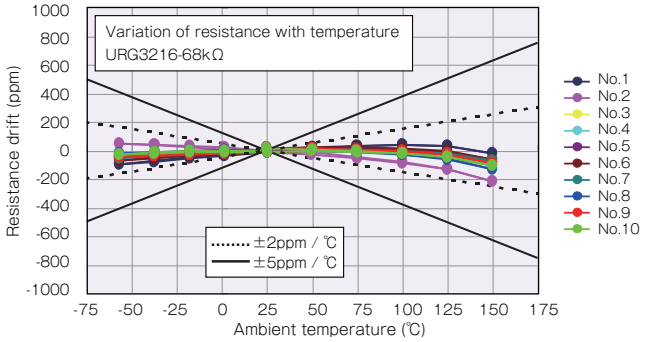
○URG2012



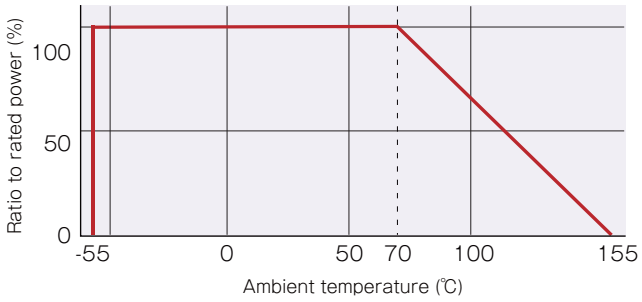


○URG3216





◆Derating Curve





Lead free　Halogen free　RoHS Compliance

Metal thin film chip resistors
(the highest precision)

■RG series　　**AEC-Q200 Compliant**

Features

- Long term stability with inorganic passivation
- Less than ±0.1% drift after 10000 hours of reliability test
- High precision resistance tolerance: ±0.05%, very small TCR: ±5ppm/℃
- Thin film structure enabling low noise and anti-sulfur

Applications

- Automotive electronics
- Industrial measurement instrumentation, industrial machines
- Various sensors, medical electronics

◆Part numbering system

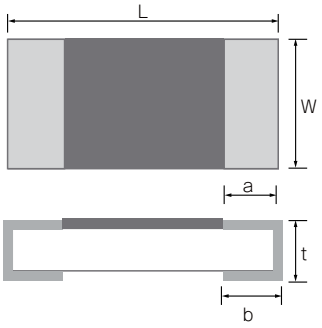
RG　1608　N - 102 - B - T5

- RG: Series code
- 1608: Size: RG0603, RG1005, RG1608, RG2012, RG3216
- N: Temperature coefficient of resistance
- 102: Nominal resistance value (E-24: 3 digit, E-96: 4 digit, RG3216: all 4 digit)
- B: Resistance tolerance
- T5: Packaging quantity: T5(5,000pcs), T10(10,000pcs)

◆Electrical Specification

Type	Power ratings			Temperature coefficient of resistance	Resistance range (Ω) Resistance tolerance (%)			Maximum voltage	Resistance value series	Operating temperature	Pakaging quantity
	Low	Regular	High	(ppm/°C)	±0.05% (W)	±0.1% (B)	±0.5%(D)				
RG0603	1/20W	1/16W	—	±10(N)	—	100≦R≦22k		30V	E-24, E-96	-55℃ ~ 155℃	T10
				±25(P)							
				±50(Q)		—	47≦R≦56k				
				±100(R)			10≦R<47				
RG1005	1/32W	1/16W	1/8W	±5(V)	100≦R<3k			75V			T5 T10
				±10(N)	47≦R≦100k						
				±25(P)	47≦R≦150k						
				±100(R)	—	—	10≦R<47				
RG1608	1/16W	1/10W	1/6W	±5(V)	100≦R<5.1k			100V			T5
				±10(N)	47≦R≦274k						
				±25(P)	47≦R≦274k	47≦R≦1M					
				±50(Q)	—	—	10≦R<47				
RG2012	1/10W	1/8W	1/4W	±5(V)	100≦R<10.2k			150V			
				±10(N)	47≦R≦475k						
				±25(P)	47≦R≦475k	47≦R≦2.7M					
				±50(Q)	—	—	10≦R<47				
RG3216	1/8W	1/4W	—	±5(V)	100≦R≦33.2k			200V			
				±10(N)	47≦R≦1M						
				±25(P)	47≦R≦5.1M						
				±50(Q)	—	—	10≦R<47				

◆Dimensions



Type	Size (inch)	L	W	a	b	t
RG0603	0201	0.60±0.05	0.30±0.05	0.13±0.05	0.15±0.05	0.23±0.03
RG1005	0402	1.0±0.05	0.50±0.05	0.20±0.10	0.25±0.05	0.35±0.05
RG1608	0603	1.60±0.20	0.80±0.20	0.30±0.20	0.30±0.20	0.40±0.10
RG2012	0805	2.00±0.20	1.25±0.20	0.40±0.20	0.40±0.20	0.40±0.10
RG3216	1206	3.20±0.20	1.60±0.20	0.50±0.25	0.50±0.20	0.40±0.10

(unit : mm)

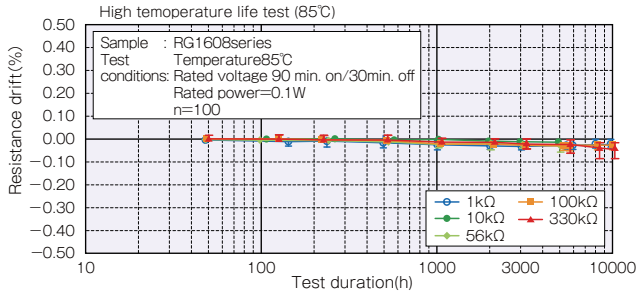
◆Reliability specification

Test Items	Condition (test methods)	Low		Regular		High		Typical
		≦47Ω	≧47Ω	≦47Ω	≧47Ω	≦47Ω	≧47Ω	Low
Short time overload	2.5 x rated voltage,*1 5 seconds	±(0.05%+0.01Ω)	±(0.05%+0.01Ω)	±(0.05%+0.01Ω)	±(0.05%+0.01Ω)	—	±(0.05%+0.01Ω)	±(0.01%)
Life (biased)	70℃, rated voltage,*1 90min on 30min off, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)	±(0.5%+0.05Ω)	±(0.25%+0.05Ω)	—	±(0.5%+0.01Ω)	±(0.01%)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)	±(0.5%+0.05Ω)	±(0.25%+0.05Ω)	—	±(0.5%+0.01Ω)	±(0.05%)
Temperature shock	-55℃ (30min) ~ 125℃ (30min) 1000cycles	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)	—	±(0.1%+0.01Ω)	±(0.01%)
High temperature exposure	155℃, no bias, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)	—	±(0.1%+0.01Ω)	±(0.01%)
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.05%+0.01Ω)	±(0.05%+0.01Ω)	±(0.05%+0.01Ω)	±(0.05%+0.01Ω)	—	±(0.05%+0.01Ω)	±(0.01%)

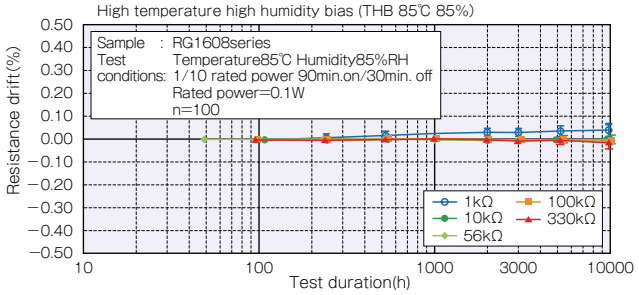
*1 Rated voltage is given by E= $\sqrt{R \times P}$ E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆10000 hour reliability test data

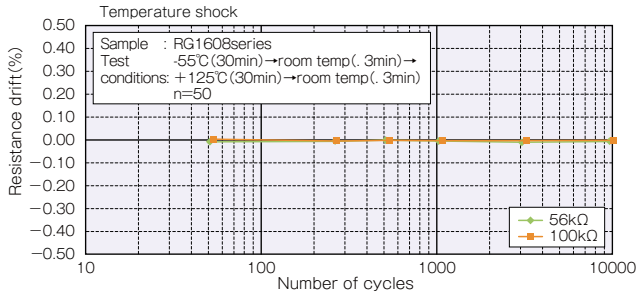
○Biased life test



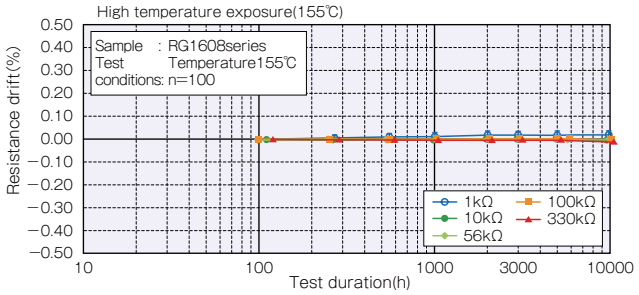
○High temperature high humidity (biased)



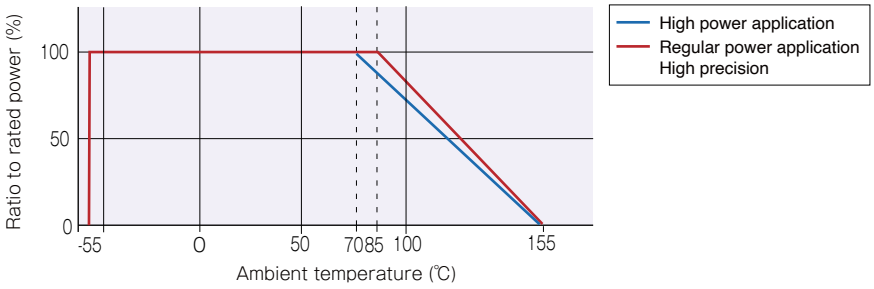
○Temperature shock



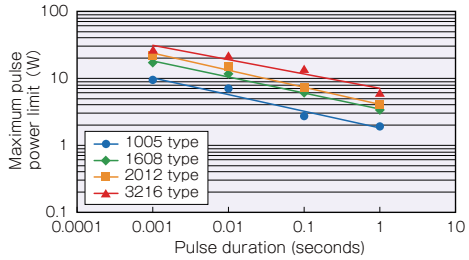
○High temperature exposure



◆Derating Curve



◆Maximum pulse power limit



Test procedure

Voltage pulse is applied to the test samples mounted on the test board.
After each pulse, resistance drift is measured. Pulse voltage is increased until the drift exceeds +/-0.5%.
The power at that voltage is defined as the maximum pulse power.



Metal thin film chip resistors
(wide temperature range)

■RGT series **AEC-Q200 Compliant**

Lead free Halogen free RoHS Compliance

Features

- Wide temperature operation (Upper category temperature :175°C)
- Long term stability with inorganic passivation
- Resistance tolerance : ±0.1% , TCR : ±10ppm/°C
- Thin film structure enabling low noise and anti-sulfur

Applications

- Automotive electronics
- Industrial measurement instrumentation, industrial machines
- Wide temperature operation machines

◆Part numbering system

RGT 2012 N - 105 - B - T5

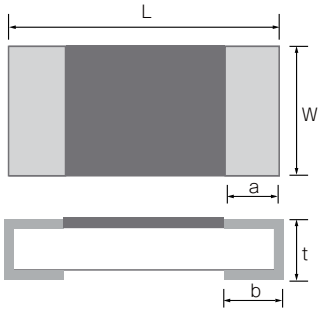
- RGT: Series code
- 2012: Size: RGT1005, RGT1608, RGT2012, RGT3216
- N: Temperature coefficient of resistance
- 105: Nominal resistance value (E-24: 3 digit, E-96: 4 digit, RGT3216 : all 4 digit)
- B: Resistance tolerance
- T5: Packaging quantity : T5(5,000pcs) T10(10,000pcs)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/℃)	Resistance range(Ω) Resistance tolerance ±0.1%(B)	±0.5%(D)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
RGT1005	1/32W	±10(N)	47≦R≦100k		50V	E-24, E-96	-55℃~ 175℃	T5 T10*1
		±25(P)	47≦R≦150k					
RGT1608	1/16W	±10(N)	47≦R≦270k		100V			T5
		±25(P)	47≦R≦1M					
RGT2012	1/10W	±10(N)	47≦R≦470k		150V			
		±25(P)	47≦R≦2.7M					
RGT3216	1/8W	±10(N)	47≦R≦1M		200V			
		±25(P)	47≦R≦5.1M					

*1 : Resistance tolerance ± 0.5% (D) of RGT1005 is available only at T10

◆Dimensions



Type	Size (inch)	L	W	a	b	t
RGT1005	0402	1.00+0.1/-0.05	0.50±0.05	0.20±0.10	0.25±0.05	0.35±0.05
RGT1608	0603	1.60±0.20	0.80+0.25/-0.20	0.30±0.20	0.30±0.20	0.40+0.15/-0.10
RGT2012	0805	2.00±0.20	1.25+0.25/-0.20	0.40±0.20	0.40±0.20	0.40+0.15/-0.10
RGT3216	1206	3.20±0.20	1.60±0.25	0.50±0.25	0.50±0.20	0.40+0.15/0.10

(unit : mm)

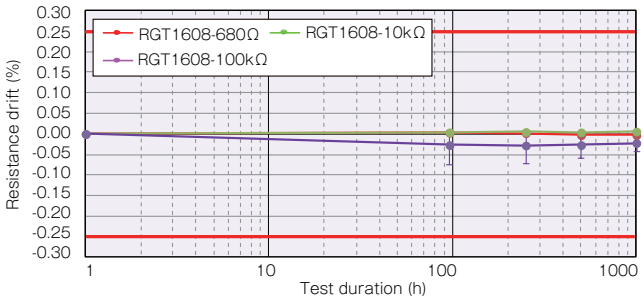
◆Reliability specification

Test items	Condition(IEC60115-1/JIS C5201-1)	Standard
Short time overload	2.5 x rated voltage,※1 5 seconds	±(0.05%+0.01Ω)
Life (biased)	125℃, rated voltage※1, 90min. ON/ 30min. OFF, 1000hours	±(0.25%+0.05Ω)
High temperature high humidity	85℃、85%RH, 1/10 of rated power, 90min. ON/ 30min. OFF, 1000hours	±(0.25%+0.05Ω)
Temperature shock	-55℃ (30min) ~ 125℃(30min) 1000 cycles	±(0.1%+0.01Ω)
High temperature exposure	175℃, no baias, not mounted, 1000h	±(0.1%+0.01Ω)
Resistance to soldering heat	260±5℃, 10seconds (reflow)	±(0.05%+0.01Ω)

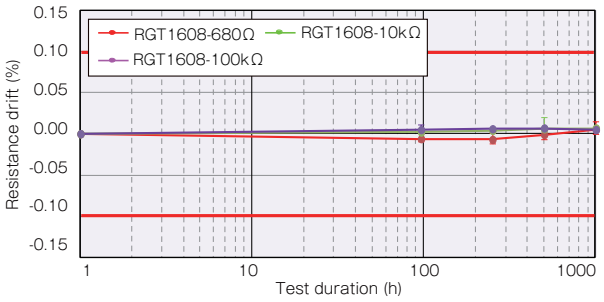
*1 Rated voltage is given by E= $\sqrt{R \times P}$ E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆Reliability test data

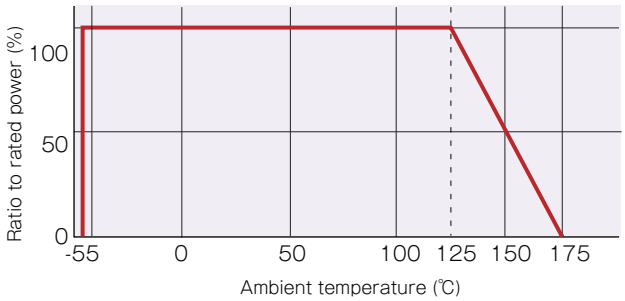
◯Biased life test



◯High temperature exposure



◆Derating Curve





Metal thin film chip resistors
(high voltage operation)

■RGV series **AEC-Q200 Compliant**

Features

- High voltage operation is possible because the limiting element voltage is high. (RGV3225 1000V)
- Long term stability with inorganic passivation.
- Resistance tolerance : ±0.1% , TCR : ±25 ppm/℃
- Thin film structure enabling low noise and anti-sulfur

Applications

- Automotive electronics
- Industrial measurement instrumentation, Industrial machines.
- High voltage circuit and equipment.

◆Part numbering system

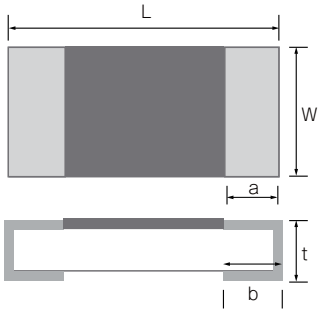
RGV 3216 P - 2004 - B - T5

- RGV — Series code
- 3216 — Size : RGV3216, RGV3225
- P — Temperature coefficient of resistance
- 2004 — Nominal resistance value(all 4 digit)
- B — Resistance tolerance
- T5 — T1(1,000pcs) T5(5,000pcs)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/℃)	Resistance range(Ω) Resistance tolerance ±0.1%(B)	±0.5%(D)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
RGV3216	1/4W	±5(V)	2MΩ		700V	E-24, E-96	-55℃~ 155℃	T1 T5
		±25(P)	120KΩ≦R≦3MΩ					
		±50(Q)						
RGV3225	1/3W	±25(P)	120KΩ≦R≦4.3MΩ		1000V			
		±50(Q)						

◆Dimensions



Type	Size (inch)	L	W	a	b	t
RGV3216	1206	3.20±0.20	1.60±0.25	0.50±0.25	0.50±0.20	0.40+0.15/-0.1
RGV3225	1210	3.20±0.20	2.50±0.25	0.50±0.25	0.50±0.20	0.40+0.15/-0.1

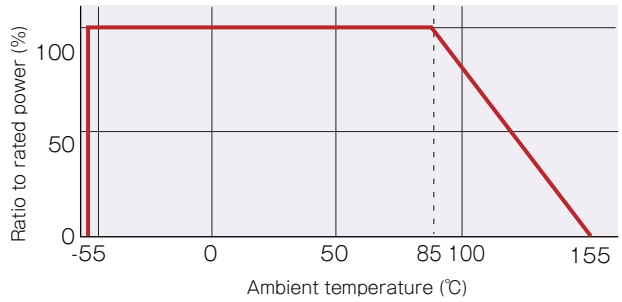
(unit : mm)

◆Reliability specification

Test items	Condition(IEC60115-1/JIS C5201-1)	Standard
Life (Biased)	85℃, rated voltage ※1, 90min. ON/ 30min. OFF, 1000hours	±(0.05%+0.05Ω)
High temperature high humidity	85℃、85%RH, 1/10 of rated power, 90min. ON/ 30min. OFF, 1000hours	±(0.1%+0.05Ω)
Temperature shock	-55℃ (30min) ~ 125℃(30min) 1000 cycles	±(0.1%+0.01Ω)
High temperature exposure	155℃, no bias, not mounted, 1000h	±(0.1%+0.01Ω)
Resistance to soldering heat	260±5℃, 10seconds (reflow)	±(0.05%+0.01Ω)

*1 Rated voltage is given by E= $\sqrt{R \times P}$ E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆Derating Curve





Non-magnetic metal thin film chip resistors

■NRG series

Features

- Thin film chip resistors using non-magnetic materials
- Long term stability with inorganic passivation
- High precision resistance tolerance: ±0.05%, very small TCR: ±5ppm/°C
- Thin film structure enabling low noise and anti-sulfur

Applications

- Medical electronics, industrial measurement instrumentation
- equipment/devices under magnetic field

◆Part numbering system

NRG 2012 N - 104 - W - T1

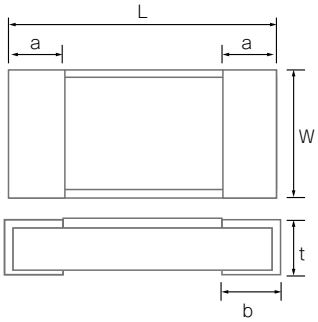
- NRG: Series code
- 2012: Size: NRG1005,NRG1608, NRG2012, NRG3216
- N: Temperature coefficient of resistance
- 104: Nominal resistance value (E-24: 3 digit, E-96: 4 digit, NRG3216: all 4 digit)
- W: Resistance tolerance
- T1: Packaging quantity: T5(5,000pcs) T10(10,000pcs)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/°C)	Resistance range(Ω) Resistance tolerance ±0.05% (W)	±0.1%(B)	±0.5%(D)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
NRG1005	1/16W	±5(V)	100≦R≦3k		—	75V	E-24,E-96	-55℃ ~155℃	T5 T10*1
		±10(N)	47≦R≦100k						
		±25(P)	47≦R≦150k						
		±100(R)	—		10≦R≦47				
NRG1608	1/10W	±5(V)	100≦R<5.1k			100V			T5
		±10(N)	47≦R≦270k						
		±25(P)	47≦R≦270k	47≦R≦332k	47≦R≦360k				
		±50(Q)	—	—	10≦R<47				
NRG2012	1/8W	±5(V)	100≦R<10.2k			150V			
		±10(N)	47≦R≦475k						
		±25(P)	47≦R≦475k	47≦R≦1M					
		±50(Q)	—	—	10≦R<47				
NRG3216	1/4W	±5(V)	100≦R<33.2k			200V			
		±10(N)	47≦R≦1M						
		±25(P)	47≦R≦1M						
		±50(Q)	—	—	10≦R<47				

*1 : Resistance tolerance ± 0.5% (D) of NRG1005 is available only at T10

◆Dimensions



Type	Size (inch)	L	W	a	b	t
NRG1005	0402	1.00±0.05	0.50±0.05	0.20±0.10	0.25±0.05	0.35±0.05
NRG1608	0603	1.60±0.20	0.80+0.25/−0.20	0.30±0.20	0.30±0.20	0.40+0.15/−0.10
NRG2012	0805	2.00±0.20	1.25+0.25/−0.20	0.40±0.20	0.40±0.20	0.40+0.15/−0.10
NRG3216	1206	3.20±0.20	1.60±0.25	0.50±0.25	0.50±0.20	0.40+0.15/−0.10

(unit : mm)

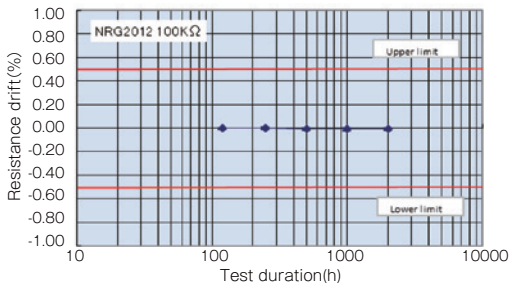
◆Reliability specification

Test items	Condition (test methods (MIL-PRF-55342/JIS C5201-1)	Standard
Short time overload	2.5 x rated voltage,*1 5seconds	±(0.5%+0.01Ω)
Life (biased)	70℃, rated voltage,*1 90min on 30min off, 1000hours	±(0.5%+0.05Ω)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.5%+0.01Ω)
Temperature shock	-55℃ (30min) ~ 125℃ (30min) 1000 cycles	±(0.5%+0.01Ω)
High temperature exposure	155℃, no bias, 1000hours	±(0.5%+0.01Ω)
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.05%+0.01Ω)

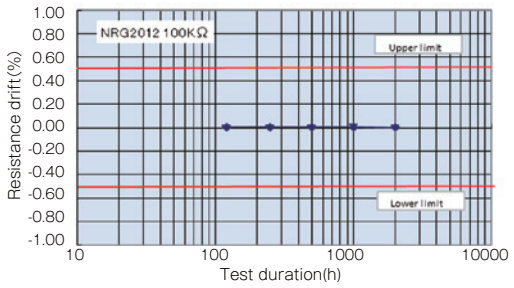
*1 Rated voltage is given by $E=\sqrt{R \times P}$ E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆Reliability test data

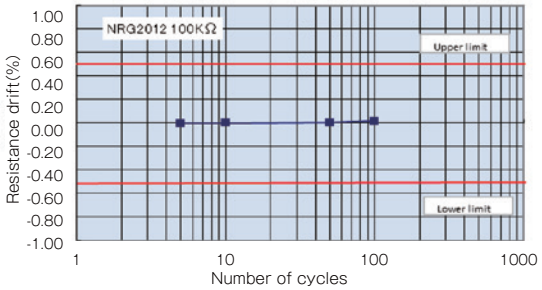
○Biased life test



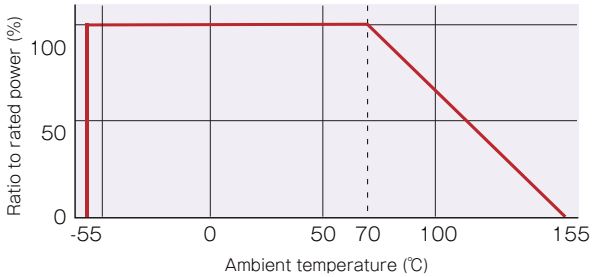
○High temperature high humidity (biased)



○Temperature shock



◆Derating Curve





Audio thin film chip resistors
(high precision)

■RS series **AEC-Q200 Compliant**

Features

- Improved low noise thin film character even further
- Choice among the same resistance/size according to the user's sound preference
- Precision resistance tolerance: ±0.1%, very small TCR: ±25ppm/°C

Applications

- High quality audio equipment
- Automotive audio equipment
- Mobile audio equipment , smartphones

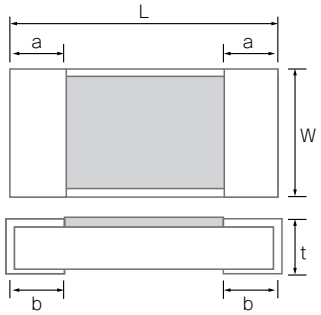
◆Part numbering system

RS 1005P - 102 - B - T10 - 3

◆Electrical Specification

Type	Power ratings		Temperature coefficient of resistance	Resistance range(Ω) Resistance tolerance		Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
	Low	Regular	(ppm/°C)	±0.1%(B)	±0.5%(D)				
RS1005	1/32W	1/16W	±25(P)	47≦R≦100K		75V	E-6	-55℃ ~ 155℃	T5 T10
RS2012	1/10W	1/8W	±25(P)	47≦R≦100K		150V			T5

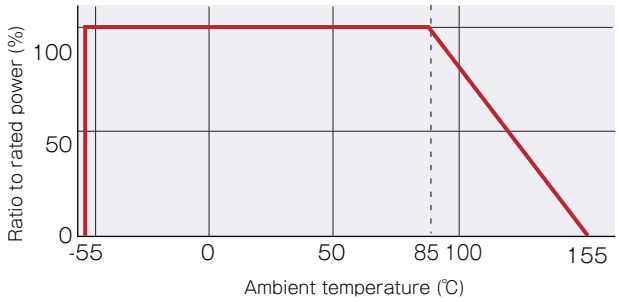
◆Dimensions



Type	Size (inch)	L	W	a	b	t
RS1005	0402	1.00+0.10/-0.05	0.50±0.10	0.20±0.10	0.25±0.05	0.35±0.05
RS2012	0805	2.00±0.20	1.25+0.25/-0.20	0.40±0.20	0.40±0.20	0.40+0.15/-0.10

(unit : mm)

◆Derating Curve





High power thin film chip resistors
(long side terminal)

■PRG series **AEC-Q200 Compliant**

Lead free Halogen free RoHS Compliance

Features

- Long side terminal enabling higher power capability
- Significantly larger power handling capability than conventional same size resistors
  Size: 3216 ~ 6432, power ratings: 0.5 ~ 3.0W, Resistance range: 2.5 ~ 250KΩ
- Precision resistance tolerance: ±0.1%, very small TCR: ±25ppm/°C
- Thin film structure enabling low noise and anti-sulfur

Applications

- Automotive electronics
- DC motor, inverters
- Robotics, Industrial control system

◆Part numbering system

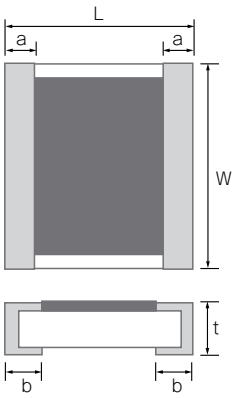
PRG 3216 P - 1001 - B - T5

- PRG — Series code
- 3216 — Size: PRG3216, PRG5025, PRG6432
- P — Temperature coefficient of resistance
- 1001 — Nominal resistance value (E-24, E-96: all 4 digit)
- B — Resistance tolerance
- T5 — Packaging quantity: T4(4,000pcs) (PRG6432, PRG5025) T5(5,000pcs) (PRG3216)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) Resistance tolerance		Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
		(ppm/°C)	±0.1% (B)	±0.5% (D)				
PRG3216	1.0W	±25(P)	47≦R≦100k	10≦R≦100k	150V	E-24, E-96	-55℃ ~ 155℃	T5
		±50(Q)		2.5≦R≦100k				
PRG5025	1.5W ~ 2.0W	±25(P)	47≦R≦200k	10≦R≦200k	200V			T4
		±50(Q)		2.5≦R≦200k				
PRG6432	2.0W ~ 3.0W	±25(P)	47≦R≦250k	10≦R≦250k	400V			
		±50(Q)		2.5≦R≦250k				

◆Dimensions



Type	Size (inch)	W	L	a	b	t
PRG3216	1206	3.20+0.40/-0.20	1.60±0.20	0.30±0.20	0.35±0.20	0.45+0.15/-0.10
PRG5025	2010	5.00±0.20	2.50±0.20	0.55±0.20	0.60±0.20	0.45+0.15/-0.10
PRG6432	2512	6.40+0.20/-0.40	3.20±0.20	0.40±0.20	0.55±0.20	0.45+0.15/-0.10

(unit : mm)

◆Reliability specification

Test items	Condition (test methods (JIS C5201-1)	Standard	
		≦47Ω	≧47Ω
Life (biased)	70℃, rated voltage,*1 90min on 30min off, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
Temperature shock	-55℃ (30min) ~ 125℃ (30min) 1000cycles	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
High temperature exposure	155℃, no bias, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.1%+0.01Ω)	±(0.05%+0.01Ω)

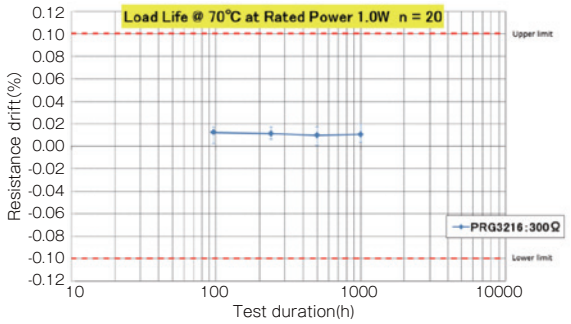
*1 Rated voltage is given by $E=\sqrt{R \times P}$
E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

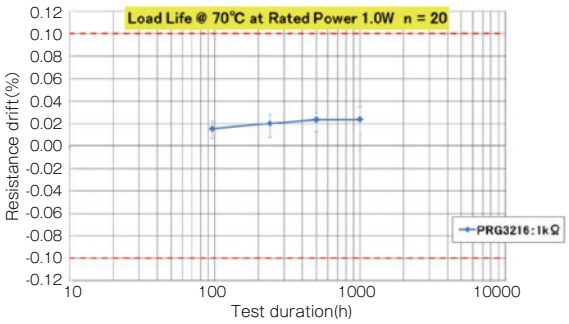
High power thin film chip resistors
(long side terminal)

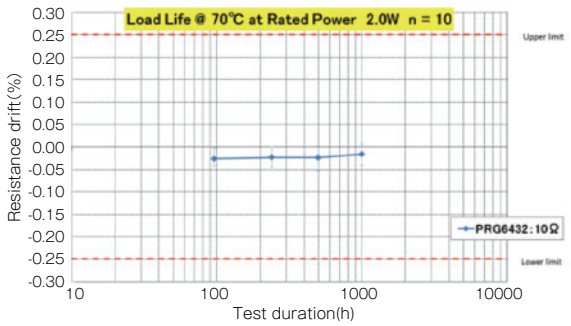
■PRG series

◆Reliability test data

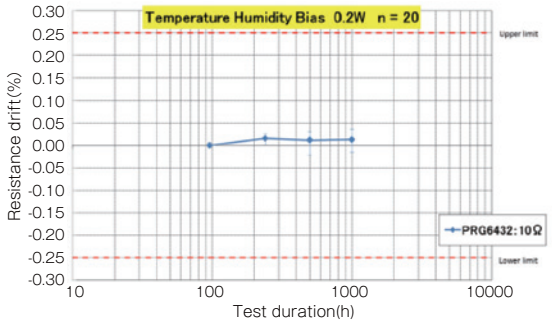
○Biased life test

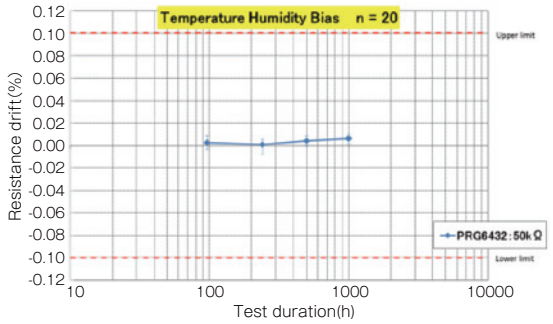


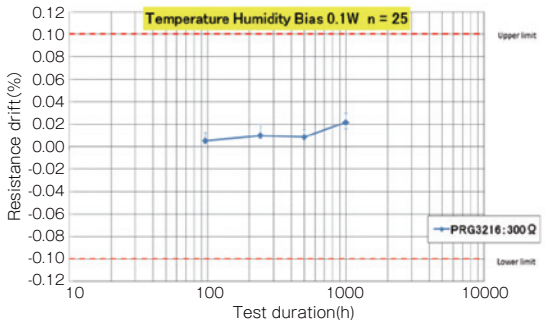


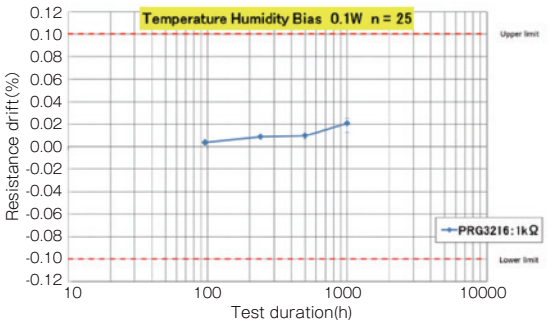


○High temperature high humidity (biased)

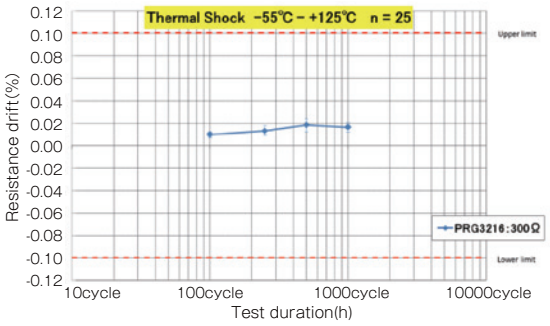


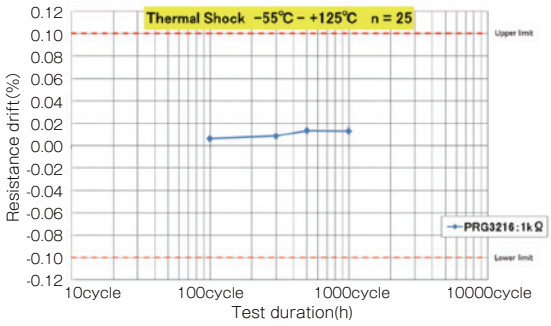


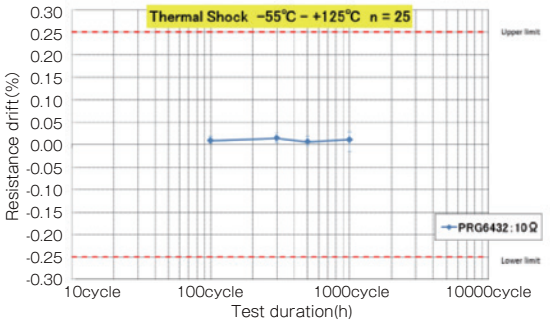


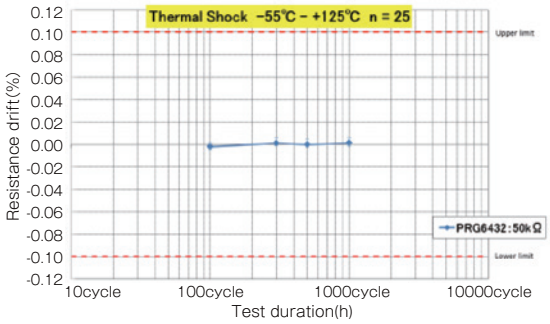


◯Temperature shock

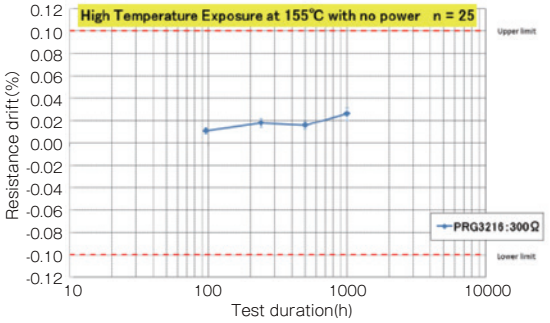


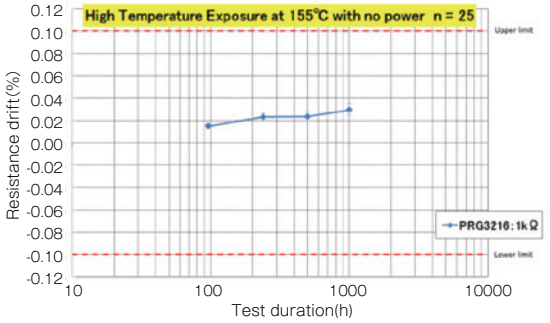


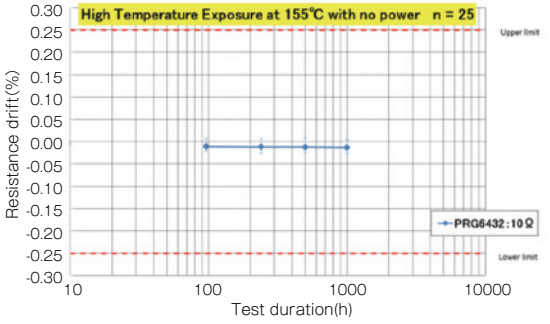


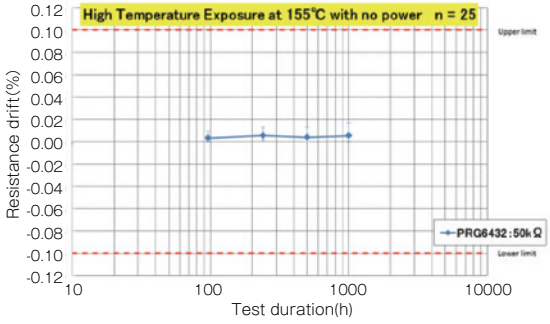


◯High temperature exposure



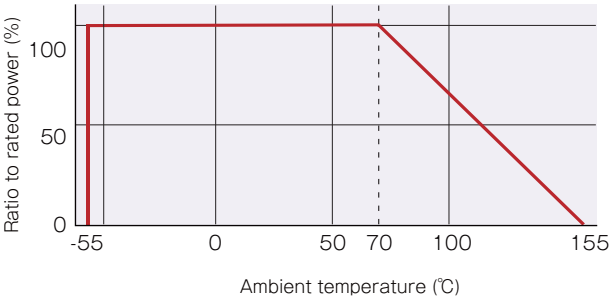




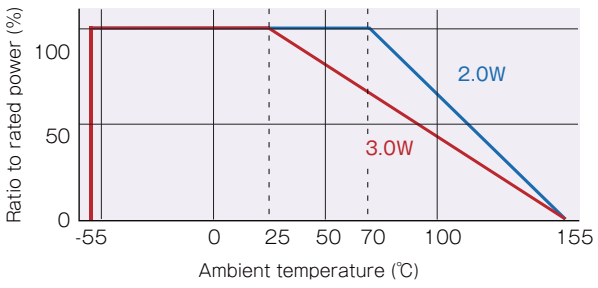


◆Derating Curve

◯PRG3216



◯PRG6432





High power thin film chip resistors
(short side terminal)

■HRG series **AEC-Q200 Compliant**

Lead free Halogen free RoHS Compliance

Features

- Wider bottom terminal enabling higher power capability (short side terminal)
- Significantly larger power handling capability than existing same size resistors
  Size: 3216, Power rating: 1.0W, Resistance range: 10 ~ 100KΩ
- Precision resistance tolerance: ±0.1%, very small TCR: ±25ppm/°C
- Thin film structure enabling low noise and anti-sulfur

Applications

- Power source related devices
- DC motors, inverters
- Robotics, Industrial control system

◆Part numbering system

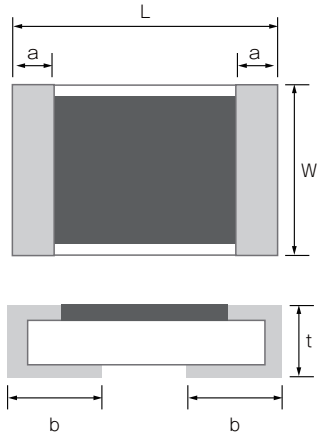
HRG 3216 P - 1001 - B - T5

- HRG: Series code
- 3216: Size: HRG3216
- P: Temperature coefficient of resistance
- 1001: Nominal resistance value (E-24, E-96: all 4 digit)
- B: Resistance tolerance
- T5: Packaging quantity: T1(1,000pcs), T5(5,000pcs)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) Resistance tolerance		Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
		(ppm/°C)	±0.1% (B)	±0.5% (D)				
HRG3216	1.0W	±25(P)	47≦R≦100k		200V	E-24, E-96	-55℃ ~ 155℃	T1 T5
		±50(Q)	47≦R≦100k	10≦R≦100k				

◆Dimensions



Type	Size (inch)	L	W	a	b	t
HRG3216	1206	3.20±0.20	1.60±0.20	0.50±0.25	1.10±0.20	0.45±0.10

(unit : mm)

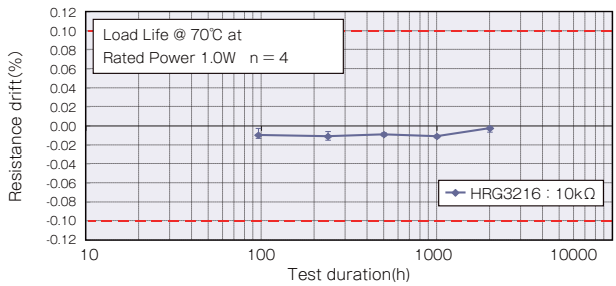
◆Reliability specification

Test items	Condition (test methods (JIS C5201-1)	Standard	
		≦47Ω	≧47Ω
Life (biased)	70℃, rated voltage,*1 90min on 30min off, 1000hours	±(0.5%+0.05Ω)	±(0.25%+0.01Ω)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
Temperature shock	-55℃ (30min) ~ 125℃ (30min) 1000cycles	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
High temperature exposure	155℃, no bias, 1000hours	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.25%+0.05Ω)	±(0.1%+0.01Ω)

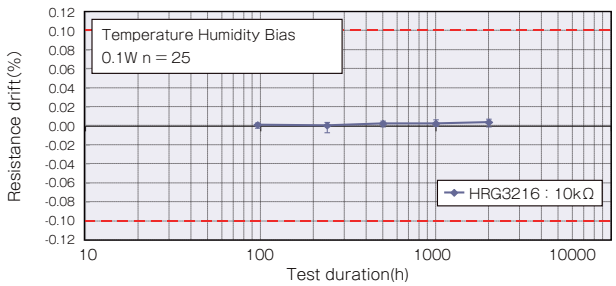
*1 Rated voltage is given by $E=\sqrt{R \times P}$
E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆Reliability test data

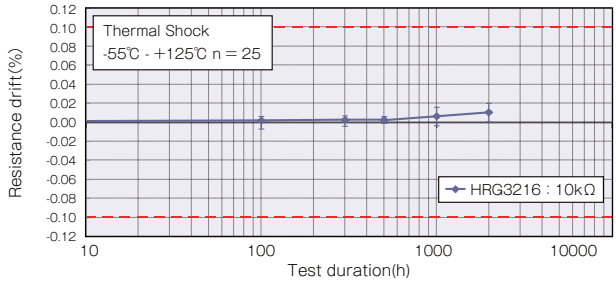
○Biased life test



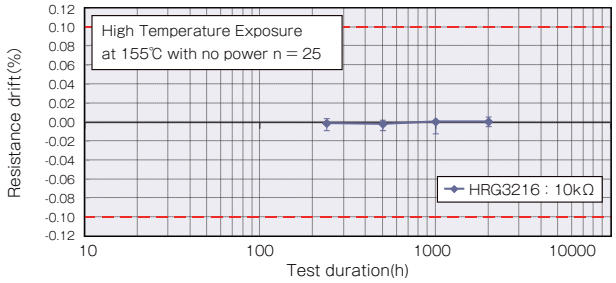
○High temperature high humidity (biased)



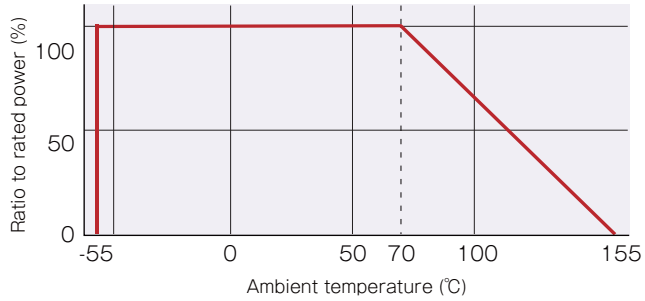
○Temperature shock



○High temperature exposure



◆Derating Curve





Anti-surge thin film chip resistors

■MRG series

AEC-Q200 Compliant

Features

- Significant improvement of anti-surge capability comparing to existing thin film resistors
- Precision resistance tolerance: ±0.5%, very small TCR: ±10ppm/°C
- Thin film structure enabling low noise and anti-sulfur

Applications

- Power source related devices
- Automotive electronics
- Robotics, Industrial control system

Lead free　Halogen free　RoHS Compliance

◆Part numbering system

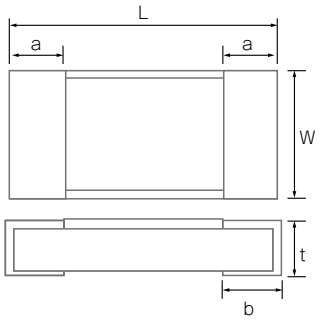
MRG 2012 N - 104 - D - T5

- MRG — Series code
- 2012 — Size: MRG2012, MRG3216, MRG5025
- N — Temperature coefficient of resistance
- 104 — Nominal resistance value (E-24, E-96, MRG3216, MRG5025: all 4 digit)
- D — Resistance tolerance
- T5 — Packaging quantity: T5(5,000pcs) (MRG2012, MRG3216) T4(4,000pcs) (MRG5025)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/°C)	Resistance range(Ω) Resistance tolerance ±0.5% (D)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
MRG2012	1/10W	±10(N)	100≦R≦1M	150V	E-24, E-96	-55℃ ~ 155℃	T5
		±25(P)					
MRG3216	1/8W	±10(N)	100≦R≦2M	200V			
		±25(P)					
MRG5025	1/2W	±10(N)	100≦R≦2M	300V			T4
		±25(P)					

◆Dimensions



Type	Size (inch)	L	W	a	b	t
MRG2012	0805	2.00±0.20	1.25+0.25/−0.20	0.40±0.20	0.40±0.20	0.40+0.15/−0.10
MRG3216	1206	3.20±0.20	1.60±0.25	0.50±0.25	0.50±0.25	0.40+0.15/−0.10
MRG5025	2010	5.00±0.20	2.50±0.25	0.60±0.25	0.60±0.25	0.45+0.15/−0.10

(unit : mm)

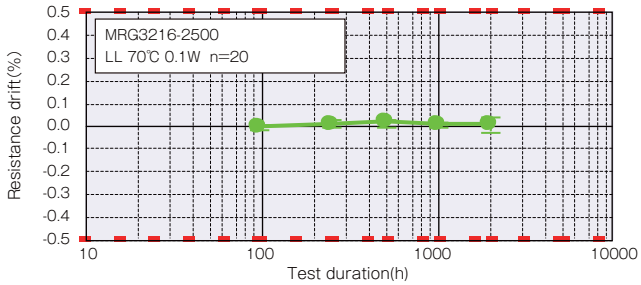
◆Reliability specification

Test items	Condition (test methods (MIL-PRF-55342/JIS C5201-1)	Standard
Short time overload	2.5 x rated voltage,*1 5seconds	±(0.05%+0.01Ω)
Life (biased)	85℃, rated voltage,*1 90min on 30min off, 2000hours	±(0.25%+0.01Ω)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 2000hours	±(0.25%+0.01Ω)
Temperature shock	-55℃ (30min) ~ 125℃ (30min) 2000cycles	±(0.25%+0.01Ω)
High temperature exposure	155℃, no bias, 2000hours	±(0.5%+0.01Ω)
ESD (HBM)	4KV (Positive 3times, negative 3 times)	±(0.5%+0.05Ω)
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.05%+0.01Ω)

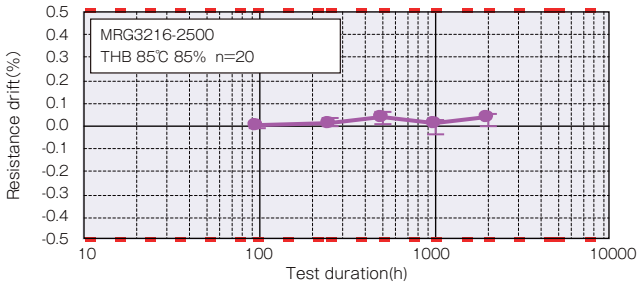
*1 Rated voltage is given by $E=\sqrt{R \times P}$ E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆Reliability test data

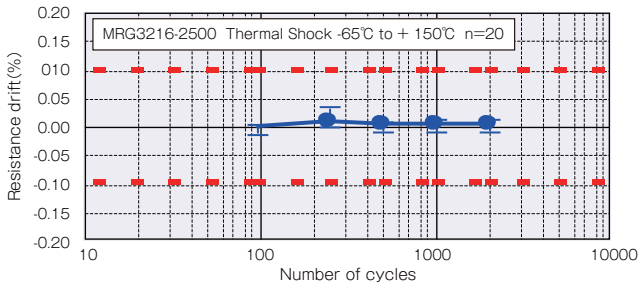
○Biased life test



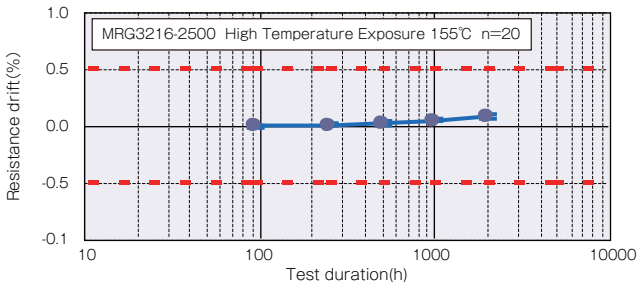
○High temperature high humidity (biased)



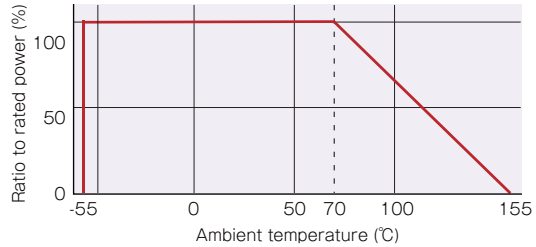
○Temperature shock



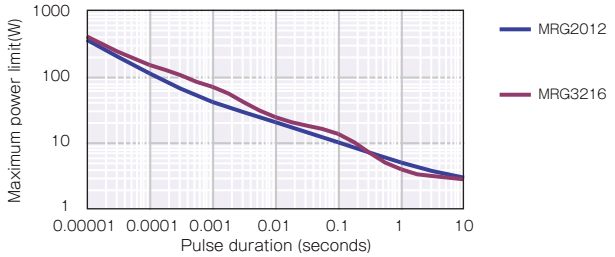
○High temperature exposure



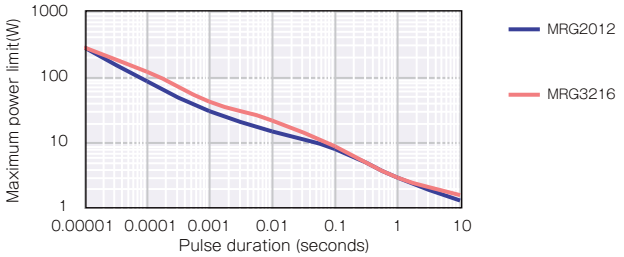
◆Derating Curve

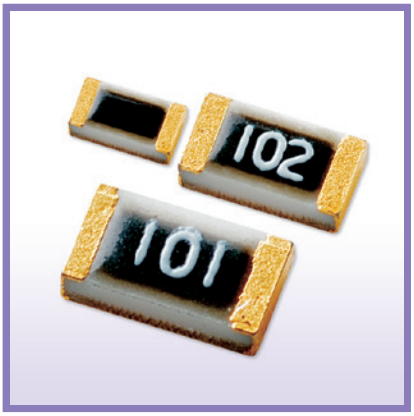


◆Maximum pulse power limit (single pulse)



◆Maximum pulse power limit (multiple pulses)





High temperature thin film chip resistors

■RGA series

AEC-Q200 Compliant

Features

- Conductive epoxy compatible
- Operating temperature up to 230°C
- Resistance tolerance: ±0.1%, TCR: ±10ppm/°C
- Thin film structure enabling low noise and anti-sulfur

Applications

- Automotive electronics
- Equipment used in high temperature
- Downhole drilling

◆Part numbering system

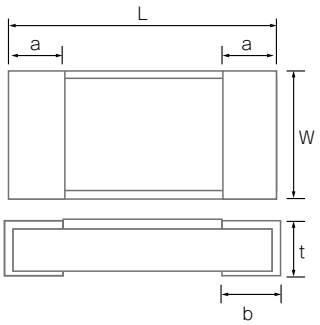
RGA 2012 N - 104 - B - T1

- RGA — Series code
- 2012 — Size: RGA1005, RGA1608,RGA2012
- N — Temperature coefficient of resistance
- 104 — Nominal resistance value (E-24: 3digit, E-96: 4digit)
- B — Resistance tolerance
- T1 — Packaging quantity: T1(1,000pcs), T5(5,000pcs)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/°C)	Resistance range(Ω) Resistance tolerance ±0.1% (B)	±0.5% (D)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
RGA1005	1/32W	±10(N)	47≦R≦100k		50V	E-24, E-96	-55℃ ~ 230℃	T1
		±25(P)						T5
RGA1608	1/16W	±10(N)	47≦R≦274k		100V			
		±25(P)	47≦R≦332k	47≦R≦360k				
RGA2012	1/10W	±10(N)	47≦R≦475k		150V			
		±25(P)	47≦R≦475k	47≦R≦1M				

◆Dimensions



Type	Size (inch)	L	W	a	b	t
RGA1005	0402	1.00+0.1/-0.05	0.50±0.05	0.20±0.10	0.25±0.05	0.35±0.05
RGA1608	0603	1.60±0.20	0.80+0.25/−0.20	0.30±0.20	0.30±0.20	0.40+0.15/−0.10
RGA2012	0805	2.00±0.20	1.25+0.25/−0.20	0.40±0.20	0.40±0.20	0.40+0.15/−0.10

(unit : mm)

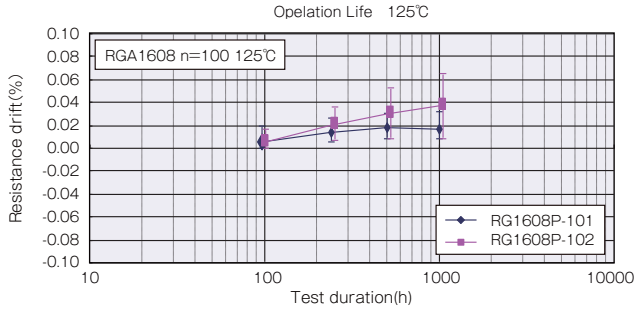
◆Reliability specification

Test items	Condition (test methods (MIL-PRF-55342/JIS C5201-1)	Standard
Short time overload	2.5 x rated voltage,*1 5seconds	±(0.1%+0.01Ω)
Life (biased)	125℃, rated voltage,*1 90min on 30min off, 1000hours	±(0.2%+0.05Ω)
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.2%+0.01Ω)
Temperature shock	-55℃ (30min) ~ 125℃ (30min) 1000cycles	±(0.2%+0.01Ω)
High temperature exposure	155℃, no bias, 1000hours	±(0.2%+0.05Ω)
Vibration	Frequency 10Hz ~ 500Hz, vibration amplitude 1.5mm or acceleration 10gn test duration for each of 3 axis: 6 hours	±(0.2%+0.05Ω)
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.5%+0.01Ω)

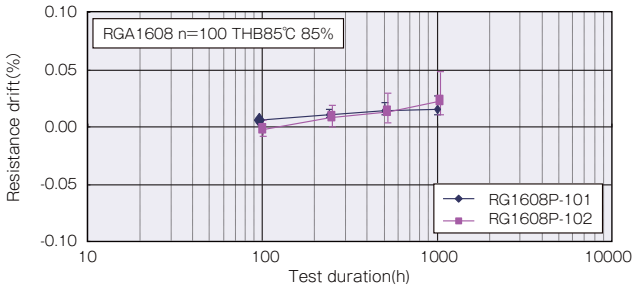
*1 Rated voltage is given by $E=\sqrt{R \times P}$
E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

◆Reliability test data

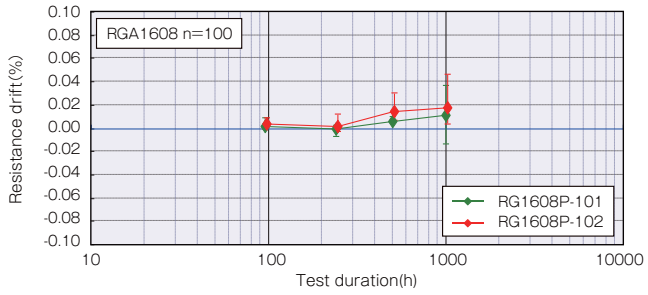
○Biased life test



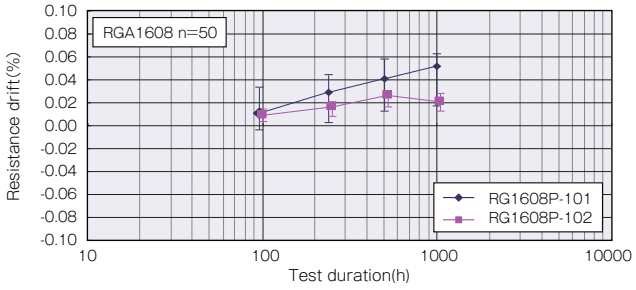
○High temperature high humidity (biased)



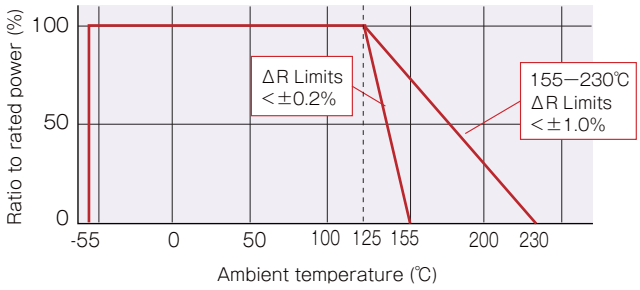
○Temperature shock



○High temperature exposure



◆Derating Curve





Lead free　Halogen free　RoHS Compliance

Metal thin film chip resistors (precision)

■RR series

Features

・Precision chip resistors excellent in resistance tolerance, TCR, frequency performance, noise characteristics, and linearity.
* This product is not currently recommended for use in new design systems. Production may be discontinued in the near future.

Applications

・Consumer electronics that requires precision resistors
・All purpose resistors in any area of electronics

◆Part numbering system

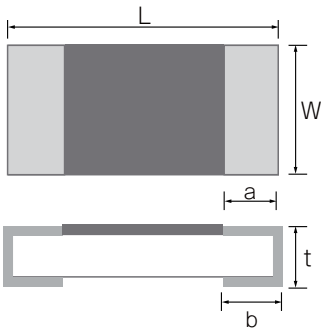
RR 0816 P - 102 - D - (M) - (***)

- Series code: RR
- Size: RR0306, RR0510, RR0816, RR1220, : 0816
- Temperature coefficient of resistance: P
- Nominal Resistance: RR0306, RR0510, RR0816, RR1220 E-24: 3 digit, RR0306, RR0510, RR0816, RR1220 E-96: 4 digit, : 102
- Resistance tolerance: D
- Letter M is added for RR1220 E-96 series 4digit codes: (M)
- only given to 3 digit coders for RR0816 E-96 series: (***)

◆Electrical Specification

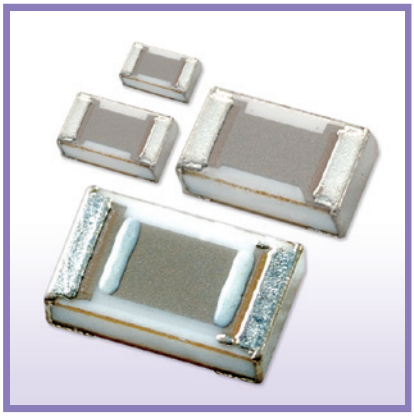
Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) Resistance tolerance			Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
		(ppm/°C)	±0.1% (B)	±0.5% (D)	±1% (F)				
RR0306	1/20W	±25(P)	–	33≦R≦22k		15V	E-24	-55℃ ~ 125℃	5,000pcs
		±100(R)	–	–	10≦R≦30				
RR0510	1/16W	±25(P)	–	100≦R≦100k	–	25V	E-24, E-96		10,000pcs
		±100(R)		10≦R<100					
RR0816	1/16W	±25(P)	–	100≦R≦360k	–	75V			5,000pcs
		±50(Q)		10≦R<100					
RR1220	1/10W	±25(P)	–	100≦R≦1M		100V			
		±50(Q)	–	10≦R<100	–				

◆Dimensions



Type	Size (inch)	L	W	a	b	t
RR0306	0201	0.60±0.05	0.30±0.05	0.12±0.05	0.12±0.05	0.23±0.03
RR0510	0402	1.00±0.05	0.50±0.05	0.20±0.10	0.25±0.05	0.35±0.05
RR0816	0603	1.60±0.20	0.80±0.20	0.30±0.20	0.30±0.20	0.40±0.10
RR1220	0805	2.00±0.20	1.25±0.20	0.40±0.20	0.40±0.20	0.40±0.10

(unit : mm)



Metal thin film trimmable chip resistors

■RT series

AEC-Q200 Compliant

Features

- Patented trimming method (Patent# 1921853)guarantees precision trimming, post trimming stability and short trimming time.
- Available as small as 0.3mm x 0.6mm

Applications

- Sensor circuits that require accuracy (e.g. automotive electronics)
- PA module of mobile phone
- Devices that requires anti-vibration stability (e.g. microphone)

Lead free　Halogen free　RoHS Compliance

◆Part numbering system

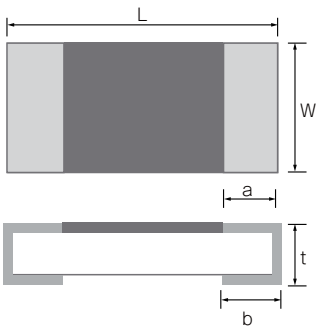
RT 0816 P - 102 - M

- RT: Series code
- 0816: Size: RT0603, RT0510, RT0816, RT1220
- P: Temperature coefficient of resistance
- 102: Nominal resistance value
- M: Resistance tolerance

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/°C)	Initial resistance value (Ω) Targetted resistance value (Ω)				Initial resisstance value tolerance (%)	Maximum voltage	Operating temperature	Packaging quantity
RT0603	1/20W	±25(P)	150	330	-	-	±20(M)	15V	-55℃ ~ 125℃	15,000pcs
			1.0k	1.9k	-	-				
		±100(R)	1.5k	-	-	-				
			10k	-	-	-				
RT0510	1/16W	±25(P)	100	270	-	-		25V		10,000pcs
			820	2.1k	-	-				
		±100(R)	1.5k	-	-	-				
			10k	-	-	-				
RT0816	1/16W	±25(P)	100	330	1.0k	-		75V		5,000pcs
			2.7k	8.0k	8.8k	-				
		±100(R)	-	3.3k	10k	--				
			-	37k	40k	-				
RT1220	1/10W	±25(P)	100	330	1.0k	-		100V		5,000pcs
			8.2k	15k	15k	-				
		±50(Q)	33	-	-	-				
			4.7k	-	-	-				
		±100(R)	3.3k	10k	33k	100k				
			100k	120k	120k	220k				

◆Dimensions



Type	Size (inch)	L	W	a	b	t
RT0603	0201	0.60±0.05	0.30±0.03	0.12±0.05	0.15±0.05	0.25±0.03
RT0510	0402	1.00±0.07	0.50±0.07	0.20±0.10	0.25±0.10	0.35±0.05
RT0816	0603	1.60±0.20	0.80±0.20	0.30±0.20	0.30±0.20	0.40±0.10
RT1220	0805	2.00±0.20	1.25±0.20	0.40±0.20	0.40±0.20	0.40±0.10

(unit : mm)



Lead free　Halogen free　RoHS Compliance

Metal thin film chip resistor networks

■RM series

AEC-Q200 Compliant

Features

- Relative resistance tolerance and relative TCR definable among multiple resistors within package.
- Relative resistance tolerance: ±0.01%, relative TCR: ±1ppm/°C
- Number of resistors in package: 2 or higher, standard and custom circuits designs available
- RG series equivalent reliability and long term stability: less than ±0.1% drift after 10000 hour stress test.
- RoHS compliant, 100% lead free

Applications

- Precision measurement instrumentation, medical electronics, automotive electronics
- Voltage divider and amplification circuits that require very precise relative resistance tolerance and TCR
- Multi step precision amplification circuits for minute signals

◆Part numbering system

RM 2012 A - */*** - P W X L 10**

- RM: Series code
- 2012: Size: RM2012, RM3216, RM3225
- A: circuits
- ***/***: Nominal Resistance Value(R1/R2)
- P: Absolute TCR
- W: Absolute resistance tolerance
- X: Relative TCR
- L: Relative resistance tolerance
- 10: Packaging quantity: 10(1,000pcs), 50(5,000pcs), T4(4.000pcs)

RM 3216 C - * - 10**

- RM: Series code
- 3216: Size: RM3216, RM3225, RM6432
- C: circuits
- ***: Custom part number (e.g.)N10
- 10: Packaging quantity: 10(1,000pcs), 50(5,000pcs),T4(4.000pcs)

※ **Please contact our sales office regarding custom products including resistance, resistance combination, number of elements, circuit, and others.**

※ **Standard quantity / reel is 1000 and 5000. Please contact our sales office for custom product's quantity / reel.**

※ **Standard resistance value pairings are shown as below**
(Standard products are 2element circuit typeA & typeB only.)

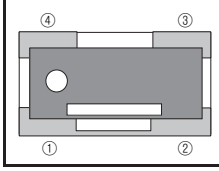
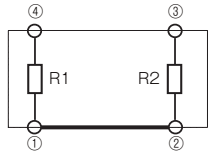
◆Standard resistance value pairings

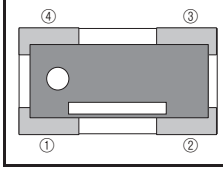
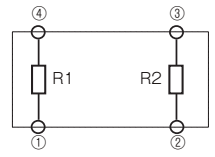
Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)	Ratio	R1 (Ω)	R2 (Ω)
1 : 1	1k	1k	1 : 3	1k	3k	1 : 5	1k	5k	1 : 9	1k	9k	1 : 20	1k	20k	1 : 50	1K	50k
	10k	10k		10k	30k		2k	10k		10k	90k		2k	40k		2K	100k
	100k	100k		100k	300k		10k	50k	1 : 10	1k	10k		5k	100k	1:100	1K	100k
1 : 2	1k	2k	1 : 4	1k	4k	1 : 6	1k	6k		2k	20k	1 : 25	1k	25k		2K	200k
	10k	20k		10k	40k		10k	60k		10k	100k		2k	50k			
	100k	200k															

※ : A combination that is in RM3216 but not in RM2012, please contact our sales.

◆Electrical Specification

○ 4 terminal, 2 element

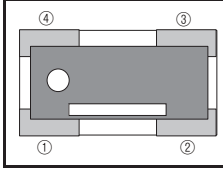
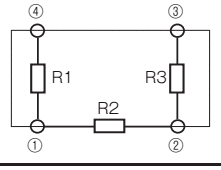
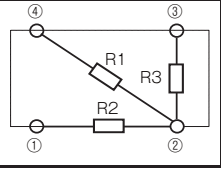
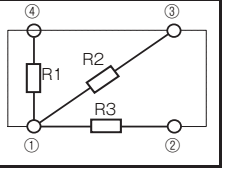
Top view, terminal number	Circuit diagram (circuit type A)
	

Top view, terminal number	Circuit diagram (circuit type B)
	

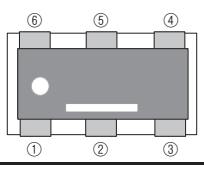
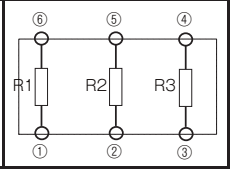
Type	Power ratings (85°C)	Resistance range (Ω)	Resistance tolerance (Code)			Temperature coefficient of resistance (Code)			Pakaging quantity (designation)
			Absolute tolerance	Tolerance ratio *1		Absolute TCR	TCR tracking *1		
				Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500		Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500	
RM2012	0.05W / Element 0.1W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) 10=1,000pcs 50=5,000pcs
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM3216	0.063W / Element 0.125W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 500k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM3225	0.1W / Element 0.2W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 500k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	

*1 Contact us for detailed information on relative tolerance and TCR.

○ 4 terminal, 3 element

Top view, terminal number	Circuit diagram (circuit type C)	Circuit diagram (circuit type D)	Circuit diagram (circuit type E)
			

○ 6 terminal, 3 element

Top view, terminal number	Circuit diagram (circuit type H)
	

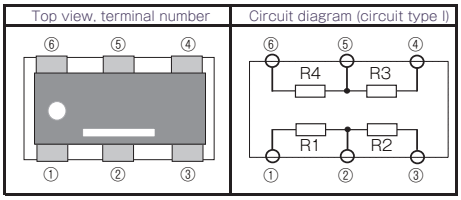
Type	Power rating (85°C)	Resistance range (Ω)	Resistance tolerance (Code)			Temperature coefficient of resistance (Code)			Pakaging quantity (designation)
			Absolute tolerance	Tolerance ratio *1		Absolute TCR	TCR tracking *1		
				Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500		Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500	
RM3216	0.042W / Element 0.125W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) 10=1,000pcs 50=5,000pcs
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM3225	0.066W / Element 0.2W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	

*1 Contact us for detailed information on relative tolerance and TCR.

Metal thin film chip resistor networks

■RM series

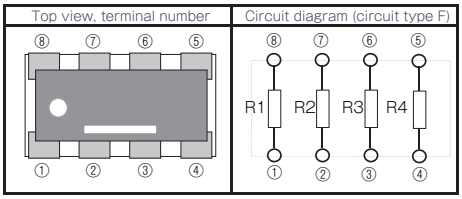
○ 6 terminal, 4 element



Type	Power ratings (85°C)	Resistance range (Ω)	Resistance tolerance (Code)				Temperature coefficient of resistance (Code)				Pakaging quantity (designation)
			Absolute tolerance	Tolerance ratio *1			Absolute TCR	TCR tracking *1			
				Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500		Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500	
RM3216	0.032W / Element 0.125W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) 10=1,000pcs 50=5,000pcs
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM3225	0.05W / Element 0.2W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	

*1 Contact us for detailed information on relative tolerance and TCR.

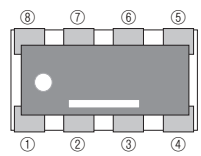
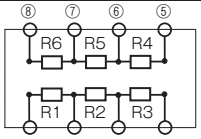
○ 8 terminal, 4 element



Type	Power ratings (85°C)	Resistance range (Ω)	Resistance tolerance (Code)				Temperature coefficient of resistance (Code)				Pakaging quantity (designation)
			Absolute tolerance	Tolerance ratio *1			Absolute TCR	TCR tracking *1			
				Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500		Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500	
RM3216	0.032W / Element 0.125W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) 10=1,000pcs 50=5,000pcs
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM3225	0.05W / Element 0.2W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM6432	0.1W / Element 0.4W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) T4=4000pcs
		300 ~ 1M	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	

*1 Contact us for detailed information on relative tolerance and TCR.

◯ 8 terminal, 6 element

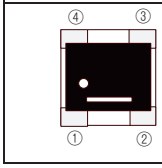
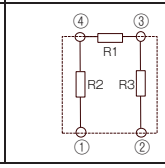
Top view, terminal number	Circuit diagram (circuit type G)
	

Type	Power ratings (85°C)	Resistance range (Ω)	Resistance tolerance (Code)				Temperature coefficient of resistance (Code)				Pakaging quantity (designation)
			Absolute tolerance	Tolerance ratio *1			Absolute TCR	TCR tracking *1			
				Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500		Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500	
RM3216	0.021W / Element 0.125W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) 10=1,000pcs 50=5,000pcs
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM3225	0.033W / Element 0.2W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RM6432	0.066W / Element 0.4W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) T4=4000pcs
		300 ~ 1M	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	

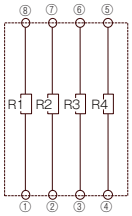
*1 Contact us for detailed information on relative tolerance and TCR.

◯ Some examples of custom RM series

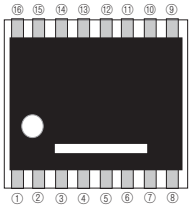
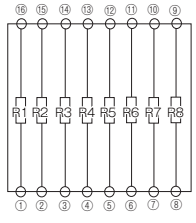
RM2525(2.5mm×2.5mm)

Top view, terminal number	Circuit diagram (e.g.)
	

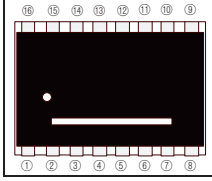
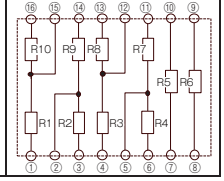
RM5882(5.8mm×8.2mm)

Top view, terminal number	Circuit diagram (e.g.)
	

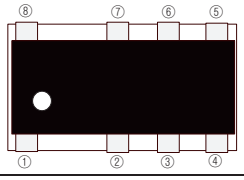
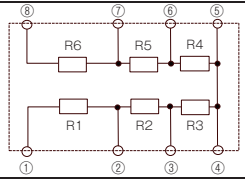
RM10280(10.2mm×7.2mm)

Top view, terminal number	Circuit diagram (e.g.)
	

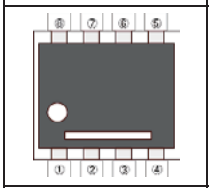
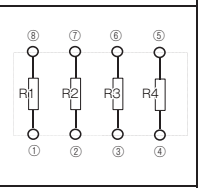
RM8258(8.2mm×5.8mm)

Top view, terminal number	Circuit diagram (e.g.)
	

RM11264(11.2mm×6.4mm)

Top view, terminal number	Circuit diagram (e.g.)
	

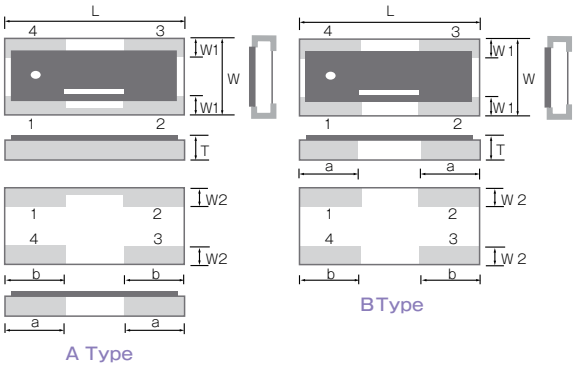
RM5050(5.0mm×5.0mm)

Top view, terminal number	Circuit diagram (e.g.)
	

Metal thin film chip resistor networks

■RM series

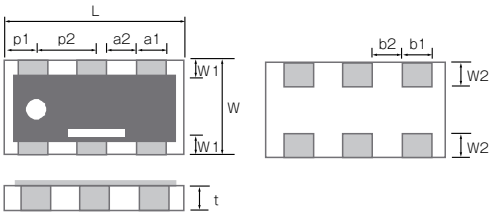
◆Dimensions



4 terminal

Type	Size (inch)	L	W	t	a	b	W1	W2
RM2012	0805	2.00±0.20	1.25±0.20	0.45±0.10	0.50±0.20	0.60±0.20	0.40±0.20	0.35±0.20
RM3216	1206	3.20±0.20	1.60±0.20	0.45±0.10	1.00±0.25	1.00±0.20	0.40±0.25	0.40±0.20
RM3225	1209	3.20±0.20	2.50±0.20	0.45±0.10	1.00±0.25	1.00±0.20	0.40±0.25	0.60±0.20

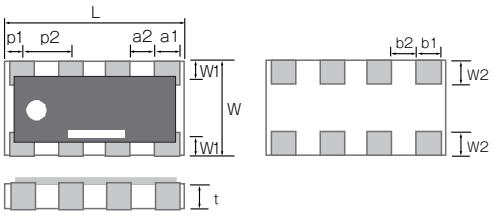
(unit : mm)



6 terminal

Type	Size (inch)	L	W	t	a1	a2	b1	b2	p1	p2	W1	W2
RM3216	1206	3.20±0.20	1.60±0.20	0.45±0.10	0.50±0.20	0.45±0.20	0.50±0.20	0.45±0.20	0.63±0.20	0.95±0.10	0.23±0.20	0.40±0.20
RM3225	1209	3.20±0.20	2.50±0.20	0.45±0.10	0.50±0.10	0.45±0.10	0.50±0.10	0.45±0.10	0.63±0.20	0.95±0.10	0.30±0.20	0.50±0.20

(unit : mm)



8 terminal

Type	Size (inch)	L	W	t	a1	a2	b1	b2	p1	p2	W1	W2
RM3216	1206	3.20±0.20	1.60±0.20	0.45±0.10	0.40±0.20	0.40±0.20	0.40±0.20	0.40±0.20	0.40±0.20	0.80±0.10	0.30±0.20	0.40±0.20
RM3225	1209	3.20±0.20	2.50±0.20	0.45±0.10	0.40 +0.20/-0.10	0.40 +0.10/-0.20	0.40 +0.20/-0.10	0.40 +0.10/-0.20	0.40±0.20	0.80±0.10	0.30±0.20	0.40±0.20
RM6432	2512	6.40±0.20	3.20±0.20	0.50±0.10	0.66 +0.20/-0.10	0.94 +0.10/-0.20	0.66 +0.20/-0.10	0.94 +0.10/-0.20	0.80±0.20	1.60±0.10	0.50±0.20	0.60±0.10

(unit : mm)

◆Reliability specification

Test items	Condition (test methods (MIL-PRF-55342/JIS C5201-1)	Standard	
		Absolute tolerance	Relative tolerance
Short time overload	2.5 x rated voltage,*1 5seconds	±(0.1%+0.01Ω)	±0.05%
Life (biased)	85℃, rated voltage,*1 90min on 30min off, 1000hours	±(0.1%+0.01Ω)	±0.05%
High temperature high humidity	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.1%+0.01Ω)	±0.05%
Temperature shock	-55℃ (38min) ~ 125℃ (30min) 1000cycles*2	±(0.1%+0.01Ω)	±0.05%
High temperature exposure	155℃, no bias, 1000hours	±(0.1%+0.01Ω)	±0.05%
Resistance to soldering heat	260±5℃, 10 seconds (reflow)	±(0.05%+0.01Ω)	±0.05%

*1 Rated voltage is given by $E=\sqrt{R \times P}$
E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.

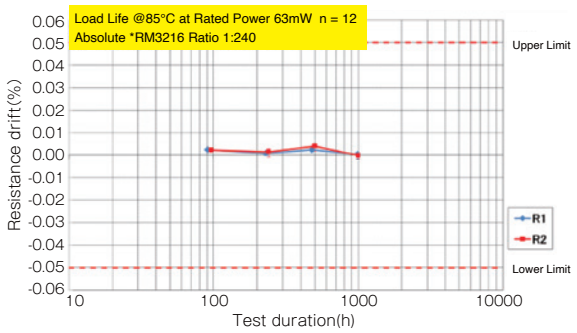
*2 Based on the tests done on RM316.RM3225.
Please contact our sales office for other or custom dimensional products

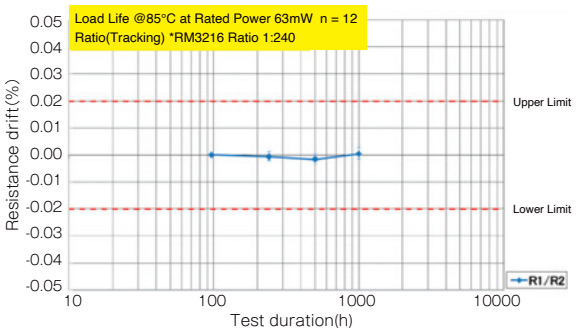
Metal thin film chip resistor networks

■RM series

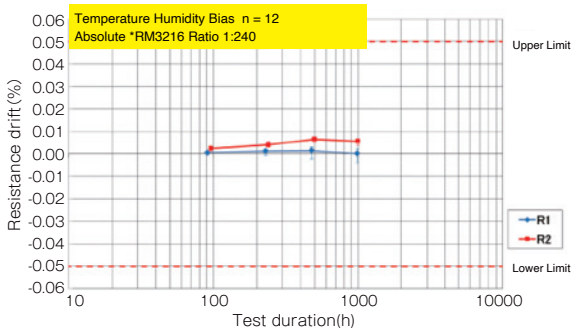
◆Reliability test data

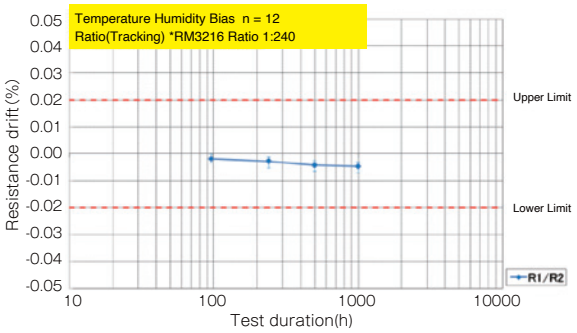
○Load life with rated power @85°C



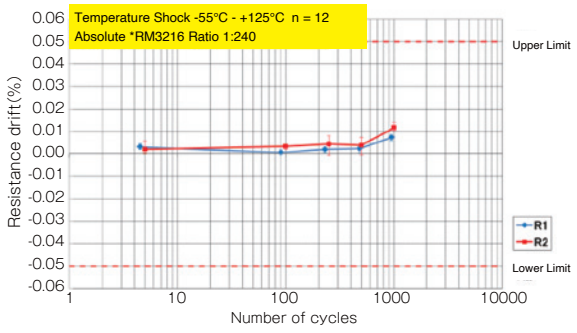


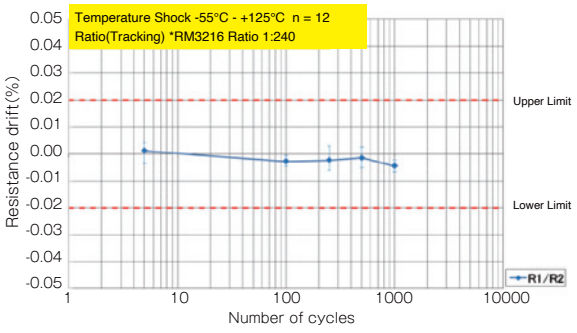
○High temperature high humidity (biased)



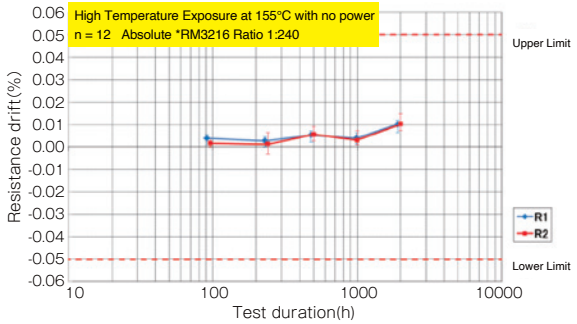


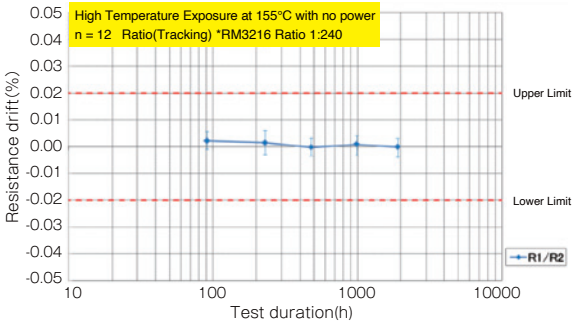
○Temperature shock



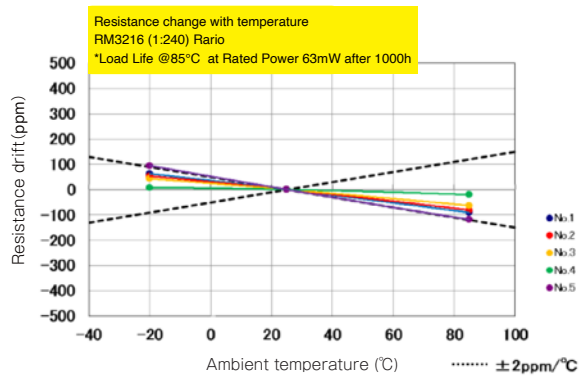


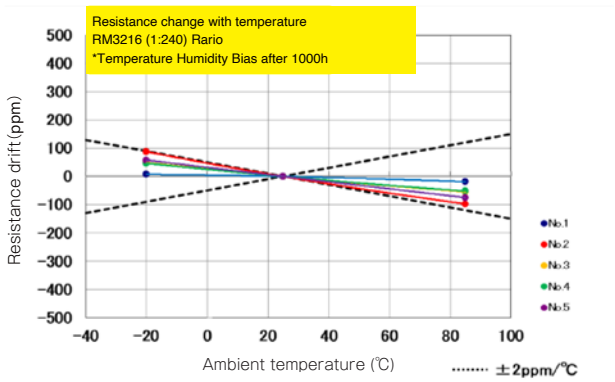
○High temperature exposure (155°C)

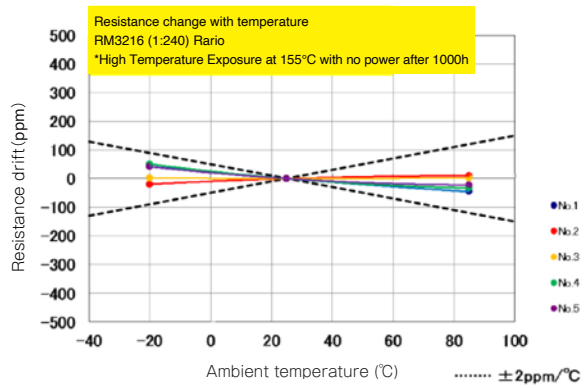


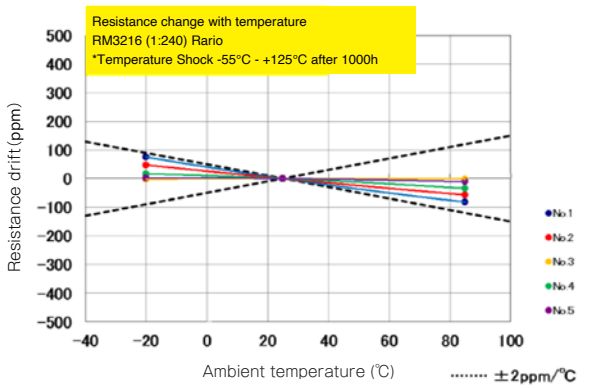


◆TCR linearity

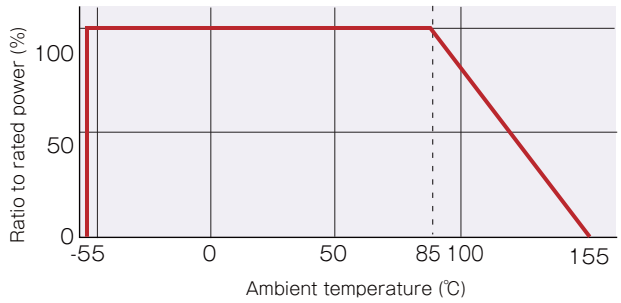


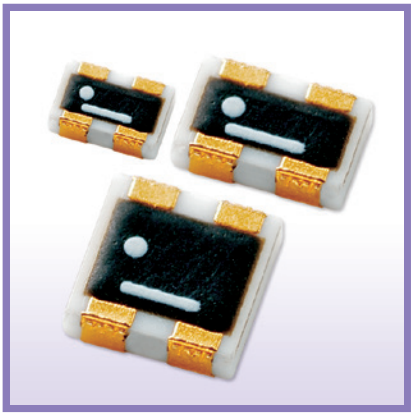






◆Derating Curve





High temperature metal thin film resistor networks

■RMA series

AEC-Q200 Compliant

Lead free　Halogen free　RoHS Compliance

Features

- Conductive epoxy compatible chip resistor network
- Relative resistance tolerance: ±0.01%, relative TCR: ±1ppm/°C
- Operating temperature up to 230°C
- RoHS compliant, 100% lead free (gold terminal)
- Thin film structure enabling low noise and anti-sulfur

Applications

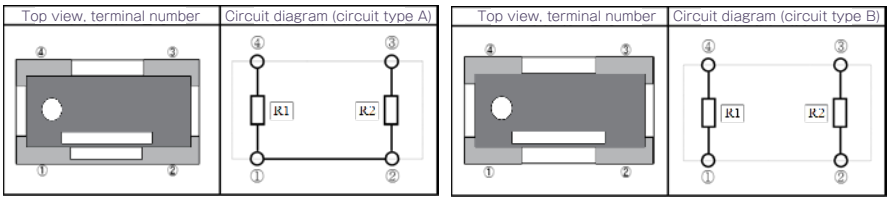
- Automotive electronics
- High temperature electronic devices
- Downhole drilling

◆Part numbering system

RMA 2012 A - */*** P B V L 10**

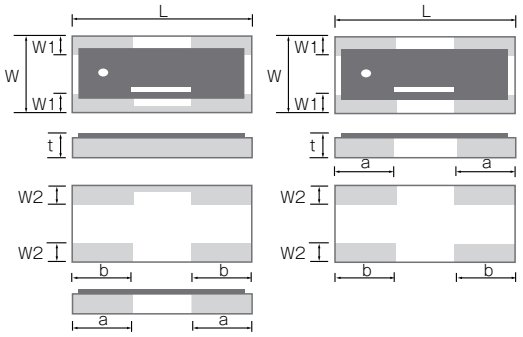
- RMA: Series code
- 2012: Size: RMA2012, RMA3216, RMA3225
- A: circuits
- ***/***: Nominal resistance value (E-24: 3 digit, E-96: all 4 digit)
- P: Absolute TCR
- B: Absolute resistance tolerance
- V: Relative TCR
- L: Relative resistance tolerance
- 10: Packaging quantity: 10(1,000pcs), 50(5,000pcs)

◆Electrical Specification



Type	Power ratings (85°C)	Resistance range (Ω)	Resistance tolerance (Code)			Temperature coefficient of resistance (Code)				Pakaging quantity (designation)
			Absolute tolerance	Tolerance ratio		Absolute TCR	TCR tracking			
				Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500		Resistance ratio =1	1< Resistance ratio ≦100	100< Resistance ratio ≦500	
RMA2012	0.05W / Element 0.1W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	tape & reel (T&R) 10=1,000pcs 50=5,000pcs
		300 ~ 100k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RMA3216	0.063W / Element 0.125W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 500k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	
RMA3225	0.1W / Element 0.2W / Package	100 ~<300	±0.1%(B) ±0.5%(D)	±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.05%(W) ±0.1%(B) ±0.5%(D)	-	±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	-	
		300 ~ 500k	±0.05%(W) ±0.1%(B) ±0.5%(D)	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B) ±0.5%(D)		±0.05%(W) ±0.1%(B) ±0.5%(D)	±5ppm/℃(V) ±10ppm/℃(N) ±25ppm/℃(P)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±1ppm/℃(X) ±2ppm/℃(W) ±5ppm/℃(V)	±2ppm/℃(W) ±5ppm/℃(V)	

◆Dimensions



Type	Size (inch)	L	W	t	a	b	W1	W2
RMA2012	0805	2.0±0.2	1.25±0.2	0.45±0.1	0.5±0.2	0.6±0.2	0.4±0.2	0.35±0.2
RMA3216	1206	3.2±0.2	1.6±0.2	0.45±0.1	1.0±0.25	1.0±0.2	0.4±0.25	0.4±0.2
RMA3225	1209	3.2±0.2	2.5±0.2	0.45±0.1	1.0±0.25	1.0±0.2	0.4±0.25	0.6±0.2

(unit : mm)

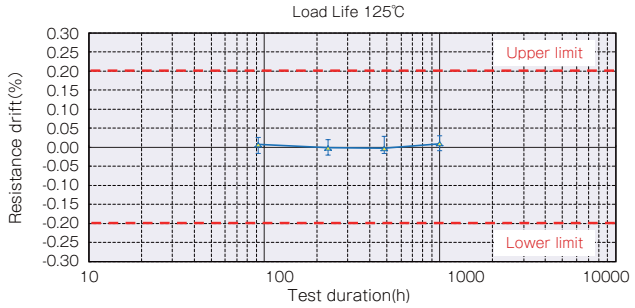
◆Reliability specification

Test items	Condition (test methods (MIL-PRF-55342/JIS C5201-1)	Standard	
		absolute	relative
Short time overload	2.5 x rated voltage*1 5seconds	±(0.1%+0.01Ω)	±0.05%
Life (biased)	70℃, rated voltage, 90min on 30min off, 1000hours	±(0.1%+0.01Ω)	±0.05%
Temperature shock	85℃, 85%RH, 1/10 of rated power, 90min on 30min off, 1000hours	±(0.1%+0.01Ω)	±0.05%
High temperature exposure*2	-55℃(30min) ~ 125℃(30min) 1000 cycles	±(0.1%+0.01Ω)	±0.05%
Resistance to soldering heat	155℃, no bias, 1000hours	±(0.1%+0.01Ω)	±0.05%

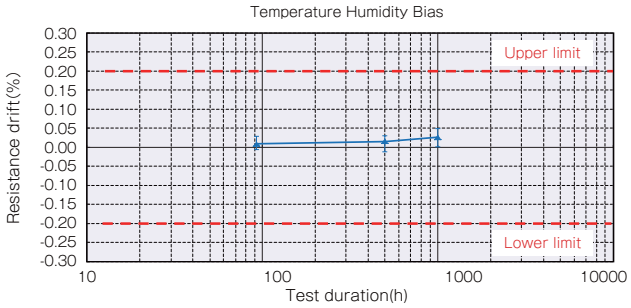
*1 Rated voltage is given by $E=\sqrt{R \times P}$ E= rated voltage (V), R=nominal resistance value(Ω), P=rated power(W)
If rated voltage exceeds maximum voltage /element, maximum voltage/element is the rated voltage.
*2 Please contact our sales office for details.

◆Reliability test data

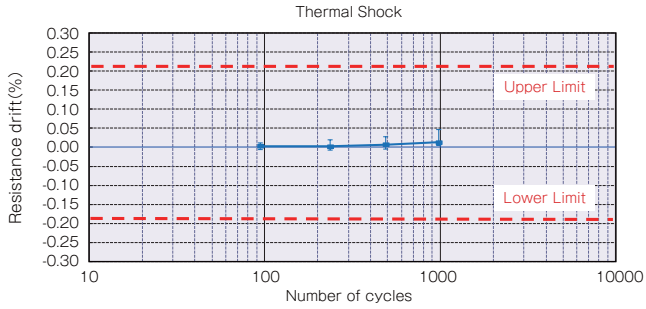
○Biased life test



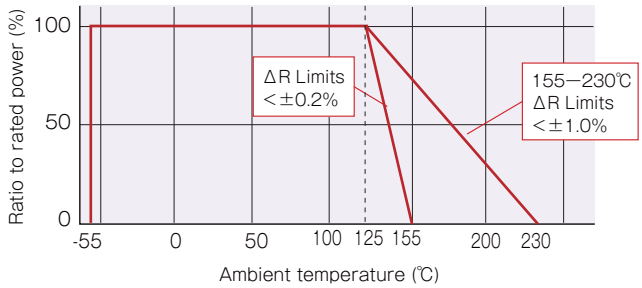
○High temperature high humidity (biased)



○Temperature shock



◆Derating Curve



MEMO

Current sensing surface mount resistors

Metal foil low resistance chip resistors
(long-side terminal)
KRL series

Metal foil low resistance chip resistors
(short-side terminal)
KRL series

Metal foil low resistance chip resistors
(4 terminal type)
KRL series

Low resistance chip resistors
(long-side terminal)
PRL / RL series

Low resistance chip resistors
(short-side terminal)
RL series

High Current chip jumpers
YJP series



Metal foil low resistance chip resistors
(long-side terminal)

■KRL series **AEC-Q200 Compliant**

Lead free | Halogen free | RoHS Compliance

Features

- High current sensing long side terminal low resistance chip resistor
- Two types available: high temperature (operating temperature up to 175°C), low emf type (operating temperature up to 155°C)
- High current handling capability and wide range of power ratings
- Size: 1608 ~ 15075, power ratings: 0.5W ~ 10W, resistance value range: 1m ~ 500mΩ
- Face down construction. Choice between bottom only or wrap around terminal.

Applications

- Automotive electronics
- Power source devises, ACDC converters, DCDC converters
- Motors, inverters, office automation equipment

◆Part numbering system

KRL 2012E - C - R010 - F - T1

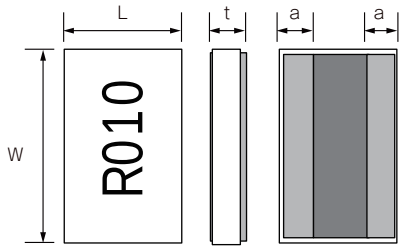
- KRL: Series code
- 2012: Size: KRL1608, KRL2012, KRL3216, KRL5025, KRL6432, KRL7638, KRL9045, KRL11050, KRL15075
- E: Terminal type: D (bottom terminal), E (wrap around terminal)
- C: Temperature characteristics type: C (high operating temperature), M (low EMF)
- R010: Nominal resistance value
- F: Resistance tolerance
- T1: Packaging quantity: T05 (500pcs) T1(1,000pcs), T5(5,000pcs)

◆Electrical Specification

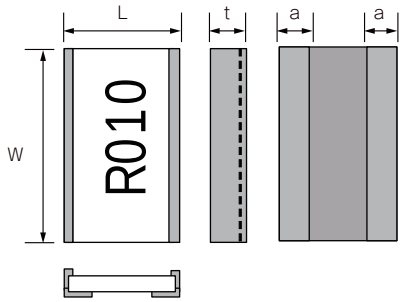
Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) Resistance tolerance *1			Resistance value series	Operating temperature		Packaging quantity
		(ppm/°C)	±1% (F)	±2% (G)	±5% (J)		C	M	
KRL1608 *2	0.5W	±50	10m≦R≦100m	—	—	E-6 *3	-55℃ ~ 175℃	-55℃ ~ 155℃	T5
		±100	—	5m≦R≦9m	—				
KRL2012	1W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				T1 T5
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL3216	1.5W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL5025	2W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL6432	3W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL7638	4W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL9045	5W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL11050	6W	±50	3m≦R≦9m (1m step) 10m≦R≦500m	—	—				T1
		±100	—	R=2m	—				
		±150	—	—	R=1m				
KRL15075	10W	±50	10m≦R≦500m	—	—				T05 T1
		±100	3m≦R≦9m (1m step)	R=2m	R=1m				
		±150	—	—	—				

*1 We can meet your requirement of less than 1mΩ. Please contact our sales office.
*2 For KRL1608, please contact our sales office
*3 We can meet your requirement of resistance value outside of E-6 series. Please contact our sales office.

◆Dimensions



D Type



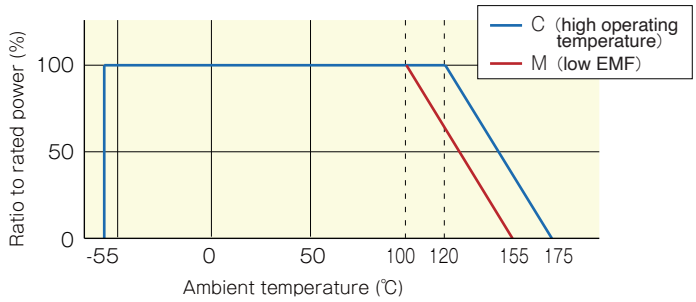
E Type

Type	Size (inch)	L	W	t	a
KRL1608[*1]	0306	0.80±0.20	1.60±0.20	0.50±0.20	0.25±0.20(5mΩ~)
KRL2012	0508	1.25±0.20	2.00±0.20	0.50±0.20	0.30±0.20(2mΩ~)/0.55±0.20(1mΩ)
KRL3216	0612	1.60±0.20	3.20±0.20	0.50±0.20	0.30±0.20(2mΩ~)/0.55±0.20(1mΩ)
KRL5025	1020	2.50±0.20	5.00±0.20	0.50±0.20	0.55±0.20(2mΩ~)/0.90±0.20(1mΩ)
KRL6432	1225	3.10±0.20	6.30±0.20	0.50±0.20	0.50±0.20(2mΩ~)/1.20±0.20(1mΩ)
KRL7638	1530	3.80±0.20	7.60±0.20	0.50±0.20	0.60±0.20(2mΩ~)/1.35±0.20(1mΩ)
KRL9045	1835	4.50±0.20	9.00±0.20	0.50±0.20	0.70±0.20(2mΩ~)/1.60±0.20(1mΩ)
KRL11050	2043	5.00±0.20	11.00±0.20	0.50±0.20	0.80±0.20(2mΩ~)/1.60±0.20(1mΩ)
KRL15075	3059	7.50±0.20	15.00±0.20	0.65±0.20	1.10±0.20(2mΩ~)/2.75±0.20(1mΩ)

*1 KRL1608 doesn't have E Type

(unit : mm)

◆Derating Curve





Metal foil low resistance chip resistors
(short-side terminal)

■KRL series **AEC-Q200 Compliant**

Lead free Halogen free RoHS Compliance

Features

- High current sensing short side terminal low resistance chip resistor
- Two types available: high temperature (operating temperature up to 175°C), low emf type (operating temperature up to 155°C).
- High current handling capability and wide range of power ratings
- Size: 0510 ~ 50110, power ratings: 0.2W ~ 5W, resistance value range: 5m ~ 1000mΩ
- Face down construction. Choice between bottom only or wrap around terminal

Applications

- Automotive electronics
- Power source devices, ACDC converters, DCDC converters
- Motors, inverters, office automation equipment

◆Part numbering system

KRL 1220E - C - R010 - F - T1

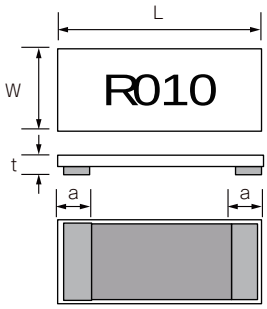
- KRL: Series code
- 1220E: Size: KRL0510, KRL0816, KRL1220, KRL1632, KRL2550, KRL3264, KRL50110; Terminal type: D (bottom terminal), E (wrap around terminal)
- C: Temperature characteristics type: C (high operating temperature), M (low EMF)
- R010: Nominal resistance value
- F: Resistance tolerance
- T1: Packaging quantity: T1(1,000pcs), T5(5,000pcs)

◆Electrical Specification

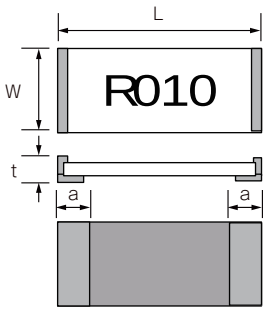
Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) *1 Resistance tolerance		Resistance value series	Operating temperature		Packaging quantity
		(ppm/°C)	±1% (F)	±2% (G)		C	M	
*2 KRL0510	0.2W	±50	50m≦R≦100m		E-6 / E-12 *3	-55℃ ~ 175℃	-55℃ ~ 155℃	10,000pcs
		±100						
KRL0816	0.3W	±50	10m≦R≦500m	—				T1 T5
		±100	5m≦R≦9m(1m step)					
KRL1220	0.5W	±50	10m≦R≦500m	—				
		±100	5m≦R≦9m(1m step)					
KRL1632	0.75W	±50	10m≦R≦500m	—				
		±100	5m≦R≦9m(1m step)					
KRL2550	1.5W	±50	10m≦R≦500m	—				
		±100	5m≦R≦9m(1m step)					
KRL3264	3W	±50	10m≦R≦1000m	—				
		±100	5m≦R≦9m(1m step)					
KRL50110	5W	±50	10m≦R≦1000m	—				T1
		±100	5m≦R≦9m(1m step)					

*1 We can meet your requirement for resistance value not specified in above table. Please contact our sales office.
*2 For KRL0510, please contact our sales office
*3 We can meet your requirement outside of E-6/E-12 series resistance. Please contact our sales office.

◆Dimensions



D Type

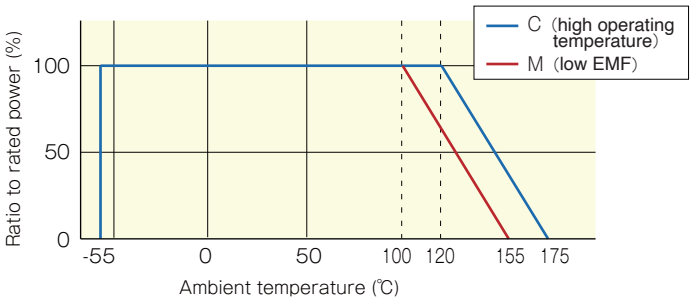


E Type

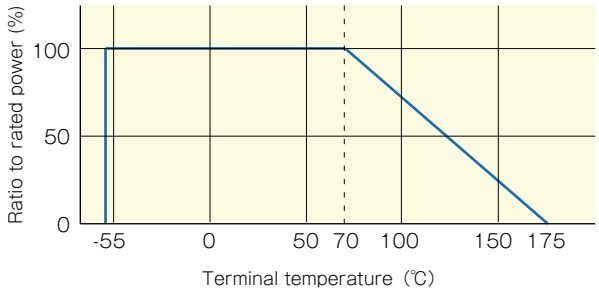
Type	Size (inch)	L	W	t	a
KRL0510	0402	1.00±0.20	0.50±0.20	0.40±0.20	0.30±0.20
KRL0816	0603	1.60±0.20	0.80±0.20	0.50±0.20	0.30±0.15(47mΩ~)/0.55±0.15(20~39mΩ) 0.70±0.15(10~18mΩ)
KRL1220	0805	2.00±0.20	1.25±0.20	0.50±0.20	0.40±0.20
KRL1632	1206	3.20±0.20	1.60±0.20	0.50±0.20	0.50±0.20(9mΩ~)/1.10±0.20(5 ~ 8mΩ)
KRL2550	2010	5.00±0.20	2.50±0.20	0.50±0.20	0.60±0.20(9mΩ~ /1.40±0.20(5 ~ 8mΩ)
KRL3264	2512	6.30±0.20	3.10±0.20	0.50±0.20	1.00±0.20(9mΩ~)/1.90±0.20(5 ~ 8mΩ)
KRL50110	4320	11.00±0.20	5.00±0.20	0.65±0.20	2.36±0.30(8mΩ~)/3.60±0.30(5 ~ 7mΩ)

(unit : mm)

◆Derating Curve



KRL1632E-3A series (1W) is also in our line-up.





Metal foil low resistance chip resistors
(4 terminal type)

■KRL series

Lead free　Halogen free　RoHS Compliance

Features

- Separated voltage terminal for precise measurement of voltage
- TCR stable at very low resistance: 4mΩ: ±50ppm/°C
- Power ratings: 1W ~ 5W

Applications

- Smartphones, mobile telephones, PCs, HDD, audio visual equipment, power devices, inverters.
- automotive electronics, industrial measurement instrumentation/equipment.

◆Part numbering system

KRL 3216T4 - M - R010 - F - T1
(KRL 3216T4A - M - R010 - F - T1)

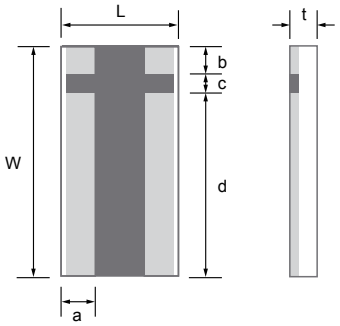
- Series code
- Size: KRL3216T4, KRL6432T4, KRL7638T4 KRL9045T4, KRL11050T4,
- Temperature characteristics type: M (low EMF)
- Nominal resistance value
- Resistance tolerance
- Packaging quantity: T1(1,000pcs), T5(5,000pcs)

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance	Resistance range(Ω) *1 Resistance tolerance			Resistance value series	Operating temperature	Packaging quantity
		(ppm/°C)	±1% (F)	±2% (G)	±5% (J)			
KRL3216T4 (KRL3216T4A)	1W	±50 (±35)	4m≦R≦9m (1m step) 10m≦R≦100m R=200m, 500m	–	–	*2 E6	-55℃ ~ 155℃ (Code M)	T1 T5
		±100 (±75)	R=3m	R=2m	R=1m			
KRL6432T4	2W	±50	4m≦R≦9m (1m step) 10m≦R≦100m R=200m, 500m	–	–			
		±100	R=3m	R=2m	R=1m			
KRL7638T4	3W	±50	4m≦R≦9m (1m step) 10m≦R≦100m R=200m, 500m	–	–			
		±100	R=3m	R=2m	R=1m			
KRL9045T4	4W	±50	4m≦R≦9m (1m step) 10m≦R≦100m R=200m, 500m	–	–			
		±100	R=3m	R=2m	R=1m			
KRL11050T4	5W	±50	4m≦R≦9m (1m step) 10m≦R≦100m R=200m, 500m	–	–			T1
		±100	R=3m	R=2m	R=1m			

*1 We can meet your requirement of less than 1mΩ. Please contact our sales office.
*2 We can meet your requirement of resistance value outside of E-6 series. Please contact our sales office.

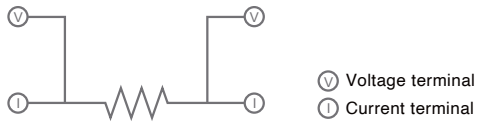
◆Dimensions



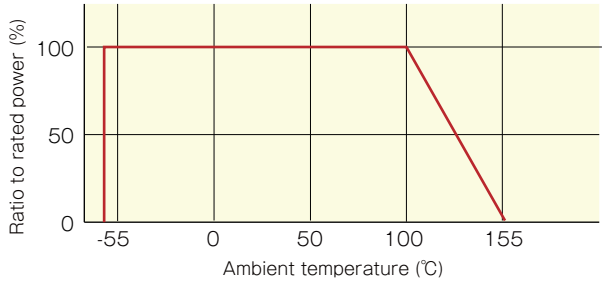
Type	Size (inch)	L	W	a	b	c	d	t
KRL3216T4	0612	1.60±0.20	3.20±0.20	0.35±0.20	0.35±0.15	0.20±0.10	2.65±0.15	0.50±0.20
KRL3216T4A	0612	1.60±0.20	3.20±0.20	0.45±0.20	0.50±0.20	0.50±0.20	2.20±0.20	0.50±0.20
KRL6432T4	1225	3.20±0.20	6.40±0.20	0.50±0.20	0.70±0.15	0.50±0.10	5.20±0.15	0.50±0.20
KRL7638T4	1530	3.80±0.20	7.60±0.20	0.55±0.20	0.80±0.20	0.60±0.20	6.20±0.10	0.50±0.20
KRL9045T4	1835	4.50±0.20	9.00±0.20	0.50±0.20	0.70±0.20	0.50±0.20	5.20±0.10	0.50±0.20
KRL11050T4	2043	5.00±0.20	11.0±0.20	0.70±0.20	1.40±0.20	1.10±0.20	8.50±0.10	0.50±0.20

(unit : mm)

◆Circuit diagram



◆Derating Curve





Low resistance chip resistors
(long-side terminal)

■PRL / RL series

Lead free　Halogen free　RoHS Compliance

Features

・Innovative structure that takes consideration of heat dissipation suppresses the surface temperature enabling the small sizes, reduction of the influence on surrounding components, excellent temperature cycle resistance, low ESL and low noise.

Applications

・PC power sources, inverters, automotive electronics, adopters, industrial machines

◆Part numbering system

PRL 1220 - R010 - D - T5

- T5 (5,000pcs): Packaging quantity
- D: Resistance tolerance
- R010: Nominal resistance value
- 1220: Size: PRL0816, PRL1220, PRL1632, PRL3264
- PRL: Series code

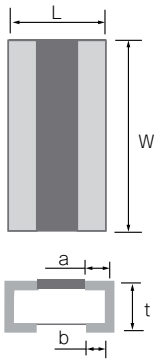
RL 3720W T - R10 - F

- F: Resistance tolerance
- R10: Nominal resistance value
- T: Temperature coefficient of resistance
- 3720W: Size: RL3720W, RL7520W
- RL: Series code

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/°C)	Resistance range(Ω) Resistance tolerance ±0.5% (D)	±1% (F)	±2% (G)	±5% (J)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
PRL0816	1/3W	±50	75m≦R≦100m		–	–	√(P・R)	E-24	-40℃ ~ 125℃	T5
		±100	43m≦R≦68m							
		±100	–	33m≦R≦39m						
		0～+200	–	18m≦R≦27m						
		0～+350	–	10m≦R≦15m						
PRL1220	2/3W	±50	56m≦R≦100m			–		E-24 1m step (7m ~ 10m)		
		±100	47m≦R≦51m							
		±100	–	20m≦R≦43m						
		0～+200	–	10m≦R≦18m						
		0～+350	–	–	7m≦R≦9m					
PRL1632	1W	±50	56m≦R≦100m			–		E-24 1m step (5m ~ 10m)		
		±100	20m≦R≦51m							
		0～+200	10m≦R≦18m							
		0～+350	–	5m≦R≦9m						
PRL3264	2W	±50	56m≦R≦100m			–		E-24 1m step (3m ~ 10m)		
		±50	47m≦R≦51m							
		±100	–	20m≦R≦43m						
		0～+200	–	10m≦R≦18m						
		0～+350	–	5m≦R≦9m		3m≦R≦4m				
RL3720W	1W	±50(Q)	–	100m≦R≦1		–		E-24 1m step (1m ~ 10m)	-55℃ ~ 125℃	4,000pcs
		±100(R)								
		0～+200(S)	–	5m≦R≦91m						
		0～+350(T)	–	1m≦R≦4m						
RL7520W	2W	±50(Q)	–	100m≦R≦470m		–		E-24 1m step (1m ~ 10m)		
		±100(R)		10m≦R≦91m						
		0～+200(S)	–	100m≦R≦470m						
		0～+350(T)	–	10m≦R≦91m						
		0～+420(T)	–	5m≦R≦9m						
		0～+800(T)	–	1m≦R≦4m						

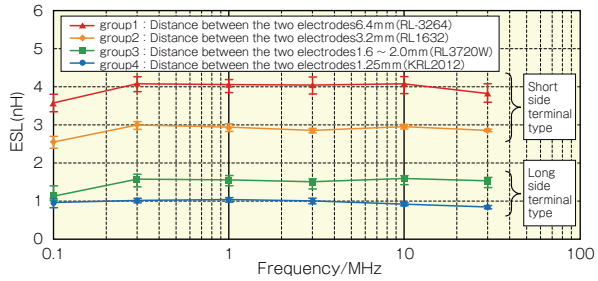
◆Dimensions



Type	Size (inch)	L	W	a	b	t
PRL0816	0306	0.80±0.20	1.60±0.20	–	0.20±0.10	0.40±0.10
PRL1220	0508	1.25±0.20	2.00±0.20	–	0.35±0.15	0.50±0.10
PRL1632	0612	1.60±0.20	3.20±0.20	–	0.45±0.15	0.50±0.10
PRL3264	1225	3.20±0.20	6.40±0.20	–	0.90±0.15	0.50±0.10
RL3720W	0815	2.00±0.20	3.75±0.30	0.40±0.20	0.40+0.20	0.50±0.20
RL7520W	0830	2.00±0.20	7.50±0.30	0.40±0.20	0.40±0.20	0.50±0.20

(unit：mm)

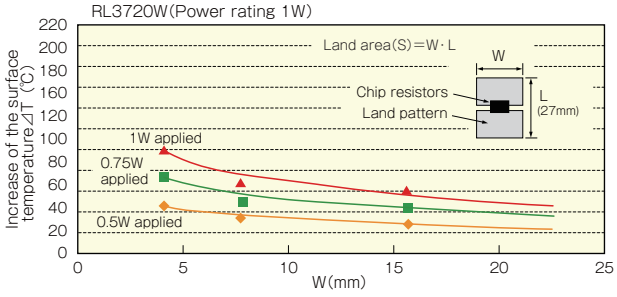
◆ESL (Equivalent series inductance)

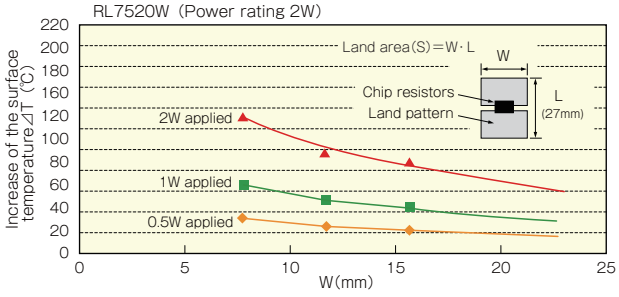


◆Surface temperature data

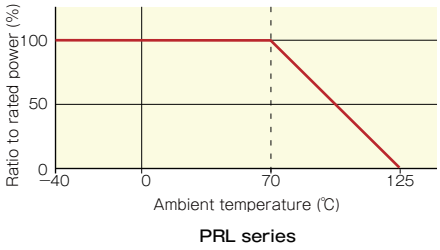
○ The high power type land pattern and surface temperature

These high-power low resistance chip resistors are designed to dissipate heat efficiently through the land patterns on circuit boards. The actual temperature of the surface of the resistor is dependent upon the dimensions and the shape of the land patterns.

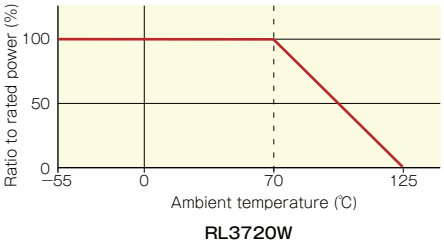




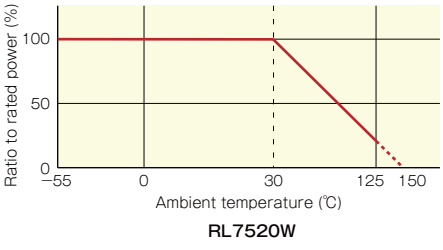
◆Derating Curve



PRL series

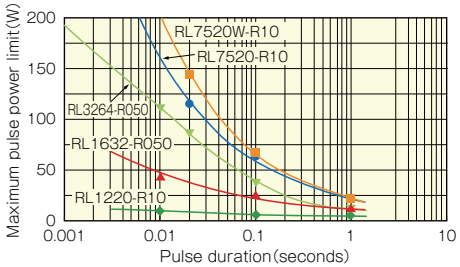


RL3720W



RL7520W

◆Resistance to pulse power



Test procedure

Voltage pulse is applied to the test samples mounted on the test board.
After each pulse, resistance drift is measured. Pulse vol tage is increased until the drift exceeds +/-0.5%.
The power at that voltage is defined as the maximum pulse power.



Low resistance chip resistors
(short-side terminal)

■RL series

Features

・Innovative structure that takes consideration of heat dissipation suppress the surface temperature enabling the small sizes reducing the influence of heat on surrounding components.

Applications

・PC power sources, inverters, automotive electronics, adopters, industrial machines

Lead free *1 | Halogen free | RoHS Compliance

*1 : Except for RL0510, RL1632 and RL3264

◆Part numbering system

RL 1220 S - 1R0 - F

- F: Resistance tolerance
- 1R0: Nominal resistance Value 1R0=1.0Ω
- S: Temperature coefficient of resistance
- 1220: Size : RL0510, RL0816, RL1220
- RL: Series code

RL 1632 S - R047 - F - T5

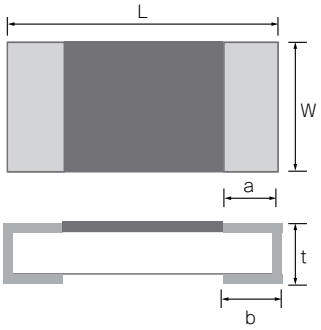
- T5: Packing quantity : T1 (1,000pcs), T5 (5,000pcs)
- F: Resistance tolerance
- R047: Nominal resistance Value 4digit
- S: Temperature coefficient of resistance
- 1632: Size : RL1632
- RL: Series code

◆Electrical Specification

Type	Power ratings	Temperature coefficient of resistance (ppm/°C)	Resistance range(Ω) Resistance tolerance ±1% (F)	±2% (G)	±5% (J)	Maximum voltage	Resistance value series	Operating temperature	Packaging quantity
RL0510	1/8W	0～+350(T)	50m<R<100m		—	√(P・R)	E-24	-55℃ ~ 125℃	10,000pcs
	1/6W	0～+200(S)	100m≦R≦47		—				
			5.1≦R≦47						
RL0816	1/4W	0～+200(S)	20m≦R<100m						5,000pcs
		0～+350(T)							
	1/5W	0～+100(R)	100m≦R≦6.8	—					
		0～+200(S)	7.5≦R≦68						
RL1220	1/4W	0～+200(S)	43m≦91m						
		0～+350(T)	10m≦91m						
	1/3W	0～+100(R)	100m≦R≦10						
		0～+200(S)	11≦R≦100						
RL1632	1/2W	0～+100(R)	510m≦R≦4.7*1	56m≦R≦470m	—				T1 T5
		0～+200(S)	—	33m≦R≦51m					
		0～+350(T)		27m≦R≦30m	18m≦R≦24m				
		0～+500(T)		—	10m≦R≦16m				

*1 RL series with resistance tolerance 0.5% is also available. Please contact our sales office.

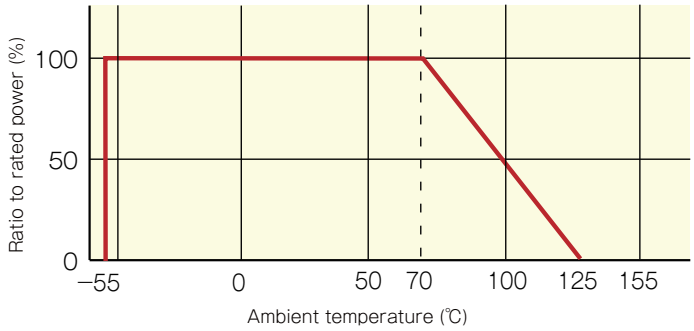
◆Dimensions



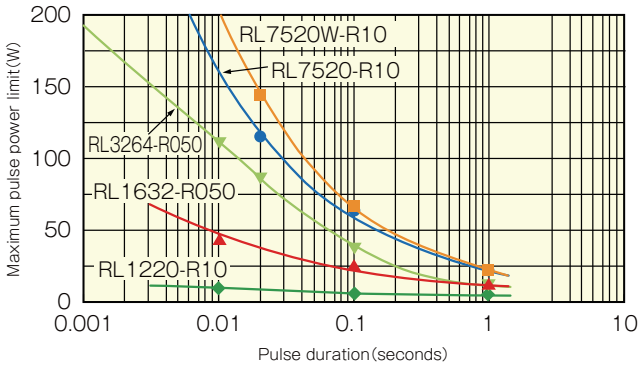
Type		Size (inch)	L	W	a	b	t
RL0510	R≦0.2Ω	0402	1.00±0.05	0.50±0.05	0.15±0.10	0.25±0.10	0.35+0.15/−0.10
	R>0.2Ω					0.15±0.10	0.35±0.10
RL0816	R≦0.082Ω	0603	1.60±0.20	0.80±0.20	0.20±0.15	0.25±0.20	0.45+0.15/−0.10
	R>0.091Ω					0.20±0.15	0.45±0.10
RL1220	R≦0.068Ω	0805	2.00±0.20	1.25±0.20	0.40±0.20	0.40±0.20	0.50±0.20
	R>0.075Ω						0.40±0.10
RL1632		1206	3.20±0.20	1.60±0.20	—	1.00±0.15	0.50±0.15

(unit : mm)

◆Derating Curve



◆Resistance to pulse power



Test procedure

Voltage pulse is applied to the test samples mounted on the test board.
After each pulse, resistance drift is measured. Pulse voltage is increased until the drift exceeds +/-0.5%.
The power at that voltage is defined as the maximum pulse power.



High Current chip jumpers

■YJP series

Features

- Simplify power line change, looping and circuit design when changing current
- Less than 0.3mΩ within operating temperature range
- Surface mount type eliminating jumper leads
- Help reduce the voltage drop/current loss in high current circuit
- Highly stable within operating temperature (-40~125°C)
- Halogen free

Applications

- Mobile phones, smart phones, automotive electronics, power sources, servers, PCs, etc.

Lead free　Halogen free　RoHS Compliance

◆Part numbering system

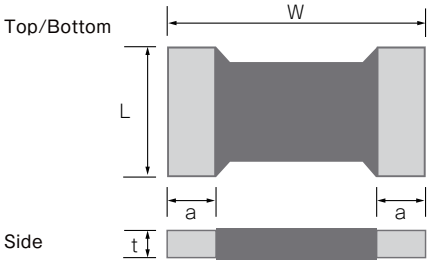
YJP 1608 - R001

- YJP — Series code
- 1608 — Size : YJP1608
- R001 — Maximum resistor value

◆Electrical Specification

Type	Resistance range (Ω)	Rated maximum current	Operating temperature	Rated ambient temperature	Packaging quantity
YJP1608	0.2±0.1mΩ Maximum resistance is less than 0.3mΩ under the operating temperature range	10A	−40 ~+125℃	+70℃	5,000pcs

◆Dimensions



Type	Size (inch)	L	W	a	t
YJP1608	0603	1.60±0.20	0.80±0.20	0.30±0.10	0.30±0.10

(unit : mm)

MEMO

MEMO