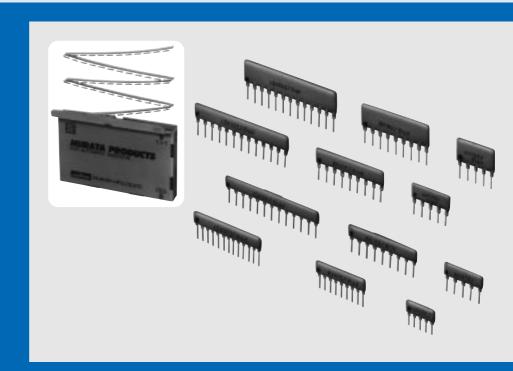
# **R-NETWORK**







### 1

# **CONTENTS**

Part Numbering ————————————————————————————————————	
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■ Part Numbering (The structure of the "Global Part Numbers" that have been adopted since June 2001 and the meaning of each code are described herein.)

### R Network

(Global Part Number)

Custom Circuit RG LD 8 A 1234

#### Product ID

Product ID	
RG	R Networks

### 2Structure

Code	Structure	
LD	Terminal Pitch : 2.54mm, Height : 5.0mm max.	
LE	Terminal Pitch: 1.78mm, Height: 5.0mm max.	
SD	Terminal Pitch : 2.54mm, Height : 6.5mm max.	
HD	Terminal Pitch: 2.54mm, Height: 9.0mm max.	

#### 3Number of Element

Code	Number of Element	
8	1 or 2 digits shows the number of element.	

### **4**Circuit

Code	Circuit		
Х	Pull-up, Pull-down Circuit		
Υ	Isolated Circuit		
Z	Double Terminator Circuit		
М	Divider Circuit		
L	R/2R Ladder Circuit		
Α	Custom Circuit		

**⑤**Nominal Resistance (Z, M Circuit : R<sub>A</sub> L Circuit : Output Impedance)

Expressed by three figures. The unit is ohm  $(\Omega)$ . The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two figures.

Ex.)	Code	Nominal Resistance
	150	15Ω
	103	10kΩ

Code	Resistance Tolerance	
J	±5%	
G	±2%(22Ω min.)	

Nominal Resistance (Z, M Circuit : R<sub>B</sub>)

Expressed by three figures. The unit is ohm  $(\Omega)$ . The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two figures.

Ex.)	Code	Nominal Resistance	
	150	15Ω	
	104	100kΩ	

If  $R_A$  and  $R_B$  values are the same,  $\ \ \ \ \ \$  and  $\ \ \ \ \ \ \ \ \ \ \$  remain blanks, and the corresponding code is omitted.

#### Resistance Tolerance (Z, M Circuit : R<sub>B</sub>)

Code	Resistance Tolerance		
J	±5%		
G	±2%(22Ω min.)		

### Packaging

Code	Packaging	
T1	All-Pin Taping	
T2	3pins Taping	

### **10**Design No.

Code	Design No.	
1234	Expressed by four figures	



### **SIP Resistor Network Features/Applications**

These high quality SIP resistor networks are designed using Murata's years of experience in thick film resistor technology. Their reliability is assured by a massproduction system that puts quality first.

### **■**Features

### 1. Various Types

Murata's R-networks are designed to meet a wide variaty of resistor needs. Three types are available: standard low profile (approximately the same height as ICs, 5mm max.), middle profile, and high profile.

#### Series Name

Pin Pitch			
	2.54mm	1.78mm	Remarks
Height			
9.0mm max.	RGHD	_	Custom Series
6.5mm max.	RGSD	_	Custom Series
5.0mm max.	RGLD	RGLE	Standard Series

#### 2. Standard Circuits

Murata offers the circuits shown below in the standard series; they are frequently used in digital circuits and equipment. Also, Murata produces various custom products to fully meet the customer's needs.

### 3. Compact Design

Compact design allows these resistors to be used in applications requiring high density insertion. An added feature of the 2.54mm pitch types enables insertion along rows and lines of holes with the same pitch.

#### 4. Automatic Insertion

To meet demands to decrease assembly and labor costs, Murata offers two taping types. This allows the products to be automatically inserted in the same way as general radial taping parts. Please note that some automatic insertion machines are not supported.

### **Standard Circuits**

Type Code	X Type	Y Type	M Type	Z Type	L Type (RGSD)
Circuit	***		₩ ₩₩R2	₩₩₩R2 ₩₩₩R1	R R R R R R R R R R R R R R R R R R R

### ■Applications

#### Home Electronics

Color TVs, VCRs, audio equipment, home appliances containing microcomputers (air-conditioners, fan-heaters, washing machines, refrigerators, microwave ovens, etc.).

### Industrial Equipment

Computer and peripheral devices, office supplies (printers, word-processors, plain paper copiers, electric typewriters, etc.) Communication equipment (telephones, digital exchanges, communication systems, etc.) Programmable controllers, Measuring equipment, Car electronics and other types of equipment.

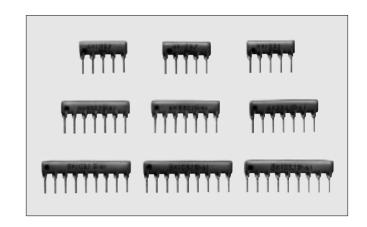




### **Standard Resistor Network RGLD Series**

### **■**Features

- 1. The popular RGLD series has standard low profile dimensions equivalent to those of an IC (height: 5.0mm max.; pitch: 2.54mm).
- 2. Available in tape packaging to meet assembly cost reduction demands.
- 3. Products of this series are used in standard digital circuits.



### **■**Standard Circuits

Circuit Type	Pull up, Pull down	Isolated	Double Terminator	Divider
Type Code	Х Туре	Ү Туре	Z Type	М Туре
Circuit	$R_1 \geqslant R_2 \geqslant R_3 \geqslant R_n \geqslant$ $1 \qquad 2 \qquad 3 \qquad 4 \qquad n+1$ $R_1 = R_2 = \cdots = R_n$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$R_1 \geqslant R_2 \geqslant \cdots R_{\frac{n}{2}} \geqslant $
Number of Elements (Pins)	n=3 to 12 (4 to 13)	n=3 to 7 (6 to 14)	n=8 to 18 (even number) (6 to 11)	n=6 to 12 (even number) (7 to 13)

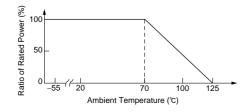
<sup>•</sup> Products with other circuits and other element numbers are also available as custom parts.

■Rating

	RGLD <sub>n</sub> X Type	RGLDnY Type	RGLDnM Type	RGLDnZ Type	
Power Rating Each Resistor *1	1/8W	1/8W	1/8W	1/8W	
Total Rated Power	1/8W×Number of elements (n)	1/8W×Number of elements (n)	1/8W×Number of elements (n)	1/8W×Number of elements (n) ×0.6	
Rated Voltage *2	Rate	ed voltage (V) =√Power rating	(W) ×Nominal resistance value	e (Ω)	
Standard Resistance	E-12 series*3			The following values*4	
Resistance Range		10( $\Omega$ ) to 1M $\Omega$		The following values 4	
Resistance Tolerance*5		J : ±5%, G : ±	-2% (22Ωmin.)		
Temp.Coeff.of Resistance		±200ppm/°C			
Max. Operating Voltage	100V				
Operating Temperature		-55 to +125°C			

<sup>\*1</sup> Derating Curve

The rated power per element and the total rated power are derated according to the following curve.



10, 12, 15, 18, 22, 27,

33, 39, 47, 56, 68, 82

\*5 Resistance tolerance : ±1%, T.C.R : ±100ppm/°C is also available.

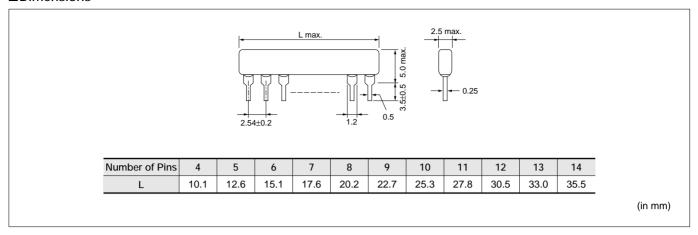


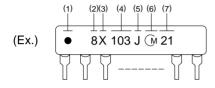
<sup>\*2</sup> When rated voltage exceeds the max. operating voltage, the max. operating voltage shall be regarded as the rated voltage.

<sup>\*3</sup> E-12 Standard Values

<sup>\*4</sup> Standard Resistance Value for Z type ( $\Omega$ ) R<sub>A</sub>/R<sub>B</sub>=180/390, 220/330, 330/390, 330/470

### **■**Dimensions





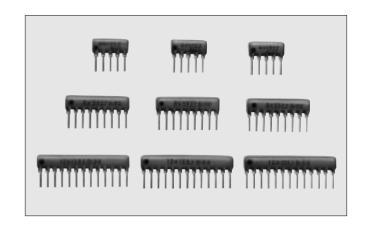
- (1) Pin 1 identification
- (2) Number of Resistors
- (3) Type (Circuit) Designation
- (4) Nominal Resistance Value (3 digits)
- (5) Resistance Tolerance
- (6) Manufacturer's Code
- (7) Date Code (Year, Month)



### **Shrink Pitch Resistor Network RGLE Series**

### **■**Features

- 1. The RGLE series comprises standard low profile R-networks with dimensions equivalent to those of a shrink pin pitch IC (height: 5.0mm; pitch: 1.78mm).
- 2. Equivalent dimensions to shrink pin pitch IC facilitates PCB pattern design and enables high density insertion.



### **■**Standard Circuits

Circuit Type	Pull up, Pull down	Isolated	Divider
Type Code	Х Туре	Ү Туре	М Туре
Circuit	$R_1 \stackrel{>}{\lessgtr} R_2 \stackrel{>}{\lessgtr} R_3 \stackrel{>}{\lessgtr} R_1 \stackrel{>}{\lessgtr}$ $1  2  3  4  n+1$ $R_1 = R_2 = \cdots = R_n$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$R_{1} \geqslant R_{2} \geqslant R_{\frac{n}{2}} \geqslant R_{1} \geqslant R_{2} \geqslant R_{\frac{n}{2}} \geqslant R_{1} \geqslant R_{1} \geqslant R_{2} \geqslant R_{1} \geqslant R_{1} \geqslant R_{2} \geqslant R_{1} \geqslant R_{1} \geqslant R_{1} \geqslant R_{1} \geqslant R_{1} \geqslant R_{2} \geqslant R_{1} \geqslant $
Number of Elements (Pins)	n=3 to 15 (4 to 16)	n=3 to 8 (6 to 16)	n=6 to 12 (even number) (7 to 13)

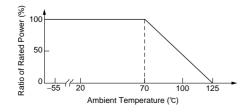
<sup>•</sup> Products with other circuits and other element numbers are also available as custom parts.

### ■ Dating

■ Rating						
	RGLE®X Type	RGLENY Type	RGLEIM Type			
Power Rating Each Resistor *1	1/10W	1/10W	1/10W			
Total Rated Power		1/10WXNumber of elements (n)				
Rated Voltage *2	Rated voltage	(V) =√Power rating (W) ×Nominal resist	ance value (Ω)			
Standard Resistance		E-12 series *3				
Resistance Range		10 $\Omega$ to 1M $\Omega$				
Resistance Tolerance *4		J: ±5%, G: ±2% (22Ωmin.)				
Temp. Coeff. of Resistance	±200ppm/°C					
Max. Operating Voltage	100V					
Operating Temperature	−55 to +125°C					

<sup>\*1</sup> Derating Curve

The rated power per element and the total rated power are derated according to the following curve.



10, 12, 15, 18, 22, 27,

33, 39, 47, 56, 68, 82

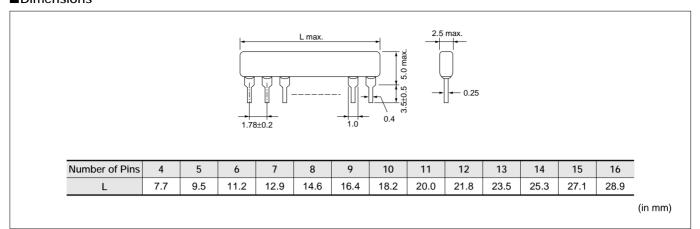


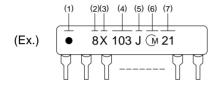
<sup>\*2</sup> When rated voltage exceeds the max. operating voltage, the max. operating voltage shall be regarded as the rated voltage.

<sup>\*3</sup> E-12 Standard Values

<sup>\*4</sup> Resistance tolerance :  $\pm 1\%$ , T.C.R :  $\pm 100$ ppm/°C is also available.

### **■**Dimensions





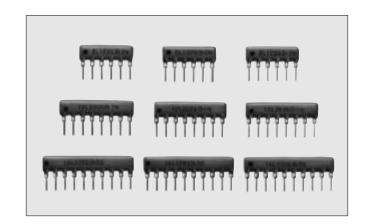
- (1) Pin 1 identification
- (2) Number of Resistors
- (3) Type (Circuit) Designation
- (4) Nominal Resistance Value (3 digits)
- (5) Resistance Tolerance
- (6) Manufacturer's Code
- (7) Date Code (Year, Month)



# **High-Power Isolated Resistor Network RGSD Series**

### **■**Features

- 1. Y type is isolated circuit type. And Y type is used as current limiting resistor, level translating resistor.
- 2. The RGSD series (height : 6.5mm max.; pitch : 2.54mm) is high-power resistor network.
- 3. Available in the tape packing to meet assembly cost reduction demands.
- An added feature of the 2.54mm pitch types enables insertion along rows and lines of holes with the same pitch.



#### **■**Standard Circuits

= Standard Circuits							
Circuit Type	Isolated	Isolated		Isolated			
Type Code	RGSD3Y Type	RGSD4	Y Type	RGSD5Y Type			
Circuit	R <sub>1</sub> R <sub>2</sub> R <sub>3</sub> WW	R <sub>1</sub> R <sub>2</sub> WW	R <sub>3</sub> R <sub>4</sub> W	R <sub>1</sub> R <sub>2</sub> R <sub>3</sub> R <sub>4</sub> R <sub>5</sub> WW			
Circuit Type	Isolated			Isolated			
Type Code	RGSD6Y Type		RGSD7Y Type				
Circuit	R <sub>1</sub> R <sub>2</sub> R <sub>3</sub> R <sub>4</sub> W W W W W W W W W W W W W W W W W W W	Rs Rs W 9 10 11 12	R <sub>1</sub> R <sub>2</sub> W	R <sub>3</sub> R <sub>4</sub> R <sub>5</sub> R <sub>6</sub> R <sub>7</sub> W W W W W W W W W W W W W W W W W W W			

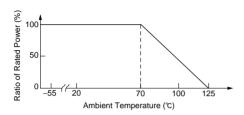
<sup>•</sup> Products with other circuits and other element numbers are also available as custom parts.

■Rating

	RGSD3Y	RGSD4Y	RGSD5Y	RGSD6Y	RGSD7Y
Power Rating Each Resistor *1			1/4W		
Total Rated Power		1/4	WXNumber of elements	(n)	
Rated Voltage *2	*2 Rated voltage (V) = $\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value }(\Omega)}$				
Standard Resistance	E-12 series *3				
Resistance Range	10 $\Omega$ to 1M $\Omega$				
Resistance Tolerance *4	J: ±5%, G: ±2% (22Ωmin.)				
Temp. Coeff. of Resistance	±200ppm/°C				
Max. Operating Voltage	100V				
Operating Temperature	−55 to +125°C				

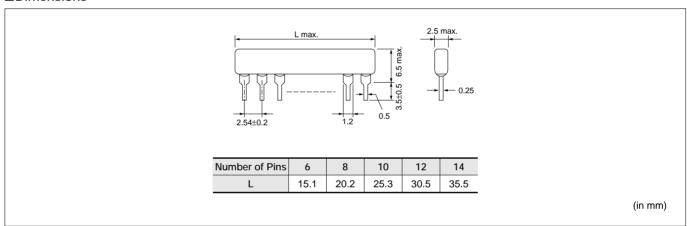
<sup>\*1</sup> Derating Curve

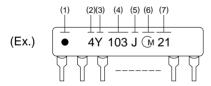
The rated power per element and the total rated power are derated according to the following curve.



- \*2 When rated voltage exceeds the max. operating voltage, the max. operating voltage shall be regarded as the rated voltage.
- \*3 E-12 Standard Values
  - 10, 12, 15, 18, 22, 27,
  - 33, 39, 47, 56, 68, 82
- \*4 Resistance tolerance :  $\pm 1\%$ , T.C.R :  $\pm 100$ ppm/°C is also available.

### **■**Dimensions





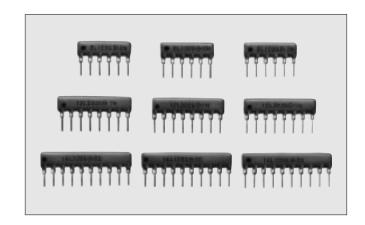
- (1) Pin 1 identification
- (2) Number of Resistors
- (3) Type (Circuit) Designation
- (4) Nominal Resistance Value (3 digits)
- (5) Resistance Tolerance
- (6) Manufacturer's Code
- (7) Date Code (Year, Month)



## R/2R Ladder Resistor Network RGSD Series

### **■**Features

- 1. These high performance R/2R ladder R-networks enabled by thick film technology have a maximum of 8 bits.
- 2. The linearity of RGSD series R/2R ladder R-networks is guaranteed. They have the performance of  $\pm 1/2$ LSB.
- 3. This series has a compact design (height: 6.5mm) and is used in AD/DA converters in a variety of digital circuits and equipment.



### **■Standard Circuits**

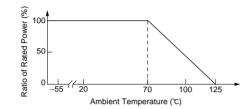
Circuit Type	4Bit R/R2 Ladder Circuit 5Bit R/R2 Lad		ndder Circuit 6Bit R/R2 Ladder Circuit		Circuit
Type Code	RGSD8L Type	RGSD1	OL Type	RGSD12L Type	
Circuit	\$2R \$2R \$2R \$2R \$2R \$1 \$2 \$2 \$2 \$2 \$2 \$2 \$2 \$2 \$2 \$2 \$2 \$2 \$2		R R W W W W W W W W W W W W W W W W W W W	\$2R \$2R \$2R \$2R \$2R \$2R \$1 \$2 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1 \$1	<b>*</b>
Circuit Type	7Bit R/R2 Ladder Circu	uit	8Bit R/R2 Ladder Circuit		
Type Code	RGSD14L Type		RGSD16L Type		
Circuit	\$\frac{1}{2}R \frac{2}{2}R \frac{2}R \frac{2}{2}R 2		\$\frac{1}{2} \frac{1}{2} \frac		0 0 9 10 B <sub>1</sub> OUT

### ■Rating

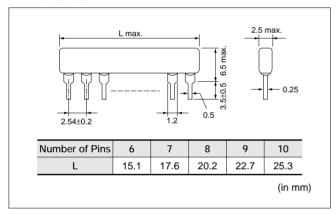
		RGSD8L	RGSD10L	RGSD12L	RGSD14L	RGSD16L		
Power Rati	ng Each Resistor *			1/32W				
Total Rate	d Power		1/32WXNumber of elements					
Rated Volta	age		Rated voltage (V) = $\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value (}\Omega\text{)}}$					
(R) Standa	rd Resistance		10, 20, 25, 50 Series					
(R) Resistance Range		100Ω to 100kΩ						
Output Imp	edance Tolerance	G: ±2%						
Linearity	Bit Error		±1/2 LSB					
Linearity	Full Scale Accuracy	±3.12%	±1.56%	±0.78%	±0.39%	±0.20%		
Temperature	Output Impedance	±200ppm/°C						
Coefficient	Bit Voltage	±50ppm/°C						
Operating Temperature			−55 to +125°C					

<sup>\*</sup> Derating Curve

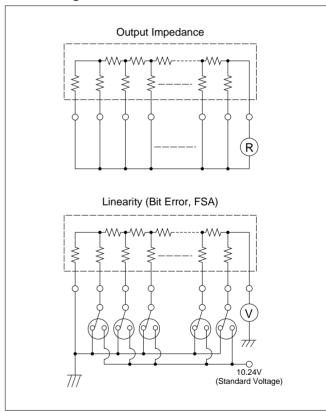
The rated power per element and the total rated power are derated according to the following curve.

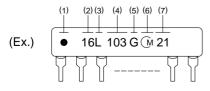


### **■**Dimensions



### ■Measuring Circuit





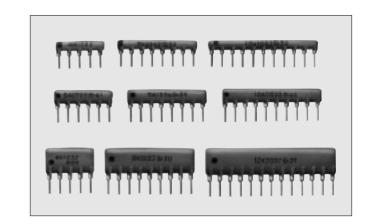
- (1) Pin 1 identification
- (2) Number of Resistors
- (3) Type (Circuit) Designation
- (4) Nominal Resistance Value (3 digits)
- (5) Impedance Tolerance
- (6) Manufacturer's Code
- (7) Date Code (Year, Month)



### **Custom Resistor Network Series**

### **■**Features

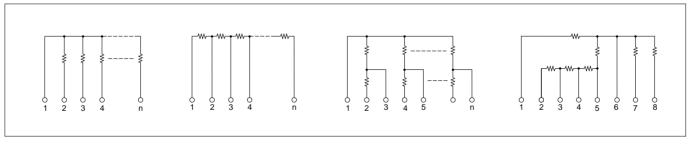
- The profiles of custom resistor network series products range from high profile (9.0mm) to low profile (5.0mm).
   All R-network needs can be accommodated.
- 2. High accuracy performance on resistance tolerance, temperature coefficient etc, is available with high technology and high grade materials.
- 3. Also, on the relative precision of the performance between resistor elements, the high accuracy is available.



### ■Standard Series

Series Name	RGHD Series	RGSD Series	RGLD Series	RGLE Series
Dimensions (in mm)	2.54±0.2	2.54±0.2	x x x x x x x x x x x x x x x x x x x	7.78±0.2
Standard No. of pins	4 to 14	4 to 14	4 to 14	4 to 16

### **■**Example Custom Circuits

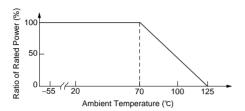


■Rating

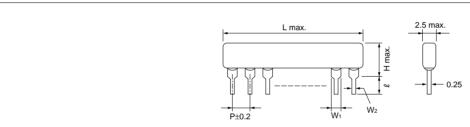
	RGHD Series	RGSD Series	RGLD Series	RGLE Series	
Power Rating Each Resistor *1	to 1/2W	to 1	/4W	to 1/8W	
Total Rated Power *1	1/5X(Number of pins-1)W	1/8×(Numbe	r of pins-1)W	1/16X(Number of pins-1)W	
Rated Voltage *2	Rated voltage (V) = $\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value (}\Omega\text{)}}$				
Resistance Range	10 $\Omega$ to 10M $\Omega$				
Resistance Tolerance	D : $\pm 0.5\%$ ,(100 $\Omega$ to 100k $\Omega$ ), F : $\pm 1\%$ ,(47 $\Omega$ to 220k $\Omega$ ), $\pm 2\%$ (22 $\Omega$ Over), J : $\pm 5\%$				
Resistance Value Ratio	±0.5%, ±1%, ±2% (Per customer's specifications)				
Temp.Coeff.of Resistance	±200ppm/°C (±100ppm/°C is also available)				
Max. Operating Voltage			to 500V		
Operating Temperature —55 to +125°C					

<sup>\*1</sup> Derating Curve

The rated power per element and the total rated power are derated according to the following curve.



### **■**Dimensions

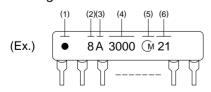


Series	RGHD	RGSD	RGLD	RGLE	
Н	9.0	6.5	5.0	5.0	
l	3.5±0.5				

Dimension Series	Р	W1	W2
RGLE	1.78	1.0	0.4
Others	2.54	1.2	0.5

Nu Series	mber of Pins	4	5	6	7	8	9	10	11	12	13	14	15	16
L	RGLE	7.7	9.5	11.2	12.9	14.6	16.4	18.2	20.0	21.8	23.5	25.3	27.1	28.9
	Others	10.1	12.6	15.1	17.6	20.2	22.7	25.3	27.8	30.5	33.0	35.5	_	

(in mm)



- (1) Pin 1 identification
- (2) Number of Resistors
- (3) Type (Circuit) Designation
- (4) Murata's design No.
- (5) Manufacturer's Code
- (6) Date Code (Year, Month)

<sup>\*2</sup> When rated voltage exceeds the max. operating voltage, the max. operating voltage shall be regarded as the rated voltage.

# **Performance and Test Method**

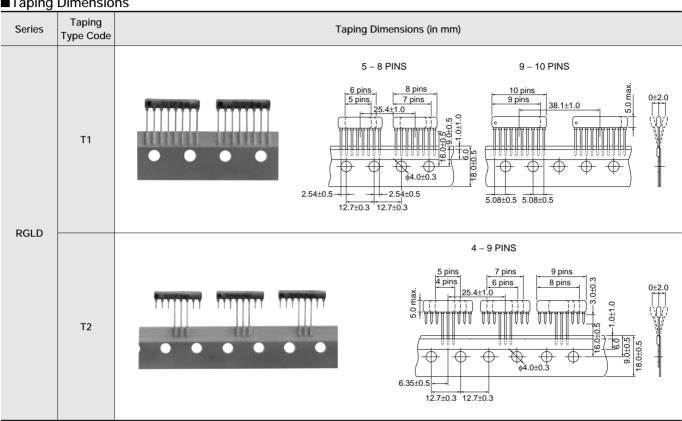
	Test Item	Performance	Test Method					
			Based on JIS C 5202 5.1. Maximum applied voltage is shown in the table below.					
DC Resistance value Within the spec		Within the specified Value	Nominal Resistance Range(Ω)	0.3 1 3 10 25 50	(V)			
Temperature Coefficient of Resistance  Within ±200ppm/°C			Based on JIS C 5202 5.2. Measure after maintaining for over 30 minutes at each stage shown in the table below, Calculation shall be made with the formula shown below.					
Short Time Overload No noticeable abnormalities in appearance. $\Delta R: \mbox{Within $\pm 1.0\%$}$		Apply 2.5 times the rated voltage for 5 seconds to each resistor in the network, one at a time. Maintain at room temperature for 30 minutes after remove the voltage, then measure.						
Terminal Strength	Pull Test	There shall be no broken or loose pins.	Fix the sample body and app Maintain the force for 10 secon	nds.				
Te	Bend Test	pino.	Bend the pin by 90° in the vertical direction and return to the previous position under applying a load of 5N. And repeat a similar operation in the opposite direction.					
Resistance to Soldering Heat  There shall be neither mechanical damage nor noticeable change in appearance.  ΔR: Within ±0.5%		Immerse the pin in melted solder at 260±5℃ up to the level of the seating plane of pin for 10±1 second and raise. Then maintain at room temperature for over 1 hour and measure.						
Solderability  Over 95% of the immersed part of the pins is covered with new solder.			Immerse the pin in a flux comprising methanol and resin (weight ratio 25%) up to the level of the seating plane of pin for 5−10seconds. Then, immerse in melted solder at 235±5°C for 2±0.5 second and raise slowly.					
Cycling		There shall be no mechanical damage. $\Delta R: \mbox{Within $\pm 0.5\%$}$	Based on JIS C 5202 7.4 After room temperature for 1−2 hou         Stage       1         Temp.(°C)       −55±3         Time (min.)       30		shown in the table  4  Room Temp. 2 to 3	below, maintain at		
Humidity  There shall be no noticeable abnormalities in appearance. $\Delta R$ : Within $\pm 2.0\%$		Maintain without load at a constant temperature 40±2℃ and constant humidity of 90–95% for 1000±⁴8 hours. Remove and maintain at room temperature for over 1 hour, then measure.						
Humidity Load  There shall be no noticeable abnormalities in appearance.  ΔR: Within ±2.0%			Apply the rated voltage intermittently, 1.5 hours on and 0.5 hours off in a chamber at a constant temperature of 40±2°c and constant humidity of 90−95% for 1000±⁴8 hours. Remove and maintain at room temperature for over 1 hour, then measure.					
Load	Life	There shall be no noticeable abnormalities in appearance. ΔR: Within ±2.0%	Apply the rated voltage intermittently, 1.5 hours on and 0.5 hours off in a high-temperature chamber at 70±3°C for 1000±48 hours. Remove and maintain at room temperature for over 1 hour, then measure.					



## Packaging

- 1. R-networks are available in two types of taping: 3-pin taping and all-pin taping.
- 2. 3-pin taping type is applicable to automatic insertion equivalent to 5mm pitch radial taping parts. The tips of untaped terminals are shaped by a V-cut for high accuracy insertion.

■Taping Dimensions



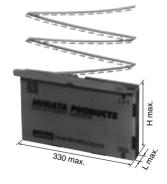
### ■Standard Ammo Pack Package Quantity

1000pcs./case

### ■Package and Marking

• H, L (Height and Length)

Туре	Number of pins	Н	L	
T1	5 to 8	200	40	
	9 to 10	290	40	
T2	4 to 9	210	45	
			(in mm)	



### ■Minimum Quantity 1000pcs.

### **⚠Caution/Notice**

### 

Use within rated voltage
To avoid resistor burning or breakdown, do not use
beyond the rated voltage calculated by taking the square
root of the product or rated power and nominal resistance
value.

### ■Notice

- Handling after mounting to PCB
   Do not bend the product after mounting and soldering the product. If subjected to mechanical stress, the resistor may become damaged.
- 2. Confirmation of resistor operation in application Ensure proper performance of the product in your application.
- 3. Environmental conditions

  Do not use or store the product in locations containing corrosive gasses (Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, NO<sub>x</sub>, etc.) or having such high humidity as will dew as the product's resin coating does not form a perfect seal.



# ISO 9000 Certifications

Manufacturing plants of these products in this catalog have obtained the ISO9002 quality system certificate.

<u> </u>	<u> </u>	1 , ,	
Plant	Certified Date	Organization	Registration No.
Kanazu Murata Manufacturing Co., Ltd.	July. 1. 1998	UL*	A6734

<sup>\*</sup> UL : Underwriters Laboratories Inc.



### **⚠ Note:**

1. Export Control

(For customers outside Japan)

No muRata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction (nuclear, chemical or biological weapons or missiles) or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required

- 2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.
  - 1 Aircraft equipment 3 Undersea equipment
- 2 Aerospace equipment
- (5) Medical equipment
- 4 Power plant equipment (6) Transportation equipment (vehicles, trains, ships, etc.)
- (7) Traffic signal equipment
- ® Disaster prevention / crime prevention equipment
- 9 Data-processing equipment
- (1) Application of similar complexity and/or reliability requirements to the applications listed above
- 3. Product specifications in this catalog are as of November 2001. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.
- 4. Please read rating and ACAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
- 5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
- 6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.
- 7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.



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