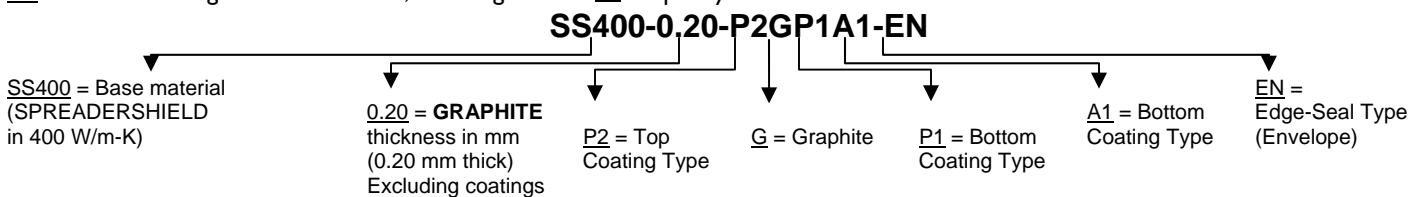


DATA SHEET FOR eGRAF® SPREADERSHIELD™ PRODUCTS

Made from flexible graphite, eGRAF SPREADERSHIELD products function as both a passive heat *spreader* and heat *shield*. SPREADERSHIELD material is offered in a variety of in-plane thermal conductivities, from 300 to 1500 W/m-K, and can be die-cut, press-formed, or laminated with plastics, metals, adhesives and other materials. Every SPREADERSHIELD part is customized to meet specific application needs and improve thermal performance within a limited space and weight.

Part Designation

Every SPREADERSHIELD part is identified by a specific grade, named for its characteristics. For example, **SS400-0.20-P2GP1A1-EN** represents a SPREADERSHIELD part in 400 W/m-K, with 0.20 mm thick GRAPHITE, with P2 Plastic coating on one side, P1 Plastic and A1 Adhesive coating on the other side, with edge-seal in Envelope Style.



Typical¹ Graphite Properties

Grade	SS300	SS400	SS500	SS600	SS1500
Characteristic					
Available Thickness Range (mm)	0.25-1.00	0.05-1.00	0.127 and 0.76	0.10 – 0.127	0.020
Standard Thicknesses- Typically In-stock for Sampling (mm)	0.51 and 0.94	0.051, 0.076, 0.127, 0.25, 0.38, 0.43, 0.51, 0.94	0.127 and 0.76	0.10 and 0.127	0.020
Maximum Width – Graphite Only (mm)	1000	610 ²	457 and 305	152	540
Nominal Thermal Conductivity ³ - In-Plane (W/m-K)	300	400	500	600	1,500
Nominal Thermal Conductivity ⁴ - Through-Plane (W/m-K)	4.5	3.7	2.8	3.5	3.4
Flammability Rating	UL 94V-0				
Operating Temperature	-40 ° to +400 °C				
Coefficient of Thermal Expansion (In-Plane)	-0.4 x 10 ⁻⁶ m/m °C				
Coefficient of Thermal Expansion (Through-Plane)	27 x 10 ⁻⁶ m/m °C				
Specific Heat	700 J/kg °C				
Thermal Contact Impedance – Per Side (°C•cm ² /W)					
* at 0.50 mm spreader thickness	0.30*	0.38*	0.90 [†]	0.44 [†]	0.15 ^{††}
† at 0.10 mm spreader thickness					
†† at 0.02 mm spreader thickness					
Tensile Strength (MPa)	NA	9.7	7.7	9.7	37
Electrical Resistivity- In-Plane (μΩm)	6.5	5.2	4.2	3.4	0.5
Electrical Conductivity- In-Plane (S/cm)	1600	1900	2400	2900	19000
Electrical Conductivity- Through-Plane (S/cm)	28	18	15	10	5

Custom widths, lengths & thicknesses may be available upon request.

¹ Properties listed are typical and cannot be used as accept/reject specifications.

² Varies based on thickness

³ Angstrom's Method

⁴ ASTM D5470 Modified Method

For additional information, contact the GrafTech Sales Office: +1 (800) 253-8003 (Toll-Free in USA), +1 (216) 529-3777 (International), +1 (216) 529-3922 (Fax)

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Specific Application Requirements

What applications require specific SPREADERSHIELD product options?

SPREADERSHIELD products have provided valuable thermal solutions in a variety of industries and applications, including displays (PDP, LCD CCFL, LED BLU, OLED), cell phones, laptop and ruggedized computers, handheld gaming devices, batteries, projectors, set-top boxes and automotive electronics. Each application is specialized to require different characteristics of SPREADERSHIELD products. Please contact GrafTech Sales office for application solutions.

Grade	SS300	SS400	SS500	SS600	SS1500
Typical Applications	Large Displays	Large Displays, Notebook PCs, Handsets	Notebook PCs, Handsets, Cameras	Handsets, Pico-projectors, Cameras	Handsets, Pico-projectors, Cameras

Typical Coating Examples for SPREADERSHIELD products

What materials can be laminated with SPREADERSHIELD products?

SPREADERSHIELD products are available with or without coatings. The material can be laminated with adhesives, plastics, or metals to enhance physical properties, along with an option to “edge-seal” or encapsulate the graphite. Coating examples are listed below.

Typical¹ Coating Properties

Coating	A1	C1	P1	P2	P1A1	P6A6	M3	EN
Description	Acrylic based adhesive ⁵	Acrylic Coating	PET Film	PET Film	Double-coated adhesive ⁶ tape	An ultra-thin, double-coated adhesive ⁷ tape	Thin Aluminum foil coating	Envelope Edge-Seal Example PIGPI-EN
Dielectric Strength	NA	NA	2800 V	200 V	2800 V	200 V	NA	NA
Operating Temperature	-40 to 150°C					0 to 80°C	-40 to 150°C	
Thermal Contact Impedance ⁸ - Per Side (°C•cm ² /W)	0.16	NA	1.6	0.32	NA	NA	NA	NA
Thermal Conductivity - Through Thickness (W/m-K)	NA	NA	0.16	0.16	0.16	0.16	210	NA
Structure	Graphite Adhesive 0.0127mm 	0.00254mm Acrylic Graphite 	Plastic 0.0127mm Adhesive 0.0127mm Graphite 	Plastic 0.0014mm Adhesive 0.008mm Graphite 	Graphite Adhesive 0.0127mm Plastic 0.0127mm Adhesive 0.0127mm 	0.01mm Total Acrylic Adhesive Polyester Film Acrylic Adhesive Release Liner 	0.127mm Al 0.0255mm PSA 	Plastic 0.0127 mm Adhesive 0.0127 mm Graphite Adhesive 0.0127 mm Plastic 0.0127 mm Edge-Seal in “Envelope” Style

A variety of other coatings and combinations are available through our partner networks. Please contact GrafTech Sales office for more information on available coatings.

⁵ Adhesive Strength (700 g/cm² Typical) is based on a lap shear test (ASTM D3163) with material adhering to a glass plate. Note that the speed of peel from the release paper is directly related to adhesive strength. The higher the adhesive strength, the slower the peel speed from the release paper.

⁶ Adhesive Strength (1100 g/cm² Typical) is based on a lap shear test (ASTM D3163) with material adhering to a glass plate. Note that the speed of peel from the release paper is directly related to adhesive strength. The higher the adhesive strength, the slower the peel speed from the release paper.

⁷ ~8 N/20mm per Manufacturing Specification

⁸ ASTM D5470 Modified (at 110kPa/16 psi/1.1 bar). Total thermal impedance = thermal impedance of graphite + thermal impedance of coating.

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