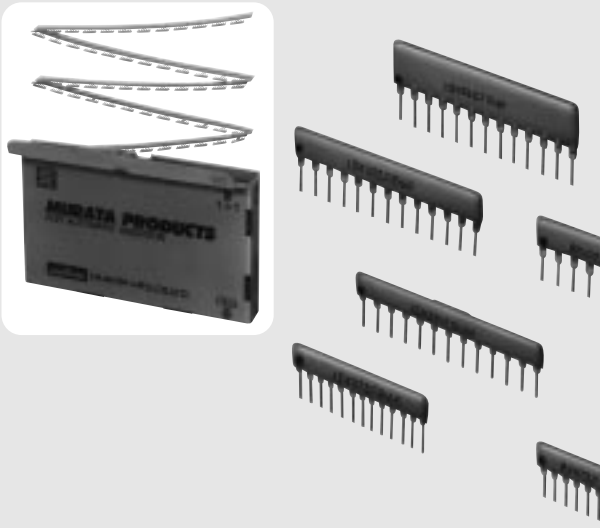
R-NETWORK



Innovator in Electronics

Murata
Manufacturing Co., Ltd.

(Global Part Number)

X, Y, L Circuit

❶	❷	❸	❹	❺	❻		❾
RG	LD	8	X	103	J		T2

Z, M Circuit

❶	❷	❸	❹	❺	❻	❼	❽	❾
RG	LD	8	M	103	J	104	J	T2

Custom Circuit

❶	❷	❸	❹	❿
RG	LD	8	A	1234

❶Product ID

Product ID	
RG	R Networks

❷Structure

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.

❸Number of Element

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

❹Circuit

Code	Circuit
X	Pull-up, Pull-down Circuit
Y	Isolated Circuit
Z	Double Terminator Circuit
M	Divider Circuit
L	R/2R Ladder Circuit
A	Custom Circuit

❺Nominal Resistance (Z, M Circuit : R_A / L Circuit : Output Impedance)

Expressed by three figures. The unit is ohm (Ω). 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

❻Resistance Tolerance (Z, M Circuit : R_A / L Circuit : Impedance Tolerance)

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

❼Nominal Resistance (Z, M Circuit : R_B)

Expressed by three figures. The unit is ohm (Ω). 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, ❼ and ❽ remain blanks, and the corresponding code is omitted.

❽Resistance Tolerance (Z, M Circuit : R_B)

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

❾Packaging

Code	Packaging
T1	All-Pin Taping
T2	3pins Taping

❿Design No.

Code	Design No.
1234	Expressed by four figures

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 / Height	2.54mm	1.78mm	Remarks
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.

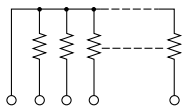
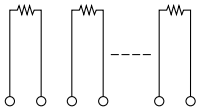
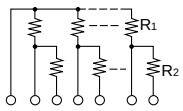
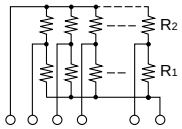
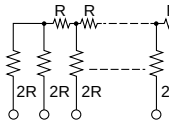
3. Compact Design

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

4. Automatic Insertion

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

Standard Circuits

Type Code	X Type	Y Type	M Type	Z Type	L Type (RGSD
Circuit					

■Applications

● Home Electronics

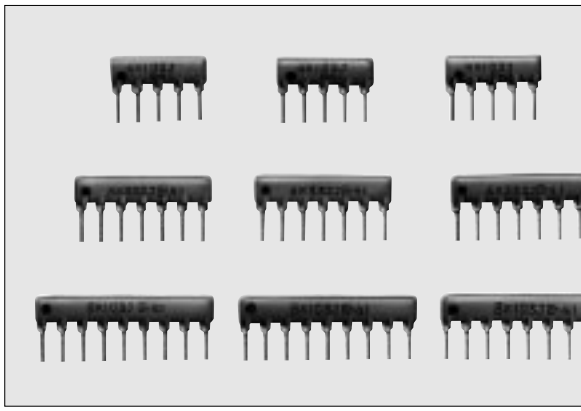
Color TVs, VCRs, audio equipment, home appliances containing microcomputers (air-conditioners, fan-heaters, washing machines, refrigerators, microwave ovens, etc.).

● Industrial Equipment

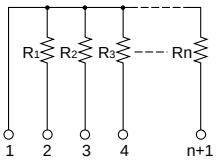
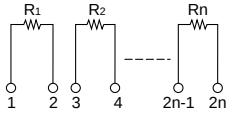
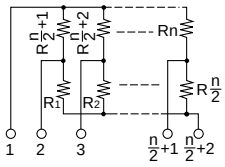
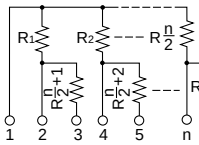
Computer and peripheral devices, office supplies (printers, word-processors, plain paper copiers, electric typewriters, etc.) Communication equipment (telephones, digital exchanges, communication systems, etc.) Programmable controllers, Measuring equipment, Car electronics and other types of equipment.

■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	X Type	Y Type	Z Type	M Type
Circuit	 $R_1 = R_2 = \cdots\cdots = R_n$	 $R_1 = R_2 = \cdots\cdots = R_n$	 $R_A = R_1 = R_2 = \cdots\cdots = R\frac{n}{2}$ $R_B = R\frac{n}{2}+1 = R\frac{n}{2}+2 = \cdots = Rn$	 $R_A = R_1 = R_2 = \cdots\cdots = R\frac{n}{2}$ $R_B = R\frac{n}{2}+1 = R\frac{n}{2}+2 = \cdots =$
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 numb (7 to 13)

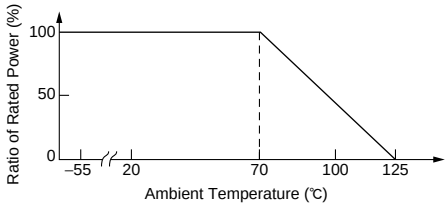
• Products with other circuits and other element numbers are also available as custom parts.

■Rating

	RGLD□X Type	RGLD□Y Type	RGLD□M Type	RGLD□Z 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
Rated Voltage *2	Rated voltage (V) = $\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value } (\Omega)}$			
Standard Resistance	E-12 series*3			The following value
Resistance Range	10(Ω) to 1MΩ			
Resistance Tolerance*5	J : ±5%, G : ±2% (22Ωmin.)			
Temp.Coeff.of Resistance	±200ppm/°C			
Max. Operating Voltage	100V			
Operating Temperature	−55 to +125°C			

*1 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. opera voltage shall be regarded as the rated voltage.

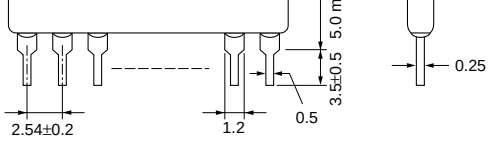
*3 E-12 Standard Values

10, 12, 15, 18, 22, 27,
33, 39, 47, 56, 68, 82

*4 Standard Resistance Value for Z type (Ω)

R_A/R_B=180/390, 220/330, 330/390, 330/470

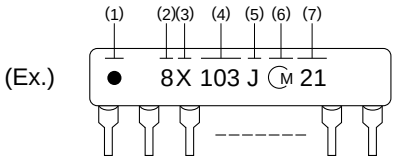
*5 Resistance tolerance : ±1%, T.C.R : ±100ppm/°C is also available.



Number of Pins	4	5	6	7	8	9	10	11	12	13	14
L	10.1	12.6	15.1	17.6	20.2	22.7	25.3	27.8	30.5	33.0	35.5

(in m

■Marking

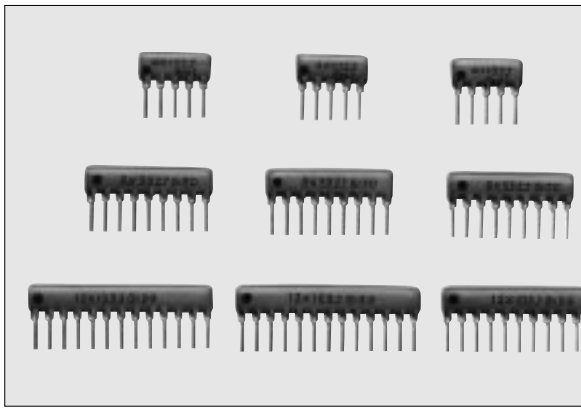


(1) Pin 1 identification
(2) Number of Resistors
(3) Type (Circuit) Designation
(4) Nominal Resistance Value (3 digits)
(5) Resistance Tolerance
(6) Manufacturer's Code
(7) Date Code (Year, Month)

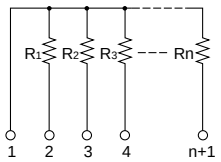
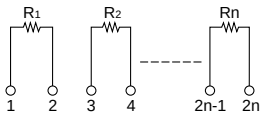
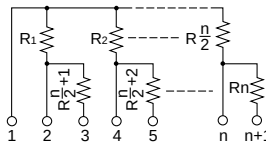
2

■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

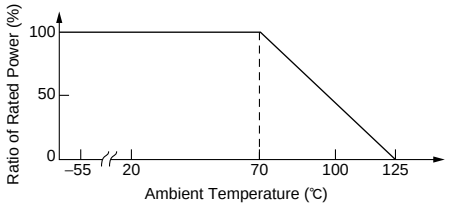
Circuit Type	Pull up, Pull down	Isolated	Divider
Type Code	X Type	Y Type	M Type
Circuit	 $R_1 = R_2 = \cdots\cdots = R_n$	 $R_1 = R_2 = \cdots\cdots = R_n$	 $R_A = R_1 = R_2 = \cdots\cdots = R\frac{n}{2}$ $R_B = R\frac{n}{2}+1 = R\frac{n}{2}+2 = \cdots = Rn$
Number of Elements (Pins)	n=3 to 15 (4 to 16)	n=3 to 8 (6 to 16)	n=6 to 12 (even number) (7 to 13)

• Products with other circuits and other element numbers are also available as custom parts.

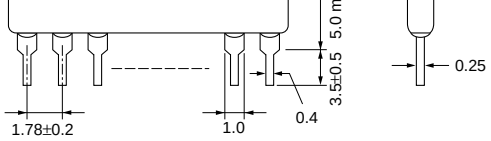
■Rating

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

*1 Derating Curve
The rated power per element and the total rated power are derated according to the following curve.



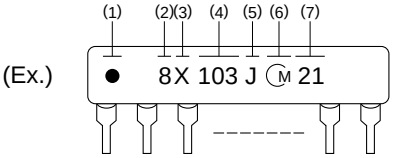
*2 When rated voltage exceeds the max. operating voltage, the max. operat voltage shall be regarded as the rated voltage.
*3 E-12 Standard Values
10, 12, 15, 18, 22, 27,
33, 39, 47, 56, 68, 82
*4 Resistance tolerance : ±1%, T.C.R : ±100ppm/°C is also available.



Number of Pins	4	5	6	7	8	9	10	11	12	13	14	15	16
L	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

(in m

■Marking

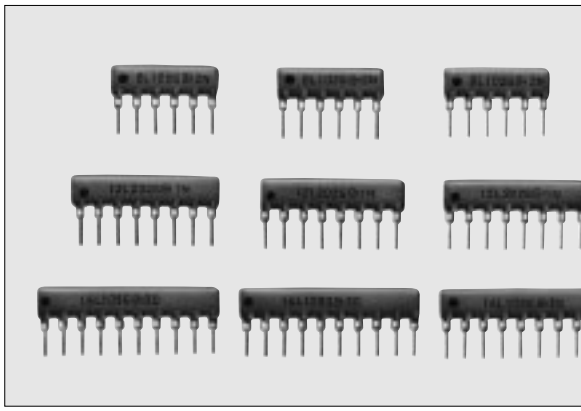


(1) Pin 1 identification
(2) Number of Resistors
(3) Type (Circuit) Designation
(4) Nominal Resistance Value (3 digits)
(5) Resistance Tolerance
(6) Manufacturer's Code
(7) Date Code (Year, Month)

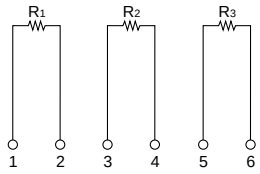
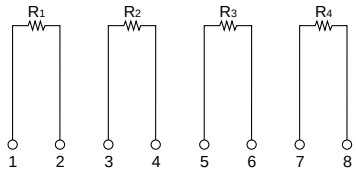
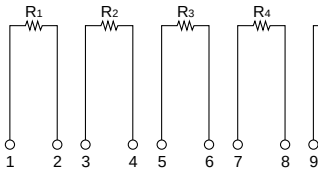
3

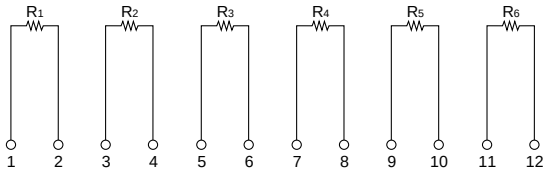
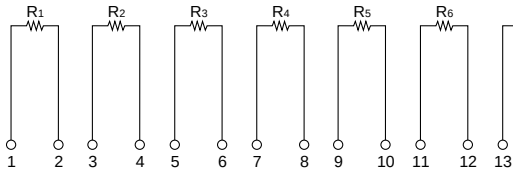
■Features

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.
4. An added feature of the 2.54mm pitch types enables insertion along rows and lines of holes with the same pitch.



■Standard Circuits

Circuit Type	Isolated	Isolated	Isolated
Type Code	RGSD3Y Type	RGSD4Y Type	RGSD5Y Type
Circuit			

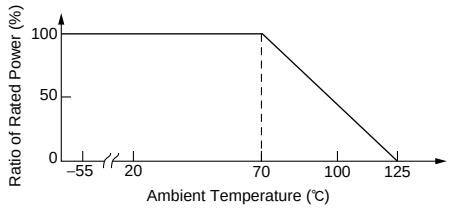
Circuit Type	Isolated	Isolated
Type Code	RGSD6Y Type	RGSD7Y Type
Circuit		

• Products with other circuits and other element numbers are also available as custom parts.

Rated Voltage *2	Rated voltage (V) $=\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value (Ω)}}$
Standard Resistance	E-12 series *3
Resistance Range	10Ω to 1MΩ
Resistance Tolerance *4	J : ±5%, G : ±2% (22Ωmin.)
Temp. Coeff. of Resistance	±200ppm/°C
Max. Operating Voltage	100V
Operating Temperature	−55 to +125°C

*1 Derating Curve

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



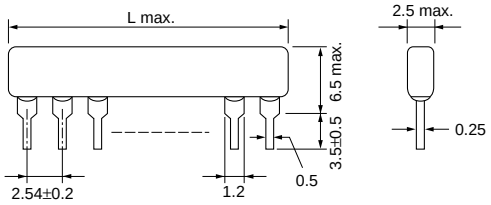
*2 When rated voltage exceeds the max. operating voltage, the max. opera voltage shall be regarded as the rated voltage.

*3 E-12 Standard Values

10, 12, 15, 18, 22, 27,
33, 39, 47, 56, 68, 82

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

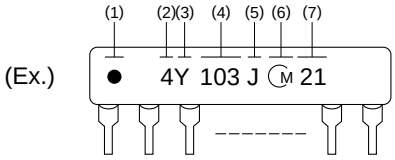
■Dimensions



Number of Pins	6	8	10	12	14
L	15.1	20.2	25.3	30.5	35.5

(in m

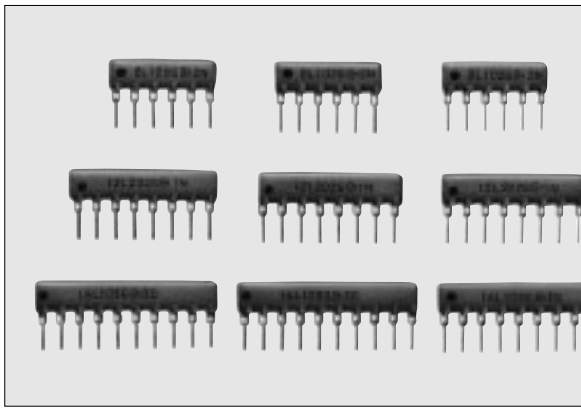
■Marking



(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)

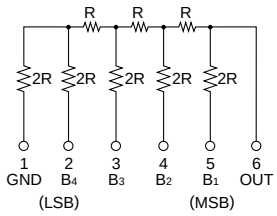
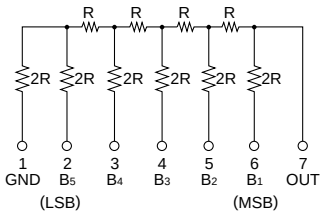
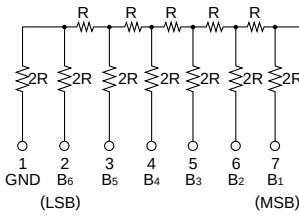
■Features

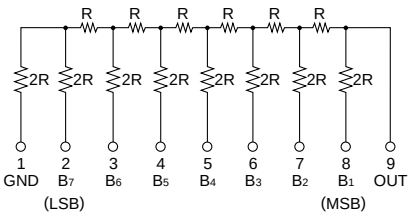
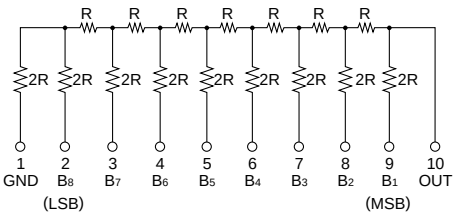
1. These high performance R/2R ladder R-networks enabled by thick film technology have a maximum of 8 bits.
2. The linearity of RGSD series R/2R ladder R-networks is guaranteed. They have the performance of ±1/2LSB.
3. This series has a compact design (height : 6.5mm) and is used in AD/DA converters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



4

■Standard Circuits

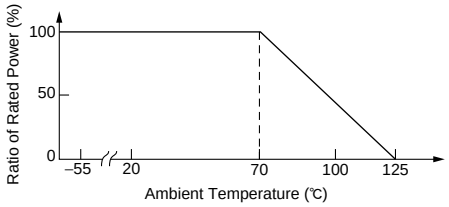
Circuit Type	4Bit R/R2 Ladder Circuit	5Bit R/R2 Ladder Circuit	6Bit R/R2 Ladder Circuit
Type Code	RGSD8L Type	RGSD10L Type	RGSD12L Type
Circuit			

Circuit Type	7Bit R/R2 Ladder Circuit	8Bit R/R2 Ladder Circuit
Type Code	RGSD14L Type	RGSD16L Type
Circuit		

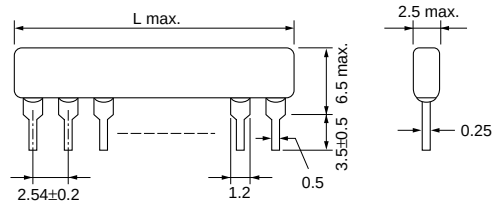
Rated Voltage		Rated voltage (V) = $\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value (Ω)}}$				
(R) Standard Resistance		10, 20, 25, 50 Series				
(R) Resistance Range		100Ω to 100kΩ				
Output Impedance Tolerance		G : ±2%				
Linearity	Bit Error	±1/2 LSB				
	Full Scale Accuracy	±3.12%	±1.56%	±0.78%	±0.39%	±0.20%
Temperature Coefficient	Output Impedance	±200ppm/°C				
	Bit Voltage	±50ppm/°C				
Operating Temperature		−55 to +125°C				

* Derating Curve

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



■Dimensions

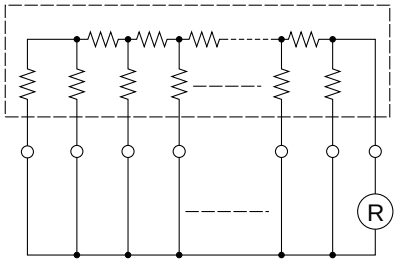


Number of Pins	6	7	8	9	10
L	15.1	17.6	20.2	22.7	25.3

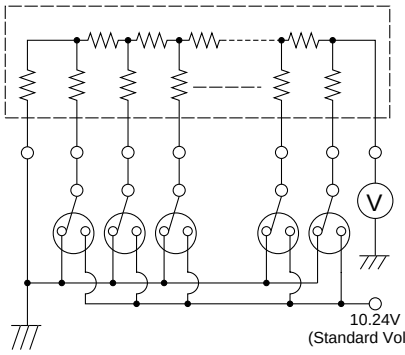
(in mm)

■Measuring Circuit

Output Impedance

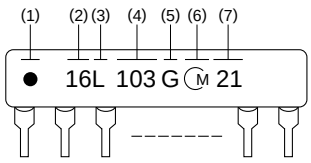


Linearity (Bit Error, FSA)



■Marking

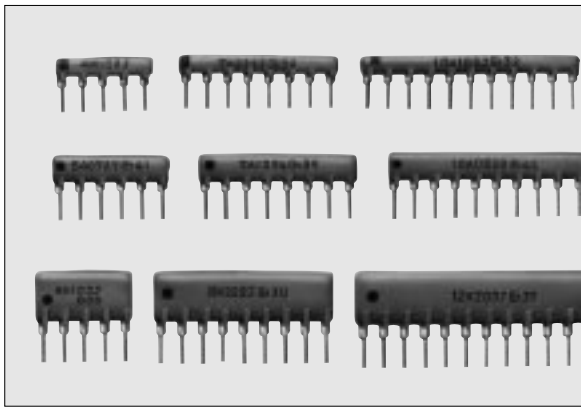
(Ex.)



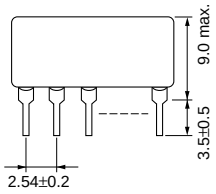
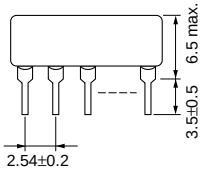
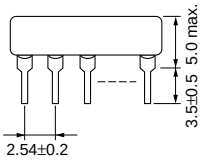
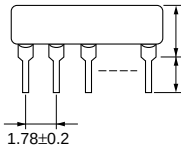
(1) Pin 1 identification
(2) Number of Resistors
(3) Type (Circuit) Designation
(4) Nominal Resistance Value (3 digits)
(5) Impedance Tolerance
(6) Manufacturer's Code
(7) Date Code (Year, Month)

■Features

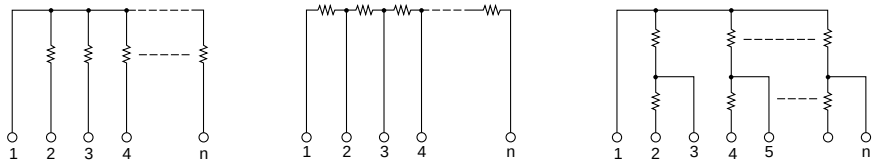
1. The profiles of custom resistor network series products range from high profile (9.0mm) to low profile (5.0mm). All R-network needs can be accommodated.
2. High accuracy performance on resistance tolerance, temperature coefficient etc, is available with high technology and high grade materials.
3. 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)				
Standard No. of pins	4 to 14	4 to 14	4 to 14	4 to 16

■Example Custom Circuits

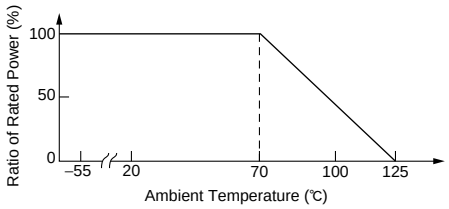


5

Rated Voltage *2	Rated voltage (V) $=\sqrt{\text{Power rating (W)} \times \text{Nominal resistance value (Ω)}}$
Resistance Range	10Ω to 10MΩ
Resistance Tolerance	D : ±0.5%,(100Ω to 100kΩ), F : ±1%,(47Ω to 220kΩ), ±2% (22Ω Over), J : ±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

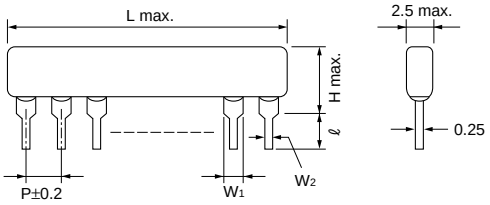
*1 Derating Curve

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. opera voltage shall be regarded as the rated voltage.

■Dimensions



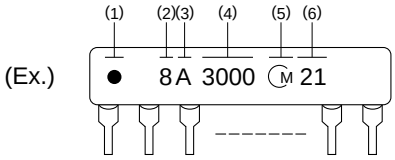
Dimension \ Series	RGHD	RGSD	RGLD	RGLE
H	9.0	6.5	5.0	5.0
ℓ	3.5±0.5			

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

Series \ Number 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 m

■Marking



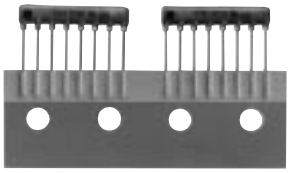
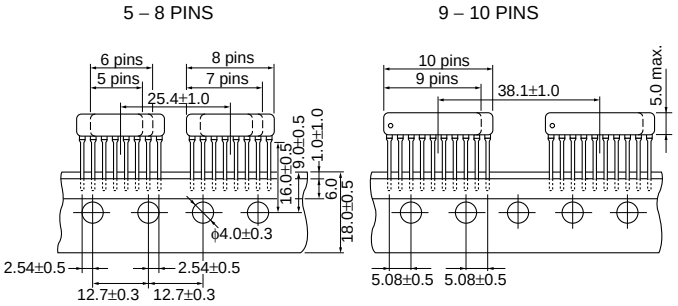
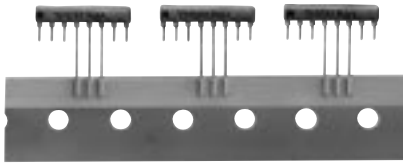
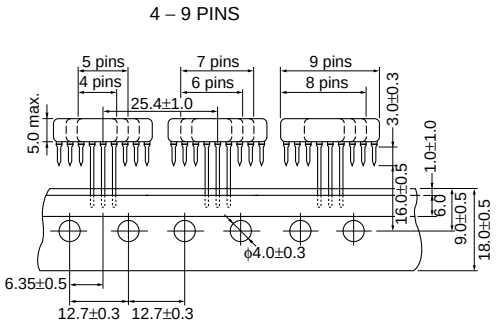
(1) Pin 1 identification
(2) Number of Resistors
(3) Type (Circuit) Designation
(4) Murata's design No.
(5) Manufacturer's Code
(6) Date Code (Year, Month)

<table>
<tr><td>DC Resistance value</td><td>Within the specified Value</td><td>Based on JIS C 5202 5.1. Maximum applied voltage is shown in the table below.
<table><tr><th>Nominal Resistance Range(Ω)</th><th>Max. Applied Voltage (V)</th></tr><tr><td><100</td><td>0.3</td></tr><tr><td>100≦R<1k</td><td>1</td></tr><tr><td>1k≦R<10k</td><td>3</td></tr><tr><td>10k≦R<100k</td><td>10</td></tr><tr><td>100k≦R<1M</td><td>25</td></tr><tr><td>≧1M</td><td>50</td></tr></table></td></tr>
<tr><td>Temperature Coefficient of Resistance</td><td>Within ±200ppm/℃</td><td>Based on JIS C 5202 5.2. Measure after maintaining for over 30 minutes at each shown in the table below, Calculation shall be made with the formula shown below.
<table><tr><th>Stage</th><th>Temp.°C</th><th>Remarks</th></tr><tr><td>1</td><td>20^{+5}_{-1}</td><td>Standard temp. on low-temp. side</td></tr><tr><td>2</td><td>−55±3</td><td></td></tr><tr><td>3</td><td>20^{+5}_{-1}</td><td>Standard temp. on high-temp. side</td></tr><tr><td>4</td><td>125±3</td><td></td></tr></table>R : Actual measured resistance value(Ω) at t ℃
R_0 : Actual measured resistance value(Ω) at t_0 ℃
t : Actual measured value of test temperature (℃)
t_0 : Actual measured value of standard temperature (℃)
$TCR(ppm/℃)=\frac{R-R_0}{R_0}\times\frac{1}{t-t_0}\times10^6$</td></tr>
<tr><td>Short Time Overload</td><td>No noticeable abnormalities in appearance.
ΔR : Within ±1.0%</td><td>Apply 2.5 times the rated voltage for 5 seconds to each resistor in the network, one at a Maintain at room temperature for 30 minutes after remove the voltage, then measure.</td></tr>
<tr><td rowspan="2">Terminal Strength</td><td>Pull Test</td><td rowspan="2">There shall be no broken or loose pins.</td><td>Fix the sample body and apply a load of 10N gradually to the pin in the axial dire Maintain the force for 10 seconds.</td></tr>
<tr><td>Bend Test</td><td>Bend the pin by 90° in the vertical direction and return to the previous position under ap a load of 5N. And repeat a similar operation in the opposite direction.</td></tr>
<tr><td>Resistance to Soldering Heat</td><td>There shall be neither mechanical damage nor noticeable change in appearance.
ΔR : Within ±0.5%</td><td>Immerse the pin in melted solder at 260±5℃ up to the level of the seating plane of 10±1 second and raise. Then maintain at room temperature for over 1 hour and measu</td></tr>
<tr><td>Solderability</td><td>Over 95% of the immersed part of the pins is covered with new solder.</td><td>Immerse the pin in a flux comprising methanol and resin (weight ratio 25%) up to the l the seating plane of pin for 5−10seconds. Then, immerse in melted solder at 235±5 2±0.5 second and raise slowly.</td></tr>
<tr><td>Temperature Cycling</td><td>There shall be no mechanical damage.
ΔR : Within ±0.5%</td><td>Based on JIS C 5202 7.4 After repeating the 5 cycles shown in the table below, main room temperature for 1−2 hours, then measure.
<table><tr><th>Stage</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp.(℃)</td><td>−55±3</td><td>Room Temp.</td><td>125±2</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>30</td><td>2 to 3</td><td>30</td><td>2 to 3</td></tr></table></td></tr>
<tr><td>Humidity</td><td>There shall be no noticeable abnormalities in appearance.
ΔR : Within ±2.0%</td><td>Maintain without load at a constant temperature 40±2℃ and constant humidity of 90−9 1000^{+48}_{0} hours. Remove and maintain at room temperature for over 1 hour, then meas</td></tr>
<tr><td>Humidity Load</td><td>There shall be no noticeable abnormalities in appearance.
ΔR : Within ±2.0%</td><td>Apply the rated voltage intermittently, 1.5 hours on and 0.5 hours off in a chambe constant temperature of 40±2℃ and constant humidity of 90−95% for 1000^{+48}_{0} Remove and maintain at room temperature for over 1 hour, then measure.</td></tr>
<tr><td>Load Life</td><td>There shall be no noticeable abnormalities in appearance.
ΔR : Within ±2.0%</td><td>Apply the rated voltage intermittently, 1.5 hours on and 0.5 hours off in a high-tempe chamber at 70±3℃ for 1000^{+48}_{0} hours. Remove and maintain at room temperature for hour, then measure.</td></tr>
</table>

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

Series	Taping Type Code	Taping Dimensions (in mm)
RGLD	T1	 
	T2	 

■Standard Ammo Pack Package Quantity

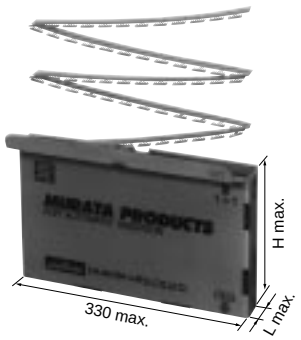
1000pcs./case

■Package and Marking

• H, L (Height and Length)

Type	Number of pins	H	L
T1	5 to 8	200	40
	9 to 10	290	
T2	4 to 9	210	45

(in mm)



■Minimum Quantity

1000pcs.

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

1. 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_2, H_2S, NH_3, SO_2, NO_X, etc.) or having such high humidity as will dew as the product's resin coating does not form a perfect seal.

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

* UL : Underwriters Laboratories Inc.

⚠Note:

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   applications other than those specified in this catalog.
   ① Aircraft equipment ② Aerospace equipment
   ③ Undersea equipment ④ Power plant equipment
   ⑤ Medical equipment ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment ⑩ 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
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5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifica
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7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

muRata **Murata Manufacturing Co., Ltd.**

http://www.murata

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