

## "PGS" Graphite Sheets

Type : EYG



**This part numbers is not a recommended product.**

**Not recommended for new design.**

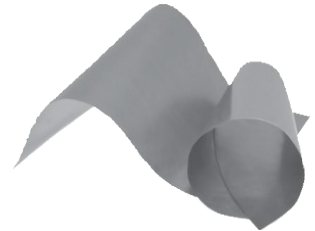
EYGA△△△△OO□□ / EYGE△△△△OO□□

EYGS△△△△01 / EYGS△△△△02 / EYGS△△△△03

EYGS△△△△04 / EYGS△△△△05

"PGS (Pyrolytic Graphite Sheet)" is a thermal conductivity sheet which is very thin, synthetically made, has high thermal conductivity, and is made from a polymer film.

It is ideal for providing thermal management/heat-sinking in limited spaces. This material is flexible and can be cut into customizable shapes.



SSM (Semi-Sealing Material) is the product which is compounding PGS Graphite sheet and High thermal conductive Elastomer resin.

It has a function to absorb heat by resin and transfer the heat by utilizing high thermal conductivity of PGS Graphite sheet.

It also enables taking better attachment to the component which has different height on the electronic board and reducing stress to the electronic board.

### Features

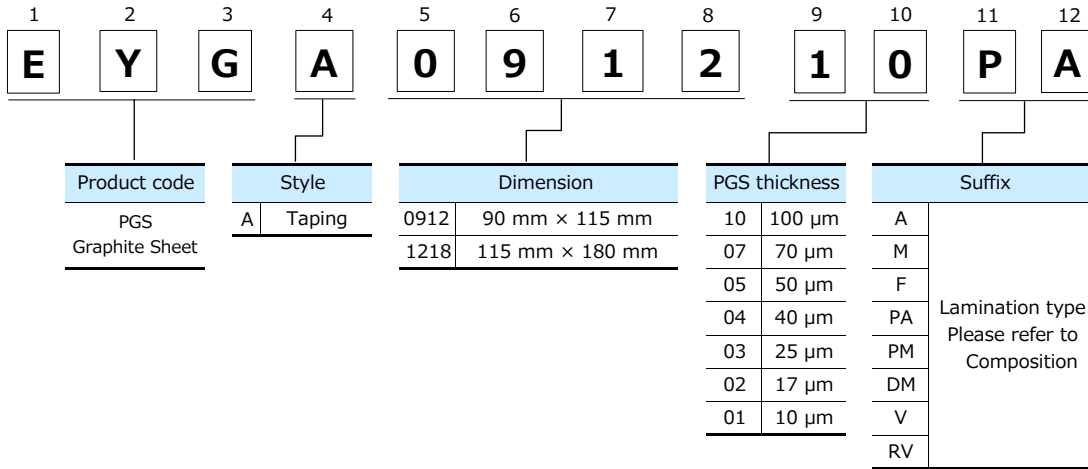
- Excellent thermal conductivity : 700 to 1950 W/(m·K)  
(2 to 5 times as high as copper, 3 to 8 time as high as aluminum)
- Lightweight: Specific gravity 0.85 to 2.13 g/cm<sup>3</sup>  
(1/4 to 1/10 of copper, 1/1.3 to 1/3 of aluminum in density)
- Flexible and easy to be cut or trimmed. (withstands repeated bending)
- Low thermal resistance
- Low heat resistance with flexible Graphite sheet (SSM)
- Low repulsion and easy to keep the product's shape after attaching (SSM)
- Siloxane Free (SSM)
- High dielectric voltage : 17 kVac/mm (SSM)
- RoHS compliant

### Recommended applications

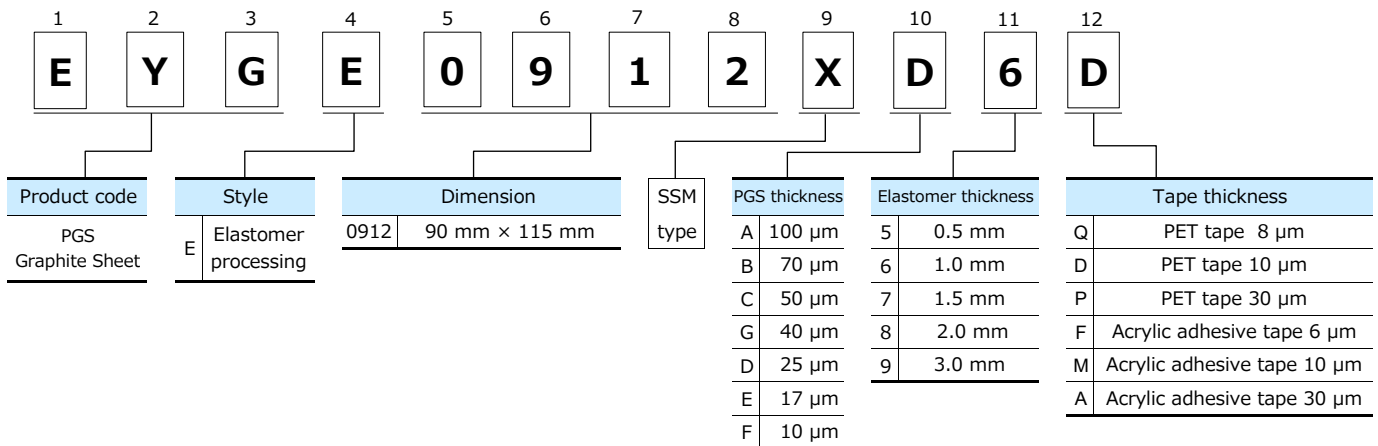
- Semiconductor manufacturing equipment (Sputtering, Dry etching, Steppers)
- Optical communications equipment
- Smart phones, Mobile phones, DSC, DVC, Tablet PCs, PCs and peripherals, LED Devices

**Explanation of part numbers**

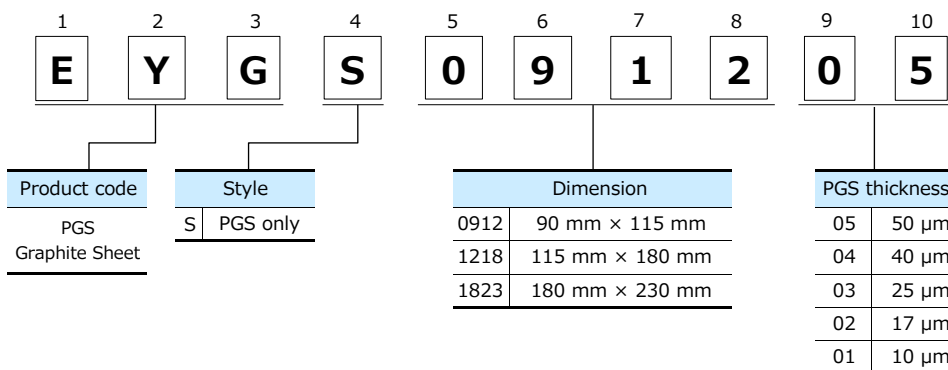
● Taping (EYGA\*\*\*\*\*)



● Thermally conductive elastomer processing (EYGE\*\*\*\*\*)



● PGS only (EYGS\*\*\*\*\*)



## Characteristics of PGS Graphite Sheets

Thickness	100 μm	70 μm	50 μm	40 μm
	0.10±0.03 mm	0.07±0.015 mm	0.050±0.015 mm	0.040±0.012 mm
Density	0.85 g/cm <sup>3</sup>	1.21 g/cm <sup>3</sup>	1.70 g/cm <sup>3</sup>	1.80 g/cm <sup>3</sup>
Thermal conductivity a-b plane	700 W/(m·K)	1000 W/(m·K)	1300 W/(m·K)	1350 W/(m·K)
Electrical conductivity	10000 S/cm	10000 S/cm	10000 S/cm	10000 S/cm
Extensional strength	20.0 MPa	20.0 MPa	20.0 MPa	25.0 MPa
Expansion coefficient	a-b plane	9.3×10 <sup>-7</sup> 1/K	9.3×10 <sup>-7</sup> 1/K	9.3×10 <sup>-7</sup> 1/K
	c axis	3.2×10 <sup>-5</sup> 1/K	3.2×10 <sup>-5</sup> 1/K	3.2×10 <sup>-5</sup> 1/K
Heat resistance *1	400 °C			
Bending(angle 180,R5)	10000 cycles			

Thickness	25 μm	17 μm	10 μm
	0.025±0.010 mm	0.017±0.005 mm	0.010±0.002 mm
Density	1.90 g/cm <sup>3</sup>	2.10 g/cm <sup>3</sup>	2.13 g/cm <sup>3</sup>
Thermal conductivity a-b plane	1600 W/(m·K)	1850 W/(m·K)	1950 W/(m·K)
Electrical conductivity	20000 S/cm	20000 S/cm	20000 S/cm
Extensional strength	30.0 MPa	40.0 MPa	40.0 MPa
Expansion coefficient	a-b plane	9.3×10 <sup>-7</sup> 1/K	9.3×10 <sup>-7</sup> 1/K
	c axis	3.2×10 <sup>-5</sup> 1/K	3.2×10 <sup>-5</sup> 1/K
Heat resistance *1	400 °C		
Bending(angle 180,R5)	10000 cycles		

\*1 : Withstand temperature refers to PGS only. (Lamination material such as PET tape etc. is not included)

\* Values are for reference, not guaranteed.

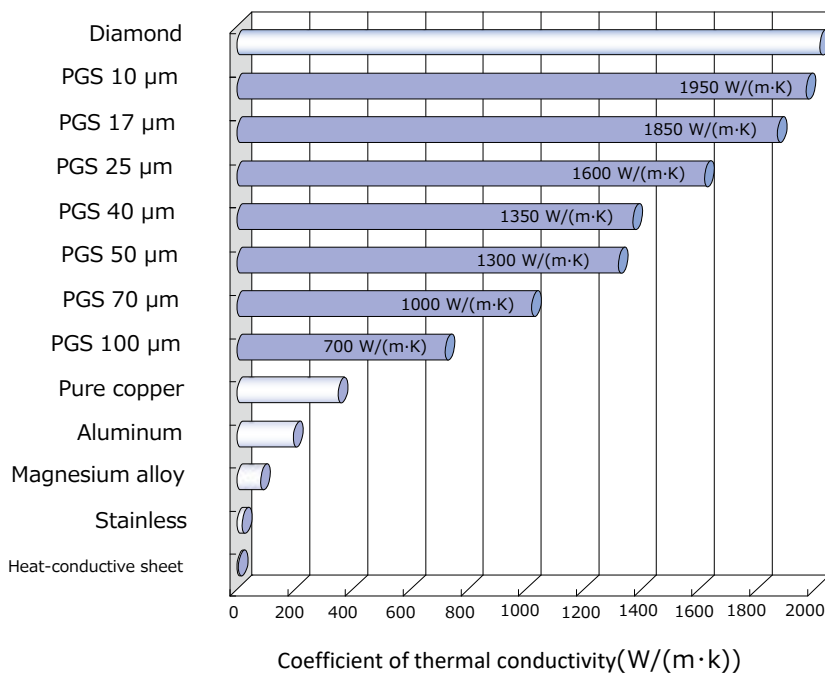
## Characteristics of SSM (Elastomer)

Thickness		1 mm	2 mm	3 mm
Specific heat		1.4 J/(g·C)		
Density		1.88 g/cm <sup>3</sup>		
Thermal conductivity		1.6 W/(m·K) *2		
Thermal resistance	100 kPa	7.53 (C·cm <sup>2</sup> )/W	14.82 (C·cm <sup>2</sup> )/W	19.48 (C·cm <sup>2</sup> )/W
	200 kPa	6.71 (C·cm <sup>2</sup> )/W	13.17 (C·cm <sup>2</sup> )/W	16.01 (C·cm <sup>2</sup> )/W
	300 kPa	5.90 (C·cm <sup>2</sup> )/W	10.73 (C·cm <sup>2</sup> )/W	11.38 (C·cm <sup>2</sup> )/W
Compressibility	100 kPa	4.93 %	4.05 %	4.43 %
	200 kPa	9.58 %	8.66 %	14.04 %
	300 kPa	18.41 %	22.13 %	40.49 %
Resistivity		> 10×10 <sup>14</sup> Ω·cm		
Dielectric voltage		> 17 kVac/mm		
Hardness (Type E)		39		
Adhesive force	SUS	39 mN/cm		
	Aluminum	31 mN/cm		
	Glass	38 mN/cm		

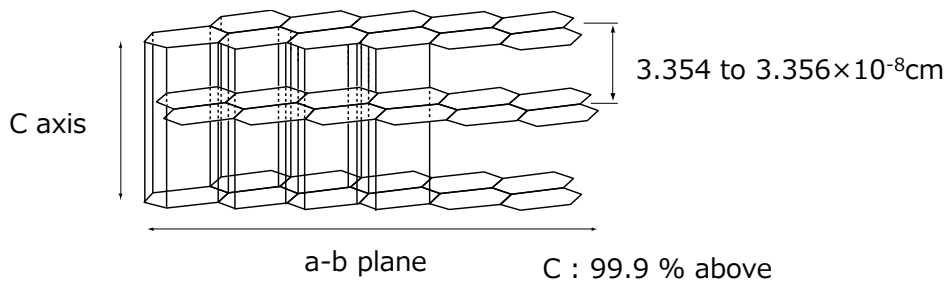
\*2 : Values are for reference, not guaranteed.

\* Characteristics refer to Elastomer resin only.

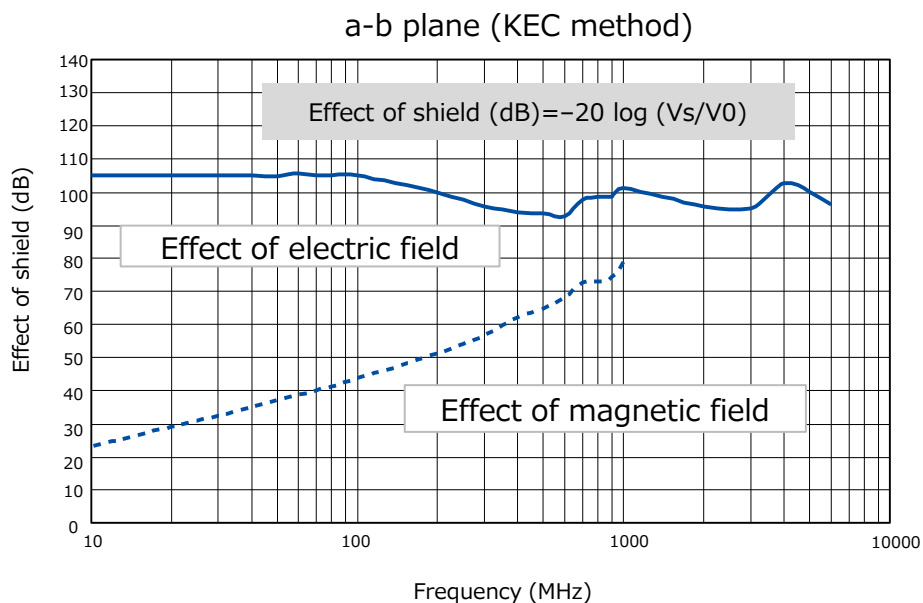
**Comparison of thermal conductivity (a-b plane)**



**Layered structure of PGS**

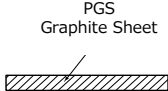
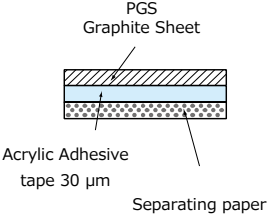
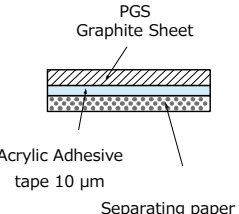
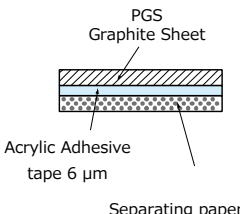


**Electric field shield performance**



**Lamination type / Composition example**

- Standard (PGS 100, 70, 50, 40, 25, 17, 10 μm series)

Type	PGS Only	Adhesive Type			
	S type	A – A type	A – M type	A – F type	
Front face	-	-	-	-	
Rear face	-	Insulative adhesive tape 30 μm	Insulative adhesive tape 10 μm	Insulative adhesive tape 6 μm	
Structure					
Features	<ul style="list-style-type: none"> <li>⊙High thermal conductivity high flexibility</li> <li>⊙Low thermal resistance</li> <li>⊙Available up to 400 °C</li> <li>⊙Conductive material</li> </ul>	<ul style="list-style-type: none"> <li>⊙With insulation material on one side</li> <li>⊙With strong adhesive tape for putting chassis</li> <li>⊙Withstanding voltage : 2 kV</li> </ul>	<ul style="list-style-type: none"> <li>⊙With insulation material on one side</li> <li>⊙Low thermal resistance comparison with A-A type</li> <li>⊙Withstanding voltage : 1 kV</li> </ul>	<ul style="list-style-type: none"> <li>⊙With insulation material on one side</li> <li>⊙Low thermal resistance comparison with A-A type</li> </ul>	
Withstand temperature	400 °C	100 °C	100 °C	100 °C	
Standard size (mm)	90 × 115	90 × 115	90 × 115	90 × 115	
Maximum size (mm)	115 × 180	115 × 180	115 × 180	115 × 180	
100 μm	Part No.	-	EYGA091210A	EYGA091210M	EYGA091210F
	Thickness	-	130 μm	110 μm	106 μm
70 μm	Part No.	-	EYGA091207A	EYGA091207M	EYGA091207F
	Thickness	-	100 μm	80 μm	76 μm
50 μm	Part No.	EYGS121805	EYGA091205A	EYGA091205M	EYGA091205F
	Thickness	50 μm	80 μm	60 μm	56 μm
40 μm	Part No.	EYGS121804	EYGA091204A	EYGA091204M	EYGA091204F
	Thickness	40 μm	70 μm	50 μm	46 μm
25 μm	Part No.	EYGS121803	EYGA091203A	EYGA091203M	EYGA091203F
	Thickness	25 μm	55 μm	35 μm	31 μm
17 μm	Part No.	EYGS121802	EYGA091202A	EYGA091202M	EYGA091202F
	Thickness	17 μm	47 μm	27 μm	23 μm
10 μm	Part No.	EYGS121801	EYGA091201A	EYGA091201M	EYGA091201F
	Thickness	10 μm	40 μm	20 μm	16 μm

\* Withstanding Voltages are for reference, not guaranteed.

**Lamination type / Composition example**

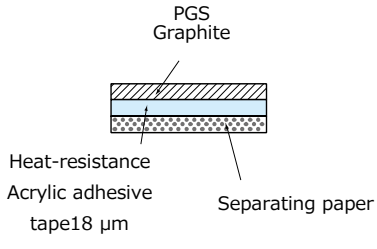
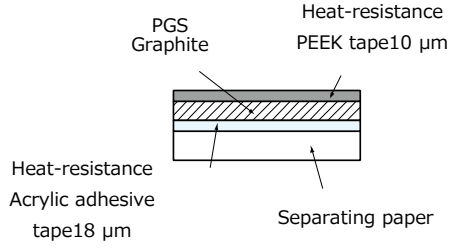
- Standard (PGS 100, 70, 50, 40, 25, 17, 10 μm series)

Type	Laminated type (Insulation & Adhesive)				
	A – PA type	A – PM type	A – DM type	A – DF type	
Front face	Polyester tape standard type 30 μm	Polyester tape standard type 30 μm	Polyester tape standard type 10 μm	Polyester tape standard type 10 μm	
Rear face	Insulative adhesive tape 30 μm	Insulative adhesive tape 10 μm	Insulative adhesive tape 10 μm	Insulative adhesive tape 6 μm	
Structure					
Features	<ul style="list-style-type: none"> <li>◎ With insulation material on one side</li> <li>◎ Withstanding Voltage PET tape : 4 kV Adhesive Tape : 2 kV</li> </ul>	<ul style="list-style-type: none"> <li>◎ With insulation material on one side</li> <li>◎ Withstanding Voltage PET tape : 4 kV Adhesive Tape : 1 kV</li> </ul>	<ul style="list-style-type: none"> <li>◎ With insulation material on one side</li> <li>◎ Withstanding Voltage PET tape : 1 kV Adhesive Tape : 1 kV</li> </ul>	<ul style="list-style-type: none"> <li>◎ With insulation material on one side</li> <li>◎ Withstanding Voltage PET tape : 1 kV</li> </ul>	
Withstand temperature	100 °C	100 °C	100 °C	100 °C	
Standard size (mm)	90 × 115	90 × 115	90 × 115	90 × 115	
Maximum size (mm)	115 × 180	115 × 180	115 × 180	115 × 180	
100 μm	Part No.	EYGA091210PA	EYGA091210PM	EYGA091210DM	EYGA091210DF
	Thickness	160 μm	140 μm	120 μm	116 μm
70 μm	Part No.	EYGA091207PA	EYGA091207PM	EYGA091207DM	EYGA091207DF
	Thickness	130 μm	110 μm	90 μm	86 μm
50 μm	Part No.	EYGA091205PA	EYGA091205PM	EYGA091205DM	EYGA091205DF
	Thickness	110 μm	90 μm	70 μm	66 μm
40 μm	Part No.	EYGA091204PA	EYGA091204PM	EYGA091204DM	EYGA091204DF
	Thickness	100 μm	80 μm	60 μm	56 μm
25 μm	Part No.	EYGA091203PA	EYGA091203PM	EYGA091203DM	EYGA091203DF
	Thickness	85 μm	65 μm	45 μm	41 μm
17 μm	Part No.	EYGA091202PA	EYGA091202PM	EYGA091202DM	EYGA091202DF
	Thickness	77 μm	57 μm	37 μm	33 μm
10 μm	Part No.	EYGA091201PA	EYGA091201PM	EYGA091201DM	EYGA091201DF
	Thickness	70 μm	50 μm	30 μm	26 μm

\* Withstanding Voltages are for reference, not guaranteed.

## Lamination type / Composition example

- High heat resistance (PGS 100, 70, 50, 40, 25, 17, 10 μm series)

Type	High heat resistance type		
	A-V type	A-RV type	
Front face	-	High heat resistance and insulation 13 μm	
Rear face	High heat resistance and insulation adhesion type 18 μm	High heat resistance and insulation adhesion type 18 μm	
Structure	 <p>PGS Graphite</p> <p>Heat-resistance Acrylic adhesive tape 18 μm</p> <p>Separating paper</p>	 <p>PGS Graphite</p> <p>Heat-resistance PEEK tape 10 μm</p> <p>Heat-resistance Acrylic adhesive tape 18 μm</p> <p>Separating paper</p>	
Features	<ul style="list-style-type: none"> <li>◎ With high heat resistance and insulation tape on one side</li> <li>◎ Withstanding voltage Adhesive tape : 2 kV</li> </ul>	<ul style="list-style-type: none"> <li>◎ With high heat resistance and insulation tape on both side</li> <li>◎ Withstanding voltage PEEK tape : 2 kV Adhesive tape : 2 kV</li> </ul>	
Withstand temperature	150 °C	150 °C	
Standard size (mm)	90 × 115	90 × 115	
Maximum size (mm)	115 × 180	115 × 180	
100 μm	Part No.	EYGA091210V	EYGA091210RV
	Thickness	118 μm	131 μm
70 μm	Part No.	EYGA091207V	EYGA091207RV
	Thickness	88 μm	101 μm
50 μm	Part No.	EYGA091205V	EYGA091205RV
	Thickness	68 μm	81 μm
40 μm	Part No.	EYGA091204V	EYGA091204RV
	Thickness	58 μm	71 μm
25 μm	Part No.	EYGA091203V	EYGA091203RV
	Thickness	43 μm	56 μm
17 μm	Part No.	EYGA091202V	EYGA091202RV
	Thickness	35 μm	48 μm
10 μm	Part No.	EYGA091201V	EYGA091201RV
	Thickness	28 μm	41 μm

\* Withstanding Voltages are for reference, not guaranteed.

**Guidelines and precautions regarding the technical information and use of our products described in this online catalog.**

- If you want to use our products described in this online catalog for applications requiring special qualities or reliability, or for applications where the failure or malfunction of the products may directly jeopardize human life or potentially cause personal injury (e.g. aircraft and aerospace equipment, traffic and transportation equipment, combustion equipment, medical equipment, accident prevention, anti-crime equipment, and/or safety equipment), it is necessary to verify whether the specifications of our products fit to such applications. Please ensure that you will ask and check with our inquiry desk as to whether the specifications of our products fit to such applications use before you use our products.
- The quality and performance of our products as described in this online catalog only apply to our products when used in isolation. Therefore, please ensure you evaluate and verify our products under the specific circumstances in which our products are assembled in your own products and in which our products will actually be used.
- If you use our products in equipment that requires a high degree of reliability, regardless of the application, it is recommended that you set up protection circuits and redundancy circuits in order to ensure safety of your equipment.
- The products and product specifications described in this online catalog are subject to change for improvement without prior notice. Therefore, please be sure to request and confirm the latest product specifications which explain the specifications of our products in detail, before you finalize the design of your applications, purchase, or use our products.
- The technical information in this online catalog provides examples of our products' typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.
- If any of our products, product specifications and/or technical information in this online catalog is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially with regard to security and export control, shall be observed.

**<Regarding the Certificate of Compliance with the EU RoHS Directive/REACH Regulations>**

- The switchover date for compliance with the RoHS Directive/REACH Regulations varies depending on the part number or series of our products.
- When you use the inventory of our products for which it is unclear whether those products are compliant with the RoHS Directive/REACH Regulation, please select "Sales Inquiry" in the website inquiry form and contact us.

**We do not take any responsibility for the use of our products outside the scope of the specifications, descriptions, guidelines and precautions described in this online catalog.**



## Precautions on the whole

- Do not use the products beyond the descriptions in this catalog.
- This catalog guarantees the quality of the products as individual components.  
Before you use the products, please make sure to check and evaluate the products in the circumstance where they are installed in your product.
- This product was designed and manufactured for standard applications such as general electronics devices, office equipment, information and communications equipment, measuring instruments, household appliances and audio-video equipment.  
For applications in which special quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or cause threat of personal injury (such as for aircraft and aerospace equipment, traffic and transport equipment, combustion equipment, medical equipment, accident prevention and anti-theft devices, and safety equipment), please be sure to consult with our sales representative in advance and to exchange product catalog which conform to such applications.

## Safety and Design considerations

- We are trying to improve the quality and the reliability, but the durability differs depending on the use environment and the use conditions. On use, be sure to confirm the actual product under the actual use conditions.
- Install the following systems for a failsafe design to ensure safety if these products are to be used in equipment where a defect in these products may cause the loss of human life or other significant damage, such as damage to vehicles (automobile, train, vessel), traffic lights, medical equipment, aerospace equipment, electric heating appliances, combustion/ gas equipment, rotating equipment, and disaster/crime prevention equipment.
  - The system is equipped with a protection circuit and protection device.
  - The system is equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault.
  - The system is equipped with an arresting the spread of fire or preventing glitch.
- When a dogma shall be occurred about safety for this product, be sure to inform us rapidly, operate your technical examination.
- The temperature of this product at the time of use changes depending on mounting conditions and usage conditions, therefore, please confirm that the temperature of this product is the specified temperature after mounting it.
- This product does not take the use under the following special environments into consideration. Accordingly, the use in the following special environments, and such environmental conditions may affect the performance of the product; prior to use, verify the performance, reliability, etc. thoroughly.
  - 1) Use in liquids such as water, oil, chemical, and organic solvent.
  - 2) Use under direct sunlight, in outdoor or in dusty atmospheres.
  - 3) Use in places full of corrosive gases such as sea breeze,  $C_{12}$ ,  $H_2S$ ,  $NH_3$ ,  $SO_2$ , and  $NO_x$ .
  - 4) Use the product in a contaminated state.
  - 5) Use in acid.
  - 6) Use outside the range defined by the operating temperature range.
  - 7) Use under reduced pressure or vacuum.

## Precaution of installation

- Do not reuse this product after removal from the mounting board.
- Do not drop this product on the floor. If this product is dropped, it can be damaged mechanically. Avoid using the dropped product.
- This product is soft, do not rub or touch it with rough materials to avoid scratching it.
- Lines or folds in this product may affect thermal conductivity.
- Never touch a this product during use because it may be extremely hot.
- Use protective materials when handling and/or applying this product, do not use items with sharp edges as they might tear or puncture this product.
- Do not handle with bare hands as there is a concern about performance degradation.

## Precaution on storage conditions

- Storage period is less than one year after our shipping inspection is completed. Please use within the period.
- If the product is stored in the following environments and conditions, the performance may be badly affected, avoid the storage in the following environments.
  - (1) Storage in places full of corrosive gases such as sea breeze,  $\text{Cl}_2$ ,  $\text{H}_2\text{S}$ ,  $\text{NH}_3$ ,  $\text{SO}_2$ , and  $\text{NO}_x$ .
  - (2) Storage in places exposed to ultraviolet light.
    - \*Recommended storage in the dark.
  - (3) Store at a temperature outside the storage temperature range specified by this catalog.
- In the case of a product configuration that assumes bonding, please use after checking the adhesiveness of the product when the storage period is over.

## Precaution specific to this product

- This product has conductivity. If required, This product should be provided insulation.
- This product can not guarantee the insulation because there is a concern for powder falling off of conductive materials.
- Thermal conductivity is dependent on the way it is used. Test the adaptability of the product to your application before use.

## Applicable laws and regulations, others

- No ODCs or other ozone-depleting substances which are subject to regulation under the Montreal Protocol are used in our manufacturing processes, including in the manufacture of this product.
- This product complies with the RoHS Directive (Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (DIRECTIVE 2011/65/EU and (EU)2015/863) .
- All the materials used in this part are registered material under the Law Concerning the Examination and Regulation of Manufactures etc. of Chemical substances.
- If you need the notice by letter of "A preliminary judgment on the Laws of Japan foreign exchange and Foreign Trade control", be sure to let us know.
- These products are not dangerous goods on the transportation as identified by UN(United Nations) numbers or UN classification.
- As to the disposal of the module, check the method of disposal in each country or region where the modules are incorporated in your products to be used.
- The technical information in this catalog provides examples of our products typical operations and application circuits. We do not guarantee the non-infringement of third party's intellectual property rights and we do not grant any license, right, or interest in our intellectual property.