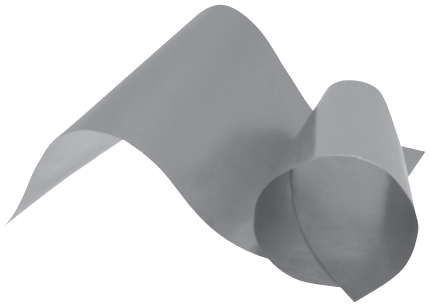
"PGS" Graphite Sheets

Type: EYG



"PGS (Pyrolytic Graphite Sheet)" is a thermal interface material which is very thin, synthetically made, has high thermal conductivity, and is made from a higly oriented graphite polymer film. It is ideal for providing thermal management/heat-sinking in limited spaces or to provide supplemental heat-sinking in addition to conventional means. This material is flexible and can be cut into customizable shapes.
"SSM(Semi-Sealing Material)" is the product which is copounding PGS Graphite sheet and High thermal conductive Elastomer resin. It has a function to absorb heat by resin and release 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, 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^3
  (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 elasticity 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

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

Explanation of Part Numbers

● PGS only (EYGS******)

1	2	3	4	5	6	7	8	9	10
E	Y	G	S	0	9	1	2	1	0

Product Code

Style	
S	PGS only

Dimension	
0912	90 mm × 115 mm
1218	115 mm × 180 mm
1823	180 mm × 230 mm

PGS thickness*	
10	100 µm
07	70 µm
05	50 µm
04	40 µm
03	25 µm

* PGS thickness of 17 µm, 10 µm does not support as single item.

● Taping (EYGA********)

1	2	3	4	5	6	7	8	9	10	11	12
E	Y	G	A	0	9	1	2	1	0	D	M

Product Code

Style	
A	Taping

Dimension**	
0912	90 mm × 115 mm
1218	115 mm × 180 mm

** Please contact us for other dimensions other than those above.

PGS thickness	
10	100 µm
07	70 µm
05	50 µm
04	40 µm
03	25 µm
02	17 µm
01	10 µm

Suffix	
A	Lamination type * Please refer to Composition example.
M	
F	
PA	
PM	
DM	
DF	
V	
RV	
KV	

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

1	2	3	4	5	6	7	8	9	10	11	12
E	Y	G	E	0	9	1	2	X	B	6	D

Product Code

Style	
E	Elastomer processing

Dimension**	
0912	90 mm × 115 mm

SSM type

** Please contact us for other dimensions other than those above.

PGS thickness	
A	100 µm
B	70 µm
C	50 µm
G	40 µm
D	25 µm
E	17 µm
F	10 µm

Elastomer thickness	
5	0.5 mm
6	1.0 mm
7	1.5 mm
8	2.0 mm
9	3.0 mm

Tape thickness	
Q	PET tape 8 µm
D	PET tape 10 µm
P	PET tape 30 µm
F	Acrylic adhesive tape 6 µm
M	Acrylic adhesive tape 10 µm
A	Acrylic adhesive tape 30 µm

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^3	1.21 g/cm^3	1.70 g/cm^3	1.80 g/cm^3
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^{-7} 1/K	9.3×10^{-7} 1/K	9.3×10^{-7} 1/K	9.3×10^{-7} 1/K
	c axis	3.2×10^{-5} 1/K	3.2×10^{-5} 1/K	3.2×10^{-5} 1/K	3.2×10^{-5} 1/K
Heat resistance*		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^3	2.10 g/cm^3	2.13 g/cm^3
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^{-7} 1/K	9.3×10^{-7} 1/K	9.3×10^{-7} 1/K
	c axis	3.2×10^{-5} 1/K	3.2×10^{-5} 1/K	3.2×10^{-5} 1/K
Heat resistance*		400 °C		
Bending(angle 180,R5)		10000 cycles		

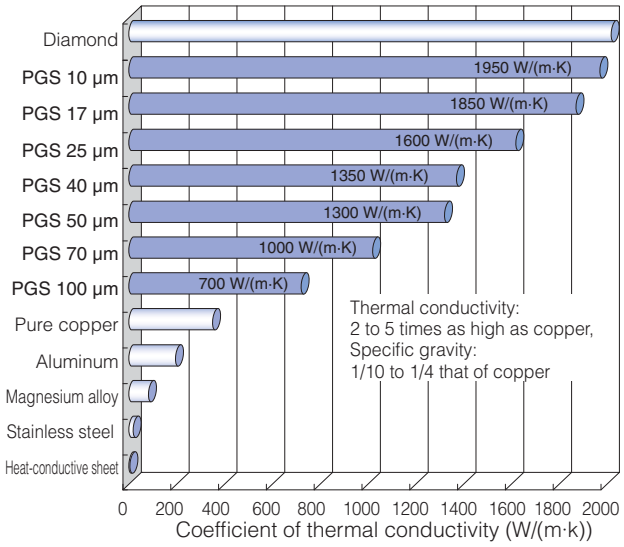
* Withstand temperature refers to PGS only.
(Lamination material such as PET tape etc. is not included)
** Values are for reference, not guaranteed.

Characteristics of SSM (Elastomer)

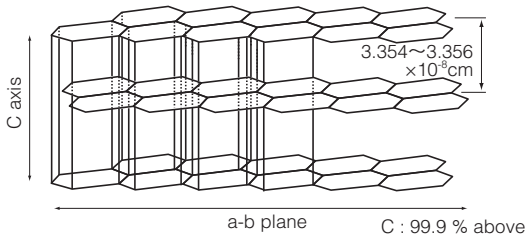
Thickness		1 mm	2 mm	3 mm
Specific heat		1.4 J/(g·C)		
Density		1.88 g/cm^3		
Thermal conductivity		1.6 W/(m·K)		
Thermal resistance	100 kPa	7.53 (C·cm^2)/W	14.82 (C·cm^2)/W	19.48 (C·cm^2)/W
	200 kPa	6.71 (C·cm^2)/W	13.17 (C·cm^2)/W	16.01 (C·cm^2)/W
	300 kPa	5.90 (C·cm^2)/W	10.73 (C·cm^2)/W	11.38 (C·cm^2)/W
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		> $10\times10^{14}\Omega$·cm		
Withstanding Voltage		> 17 kVac/mm		
Hardness (Type E)		39		
Adhesive force	SUS	39 mN/cm		
	Aluminum	31 mN/cm		
	Glass	38 mN/cm		

* Characteristics refer to Elastomer only.

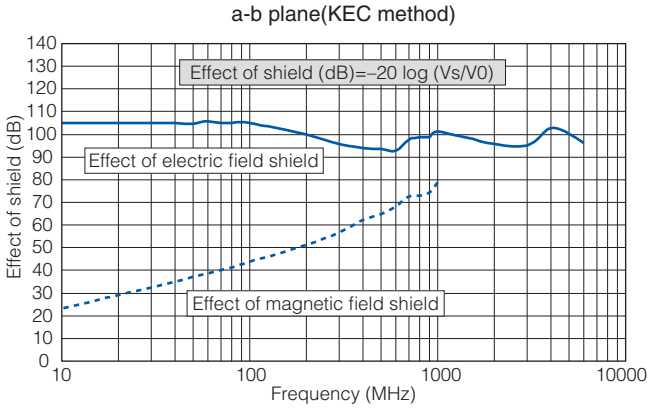
Comparison of thermal conductivity (a-b plane)



Layered structure of PGS



Electric field shield performance



Lamination type/Composition example

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

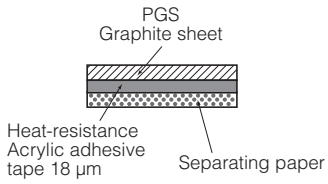
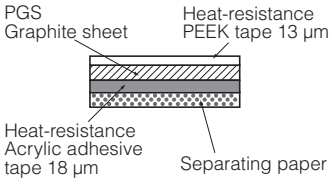
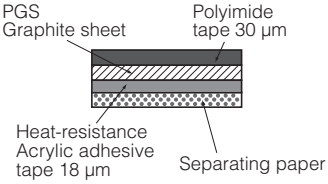
Type		PGS Only	Adhesive Type		
		S type	A-A type	A -M type	A -F type
Front face		–	–	–	–
Rear face		–	Insulative adhesion type 30 μm	Insulative thin adhesion type 10 μm	Insulative thin adhesion type 6 μm
Structure		PGS Graphite sheet	PGS Graphite sheet Acrylic Adhesive tape 30 μm Separating paper	PGS Graphite sheet Acrylic Adhesive tape 10 μm Separating paper	PGS Graphite sheet Acrylic Adhesive tape 6 μm Separating paper
Features		· High Thermal Conductivity High Flexibility · Low Thermal Resistance · Available up to 400 °C · Conductive Material	· With insulation material on one side · With strong adhesive tape for putting chassis · Withstanding Voltage : 2 kV	· With insulation material on one side · Low thermal resistance comparison with A-A type · Withstanding Voltage : 1 kV	· With insulation material on one side · Low thermal resistance comparison with A-A type
Withstand temperature		400 °C	100 °C	100 °C	100 °C
Standard Size		115 × 180 mm	90 × 115 mm	90 × 115 mm	90 × 115 mm
Maximam size		180 × 230 mm (25 μm to)	115 × 180 mm	115 × 180 mm	115 × 180 mm
100 μm	Part No.	EYGS121810	EYGA091210A	EYGA091210M	EYGA091210F
	Thickness	100 μm	130 μm	110 μm	106 μm
70 μm	Part No.	EYGS121807	EYGA091207A	EYGA091207M	EYGA091207F
	Thickness	70 μm	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.	–	EYGA091202A	EYGA091202M	EYGA091202F
	Thickness	–	47 μm	27 μm	23 μm
10 μm	Part No.	–	EYGA091201A	EYGA091201M	EYGA091201F
	Thickness	–	40 μm	20 μm	16 μm

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 thin type 10 μm	Polyester tape thin type 10 μm
Rear face		Insulative adhesion type 30 μm	Insulative thin adhesion type 10 μm	Insulative thin adhesion type 10 μm	Insulative thin adhesion type 6 μm
Structure		PGS Graphite sheet Polyester(PET) tape 30 μm Acrylic Adhesive tape 30 μm Separating paper	PGS Graphite sheet Polyester(PET) tape 30 μm Acrylic Adhesive tape 10 μm Separating paper	PGS Graphite sheet Polyester(PET) tape 10 μm Acrylic Adhesive tape 10 μm Separating paper	PGS Graphite sheet Polyester(PET) tape 10 μm Acrylic Adhesive tape 6 μm Separating paper
Features		· With insulation material on both side · Withstanding Voltage PET tape : 4 kV Adhesive Tape : 2 kV	· With insulation material on both side · Withstanding Voltage PET tape : 4 kV Adhesive Tape : 1 kV	· With insulation material on both side · Withstanding Voltage PET tape : 1 kV Adhesive Tape : 1 kV	· With insulation material on both side · Withstanding Voltage PET tape : 1 kV
Withstand temperature		100 °C	100 °C	100 °C	100 °C
Standard Size		90 × 115 mm	90 × 115 mm	90 × 115 mm	90 × 115 mm
Maximam size		115 × 180 mm	115 × 180 mm	115 × 180 mm	115 × 180 mm
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

✻ Please contact us for other lamination type product.
✻✻ Withstanding Voltages are for reference, not guaranteed.

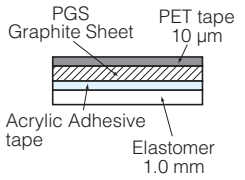
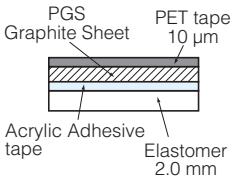
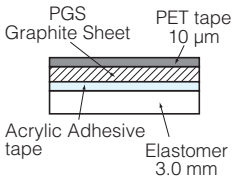
Lamination type/Composition example

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

Type		High heat resistance type		
		A-V type	A-RV type	A-KV type
Front face		–	High heat resistance and insulation type 13 μm	High heat resistance and insulation type 30 μm
Rear face		High heat resistance and insulation adhesion type 18 μm	High heat resistance and insulation adhesion type 18 μm	High heat resistance and insulation adhesion type 18 μm
Structure				
Features		·With high heat resistance and insulation tape on one side ·Withstanding Voltage Adhesive tape : 2 kV	·With high heat resistance and insulation tape on both side ·Withstanding Voltage PEEK tape : 2 kV Adhesive tape : 2 kV	·With high heat resistance and more insulated tape on both side ·Withstanding Voltage PI tape : 5 kV Adhesive tape : 2 kV
Withstand temperature		150 °C	150 °C	150 °C (Polyimide : 180 °C)
Standard Size		90 × 115 mm	90 × 115 mm	90 × 115 mm
Maximam size		115 × 180 mm	115 × 180 mm	115 × 180 mm
100 μm	Part No.	EYGA091210V	EYGA091210RV	EYGA091210KV
	Thickness	118 μm	131 μm	148 μm
70 μm	Part No.	EYGA091207V	EYGA091207RV	EYGA091207KV
	Thickness	88 μm	101 μm	118 μm
50 μm	Part No.	EYGA091205V	EYGA091205RV	EYGA091205KV
	Thickness	68 μm	81 μm	98 μm
40 μm	Part No.	EYGA091204V	EYGA091204RV	EYGA091204KV
	Thickness	58 μm	71 μm	88 μm
25 μm	Part No.	EYGA091203V	EYGA091203RV	EYGA091203KV
	Thickness	43 μm	56 μm	73 μm
17 μm	Part No.	EYGA091202V	EYGA091202RV	EYGA091202KV
	Thickness	35 μm	48 μm	65 μm
10 μm	Part No.	EYGA091201V	EYGA091201RV	EYGA091201KV
	Thickness	28 μm	41 μm	58 μm

✻ Please contact us for other lamination type product.
✻✻ Withstanding Voltages are for reference, not guaranteed.

● Standard series (SSM)

Type		E-6 type	E-8 type	E-9 type
Elastomer thickness		1.0 mm	2.0 mm	3.0 mm
Structure				
Features		·Soft and low thermal resistance (Elastomer) ·Low repulsion ·Withstanding Voltage : 1.7 kV	·Soft and low thermal resistance (Elastomer) ·Low repulsion ·Withstanding Voltage : 1.7 kV	·Soft and low thermal resistance (Elastomer) ·Low repulsion ·Withstanding Voltage : 1.7 kV
Withstand temperature		100 °C	100 °C	100 °C
Standard Size		90 × 115 mm	90 × 115 mm	90 × 115 mm
70 μm	Part No.	EYGE0912XB6D	EYGE0912XB8D	EYGE0912XB9D
	Thickness	1.09 mm	2.09 mm	3.09 mm
25 μm	Part No.	EYGE0912XD6D	EYGE0912XD8D	EYGE0912XD9D
	Thickness	1.05 mm	2.05 mm	3.05 mm

Minimum order

Item	Type	Part No.	Size	Minimum order
PGS Graphite Sheet Only	S type 100 µm	EYGS091210	90×115 mm	20
		EYGS121810	115×180 mm	10
		EYGS182310	180×230 mm	10
	S type 70 µm	EYGS091207	90×115 mm	20
		EYGS121807	115×180 mm	10
		EYGS182307	180×230 mm	10
	S type 50 µm	EYGS091205	90×115 mm	20
		EYGS121805	115×180 mm	10
		EYGS182305	180×230 mm	10
	S type 40 µm	EYGS091204	90×115 mm	20
		EYGS121804	115×180 mm	10
		EYGS182304	180×230 mm	10
	S type 25 µm	EYGS091203	90×115 mm	20
		EYGS121803	115×180 mm	10
		EYGS182303	180×230 mm	10
PGS 70, 25, 17 µm Adhesive Type [Standard series]	A-A type 70 µm	EYGA091207A	90×115 mm	20
		EYGA121807A	115×180 mm	10
	A-A type 25 µm	EYGA091203A	90×115 mm	20
		EYGA121803A	115×180 mm	10
	A-A type 17 µm	EYGA091202A	90×115 mm	20
		EYGA121802A	115×180 mm	10
	A-M type 70 µm	EYGA091207M	90×115 mm	20
		EYGA121807M	115×180 mm	10
	A-M type 25 µm	EYGA091203M	90×115 mm	20
		EYGA121803M	115×180 mm	10
	A-M type 17 µm	EYGA091202M	90×115 mm	20
		EYGA121802M	115×180 mm	10
PGS 70, 25, 17 µm Laminated Type (Insulation & Adhesive) [Standard series]	A-PA type 70 µm	EYGA091207PA	90×115 mm	20
		EYGA121807PA	115×180 mm	10
	A-PA type 25 µm	EYGA091203PA	90×115 mm	20
		EYGA121803PA	115×180 mm	10
	A-PA type 17 µm	EYGA091202PA	90×115 mm	20
		EYGA121802PA	115×180 mm	10
	A-PM type 70 µm	EYGA091207PM	90×115 mm	20
		EYGA121807PM	115×180 mm	10
	A-PM type 25 µm	EYGA091203PM	90×115 mm	20
		EYGA121803PM	115×180 mm	10
	A-PM type 17 µm	EYGA091202PM	90×115 mm	20
		EYGA121802PM	115×180 mm	10
	A-DM type 70 µm	EYGA091207DM	90×115 mm	20
		EYGA121807DM	115×180 mm	10
	A-DM type 25 µm	EYGA091203DM	90×115 mm	20
		EYGA121803DM	115×180 mm	10
	A-DM type 17 µm	EYGA091202DM	90×115 mm	20
		EYGA121802DM	115×180 mm	10

* Only S type supports 180×230 mm size.
(PGS thickness of 17 µm, 10µm does not support as single item)
** PGS of 10 µm, 40 µm, 50 µm type is also possible to be made as lamination type.
*** The above-listed part number is sample part number for testing.
**** Please contact us about your request of custom part number which will be arranged separately.
***** Please contact us if quantity is below Minimum Order Quantity.

Minimum order

Item	Type	Part No.	Size	Minimum order
PGS 70, 25, 17 µm [High heat resistance type]	A-V type 70 µm	EYGA091207V	90×115 mm	20
		EYGA121807V	115×180 mm	10
	A-V type 25 µm	EYGA091203V	90×115 mm	20
		EYGA121803V	115×180 mm	10
	A-V type 17 µm	EYGA091202V	90×115 mm	20
		EYGA121802V	115×180 mm	10
	A-RV type 70 µm	EYGA091207RV	90×115 mm	20
		EYGA121807RV	115×180 mm	10
	A-RV type 25 µm	EYGA091203RV	90×115 mm	20
		EYGA121803RV	115×180 mm	10
	A-RV type 17 µm	EYGA091202RV	90×115 mm	20
		EYGA121802RV	115×180 mm	10
	A-KV type 70 µm	EYGA091207KV	90×115 mm	20
		EYGA121807KV	115×180 mm	10
	A-KV type 25 µm	EYGA091203KV	90×115 mm	20
		EYGA121803KV	115×180 mm	10
	A-KV type 17 µm	EYGA091202KV	90×115 mm	20
		EYGA121802KV	115×180 mm	10
SSM Elastomer 3.0, 2.0, 1.0 mm PGS 70, 25, 17 µm	E-9 type Elastomer 3.0 mm, PGS 70 µm	EYGE0912XD9D	90×115 mm	5
	E-9 type Elastomer 3.0 mm, PGS 25 µm	EYGE0912XB9D	90×115 mm	5
	E-8 type Elastomer 2.0 mm, PGS 70 µm	EYGE0912XD8D	90×115 mm	5
	E-8 type Elastomer 2.0 mm, PGS 25 µm	EYGE0912XB8D	90×115 mm	5
	E-6 type Elastomer 1.0 mm, PGS 70 µm	EYGE0912XD6D	90×115 mm	5
	E-6 type Elastomer 1.0 mm, PGS 25 µm	EYGE0912XB6D	90×115 mm	5

* Only S type supports 180×230 mm size.
(PGS thickness of 17 µm, 10µm does not support as single item)
** PGS of 10 µm, 40 µm, 50 µm type is also possible to be made as lamination type.
*** The above-listed part number is sample part number for testing.
**** Please contact us about your request of custom part number which will be arranged separately.
***** Please contact us if quantity is below Minimum Order Quantity.

"PGS" (Pyrolytic Graphite Sheet) Heat sink sheet

Handling Precautions

⚠ Safety Precautions

- When using our products, no matter what sort of equipment they might be used for, be sure to make a written agreement on the specifications with us in advance. The design and specifications in this catalog are subject to change without prior notice.
- Do not use the products beyond the specifications described in this catalog.
- This catalog explains the quality and performance of the products as individual components. Before use, check and evaluate their operations when installed in your products.
- 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.

✻ Systems equipped with a protection circuit and a protection device
✻ Systems equipped with a redundant circuit or other system to prevent an unsafe status in the event of a single fault

PGS (Pyrolytic Graphite Sheet) Heat sink sheet (hereafter referred to as PGS) may result in accidents or trouble when subjected to severe conditions of electrical, environmental and /or mechanical stress beyond the specified "Rating" and specified "Conditions" found in the Specifications. Please follow the recommendations in "Safety Precautions" and "Application Notes". Contact our engineering staff or the factory with any questions.

1. ⚠Safety Precautions

1.1 The PGS shall be used within the specified operating temperature range.
1.2 The PGS is soft, do not rub or touch it with rough materials to avoid scratching it.
1.3 Lines or folds in the PGS may affect thermal conductivity.
1.4 The PGS shall not be used with acid.
The PGS shall not be used in contact with a soldering iron at 400 °C or more
1.5 The PGS shall not be exposed to salt water or direct sunlight during use. The PGS shall not be used in corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia etc.).
1.6 Our PGS has been developed for general industry applications. Prior to using the PGS for special applications such as medical, work please contact our engineering staff or the factory.
1.7 Never touch a PGS during use because it may be extremely hot.
1.8 Since SSM Elastomer resin is soft, please do not preserve the parts adding weight.
1.9 Please do not use the parts at the status of hard foreign materials stuck such as metals in SSM Elastomer side.

2. Application notes

2.1 Use protective materials when handling and/or applying the PGS, do not use items with sharp edges as they might tear or puncture the PGS.
2.2 The PGS does not work properly if overheated.
2.3 Thermal conductivity is dependant on the way it is used.
Test the adaptability of PGS to your application before use.
2.4 The PGS has conductivity.
If required, the PGS should be provided insulation.
2.5 Long term storage
- The PGS shall not be stored under severe conditions of salt water, direct sunlight or corrosive gases (hydrogen sulfide, sulfurous acid, chlorine, ammonia etc.).
- The PGS shall not be stored near acid.
- Please preserve SSM packed under normal temprerture and humidity while not in use.

2.6 Once applying to the adherent which has dents, SSM Elastomer resin keeps its shape so it cannot be re-applied to different portion.

<Package markings>
Package markings include the product number, quantity, and country of origin.
In principle, the country of origin should be indicated in English.

Mouser Electronics

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