# SIP Resistor Network

# **R-NETWORK**







Murata Manufacturing Co., Ltd.



Cat.No.N16E-9

# CONTENTS

Par	t Numbering	2
SIP	Resistor Network Features / Applications	3
1	Standard Resistor Network RGLD Series	4
2	Shrink Pitch Resistor Network RGLE Series	6
3	High-Power Isolated Resistor Network RGSD Series	8
4	R/2R Ladder Resistor Network RGSD Series	10
5	Custom Resistor Network Series	12
Per	formance and Test Method	14
Pac	kaging	15
Min	imum Quantitiy	15
۩۩	aution / Notice	16
ISO	9000 Certifications	17



• 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 Nu X, Y, L Circuit	RG LD 8 X 103 J T2	2
Z, M Circuit	0       0	
Custom Circuit	RG LD 8 A <b>0 2 3 4</b>	1234 <b>D</b>

#### Product ID

Product ID	
RG	R Networks

#### 2 Structure

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.

#### 4Circuit

Circuit
Pull-up, Pull-down Circuit
Isolated Circuit
Double Terminator Circuit
Divider Circuit
R/2R Ladder Circuit
Custom Circuit

 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

#### Resistance Tolerance (Z, M Circuit : R<sub>A</sub> L Circuit : Impedance Tolerance)

	· · · · · · · · · · · · · · ·
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 <sub>A</sub> and R <sub>B</sub> values	are the same.  and  remain blanks, and

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

#### BResistance 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

#### 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.

#### Standard Circuits

# 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

3. Compact Design

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.

Compact design allows these resistors to be used in

Type Code	Х Туре	Ү Туре	М Туре	Z Туре	L Type (RGSD)
Circuit			R1	R1 R2 R2 R1 R1 R1 R1 R1	$\begin{bmatrix} 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

- 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 Туре	М Туре
Circuit	$R_{1} \ge R_{2} \ge R_{3} \ge R_{1} \ge 0$ $R_{1} \ge R_{2} \ge R_{3} \ge R_{1} \ge 0$ $R_{1} = R_{2} = \cdots = R_{n}$	$R_{1} = R_{2} = \cdots = R_{n}$	$\begin{array}{c} \hline & & & & \\ \hline & & & & \\ \hline & & & & \\ \hline & & & &$	$R_{1} = R_{2} = \cdots = R_{2}^{n}$ $R_{1} = R_{2} = \cdots = R_{2}^{n}$ $R_{2} = R_{2}^{n}$ $R_{2} = R_{2}^{n}$ $R_{3} = R_{1}^{n} = R_{2}^{n}$ $R_{4} = R_{1} = R_{2}^{n}$ $R_{4} = R_{1}^{n} = R_{2}^{n}$
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)

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

#### ■Rating

	RGLDnX Type	RGLDnY Type	RGLDIM 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)	1/8WXNumber of elements (n)	1/8WXNumber of elements (n) X0.6		
Rated Voltage *2	Rate	ed voltage (V) = $\sqrt{Power rating}$	(W) ×Nominal resistance value	e (Ω)		
Standard Resistance		E-12 series*3				
Resistance Range		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				

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

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

1



1

#### ■Dimensions



#### ■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)





# 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.

11111	11111
11111111	11111111

#### ■Standard Circuits



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

#### ■Rating

	RGLE <sup>n</sup> 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) = $\sqrt{Power rating (W) \times Nominal resist}$	ance 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. 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 :  $\pm$ 100ppm/°C is also available.



2

#### ■Dimensions



#### ■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)





# **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.
- 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	Isol	ated	Isolated	
Type Code	RGSD3Y Type	RGSD3Y Type RGSD4		RGSD5Y Type	
Circuit	$\begin{bmatrix} R_1 & R_2 & R_3 \\ \hline W & \hline \hline W & \hline W & \hline \hline \Psi & \hline \hline \hline \hline$	R1 R2 W W W 0 0 0 0 1 2 3 4	R <sub>3</sub> R <sub>4</sub> R <sub>4</sub> R <sub>4</sub> R <sub>4</sub> R <sub>4</sub> R <sub>4</sub> R <sub>4</sub> R <sub>4</sub>	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Circuit Type	Isolated			Isolated	
Type Code	RGSD6Y Type		RGSD7Y Type		
Circuit	$\begin{bmatrix} R_1 & R_2 & R_3 & R_4 \\ \hline M & \hline \hline M & \hline M & \hline \hline M & \hline \hline M & \hline \hline M & \hline \hline \Pi & \hline M & \hline \hline          $	Rs Re W S 0 0 0 0 9 10 11 12		$\begin{bmatrix} R_3 \\ W \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	

• 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	W×Number of elements	(n)		
Rated Voltage *2		Rated voltage (V) = $\sqrt{F}$	ower rating (W) ×Nomin	al resistance value ( $\Omega$ )		
Standard Resistance			E-12 series *3			
Resistance Range			10 $\Omega$ to 1M $\Omega$			
Resistance Tolerance *4		J	: ±5%, G : ±2% (22Ωmii	n.)		
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. 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 :  $\pm$ 100ppm/°C is also available.

■Dimensions



#### ■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)





# **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  $\pm$ 1/2LSB.
- 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.



■Standard C	Circuits				
Circuit Type	4Bit R/R2 Ladder Circuit	5Bit R/R2 La	adder Circuit	6Bit R/R2 Ladder Circuit	
Type Code	RGSD8L Type	RGSD1	0L Type	RGSD12L Type	
Circuit	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		R R	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Circuit Type	7Bit R/R2 Ladder Circu	uit	8	Bit R/R2 Ladder Circuit	
Type Code	RGSD14L Type			RGSD16L Type	
Circuit	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	

# muRata

#### ■Rating

		RGSD8L	RGSD10L	RGSD12L	RGSD14L	RGSD16L	
Power Rati	ng Each Resistor *	1/32W					
Total Rated	d Power	1/32W×Number of elements					
Rated Volta	age		Rated voltage (V) = $\sqrt{F}$	Power rating (W) ×Nomin	al resistance value ( $\Omega$ )		
(R) Standa	rd Resistance		10, 20, 25, 50 Series				
(R) Resista	nce 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			

\* Derating Curve

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



#### ■Dimensions



#### ■Measuring Circuit



#### ■Marking



- (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

- 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



#### ■Example Custom Circuits





#### ■Rating

	RGHD Series	<b>RGSD Series</b>	RGLD Series	RGLE Series	
Power Rating Each Resistor *1	to 1/2W	to 1	/4W	to 1/8W	
Total Rated Power *1	1/5×(Number of pins-1)W	1/8×(Numbe	r of pins-1)W	1/16×(Number of pins-1)W	
Rated Voltage *2		Rated voltage (V) = $\sqrt{Power rating (W) \times Nominal resistance value (\Omega)}$			
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		$\pm 0.5\%$ , $\pm 1\%$ , $\pm 2\%$ (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. operating voltage shall be regarded as the rated voltage.

#### Dimensions



#### ■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)



## Performance and Test Method

	Test Item	Performance		Test Method			
			Based on JIS C 5202 5.1. Max	imum applied voltage is sho	wn in the table below.		
DC Resistance value Within the specified Value		$\begin{tabular}{ c c c c c } \hline Nominal Resistance Range(\Omega) & Max. Applied Voltage (V) \\ \hline <100 & 0.3 \\ \hline 100 \leq R < 1k & 1 \\ \hline 1k \leq R < 10k & 3 \\ \hline 10k \leq R < 100k & 10 \\ \hline 100k \leq R < 1M & 25 \\ \hline \geq 1M & 50 \\ \hline \end{tabular}$		- - - - -			
•	erature icient of tance	Within ±200ppm/℃	$\begin{array}{c c} \text{Based on JIS C 5202 5.2. M} \\ \text{shown in the table below, Calc} \\ \hline \\ $	ide			
Short	Time Overload	No noticeable abnormalities in appearance. $\Delta R$ : Within ±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 Bend Test	There shall be no broken or loose pins.	<ul> <li>Fix the sample body and apply a load of 10N gradually to the pin in the axial direction. Maintain the force for 10 seconds.</li> <li>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.</li> </ul>				
	stance to ering Heat	There shall be neither mechanical damage nor noticeable change in appearance. $\Delta R$ : Within ±0.5%	Immerse the pin in melted sol	der at 260±5℃ up to the le	evel of the seating plane of pin for re for over 1 hour and measure.		
Solde	erability	Over 95% of the immersed part of the pins is covered with new solder.		-10seconds. Then, immers	weight ratio 25%) up to the level of se in melted solder at 235±5°C for		
Temp Cycli	perature ng	There shall be no mechanical damage. ΔR : Within ±0.5%	Based on JIS C 5202 7.4 After repeating the 5 cycles shown in the table below room temperature for 1–2 hours, then measure.       Stage 1 2 3 4       Temp.(°C)     -55±3     Room Temp.     125±2     Room Temp.       Time (min.)     30     2 to 3     30     2 to 3				
Humi	dity	There shall be no noticeable abnormalities in appearance. $\Delta R$ : Within ±2.0%	Maintain without load at a constant temperature $40\pm2^{\circ}$ C and constant humidity of 90–95% for $1000\pm^{48}$ hours. Remove and maintain at room temperature for over 1 hour, then measure.				
Humi	dity Load	There shall be no noticeable abnormalities in appearance. $\Delta R$ : 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 $40\pm2^{\circ}$ and constant humidity of $90-95\%$ for $1000\pm^{4}8$ hours. Remove and maintain at room temperature for over 1 hour, then measure.				
Load	Life	There shall be no noticeable abnormalities in appearance. $\Delta R$ : 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℃ for 1000± <sup>4</sup> 8 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
т1	5 to 8	200	40
11	9 to 10	290	
T2	4 to 9	210	45

(in mm)



Minimum Quantity 1000pcs.

10000003.



### **∴**Caution/Notice

#### ■ ① Caution

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.

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

\* UL : Underwriters Laboratories Inc.



#### △ Note:

1. Export Control

 $\langle {\sf For \ customers \ outside \ Japan} \rangle$ 

Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.

 $\langle For \ customers \ in \ Japan \rangle$ 

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 for export.

- 2. Please contact our sales representatives or product engineers before using our products listed in this catalog for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property, or when intending to use one of our products for other applications than 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
  - 0 Application of similar complexity and/or reliability requirements to the applications listed in the 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 your ordering. If there are any questions, please contact our sales representatives or product engineers.
- 4. Please read CAUTION and Notice in this catalog for safety. This catalog has only typical specifications. Therefore you are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.
- 5. 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 third party's intellectual property rights and other related rights in consideration of your using 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.
- 6. None of ozone depleting substances (ODS) under the Montreal Protocol is used in manufacturing process of us.

# muRata Murata Manufacturing Co., Ltd.

http://www.murata.co.jp/products/

Head Office 2-26-10, Tenjin Nagaokakyo-shi, Kyoto 617-8555, Japan Phone:81-75-951-9111 International Division 3-29-12, Shibuya, Shibuya-ku, Tokyo 150-0002, Japan Phone:81-3-5469-6123 Fax:81-3-5469-6155 E-mail:intl@murata.co.jp