

A Powerful Solution

In business over 50 years

ISO 9001 - 2015 Certified



www.mhw-thermal.com

PRODUCT **GUIDE**

Thermal Interface Material (TIM), Gaskets & Seals



All Products RoHS Compliant

THERMAL PRODUCTS

We carry thermal films, tapes, gap fillers, grease, graphite and more. Take a note of our specialty products like silicone-free material, Thermoplastic Polyurethane, and Gap Filler Liquid. We have what you need to solve your thermal problems.

Find materials and cut to size parts from Kerafol®, CSC (Chang Sung), GES and eAPUS®.

THERMAL CONSULTING

MH&W is ready to help you solve your complex thermal problems by providing:

- ▼ Thermal prediction of performance
- ▼ Material selection
- ▼ Prototyping
- ▼ Samples

CUSTOMER SERVICE

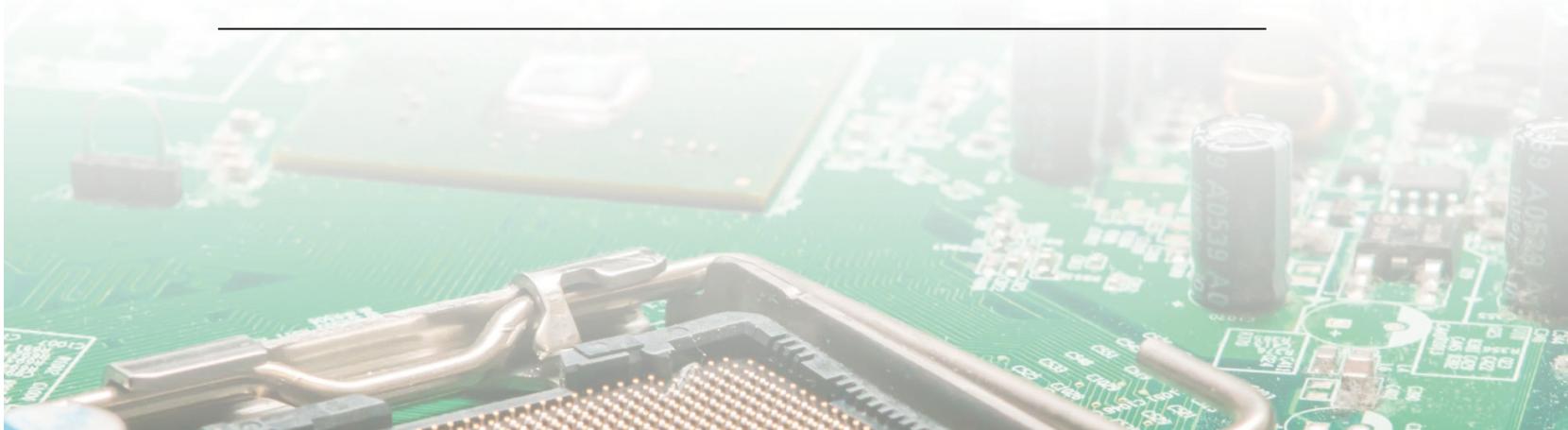
Our dedicated and professional Sales and Service team is ready to assist you from prototype to production.

From samples to materials, finished products and supply chain management everywhere on the globe, we have the experience and knowledge to assist you.

Contact us and get started.

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ABOUT OUR COMPANY

MH&W International Corporation was established in 1964 to serve the needs of the Magnetics and Thermal Interface industries. The corporation is a highly specialized sales and engineering organization in The United States, Canada, and Mexico, offering a variety of manufacturers to provide solutions for all of your thermal, seal, and gasket needs.

Our mission is to listen and understand our customer's needs and respond correctly in a timely manner. The employees of MH&W truly believe that their most important task is to optimize performance to fulfill their customer's requirements.

MH&W offers thermal solutions for all your heat management needs. With the high packing density of semi conductors, transistor chips, and discrete components, it is essential to dissipate the generated heat to extend the life of your crucial components. We carry thermal films, tapes, gap fillers, grease, graphite, and more from a variety of well known manufacturers. Take a note of our specialty products like silicone-free material, Thermoplastic Polyurethane Films, and Gap Filler Liquids.



MH&W International is proud to offer gaskets and seals for your power solutions. Offering custom gaskets, connector gaskets, waveguide gaskets, extrusions, EMI shielding, O-Rings, shock vibration mounts, and molded products.



We specialize in custom products for a wide range of industries with quick turnaround and short lead times. Our sales and engineering team work closely with customers from concept to production offering insight and exceptional customer support throughout the entire design and production process. A diverse inventory of thickness and durometer are available for all your design needs.



Our dedicated and professional Sales and Service team is ready to assist you from prototype to production.

From samples to finished products, and supply chain management everywhere on the globe, we have the experience and know how to assist you.

MH&W has what you need to solve your thermal problems.



MH&W MISSION STATEMENT

At MH&W, our confidence in the future is based on our awareness that we value and empower our employees, they provide superior service to our customers.



SALES REPRESENTATIVE NETWORK



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Hill Technical Sales Corp.
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Wisconsin)
Tel: (847) 255-4400
www.hilltech.com

Waldrop Sales, LLC
(Alabama, Florida,
Georgia, Mississippi,
North Carolina,
South Carolina,
Tennessee)
Tel: (256) 837-9549
www.waldropsalesllc.com

Diligent, LLC
(New York)
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THERMAL INTERFACE MATERIAL (TIM) MANUFACTURERS



GES GRAPHITE



KERATHERM® PRODUCT OVERVIEW



KERATHERM® STANDARD FILMS

The standard films have a smooth surface so that no air inclusions hinder the heat transfer from the component to the heatsink. The material compensates for microscopic unevenness in the contact surfaces, improving heat dissipation.



SOFTTHERM® FILMS

SOFTTHERM® films are the ideal material to compensate for larger component unevenness. Thanks to their excellent compressibility, they achieve optimal thermal contact, combined with electrical isolation. Available thicknesses from 0.5 to 5.0 mm. Special thicknesses and shapes are available upon request.



KERATHERM® THERMAL GREASE

Thermal greases are characterized by their good formability and a very low thermal resistance. No drying out or leaking of the components.



KERATHERM® GRAPHITE

S900 Graphite is a very dense natural graphite without binding material, which is rolled or pressed into films or plates. S900 is very cost-effective and has exceptional thermal properties.



KERATHERM® ADHESIVE FILMS

Adhesive films KL 90, KL 91, and KL 95 are thermally conductive and electrically insulating double-sided adhesive films. They have an excellent permanent adhesive strength with very high thermal conductivity while providing very good insulation.



KERATHERM® GAP FILLER LIQUIDS

Gap Filler Liquids are ceramic filled, two-component, silicone elastomers, without solvents. GFLs have a wide range of thermal conductivity with a high degree of thermal insulation. GFL can be used for encapsulation and application is effortless.



KERATHERM® PRODUCT OVERVIEW

KERATHERM®
Thermal Management Solutions

KERATHERM® STANDARD FILMS

U90	U85	U80	86/37
86/82	86/60	86/50	86/30

- ▼ Silicone based and silicone free films with high flexibility, filled with various thermally conductive ceramic materials.
- ▼ All film types are electrically insulating and optimize heat transfer using minimal contact pressure.
- ▼ Offered with optional fiberglass reinforcement.

SOFTTHERM® FILMS

86/600	86/525	86/450
3500	86/325	86/320
86/235	86/238	86/225
86/228	86/125	86/200

- ▼ Outstanding compressibility producing optimal thermal contact between components.
- ▼ Offered with optional fiberglass reinforcement.
- ▼ Very good thermal characteristics for gap-bridging mechanical or electrical components.

KERATHERM® THERMAL GREASE

KP12	KP97	KP98	KP99
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- ▼ Ceramic filled single component silicone with high thermal conductivity.
- ▼ Compounds do not dry out or leak from the material.
- ▼ KP12 is the silicone free option.

KERATHERM® GRAPHITE FILM S900

- ▼ 100% pure graphite without binding material offering excellent thermal properties at lower costs.

KERATHERM® CERAMIC FILLED ADHESIVE FILMS

KL90	KL91	KL95
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- ▼ Double sided adhesive films with excellent permanent adhesive strength, high thermal conductivity, and outstanding insulation properties. Silicone free.

KERATHERM® GAP FILLER LIQUID

GFL 3020	GFL 3025	GFL 1800 SL
GFL 3030	GFL 3040	

- ▼ Ceramic filled two component silicone elastomers without solvents.
- ▼ Low viscosity, ideal for dispensing and potting.

KERATHERM® STANDARD FILMS

Standard Films, silicone based and silicone free, have a smooth surface in order to ensure that there is no entrapped air that would interfere with the heat transfer between the component and the heat sink. These films are flexible, consist of silicone elastomers, and are filled with various thermo-conductive ceramic materials. All standard film types are electrically insulating and available with fiberglass reinforcement for added mechanical strength.

Small irregularities in component mating surfaces can be evened out by using only minimal contact pressure. The good thermal properties of these films guarantee optimum heat transfer to the heat sink while achieving good electrical insulation properties.

KERATHERM® STANDARD FILMS

- ✓ Very good properties even at very low contact pressure
- ✓ Smooth surface
- ✓ Low hardness
- ✓ High self-adhesion
- ✓ UL approved

PROPERTIES

- ✓ Good insulation properties
- ✓ Heat-conducting
- ✓ Good compressibility
- ✓ Fully crosslinked
- ✓ Flexible
- ✓ Environmentally friendly

APPLICATIONS

- ✓ Power supplies
- ✓ Automotive, engine controllers
- ✓ LCD displays
- ✓ White goods
- ✓ Power converters
- ✓ Audio and video components

STANDARD FILMS SILICONE FREE

Film		Thermal Conductivity	Thermal Resistance	Breakdown Voltage	Measured Thickness	Hardness	Characteristics
		W/mK	K/W	kV	mm	Shore A	
U90	Silicone Free	6.0	0.08	4.0	0.200	70-85	Silicone Free, High thermal conductivity
U85	Silicone Free	3.0	0.17	6.0	0.200	70-85	Silicone Free, High thermal conductivity & High insulation
U80	Silicone Free	1.8	0.20	4.0	0.150	80-90	Silicone Free

STANDARD FILMS

Film		Thermal Conductivity	Thermal Resistance	Breakdown Voltage	Measured Thickness	Hardness	Characteristics
		W/mK	K/W	kV	mm	Shore A	
86/82	KERATHERM® Red	6.5	0.09	1.0	0.250	60-70	Very high thermal conductivity
86/60	KERATHERM® Pink	4.5	0.14	5.0	0.250	45-60	Very high thermal conductivity, High insulation
86/50	KERATHERM® Pink	3.5	0.16	1.5	0.225	70-80	High thermal conductivity
86/30	KERATHERM® White	2.5	0.22	1.5	0.225	70-80	Good thermal conductivity/insulation
86/37	KERATHERM® Green	1.8	0.32	8.0	0.225	65-75	High insulation
70/50	KERATHERM® Brown	1.4	0.44	5.0	0.250	80-90	Good Price-Performance ratio

SOFTTHERM® FILMS

Keratherm® SOFTTHERM® materials are highly elastic, perfectly conformable, low-tension gap fillers. They are electrically insulating and possess gradual heat conductivity.

These films achieve a very good balance of different surface mounting heights such as component differences, housing irregularities, and gap-bridging in mechanical or electrical components.

KERAFOL® offers two types of SOFTTHERM® Films.



APPLICATIONS

- ✓ RD-RAM memory model
- ✓ Heat pipe thermal solutions
- ✓ Automotive engines
- ✓ Control units
- ✓ Plasma supply panels

Types 86/200, 86/228, and 86/238 have a fiberglass reinforced carrier sheet with very good thermal characteristics. These SOFTTHERM® film types can be provided with an adhesive application on the carrier sheet side.



PROPERTIES

- ✓ Outstanding flexibility
- ✓ Graduated thermal conductivity
- ✓ Good electrical insulation
- ✓ High temperature stability

Types 86/225, 86/300, 86/320, 86/325, 86/500 and 86/600 are reinforced by fiberglass fabric at thicknesses of 0.5 to 1.0 mm. These films can also be offered with an adhesive application as an assembly aid (not including 86/125, 86/225, and 86/235).

SOFTTHERM® Films should not be compressed beyond 30% of their original thickness.



CHARACTERISTICS:

- ✓ Compensates for size variations of components
- ✓ Optimized thermal transition
- ✓ Good compression behavior
- ✓ UL approved, REACH & RoHS compliant

SOFTTHERM® FILMS

Film		Thermal Conductivity	Thermal Resistance	Breakdown Voltage	Measured Thickness	Hardness	Characteristics
		W/mK	K/W	kV	mm	Shore 00	
86/600	SOFTTHERM® Film	6.0	0.20	1.5	0.500	60-75	High thermal conductivity
86/525	SOFTTHERM® Film	5.5	0.22	1.3	0.500	50-65	High thermal conductivity, Very good compressibility
86/450	SOFTTHERM® Film	4.5	0.27	5.0	0.500	65-75	Very good thermal & dielectric properties
3500	SOFTTHERM® Film	3.5	0.36	5.0	0.500	45-65	Soft, very good thermal & dielectric properties
86/325	SOFTTHERM® Film	3.0	0.41	6.0	0.500	35-50	Soft, high thermal conductivity
86/320	SOFTTHERM® Film	2.5	0.50	5.0	0.500	25-38	Very Soft, Good dielectric properties
86/235	SOFTTHERM® Film	2.0	0.60	6.0	0.500	25-40	Soft, high thermal conductivity
86/238	SOFTTHERM® Film	2.0	0.60	6.0	0.500	25-40	Double Layer
86/225	SOFTTHERM® Film	2.0	0.60	6.0	0.500	30-45	Fiberglass reinforced, good self adhesive behavior on both sides
86/228	SOFTTHERM® Film	2.0	0.60	6.0	0.500	30-45	Double Layer
86/125	SOFTTHERM® Film	1.5	0.80	6.0	0.500	10-25	Soft, High compressibility
86/200	SOFTTHERM® Film	1.0	1.20	8.0	0.500	10-20	Soft, High compressibility

SOFTTHERM® FILMS SILICONE FREE

Film		Thermal Conductivity	Thermal Resistance	Breakdown Voltage	Measured Thickness	Hardness	Characteristics
		W/mK	K/W	kV	mm	Shore 00	
U281	SOFTTHERM® Epoxide Resin	2.0	0.60	7.0	0.500	55-65	High compressibility, Silicone free

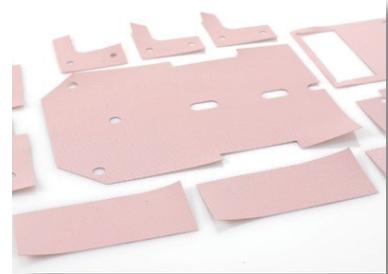


KERATHERM® 86/82 RED THERMAL FILM

The KERATHERM® 86/82 Red standard film is especially suitable for applications in the high-power area. It possesses excellent thermal and electrical properties.

Due to its good thermal performance, 86/82 can be reliably used in densely-packed electronic applications. A flexible film consisting of a silicone elastomer filled with various thermally conductive ceramic materials. KERATHERM® 86/82 film is electrically insulating and for improved handling, this film is supplied with fiberglass reinforcement. This film adapts to the component surface while evening out small irregularities by using only minimal contact pressure.

The good thermal properties of this film guarantee optimal heat transfer to the heat sink while providing good electrical insulation properties. All Keratherm® standard films are UL approved.



APPLICATIONS:

- ✓ "High end" solutions
- ✓ Control boards
- ✓ BGA applications
- ✓ Hard disk drives



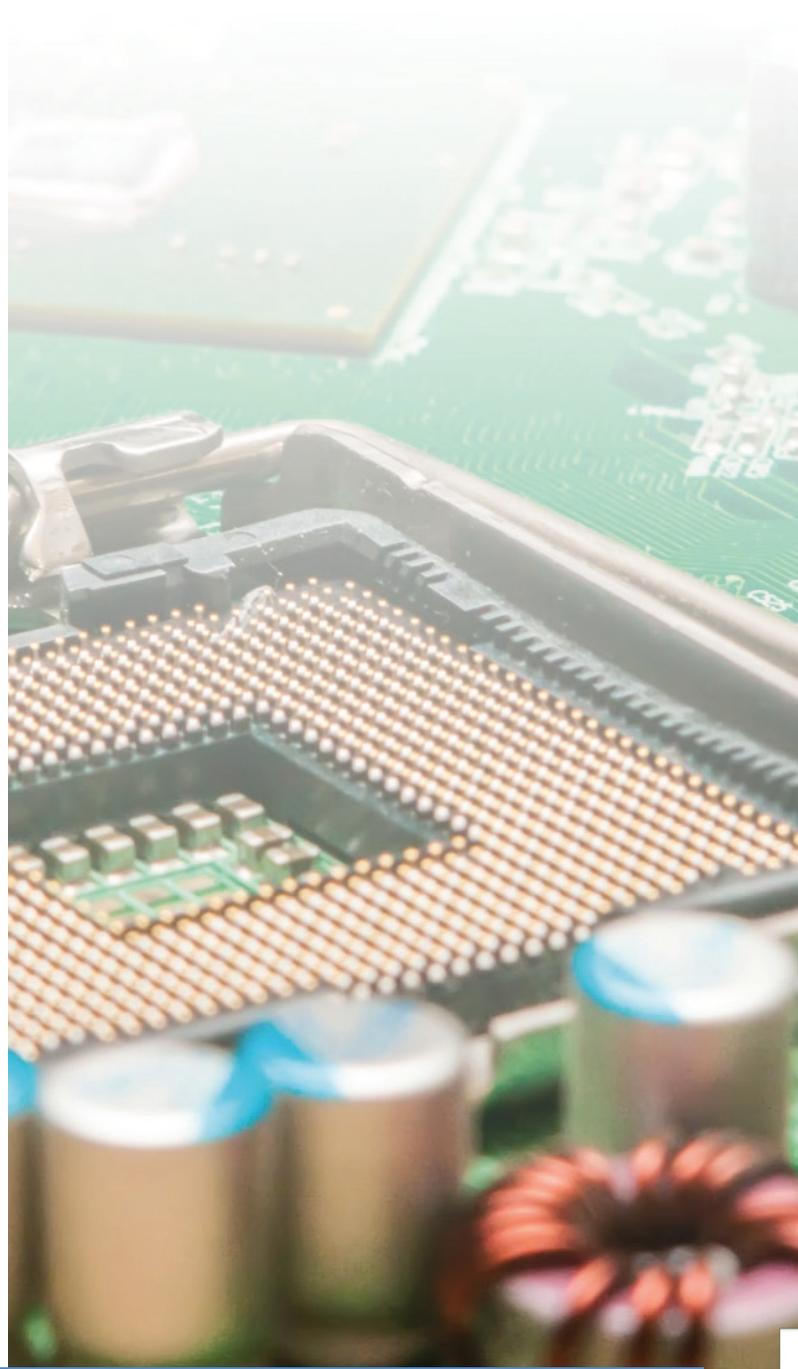
PROPERTIES:

- ✓ Good Insulation properties
- ✓ Good compressibility
- ✓ Fully crosslinked
- ✓ Fiberglass reinforced
- ✓ REACH/RoHS conforming



BENEFITS:

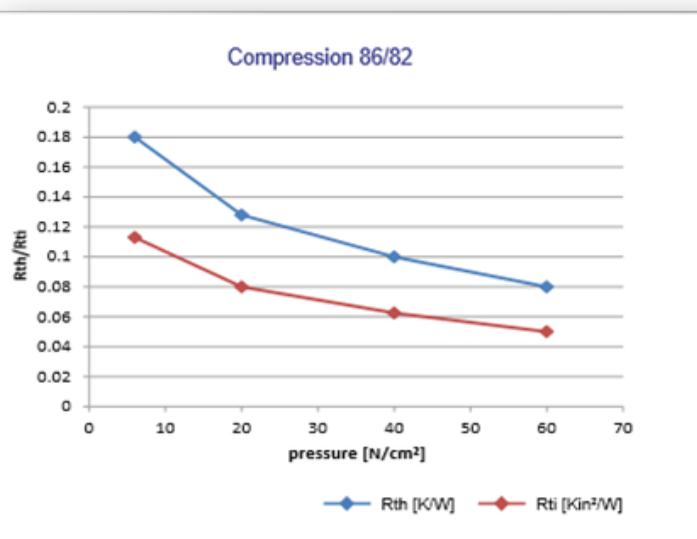
- ✓ Smooth surface
- ✓ Low hardness
- ✓ High self-adhesion
- ✓ Very good properties with low contact pressure



KERATHERM® Red 86/82 Thermal Film

- ✔ Thermal Conductivity 6.5 W/mK
- ✔ Fiberglass reinforcement
- ✔ Optimum heat transfer
- ✔ Good electrical insulation properties

Properties	Unit	86/82
Color		Red
Assembly		Fiberglass Reinforcement
Thermal Properties		
Thermal Resistance R_{th}	K/W	0.09
Thermal Impedance R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	35
	Kin^2/W	0.05
Thermal Conductivity λ	W/mK	6.5
Electrical Properties		
Breakdown Voltage $U_{d,ac}$	kV	1.0
Dielectric Breakdown $E_{d,ac}$	kV/mm	4.0
Volume Resistivity	Ωm	2.0×10^{14}
Dielectric Loss Factor $\tan \delta$		1.4×10^{-3}
Dielectric Constant ϵ_r		2.4
Mechanical Properties		
Measured Thickness (+/-10%)	mm	0.250
Hardness	Shore A	60-70
Tensile Strength	N/mm ²	13.0
Elongation	%	2
Physical Properties		
Application Temperature	$^{\circ}\text{C}$	-40 to +200
Density	g/cm ³	1.23
Flame Rating	UL-94	V-0
Possible Thickness	mm	0.25-0.3





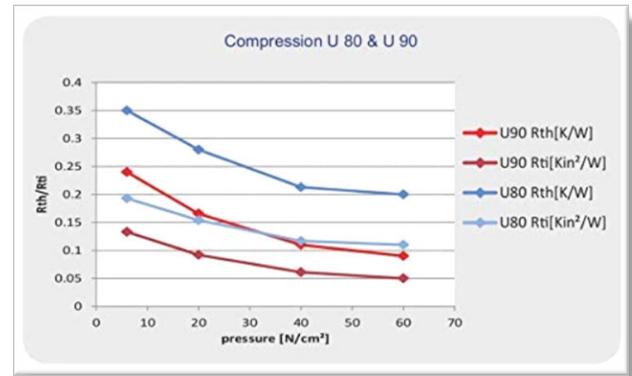
KERATHERM® U80 & U90 SILICONE FREE

When silicone-free is a necessity, KERAFOL® offers ceramic filled polyurethane KERATHERM® U-films as a silicone free alternative material.

Besides good thermal and outstanding electrical properties, these U-films are characterized by very good perforation strength. These good physical properties are achieved with an excellent price-performance ratio. Available with an optional one side adhesive coating: U80K or U90K. All Keratherm® standard films are UL approved.

KERATHERM® U90 SILICONE FREE U-FILMS

- ✓ Thermal Conductivity 6.0 W/mK
- ✓ Silicone free - Ceramic filled Polyurethane
- ✓ Heat transfer between CPU/Hard Disc Drives and heat sink
- ✓ Available with adhesive coating



Properties	Unit	U 80	U 90
Color		Blue	Light Blue
Thermal Properties			
Thermal Resistance R_{th}	K/W	0.2	0.082
Thermal Impedance R_{ti}	°Cmm²/W	73	33
	Kin²/W	0.11	0.05
Thermal Conductivity λ	W/mK	1.8	6.0
Electrical Properties			
Breakdown Voltage $U_{d,ac}$	kV	4.0	4.0
Dielectric Breakdown $E_{d,ac}$	kV/mm	25.0	20.0
Volume Resistivity	Ωm	1.4×10^{14}	2.0×10^{11}
Dielectric Loss Factor $\tan \delta$		1.3×10^{-2}	1.4×10^{-2}
Dielectric Constant ϵ_r		3.2	3.1
Mechanical Properties			
Measured Thickness (+/-10%)	mm	0.150	0.200
Hardness	Shore A	80-90	70-85
Tensile Strength	N/mm²	3.0	2.0
Elongation	%	130	150
Physical Properties			
Application Temperature	°C	-40 to +125	-40 to +125
Density	g/cm³	2.26	1.46
Flame Rating	UL-94	V-0	V-0
Possible Thickness	mm	0.15-0.3	0.1-0.3

APPLICATIONS:

- ✓ Medical equipment
- ✓ Laser equipment
- ✓ Lighting systems
- ✓ Aero/Space units

PROPERTIES:

- ✓ Good Insulation properties
- ✓ Filled Polyurethane Film
- ✓ Fully crosslinked
- ✓ Silicone free
- ✓ REACH/RoHS conforming

BENEFITS:

- ✓ Smooth surface
- ✓ UL approved
- ✓ High self-adhesion
- ✓ Very good properties with low contact pressure

KERATHERM® THERMAL GREASE



KERATHERM® Thermal Grease is a ceramic-filled single-component silicone with high thermal conductivity. The non-crosslinked thermal compounds do not dry out or leak out of the material. The KP12 silicone free thermal grease consists of synthetic thermal polymers and is suitable for fast and effective heat dissipation. The thixotropic paste is particularly suitable for silicone sensitive applications.

The KP's long term stability guarantees full operation during the entire life of the product. Under normal application conditions, KERATHERM® Thermal Grease does not cure, dry out, or melt.

KERATHERM® Thermal Greases are supplied in a variety of containers ranging from 5ml syringes to 1.0 kg cans to meet your application needs. Special packaging is available upon request.

KERATHERM® KP12— SILICONE FREE

- ▼ Thermal Conductivity 10.0 W/mK
- ▼ Silicone Free— consists of synthetic thermal polymers

KERATHERM® KP97

- ▼ Thermal Conductivity 5.0 W/mK

KERATHERM® KP98

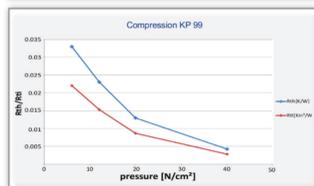
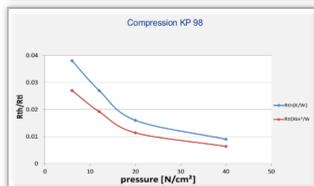
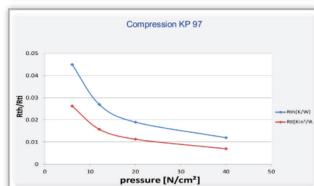
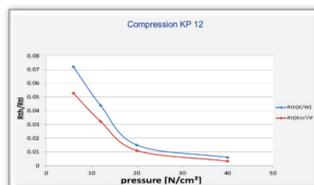
- ▼ Thermal Conductivity 6.0 W/mK

KERATHERM® KP99

- ▼ Thermal Conductivity 9.2 W/mK

APPLICATIONS

- ▼ Desktop CPU's
- ▼ IGBT units
- ▼ Notebooks



Properties	Unit	KP97	KP98	KP99	KP12 Silicon Free
Color		White	Grey	Anthracite	Silver
Soft/Pasty					
Thermal Properties					
Thermal Resistance R_{th}	K/W	0.0120	0.0100	0.0068	0.0060
Thermal Impedance R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	4.5	4.1	2.7	2.2
	Kin^2/W	0.007	0.0064	0.0042	0.0033
Thermal Conductivity λ	W/mK	5.0	6.0	9.2	10.0
Electrical Properties					
Electrical Conductivity	pS/m	0	0	0	53
Mechanical Properties					
Measured Thickness (+/-10%)	mm	0.025	0.025	0.025	0.025
Physical Properties					
Application Temperature	$^{\circ}\text{C}$	-60 to +200	-60 to +200	-60 to +200	-60 to +150
Density	g/cm^2	2.1	2.2	1.9	1.4
Viscosity	Pas	70-110	110-150	90-140	30-60
Total Mass Loss (TML)	Ma -%	< 1.3	< 1.5	< 0.80	< 0.1

S900 GRAPHITE FILM

BENIFITS

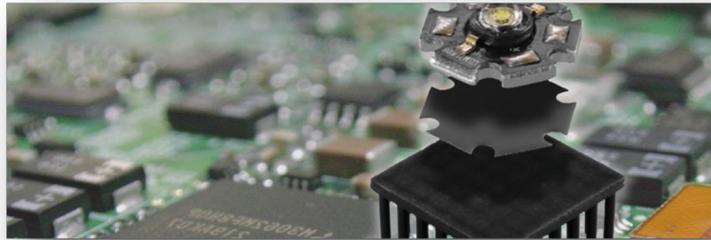
- ✓ Cost Effective
- ✓ Weight savings
- ✓ Excellent thermal properties

APPLICATIONS

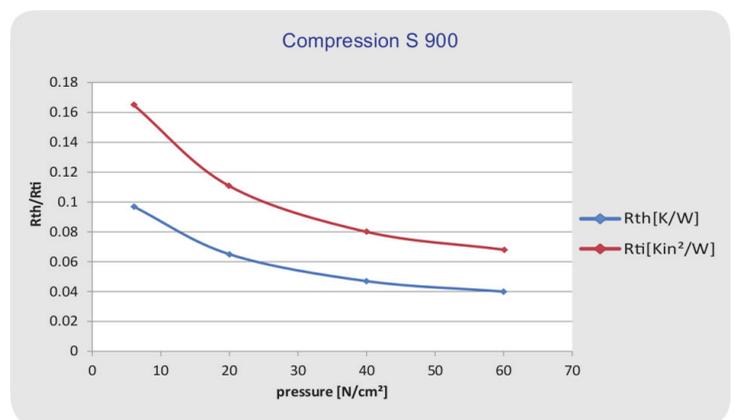
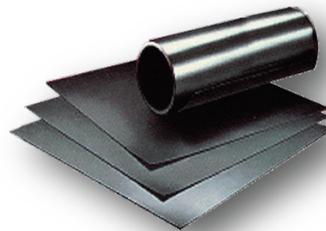
- ✓ Chipsets
- ✓ Memory Chips
- ✓ Micro BGA

Keratherm® S900 Graphite Film is 100% pure natural graphite material without binders. The film is available uncoated or for specific applications, provided with filled or standard adhesives.

Because of S900s high thermal conductivity, this film is used, among others, in CPU and GPU applications.



Properties	Unit	S900
Color		Black
Thermal Properties		
Thermal Conductivity (XY)	W/mK	7.5(>300)
Thermal Resistance	K/W	0.08
Electrical Properties		
Breakdown Voltage $U_{d,ac}$	kV	Conductive
Electrical Resistance (x/y)	$\Omega \mu\text{m}$	700-800(7-9)
Mechanical Properties		
Hardness	Shore D	25-35
Tensile Strength	N/mm ²	10
Elongation	%	5
Physical Properties		
Application Temperature	°C (°F)	-40 to +500 (-40 to +932)
Density	g/cm ³	>1.6
Total Mass Loss (TML)	Ma.-%	0.01
Flame Rating	UL-94	V-0
Possible Thickness	mm (inch)	0.15, 0.29 (0.006, 0.011)



KERATHERM® KL 90, KL 91, & KL 95 CERAMIC FILLED ADHESIVE FILMS



KERATHERM® KL series double-sided adhesive film has an excellent permanent adhesive strength with high thermal conductivities and outstanding insulation properties.

Low thermal contact resistances can be achieved by very reliable adhesive strength on a variety of surfaces.

KERATHERM® KL90 (without fiberglass) and KL91 (with fiberglass) are ceramic filled double sided adhesive films. Due to the soft surface finish of the KL90/91 film, tolerances can be compensated very well. Light weight, easy handling, and high elasticity are additional advantages.

A variety of adhesive options are available for the KL series.

KERATHERM® KL 95 (filled acrylic polymer) is a highly filled multifunctional adhesive film with good thermal conductivity, good dielectric properties, and excellent adhesive behavior. The adhesive tape is very suitable for bonding a wide variety of electronic components and heat sinks.

APPLICATIONS

- ✓ CPU's, LED's
- ✓ Flip chips, DSP's
- ✓ MOSFETS
- ✓ BGA's, PPGA's on heat sinks

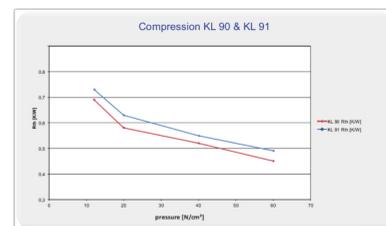
BENEFITS

- ✓ Low weight
- ✓ Highly elastic
- ✓ Adhesive
- ✓ Silicone Free
- ✓ REACH/RoHS conforming

KERATHERM® KL90, KL91 & KL95

- ✓ Ceramic filled adhesive
- ✓ Permanent adhesive strength with high thermal conductivities
- ✓ Lightweight, easy handling
- ✓ Available with or without fiberglass

Properties	Unit	KL90	KL91
Color		Black	Black
Basic Material		acrylate	acrylate
Reinforcement (fiberglass)		without	with
Thermal Properties			
Thermal Resistance R_{th}	K/W	0.52	0.55
Thermal Impedence R_{th}	$^{\circ}Cmm^2/W$	208	220
	Kin^2/W	0.32	0.34
Thermal Conductivity λ	W/mK	1.40	1.35
Electrical Properties			
Breakdown Voltage $U_{d,ac}$	kV	6.0	6.0
Dielectric Breakdown $E_{d,ac}$	kV/mm	20.0	20.0
Volume Resistivity	Ωm	2.6×10^4	2.6×10^4
Dielectric loss factor $\tan \delta$		3.1×10^{-1}	3.1×10^{-1}
Dielectric Constant ϵ_r		18.5	18.5
Mechanical Properties			
Measured Thickness (+/-10%)	mm	0.300	0.300
Hardness	Shore A	45	59
Tensile Strength	N/mm ²	0.3	11.3
Physical Properties			
Application Temperature	$^{\circ}C$	-40 to +125	-40 to +125
Density	g/cm^3	1.98	1.87
Total Mass Loss (TML)	Ma -%	<0.15	<0.15
Flame Rating	UL-94	V-0	V-0
Possible Thickness	mm	0.3-0.5	0.3



Properties	Unit	KL95
Color		Grey
Filled Acrylic Polymer		
Thermal Properties		
Thermal Conductivity λ	W/mK	1.3
Thermal Resistance R_{th}	K/W	0.32
Electrical Properties		
Breakdown Voltage $U_{d,ac}$	kV	2
Dielectric Breakdown $E_{d,ac}$	kV/mm	10
Volume Resistivity	Ωm	2.0×10^{11}
Dielectric loss factor $\tan \delta$	(1KHz)	2.4×10^{-1}
Dielectric Constant ϵ_r	(1KHz)	1.7
Mechanical Properties		
Adhesion (Bonding Strength)	Nmm	>0.5
Tack (Surface Adhesiveness)	mm	>1.0
Density	g/cm^3	2.24
Application Temperature	$^{\circ}C$	-40 to +100
Possible Thickness	mm	0.18-0.3



GFL SERIES- GAP FILLER LIQUID

KERATHERM® Gap Filler Liquids are excellently suited for the casting of large series products. The compound allows the production of permanently elastic thermal connections both in small and large gaps, and can be used as an alternate to conventional thermal pads.

Gap Filler Liquid is a two component ceramic filled silicone elastomer that is blended by a mixing tube and can be directly applied to the component by a dispensing system. Curing of the GFL series takes place at room temperature in one hour. For high volumes, the two-component GFLs are an efficient and cost-effective solution.

Compared to systems based on polyurethane or epoxy, silicone-containing GFL can absorb and compensate vibrations much better, an effect that is favored by the high softness of the GFL series. In addition, the low viscosity of the GFL allows for simple workability and has a gentle effect on the dispensing system.

The KERATHERM® GFL 1800 SL is solvent free Gap Filler Liquid based on a 2K silicone elastomer with 1.8 W/mK, 15 kV/mm, and a viscosity of < 7000 mPas. In comparison to other Gap Filler Liquids, the viscosity is 1/10th. Therefore, the material “flows like water”, has the advantage of self-levelling, and fills up every corner like a common potting material.



APPLICATIONS:

- ✓ Encapsulation
- ✓ Electric vehicles
- ✓ High fabrication tolerances
- ✓ High energy rechargeable batteries



BENEFITS:

- ✓ Room temperature curing
- ✓ Liquid assembly
- ✓ High material utilization
- ✓ High flexibility
- ✓ Automotive compliant
- ✓ Self Adhesion

KERATHERM® GFL 3020, GFL 3025, GFL 3030 & GFL 3040

- ✓ Room temperature curing
- ✓ Liquid assembly
- ✓ High flexibility
- ✓ High material utilization
- ✓ Automotive compliant

Properties	Unit	GFL3020	GFL3025	GFL3030	GFL3040	GFL1800SL
Color		Yellow	Orange	Green	Lilac	Green, White
Basic Material		Silicone	Silicone	Silicone	Silicone	Silicone
Mixing Ratio		1:1	1:1	1:1	1:1	1:1
Curing		1h;RT	1h;RT	1h;RT	1h;RT	1h;RT
Thermal Properties						
Thermal Resistance R_{th}	K/W	0.7	0.5	0.41	0.29	0.69
Thermal Conductivity λ	W/mK	1.8	2.5	3.0	4.3	1.8
Electrical Properties						
Breakdown Voltage $U_{d,ac}$	kV	10.0	8.0	6.0	5.0	7.5
Dielectric Breakdown $E_{d,ac}$	kV/mm	20.0	16.0	12.0	10.0	15.0
Mechanical Properties						
Measured Thickness (+/-10%)	mm	0.500	0.500	0.500	0.500	0.500
Hardness	Shore 00	45-60	65-85	65-85	65-85	55-75
Physical Properties						
Application Temperature	°C	-40 to +200				
Density	g/cm ³	2.30	2.83	2.94	3.05	2.3
Viscosity*	Pas	45-70	45-75	50-80	55-85	2-7
Total Mass Loss (TML)	Ma -%	0.19	<0.09	<0.06	<0.09	<0.17
Flame Rating	UL-94	V-0	V-0**	V-0	V-0	V-0**
Possible Thickness	mm	0.200-5.000	0.200-5.000	0.200-5.000	0.200-5.000	0.200-5.000

*Shear Rate $4s^{-1}/25^{\circ}C$

**KERAFOL® test according to UL



APPLICATIONS:

- ✓ All applications with small fabrication tolerances
- ✓ Encapsulation



BENEFITS:

- ✓ High temperature stability
- ✓ Compensation of tolerances
- ✓ High thermal performance
- ✓ Cycle resistant
- ✓ High dielectric strength
- ✓ Balancing of vibrations and Thermal expansions (CTE)

KERATHERM® GFL 1800 SL

- ✓ Room temperature curing
- ✓ Liquid assembly
- ✓ Compatible with industrial production sequences
- ✓ Solvent free

CHANG SUNG® PRODUCT OVERVIEW

TP-SG3005 FILM

- ✔ Thermal conductivity = 3.0 W/mK
- ✔ Thickness = 0.5mm
- ✔ High mechanical strength
- ✔ Electrically insulating

TP-SS30XX SERIES FILMS

- ✔ Thermal conductivity = 3.0 W/mK
- ✔ Thickness = 1.0—5.0mm
- ✔ Super soft hardness
- ✔ Electrically insulating

TP-US15XX SERIES FILMS

- ✔ Thermal conductivity = 1.5 W/mK
- ✔ Self adhesion properties
- ✔ Ultra soft hardness

TC-M10 & TC-M20 LIQUID

- ✔ Thermal conductivity = 1.0—2.0 W/mK
- ✔ Good adhesion to metal cases
- ✔ Low viscosity and conforming



TP-SXXXX SERIES FILMS

TP-S10XX TP-S15XX TP-S20XX
TP-S25XX TP-S30XX TP-S60XX

- ✔ Thermal conductivity = 1.0—5.5 W/mK
- ✔ Thickness = 0.5—5.0mm
- ✔ Self adhesion properties
- ✔ Electrically insulating

TP-HXXXX SERIES FILMS

TP-H10XX TP-H20XX TP-H25XX
TP-H30XX

- ✔ Thermal conductivity = 1.0—3.0 W/mK
- ✔ Thickness = 0.5—3.0mm
- ✔ Electrically insulating
- ✔ Enhanced mechanical strength

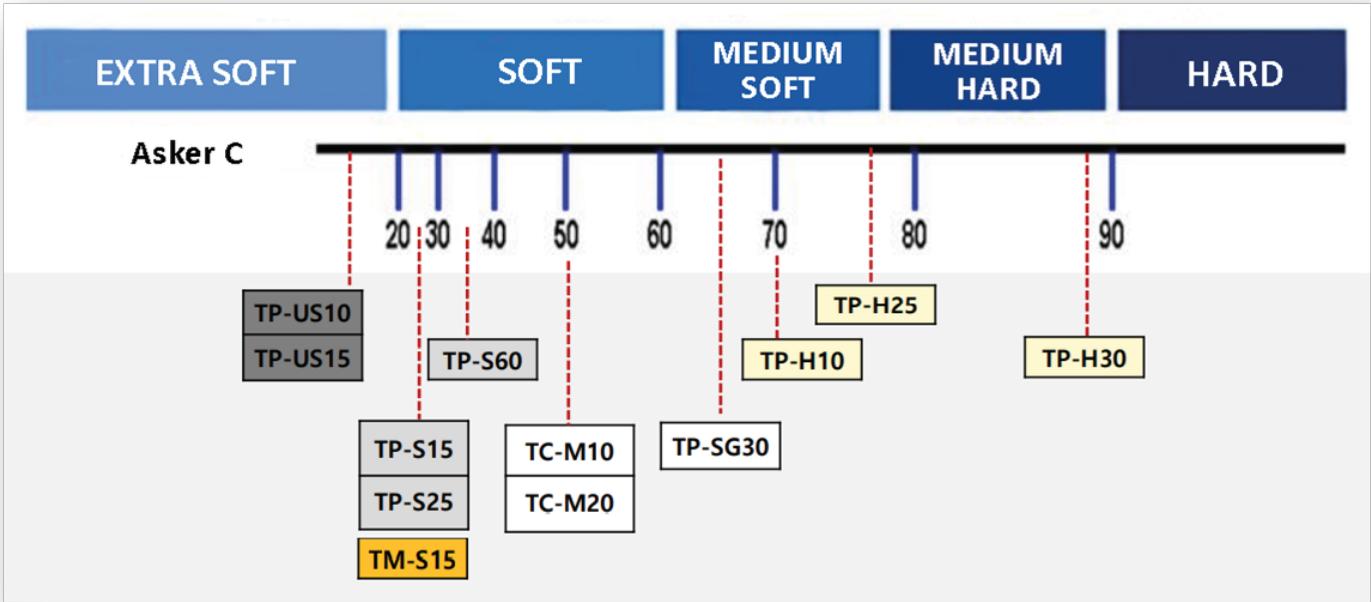
TM-S15XX SERIES FILMS

- ✔ Thermal conductivity = 1.5 W/mK
- ✔ Thickness = 0.5—3.0mm
- ✔ Power loss = 0.25 (@ 1 GHz/1 mm(T))
- ✔ Electrically insulating

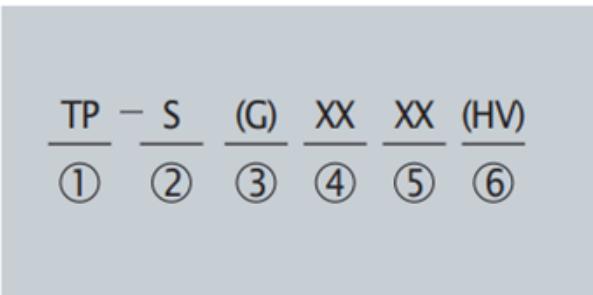
TM-H20XX SERIES FILMS

- ✔ Thermal conductivity = 2.5 W/mK
- ✔ Thickness = 0.2—2.0mm
- ✔ Power loss = 0.45 (@ 1 GHz/1 mm(T))
- ✔ Siloxane free (Acryl based)

PRODUCT HARDNESS



Designation of Product



- ① **TP** : Thermal Pad
TM : Dual Functional Pad (Thermal + EMI Absorbing)
TC : Thermal Compound
- ② **S** : Soft Type
SS : Super Soft Type
US : Ultra Soft Type
H : Hard Type
M : Molding Type (TC-M)
 Grease Type (TC-G)
- ③ **G** : Fiberglass Reinforced Type
- ④ **XX** : Thermal Conductivity (ex. 30 = 3.0 W/mK)
- ⑤ **XX** : Thickness (ex. 05 = 0.5 mm)
- ⑥ **HV** : Special Property (High Breakdown Voltage)
LS : Special Property (Low Siloxane)

SHEET MATERIAL

Chang Sung's thermal interface materials (TIM) are heat radiating with high thermal conductivity and provide effective solutions to internal heating issues observed in various electronic devices.

APPLICATIONS:

- ✔ Telecommunication Devices (router)
- ✔ Power Industries (SMPS)
- ✔ Flat Panel Displays (OLED, LCD)
- ✔ Set-top Boxes (SD/HD)
- ✔ Graphic Cards and Processors
- ✔ Memory Modules (DDR, S-Ram)
- ✔ Microprocessors

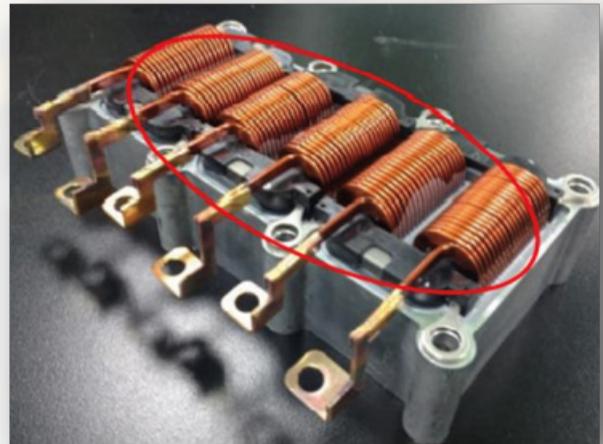


Grade	Color	Size (mm)	Thickness (mm)	Hardness (Asker C)	Thermal conductivity (W/mK)	Tensile strength (MPa)	Withstand voltage (kV)	Volume resistivity (Ω -cm)	Flammability (UL94)	
TP-S15	Gray	300 x 300	0.5 ~ 6.0	25	1.5	> 0.2	> 5	> 10^{13}	V-0	Soft
TP-S25	Purple	300 x 300	0.5 ~ 7.0	25	2.5	> 0.2	> 5	> 10^{13}	V-0	Soft
TP-S60	Pink	300 x 300	1.0 ~ 3.0	35	6.0	> 0.2	> 5	> 10^{13}	V-0	Soft
TP-US15	Sky Blue	300 x 300	0.5 ~ 5.0	9	1.5	> 0.1	> 5	> 10^{13}	V-0	Ultra Soft
TP-H10	Sky Blue	300 x 300	0.5	65	1.0	> 1.0	> 5	> 10^{13}	V-0	Hard
TP-H30	Yellow	300 x 300	0.5	45	3.0	> 0.5	> 5	> 10^{13}	V-0	Hard Adhesive
TP-SS30D	Gray	300 x 300	1.0~4.0	20	3.0	> 0.2	> 5	> 10^{13}	V-0	Hard/Soft

Grade	Color	Size (mm)	Thickness (mm)	Hardness (Asker C)	Thermal conductivity (W/mK)	Tensile strength (MPa)	Withstand voltage (kV)	Volume resistivity (Ω -cm)	*Power loss [%]	
TM-S15	Black	300 x 300	0.5 ~ 3.0	25	1.5	> 0.2	> 2.5	> 10^{10}	25	Dual
TM-S25	Dark Gray	300 x 300	0.5 ~ 3.0	25	2.5	> 0.2	> 3.0	> 10^{12}	30	Dual

LIQUID MOLDING COMPOUND

Chang Sung's thermally conductive liquid molding compounds are two component, silicone based materials. By using precise blending technology of ceramic fillers, maximum thermal conductivity can be achieved with low viscosity and low modulus.



APPLICATIONS:

- ▼ Reactor for Electric & Hybrid Vehicle
- ▼ Reactor for Fuel Cell Module
- ▼ Reactor for Solar Cell Module



Grade	A/B Mixing Ratio (wt%)	Viscosity (cps)	Density (g/cm ³)	Hardness (Asker C)	Thermal Conductivity (W/mK)	Breakdown Voltage (kV)	Volume Resistivity (Ω-cm)	Flame Resistance (UL94)	Curing Condition (°C/min)
TC-M10	100 : 100	20,000	1.70	50	1.0	> 5	> 10 ¹³	V-0	120/30
TC-M20	100 : 100	20,000	2.60	50	2.0	> 5	> 10 ¹³	V-0	120/30
TC-M30	100 : 100	20,000	2.80	50	3.0	> 5	> 10 ¹³	V-0	80/40
TC-M40	100 : 100	45,000	3.00	50	4.0	> 5	> 10 ¹³	V-0	80/40

GES[®] GRAPHITE



GES GRAPHITE

- ▼ GTS-1000i
- ▼ GTS-1000
- ▼ GTS-500
- ▼ GTS-250
- ▼ GTS-100
- ▼ GTS-25
- ▼ GTS-12

The GTS series graphite can be used in many applications requiring high thermal conductivity and extended temperature ranges. Graphite has excellent heat spreading qualities and is offered in a variety of thicknesses.

- ▼ Can be die-cut or laminated with adhesives or other materials
- ▼ This material is electrically conductive
- ▼ GTS-1000i has a plastic film on both sides providing insulation

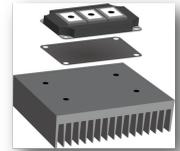


Property	Unit	GTS-1000i	GTS-1000	GTS-500	GTS-250	GTS-100	GTS-25	GTS-12
Thickness	mm	1	1	.5	.25	.125	.025	.012
Thermal conductivity through plane-in plane	W/mK	3-5 300-400	3-5 300-400	6-10 300-500	6-10 300-500	7-12 1000-1800	7-12 1000-1800	7-12 1000-1800
Bulk Density	mm	1.0-1.2	1.0-1.2	1.2-1.4	1.4-1.5		1.5-1.6	
Carbon Content		99-99.5%				99.5-99.9%		
Hardness	Shore					85		
CTE through plane in plane	K ⁻¹					-0.4ppm 27ppm		
Operating Temperature	°C	-40 to +140		-40 to +400				
Specific Heat @25°C	J/kg-°C					710		
Dielectric Breakdown	kV/mm	3		Conductive				

eAPUS® Technology offers a wide range of cost effective thermal interface materials. They offer films, gap fillers, and putty. Putty is a unique material type that allows for very low pressure to sustain any desired compression value.

eAPUS® makes their materials available in a wide range of thicknesses.

EAPUS®



eAPUS® TOP PAD RS300 Gap Filling Material

- ✓ Low oil bleeding
- ✓ Single-sided self-tacky
- ✓ Highly conformable
- ✓ Highly compressible

Applications –RS300

- ✓ Projector
- ✓ Storage devices
- ✓ Notebook
- ✓ Tablet
- ✓ Telecommunications
- ✓ Smartphone

Property	Unit	RS300	MA500	AB150AP	MA700P
Color		Yellow	Lavender	White	Gray
Base Polymer	Silicone				
Material Type		Gap Filler	Gap Filler	Film	Putty
Material Specifics		One side tacky	One side tacky	Oneside adhesive	Conformable
Thermal Properties					
Thermal Conductivity	W/mK	3.3	3.0	1.3	5.0
Thermal Impedance	^o Cin ² /W @30psi Measured Thickness	0.43 0.5mm	0.31 0.5mm	0.22 0.15mm	0.18 0.5mm
Electrical Properties					
Dielectric Breakdown	kV/mm	6	6	3	6
Volume Resistivity	M Ωm	10 ¹²	10 ¹²	10 ¹²	10 ¹¹
Mechanical Properties					
Thickness	mm	0.3-5.5	0.3-5.5	0.15	0.5-3.0
Density	g/cm ³	2.8	2.9	2.9	3.1
Hardness	Shore 00	33	42	84	-
Tensile Strength	MPa	0.08	0.12	0.19	0.1
Elongation	%	158	189	20	-
Physical Properties					
Application Temperature	^o C	-40 to +180	-40 to +180	-20 to +70	-40 to +180
Total Mass Loss	Ma-%	0.13	0.11	-	0.11

eAPUS® TOP PAD MA700P Putty Type Material

- ✓ Highly conformable
- ✓ Highly compressible

Applications - MA700P

- ✓ Projector
- ✓ Notebook
- ✓ Tablet
- ✓ Electric Vehicles
- ✓ Smartphone

eAPUS® TOP PAD AB150AP Thermally Conductive Foil

- ✓ Low oil bleeding
- ✓ Single-sided adhesive coating
- ✓ Surface side covered with PET

Applications – AB150AP

- ✓ Projector
- ✓ Optical Equipment
- ✓ Car Electronics
- ✓ Medical Instruments
- ✓ Electric Vehicles
- ✓ Smartphone

eAPUS® TOP PAD MA500 Gap Filling Material

- ✓ Low oil bleeding
- ✓ Single-sided self-tacky
- ✓ Excellent for computer industry
- ✓ Highly compressible

Applications – MA500

- ✓ Projector
- ✓ Computers
- ✓ Car Electronics
- ✓ Medical Instruments
- ✓ Telecom. Instruments
- ✓ Optical Equipment

PRODUCT OVERVIEW

GASKETS & SEALS

CUSTOM GASKETS

- ✓ O.D. / I.D. washer style gasket, window frame gasket or a gasket that is specially designed for your project.
- ✓ Tolerances $+0.003$ " to -0.005 " with repeatability.
- ✓ Sizes from $.030$ " to 6 foot outside diameter.
- ✓ Fast turnaround and lead time.

CONNECTOR GASKETS

- ✓ Specialize in tight tolerances.
- ✓ Sizes as small as $.020$ " inside dimension and a $.015$ " wall thickness with tolerances not exceeding ± 0.005 ".

EMI SHIELDING

- ✓ Made from conductive elastomers with excellent resistance to compression set over a wide temperature range, resulting in years of continuous service.
- ✓ EMI shielding gaskets meet MIL-STD-810 requirements for fungus resistance.
- ✓ These materials will provide an environmental or pressure seal if required.
- ✓ These elastomers are a unique composite of high-quality silicone and conductive microscopic particles, manufactured to strict formulations, yielding EMI shielding gaskets that meet nearly every military and/or electronic requirements.

O-RINGS

- ✓ Offers standard and nonstandard sizing.
- ✓ Custom O-rings for special engineering needs.

EXTRUSIONS

- ✓ Neoprene or rubber extrusions.
- ✓ Short runs of irregular parts to high-volume runs of standard shapes.
- ✓ Shapes include D, P, Tube, U, custom.

WAVEGUIDE GASKETS

- ✓ These gaskets can be supplied either molded or die cut in a wide range of compounds.
- ✓ Extensive range of standard tooling for common designs.

SHOCK VIBRATION MOUNTS

- ✓ Latest in finite equipment analysis, computer-aided design, and proprietary dynamic analysis software to optimize designs quickly, resulting in shorter product development cycles for our customers.
- ✓ Integrated CAD/CAM systems are used to reduce tooling lead times and allow rapid prototyping.

MOLDED PRODUCTS

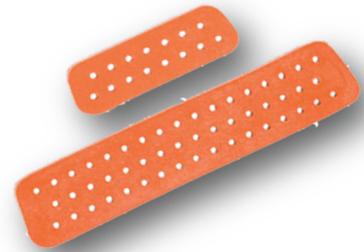
- ✓ Custom precision injection and compression molded products & components.
- ✓ Rubber Caps, Seals, Mounts, Bellows, Window closeouts, Couplings, Gaskets, etc.

GASKETS & SEALS

MATERIAL & APPLICATIONS

APPLICATIONS:

- ▼ Aerospace
- ▼ Military
- ▼ Medical
- ▼ Electronics
- ▼ Consumer Products
- ▼ Appliance



MATERIALS: Diverse Inventory of Thickness & Durometer

This is a partial list of Materials

- | | | |
|---------------------------|---------------------|---|
| ▼ Asbestos Replacement | ▼ Hypalon | ▼ Military grade compounds |
| ▼ Buna-N | ▼ Nitriles | AA59588 SILICONE |
| ▼ Butyl | ▼ Polyurethane | MIL-R-25988 FLUROSILICONE |
| ▼ Chute Lining | ▼ Pure Gum | MIL-R-83248C VITON |
| ▼ Cork & Rubber | ▼ Red Sheet Packing | MIL-R-6855 CL I & II SYNTHETIC RUBBERS |
| ▼ Custom Compounds | ▼ Silicone/Glass | MIL-G-83528 in various thicknesses/Durometers |
| ▼ Diaphragm | ▼ Teflon™ | |
| ▼ Electrically Conductive | ▼ Vellumoid | ▼ Open Cell |
| ▼ TFE/Glass | ▼ Silicone | Rubber |
| ▼ EMI/RFI Shielding | ▼ Die Injection | Neoprene |
| ▼ EPR/EPDM | Latex | |
| ▼ FDA/Class VI Medical | Closed Cell | |
| ▼ Fluorocarbons | ▼ Neoprene | |
| ▼ Fluorosilicone | Soft | |
| ▼ Gore-Tex | Medium | |
| ▼ Hydrin | Firm | |
| | Fungus Resistant | |



GET IN TOUCH



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Issued 2021