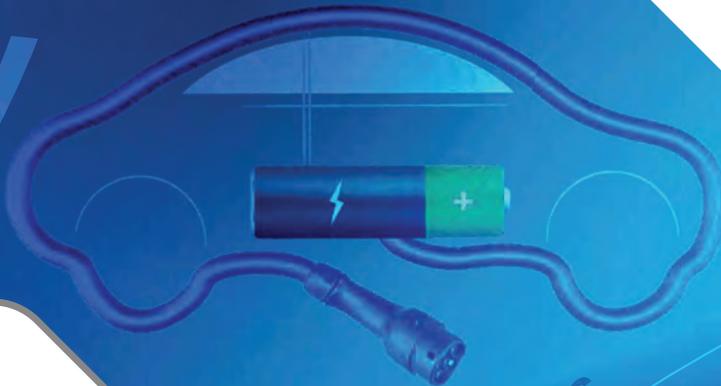




optimized
e-mobility



**power
electronics**

Hill Technical Sales

50 North Brockway Street / Suite 3-2 • Palatine, IL 60067-5068
PH +1(847)255-4400 • FAX +1(847)255-0192
sales@hilltech.com • www.hilltech.com

KERATHERM[®]

Thermal Management Solutions

Innovation in Technology and Environmental Protection

Hill Technical Sales

50 North Brockway Street / Suite 3-2 • Palatine, IL 60067-5068
 PH +1(847)255-4400 • FAX +1(847)255-0192
 sales@hilltech.com • www.hilltech.com



The information provided in this Technical Data Sheet (TDS) including the recommendations for use and application of the product are based on our knowledge and experience of the product as at the date of this TDS. The product can have a variety of different applications as well as differing application and working conditions in your environment that are beyond our control. KERAFOL® is, therefore, not liable for the suitability of our product for the production processes and conditions in respect of which you use them, as well as the intended applications and results. We strongly recommend that you carry out your own prior trials to confirm such suitability of our product. All specifications are subject to change without notice. Any liability in respect of the information in the Technical Data Sheet or any other written or oral recommendation(s) regarding the concerned product is excluded. In case KERAFOL® would be nevertheless held liable, on whatever legal ground, KERAFOL®'s liability will in no event exceed the amount of the concerned delivery. All KERAFOL® products are sold pursuant to the KERAFOL®'s Terms and Conditions of sale and delivery in effect from time to time, a copy of which will be furnished upon request.

Company Profile	4
Thermal Management and KERATHERM®	6
KERATHERM® Products	8
Specific Values and Characteristics	10
e-mobility	14
Gap Filler Liquids	16
Gap Filler Liquids (silicone free)	20
Thermal Adhesives	22
Dispensing service	23
Gap Pads (SOFTTHERM® Films)	24
Gap Pads (SOFTTHERM® Films silicone free)	35
Thermal Conductive Tapes	38
Thermal Conductive Tapes (silicone free)	46
Adhesive Films	50
Injection Moulding Granulate	52
Thermal Grease	54
Graphite Films	56
Phase-Change-Material	57
Good to know.....	58
Test Methods	60



Experienced, innovative and customer-oriented

Many years of experience with oxidic and non-oxidic ceramic materials, continuous development of innovative and customer-focused solutions, and a global sales and distribution network with short delivery times are just some of the reasons why we are one of the leading specialists and manufacturers for thermal management solutions.

Modern production facilities

Our ceramic tapes are manufactured on the latest production facilities, either as standard or customer-specific products in a continuous process. The films can be ordered as endless, rolled material, or already individually punched in several thicknesses. Thereby the flexible ceramic films can be processed in customer specific geometries.

Development, quality control and environmental compatibility

In order to offer our customers competent, customized advice and individual problem solutions, our engineers and staff are constantly doing research, development and tests on new, innovative and high quality materials in our inhouse R&D laboratory. Through tests during product development, we guarantee the environmental compatibility of all raw materials, the manufacturing process and the recyclability of our products.

All KERATHERM® products are RoHS- and REACH compliant!

KERAFOL® – Customer satisfaction in all areas

KERAFOL® offers a wide range of products, suitable for diverse applications, as for example in micro-electronics, power supply, white goods, telecommunication or AC-DC converters.

Our foremost goal is to provide our customers with competent, customer-oriented problem solutions, which we guarantee through continuous quality control, optimization of processes and manufacturing steps.



Many years of experience and a wide variety of innovative solutions makes KERAFOL® your essential partner in the field of "Thermal Management".

Why "Thermal Solutions"?

The continuously increasing technical demands, placed by the electronics industry on electronic and electrical devices, have led to a dramatic rise in the problem of heat generation. Higher frequencies, component miniaturization, enhanced functionality and increased device power ratings all lead to high temperatures that need to be controlled to ensure excellent long term stability and durability. Heat sinks, cooling plates and ventilators are often used to dissipate the heat and to reduce the temperature of the electrical circuits to a minimum.

The thermal coupling of suitable conducting materials is also gaining importance in this area. KERAFOL®, with KERATHERM® products, offers an effective, uncomplicated and cost-effective range of products for this purpose.

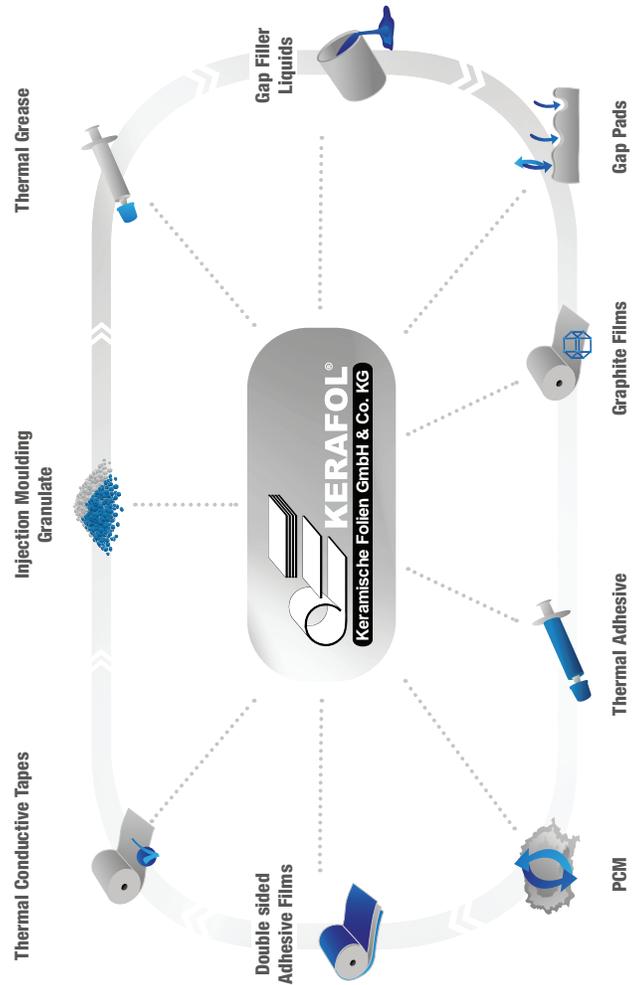
About KERATHERM®

KERATHERM® are highly flexible products that are comprised of thermally conductive and electrically insulating polymers, either single or multicomponent filled with ceramic or heat conducting materials.

KERATHERM®, when mechanically reinforced with fibreglass or other materials, offers the user a versatile product that is superior to conventional ceramic or mica discs.

KERATHERM® Products: Advantages and Properties

- ◆ KERATHERM® heat conducting films are characterized by their high thermal conductivity and their electrical insulation.
- ◆ In contrast to discs made of mica, aluminum or polyamide, KERATHERM® can be used without a heat conducting compound.
- ◆ Compared to conventional heat conducting materials, KERATHERM® does not dry out during continuous use, thus retaining its good thermal conductivity properties over the years.
- ◆ By using KERATHERM® products, mounting problems, such as smearing and assembly errors, can be avoided.
- ◆ Silicone-based KERATHERM® facilitate component mounting, thanks to their self-adhesive properties.
- ◆ Single-sided adhesive coating is also available, and allows long term attachment, even up-side down.



KERATHERM® Products

Gap Filler Liquids

Gap Filler Liquids are ceramic filled two-component elastomers without solvents, based on silicone or PU. The new product line of Kerafol product is characterized by its wide range of thermal conductivity, high degree of thermal insulation and its good rheological behavior. Due to the low viscosity, such Gap Filler Liquids are ideal for dispensing and even potting. Consequently, an installation without mechanical stress can be realized, regardless of the tolerances and irregularity of the heat source/sink.



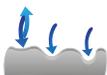
Thermal Adhesive

Two component liquid adhesive with high bond strength and room temperature curing.



Gap Pads (SOFTTHERM® Films)

SOFTTHERM® is the ideal material for smoothing out even large component irregularities. Thanks to its outstanding compressibility, it produces an optimum thermal contact combined with electrical insulation. The supplied thicknesses range from 0.5 - 5.0 mm. Other thicknesses or shapes are available on request.



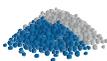
Thermal Conductive Tapes

Thermal Conductive Tapes, 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. The material smoothes out microscopic irregularities in the contact surfaces, which improves the thermal interface and therefore increases the heat dissipation.



Injection Moulding Granulate

The new series of injection moulding granulate makes it possible to achieve 3D heat transfer and a high level of electrical insulation at the same time. In addition, electrical components can be completely covered with thermally conductive materials through the overmoulding process. This means that electronic components can not only be cooled, but also protected from dust and mechanical influences – a real alternative to conventional potting materials due to the fast process time.



Adhesive Films

The Adhesive Films KL 90, KL 91 and KL 95 are thermoconducting, electrically insulating, double sided adhesive films. They have an excellent, permanent adhesive strength with high thermal conductivity and outstanding insulation characteristics at the same time.



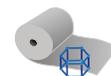
Thermal Grease

Thermal Grease is especially characterized, by its good plasticity and very low thermal resistance. There is no drying out or leaking of the silicone components.



Graphite Films

Graphite Films are based on 100% pure graphite. The films are available as uncoated types or with filled adhesive or standard adhesives for specific applications.



PCM

Phase-Change-Material (PCM) is an excellent alternative for thermal pastes. The PCM changes its aggregate state from solid to liquid at a certain melting temperature. The result is a thermal interface material with a very low bond line. Furthermore the PCM compensates even the smallest irregularities between the electronic component and the heat sink, thereby optimizing the contact between the surfaces and increasing the heat transfer.



Gap Filler Liquids

	thermal conductivity	viscosity	dielectric breakdown	density	hardness	characteristics	page
	W/mK	Pas	kV/mm	g/cm ³	Shore 00		
GFL 3040	4.3	55 - 85	5	3.1	65 - 85	Gap Filler Liquids	17
GFL 3030	3.0	50 - 80	6	2.9	65 - 85	Gap Filler Liquids	17
GFL 3020 RF NEW	2.0	45 - 85	10	2.4	45 - 60	Gap Filler Liquids	16
GFL 3020	1.8	45 - 70	10	2.3	45 - 60	Gap Filler Liquids	16
GFL 1800 SL NEW	1.8	2 - 8	7.5	2.3	55 - 75	Gap Filler Liquids	18

Gap Filler Liquids (silicone free)

	thermal conductivity	viscosity	dielectric breakdown	density	hardness	characteristics	page
	W/mK	Pas	kV/mm	g/cm ³	Shore 00		
GFU 15 silicone free NEW	1.5	140 - 180	8	2.3	65 - 85	Gap Filler Liquids	20

Thermal Conductive Tapes

		thermal conductivity	thermal resistance	breakdown voltage	hardness	characteristics	page
		W/mK	K/W	kV	Shore A		
86/82	KERATHERM® red	6.5	0.09	1.0	60 - 70	very high thermal conductivity	45
86/60	KERATHERM® pink	4.5	0.14	5.0	45 - 60	high thermal conductivity, high insulation	44
86/50	KERATHERM® pink	3.5	0.16	1.5	70 - 80	high thermal conductivity	42
86/30	KERATHERM® white	2.5	0.22	1.5	70 - 80	good thermal conductivity / insulation	40
86/37	KERATHERM® green	1.8	0.32	8.0	65 - 75	high insulation	41
L 86/50	Peek Folie NEW	1.1	0.51	8.0	70 - 80	High electrical isolation	43

Thermal Conductive Tapes (silicone free)

		thermal conductivity	thermal resistance	breakdown voltage	hardness	characteristics	page
		W/mK	K/W	kV	Shore A		
U 90	silicone free	6.0	0.08	4.0	70 - 85	silicone free, high thermal conductivity	47
U 85	silicone free	3.0	0.17	6.0	70 - 85	silicone free, high thermal conductivity and high insulation	46
U 80	silicone free	1.8	0.20	4.0	80 - 90	silicone free	47

Gap Pads (SOFTTHERM® Films)

		thermal conductivity	thermal resistance	breakdown voltage	hardness	characteristics	page
		W/mK	K/W	kV	Shore 00		
6000	SOFTTHERM® Film NEW	6.0	0.41	4.0	55 - 75	high thermal conductivity	34
86/525	SOFTTHERM® Film	5.5	0.44	1.3	50 - 65	high thermal conductivity, very good compressibility	33
86/450	SOFTTHERM® Film	4.5	0.54	5.0	65 - 75	very good thermal and dielectric properties	32
3500	SOFTTHERM® Film	3.5	0.73	5.0	45 - 65	soft, very good thermal and dielectric properties	31
86/325	SOFTTHERM® Film	3.0	0.82	6.0	35 - 50	soft, high thermal conductivity	30
86/320	SOFTTHERM® Film	2.5	1.00	5.0	25 - 38	very soft, good dielectric properties	29
86/235	SOFTTHERM® Film	2.0	1.20	6.0	25 - 40	soft, high thermal conductivity	28
86/238	SOFTTHERM® Film	2.0	1.20	6.0	25 - 40	double layer	29
86/225	SOFTTHERM® Film	2.0	1.20	6.0	30 - 45	fibreglass-reinforced, good self-adhesive behavior on both sides	27
86/228	SOFTTHERM® Film	2.0	1.20	6.0	30 - 45	double layer	27
86/125	SOFTTHERM® Film	1.5	1.60	6.0	10 - 25	soft, high compressibility	26
86/128	SOFTTHERM® Film	1.5	1.60	6.0	10 - 25	soft, high compressibility	26

Gap Pads (silicone free)

		thermal conductivity	thermal resistance	breakdown voltage	hardness	characteristics	page
		W/mK	K/W	kV	Shore 00		
U 110	SOFTTHERM® Film (silicone free) NEW	2.0	1.2	8	60 - 75	elastic, silicone free	35

Thermal Adhesive

		thermal conductivity	viscosity	dielectric breakdown	density	hardness	characteristics	page
		W/mK	Pas	kV/mm	g/cm ³	Shore A		
KERATHERM® Bond 100 RT		1.5	20 - 40	12	2.1	20 - 35	Thermal Adhesive	22

Injection Moulding Granulate

		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV	mm	Shore A		
MT 320	KERATHERM® Compound NEW	2.0	-	12.5	0.5	15 - 30		52
MT 103	KERATHERM® Compound MT-Films NEW	1.8	-	12.5	0.5	70 - 80		52

» **Specific Values and Characteristics** »

Adhesive Films

		thermal conductivity	thermal resistance	breakdown voltage	hardness	characteristics	page
		W/mK	K/W	kV/mm	Shore A		
KL 90	thermal conductive, adhesive film without fibreglass	1.40	0.52	6.0	45	thermal conductivity insulating adhesive	49
KL 91	thermal conductive, adhesive film with fibreglass	1.35	0.55	6.0	59	thermal conductivity insulating adhesive	49
KL 95	thermal conductive, adhesive film without fibreglass	1.30	0.32	10.0	60	thermal conductivity insulating adhesive	48

Thermal Grease

		thermal conductivity	thermal resistance	measured thickness	characteristics	page
		W/mK	K/W	mm		
KP 12	silicone free thermal compound	10.0	0.0060	0.025	silicone free	54
KP 99	ceramic filled silicone component	9.2	0.0068	0.025	very low thermal resistance	54
KP 98	ceramic filled silicone component	6.0	0.0100	0.025	silicone based, low thermal resistance	54
KP 97	ceramic filled silicone component	5.0	0.0120	0.025	silicone based	54

Graphite Films

		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV	mm	Shore D		
S 900	highly compressed Graphite film	7.5	0.08	not insulating	0.290	25 - 35	high thermal conductivity	56

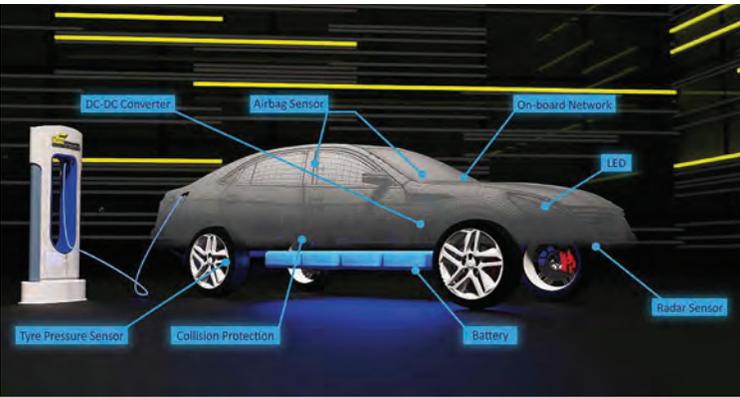
PCM

		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV	mm	Shore A		
PCM 20	phase change material NEW	2.0	0.5	not insulating	TBD	55 - 65	high thermal conductivity	57



Thermal Management - Challenges for electric vehicles

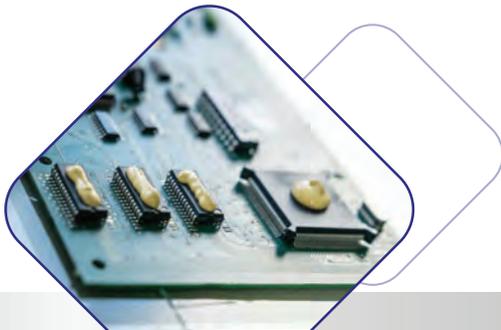
The change to electric powertrains and the increasing importance of autonomous driving imply a variety of new challenges. Thermal management or rather thermal connectivity and cooling of electrical components have an important role to play. While there is a large number of Thermal Interface Materials, the most common solution for the automotive sector are the Gap Filler Liquids (GFL) and the SOFTTHERM® Pads, both of them can be individual customized.



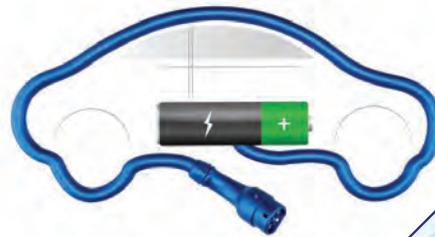
The change to electric drive systems as well as the increasing importance of autonomous driving imply completely new applications and challenges in the field of "Thermal Management." The functional relationship between the operating temperature of a battery stack and its maximum achievable number of cycles has been sufficiently proven, which can be quantified extremely precisely by the following rule of thumb:

"A reduction in operating temperature by 10°C doubles the lifetime of the battery cells"

The net reach of an electric car is also noticeably dependent on the operating temperature of the battery and thus also indirectly on the present thermal cooling. In addition to the concept for thermal connectivity of the energy source, the "car of tomorrow" also requires solutions for electrical components in the areas of LED, sensor technology, on-board network and inverter, one of the core elements of the electric powertrain.



Optimized thermal management for e-mobility and performance electronics through - Gap Filler "Liquids".



The use of thermal pad setups in e-mobility has been proved for years.

Additionally KERAFOL® also offers novel masses for mass casting as a room temperature cross-linking variant, the Gap Filler liquids, as an alternative to conventional heat conduction pads.



The thermal materials capable of dispensation allow the production of permanently elastic film layers across a wide range of layer thicknesses, which are otherwise not obtainable in the combination of properties. Owing to the excellent processing features (wet-in-wet processing), it is possible to realise short cycle lengths. Especially the combination of long-term stability and reliability at high thermal conduction capacities and a minimal mechanical component load make this material group particularly interesting. [Request our application recommendations]





Gap Filler Liquids



Gap Filler Liquids



GFL 3020 & GFL 3020 RF Gap Filler Liquid



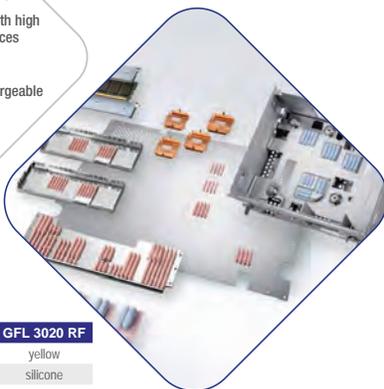
GFL 3030 & GFL 3040 Gap Filler Liquid

Applications

- ◆ All applications with high fabrication tolerances
- ◆ Encapsulation
- ◆ Electric vehicles
- ◆ High energy rechargeable batteries

Benefits

- ◆ Room temperature curing
- ◆ Liquid assembly
- ◆ High material utilization
- ◆ High flexibility
- ◆ automotive compliant



Properties	Unit	GFL 3020	GFL 3020 RF
Colour		yellow	yellow
Basic material		silicone	silicone
Mixing ratio		1 : 1	1 : 1
Curing		1h :RT	1h :RT
Thermal Properties*			
Thermal resistance R_{th}	K/W	1.4	1.2
Thermal conductivity λ	W/mK	1.8	2.0
Electrical Properties**			
Dielectric breakdown voltage $U_{g,dc}$	kV	10.0	10.0
Mechanical Properties			
Hardness	Shore 00	45 - 60	45 - 60
Physical Properties			
Application temperature	°C	-40 to +200	-40 to +200
Density	g/cm ³	2.30	2.40
Viscosity***	Pas	45 - 70	45 - 85
Total mass loss (TML)	Ma. -%	0.19	0.19
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.05 - 5.0	0.1 - 5.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm *** Shear rate 4s⁻¹ / 25°C

Dispensing technology as a service:

Consulting, development & production. As a specialist for dispensing technology, we offer consulting, development and production services for the application of thermal material to different heat sinks or to customized components.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Properties	Unit	GFL 3030	GFL 3040
Colour		green	lavac
Basic material		silicone	silicone
Mixing ratio		1 : 1	1 : 1
Curing		1h :RT	1h :RT
Thermal Properties*			
Thermal resistance R_{th}	K/W	0.82	0.58
Thermal conductivity λ	W/mK	3.0	4.3
Electrical Properties**			
Dielectric breakdown voltage $U_{g,dc}$	kV	6.0	5.0
Mechanical Properties			
Hardness	Shore 00	65 - 85	65 - 85
Physical Properties			
Application temperature	°C	-40 to +200	-40 to +200
Density	g/cm ³	2.94	3.05
Viscosity***	Pas	50 - 80	55 - 85
Total mass loss (TML)	Ma. -%	< 0.06	< 0.09
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.2 - 5.0	0.2 - 5.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm *** Shear rate 4s⁻¹ / 25°C

**NEW
OPTION**

Ceramic filled, solvent free two component silicone elastomer. Room temperature curing makes it suitable for wet in wet production.

Optionally available as GFL 3030 LV

- ✔ Extra low viscosity with 30-55 Pas
- ✔ Same properties except viscosity
- ✔ This variant is not thixotropic
- ✔ Self-levelling character

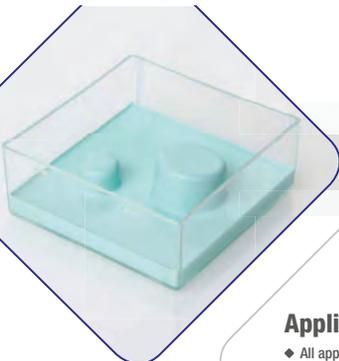
Customer benefit

- ✔ A professional service-provider for dispensing production and technology
- ✔ A more economical dispensing material compared to conventional thermal pastes and tapes
- ✔ A time-saving, easy assembly due to the prefabricated, ready dispensed components

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.



Gap Filler Liquids



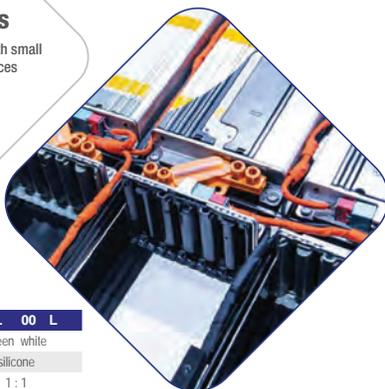
GFL 1800 SL Gap Filler Liquid

Applications

- ◆ All applications with small fabrication tolerances
- ◆ Encapsulation

Benefits

- ◆ Room temperature curing
- ◆ Liquid assembly
- ◆ compatible with industrial production sequences



Properties	Unit	GFL 00 L
Colour		green white
Basic material		silicone
Mixing ratio		1 : 1
Curing	T °C	1h ; 25 °C
Thermal Properties*		
Thermal resistance R_{th}	K/W	1.38
Thermal conductivity λ	W/mK	1.8
Electrical Properties**		
Dielectric breakdown voltage $U_{0.05}$	kV	7.5
Mechanical Properties		
Hardness	Shore 00	55 - 75
Physical Properties		
Application temperature	°C	-40 to +200
Density	g/cm ³	2.3
Viscosity***	mPas	2 000 - 8 000
Total mass loss (TML)	Ma -%	0.17
Flame rating	UL-94	V-0
Possible thickness	mm	0.2 - 5.0

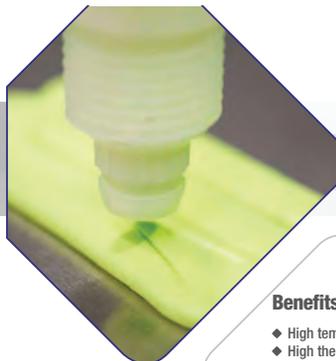
* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm *** Shear rate 4s⁻¹ / 25 °C

The GFL 1800 SL is solvent free Gap Filler Liquids based on a two component silicone elastomer with 1.8 W/mK, 15 kV/mm and a viscosity of < 8000 mPas. In comparison to other Gap Filler Liquids the viscosity is 1/10. Therefore, the material "flowing like water", has the advantage of self-levelling and filling up every corner like a common potting material.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

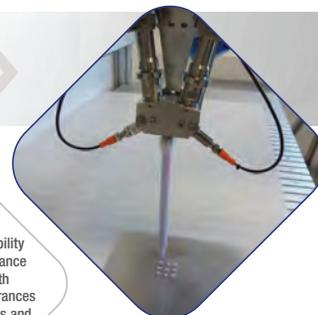


Gap Filler Liquids



Benefits

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



Consulting, development & production. As a specialist for dispensing technology, we offer consulting, development and production services for the application of thermal material to different heat sinks or to customized components.

Test	Characteristics	Thermal Conductivity	Hardness	Breakdown Voltage
Maximum Temperature	1.000 h @ 150 °C	✓	✓	✓
Temperature Cycles	-40 up to 125 °C	✓	✓	✓
Humidity/Temperature	85 % relative humidity/85 °C	✓	✓	✓
Vibration test	according VW80000 / LV124		(Application Test)	✓





GFU 15 silicone free Gap Filler Liquid

Applications

- ◆ All applications with high fabrication tolerances
- ◆ Encapsulation
- ◆ Electric vehicles
- ◆ High energy rechargeable batteries

Benefits

- ◆ Room temperature curing
- ◆ Liquid assembly

Properties	Unit	GFU
Colour		orange
Basic material		silicone free
Mixing ratio		1 : 1
Curing at room temperature	h	24 RT
Thermal Properties*		
Thermal resistance R_{th}	K/W	1.6
Thermal conductivity λ	W/mK	1.5
Electrical Properties**		
Dielectric breakdown voltage $U_{g, ac}$	kV	8
Mechanical Properties		
Hardness	Shore 00	65 - 85
Physical Properties		
Application temperature***	°C	-40 to 110
Density	g/cm ³	2.30
Viscosity A Comp.****	Pas	140 - 180
Viscosity B Comp.****	Pas	140 - 180
Flame rating*****	UL-94	V-0
Possible thickness	mm	0.2 - 5.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm *** may cause increase in hardness
**** Shear rate 4s⁻¹ / 25°C ***** KERAFOL, list according to UL

Ceramic filled, solvent free two component elastomer. Room temperature curing makes it suitable for wet in wet production.

Dispensing technology as a service:

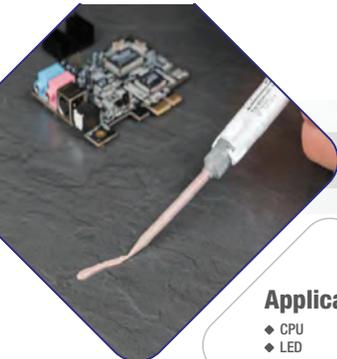
Consulting, development & production. As a specialist for dispensing technology, we offer consulting, development and production services for the application of thermal material to different heat sinks or to customized components.

Customer benefit

- ✔ A professional service-provider for dispensing production and technology
- ✔ A more economical dispensing material compared to conventional thermal pastes and tapes
- ✔ A time-saving, easy assembly due to the prefabricated, ready dispensed components

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.





KERATHERM® Bond 100 RT

KERATHERM® Thermal Adhesives

Applications

- ◆ CPU
- ◆ LED
- ◆ BGA
- ◆ Heat sinks

Benefits

- ◆ High bond strength
- ◆ Room temperature curing
- ◆ Thixotropic and filling surface structures

Properties	Unit	00 R
Colour		brown
Mixing ratio		1 : 1
Curing	T °C	20 min RT
Thermal conductivity λ^*	W/mK	1.5
Thermal resistance R_{th}	K/W	1.66
Hardness	Shore A	20 - 35
Tensile sheer strength	MPa	15
Dielectric breakdown	kV/mm	12
Density	g/cm ³	2.1
Viscosity**	Pas	20 - 40
Application temperature	°C	-40 to +180

* Measured @ thickness 1 mm ** Shear rate 4s⁻¹ / 25°C

Packing units:

- ◆ Syringe: 5 ml
- ◆ Double cartridge: 50 ml & 400 ml
- ◆ Hobcock set with 34,5 kg per component

Special packing on request!

Processing Instructions:

- ◆ All surfaces should be even and free from oil, grease or dust. Clean surface with a solvent (e.g. acetone, thinner, etc.).
- ◆ Squeeze adhesive out of the emulsion tube (in a strand of ca. 3 cm), until the adhesive emitted is of consistent light brown color. Adhesive that is not of consistent color will not bind and is thus to be disposed of.
- ◆ Evenly spread the adhesive on one of the surfaces to be bonded.
- ◆ Bond the components.
- ◆ Briefly press the components onto each other and avoid moving them for the next 30 minutes. If bonded at an angle or overhead, please secure the components.
- ◆ The initial hardness is achieved after 15 minutes, final hardness is achieved after 4 hours.

☑ Safety information:

Classification as per Regulation (EC) 1272/2008 (CLP): none

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

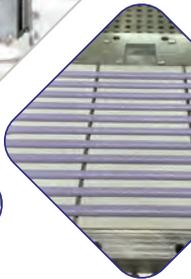
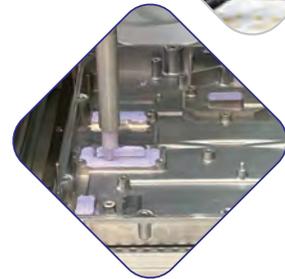
Dispensing service

Dispensing service

KERAFOL® has a professional cnc-controlled dispensing system in-house, which is available for trials under the guidance of an expert. Here, customized trial setups can be dispensed and assembled directly on site, perfect for trial setups in the sampling phase. The setting of the dispensing parameters and the dispensing patterns is based on the experience of the expert, but can also be specified or influenced by the customer. This gives a first preview of the parameters for your serial process (cycle times, dispensing quantity, etc.).

The advantage of such a service is mainly the fact that here an automated process with high repeatability and dosing accuracy can be simulated, which is not the case with a „test dosing“ by hand (human factor). The gap filler for the tests is always fresh and perfectly homogenized, which is often not the case with sample cartridges (especially incorrect storage).

Have we aroused your interest?
Request an appointment at: keratherm@kerafol.com



Preparation for the appointment:

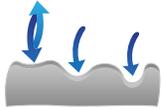
- ◆ Kick - off appointment with project presentation
- ◆ Send required parts in advance (equipment setup)
- ◆ Specification of cycle times/gap dimensions/dosing volumes (if required)
- ◆ Specification of special requirements (if requested)

Preparation for the appointment:

- ◆ Controlled (XYZ - axis system)
- ◆ Piston metering unit (20 oz Semco cartouche)
- ◆ Working area approx. 800x1000x300 mm
- ◆ Dosing volume up to 1ml/s (depending on the selected GFL)
- ◆ Fine volume adjustment (lower limit 0,005 ml)

Gap Pads (SOFTTHERM® Films)

Highly elastic and compressible



SOFTTHERM® materials are highly elastic, perfectly conformable low-tension gap fillers. They achieve a very good balance of different surface mounting heights such as component differences, housing irregularities, gap-bridging in mechanical or electronic components, distortions of PCBs, etc. SOFTTHERM® is electrically insulating and possesses gradual heat conductivity. The self-adhesiveness of the film depends on the SOFTTHERM® type selected.



KERAFOL® offers two types of Gap Pads (SOFTTHERM® Films)

Types 86/128, 86/200, 86/228 and 86/238 have a fibreglass reinforced carrier sheet with very good thermal characteristics. These SOFTTHERM® types can be provided with an adhesive application on the carrier sheet side. The mounting position of the film is determined by the carrier sheet and should always be mounted to the heat sinks or housing. This also guarantees that the formability will work effectively with the electronic components.

Application

First remove the protective sheet on the soft, compressible side (yellow side of type 86/200, red side of type 86/228). With all other Gap Pads (SOFTTHERM® Films) the installation position can be ignored unless the film has an adhesive coating. In case of an adhesive application, make sure that the adhesive coating is always applied to the surface of the heat sink or the housing.

Then apply the film to the component and remove the second protective sheet from the back. When applying, make sure that the softer side of the film is covering the components and thus compensates for the different heights.

When using a SOFTTHERM® type with adhesive, the adhesive is applied to the back of the film (carrier film) and is covered with a "remove-liner". In this case, after the removal of the "remove-liner" the film is applied with the adhesive side to the heat sink or the housing. Make sure in your application that both remove-liner on the back of the film and protective sheet on the soft side have been removed. Assemble your application and apply a mounting pressure, so that the material adapts to the components and parts.

Properties

- ◆ Highly flexible tapes
- ◆ Outstanding flexibility
- ◆ Graduated thermal conductivity
- ◆ Good electrical insulation
- ◆ High temperature stability

Benefits

- ◆ Compensates size variations of components
- ◆ Optimized thermal transition
- ◆ Good compression behaviour
- ◆ UL listed

Applications

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

Film Options

- ◆ Optional single-sided adhesive surface
- ◆ Single-sided adhesive coating possible
- ◆ Can be supplied as sheets or already punched

Attention

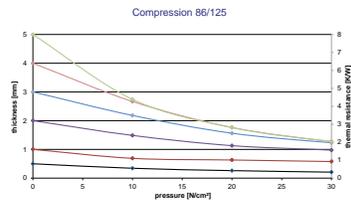
At maximum pressure, Gap Pads (SOFTTHERM® Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30%, the SOFTTHERM® material may leak out.



Gap Pads (Softtherm Films)



86/125 & 86/128 high elastic



Properties	Unit	dark orange	pink / dark orange
Colour		dark orange	pink / dark orange
Assembly		single layer, fibre glass reinforcement up to 4.0 mm	double layer carrier film 86/52 in 0.125 mm
Thermal Properties*			
Thermal resistance R_{th}	K/W	1.6	1.6
Thermal impedance R_{th}	°Cmm /W	322	322
	Kin /W	0.5	0.5
Thermal conductivity λ	W/mK	1.5	1.5
Electrical Properties**			
Dielectric breakdown voltage $U_{br, ac}$	kV	6.0	6.0
Volume resistivity	Ωm	6.1×10^{10}	1.8×10^{10}
Dielectric loss factor $\tan \delta$		1.5×10^{-1}	1.0×10^{-1}
Dielectric constant ϵ_r		4.3	2.3
Mechanical Properties			
Hardness	Shore 00	10 - 25	10 - 25
Young's modulus	/cm	24	67
Physical Properties			
Application temperature	°C	-40 to +180	-40 to +180
Density	g/cm³	2.0	1.9
Total mass loss (TML)	Ma.-%	0.29	0.29
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.5 - 5.0	0.5 - 5.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

Gap Pads (Softtherm Films) 86/125 & 86/128 has an improved thermal performance without influencing the dielectric and mechanical properties. 86/125 & 86/128 is a single layer, supported with fibre glass reinforcement.

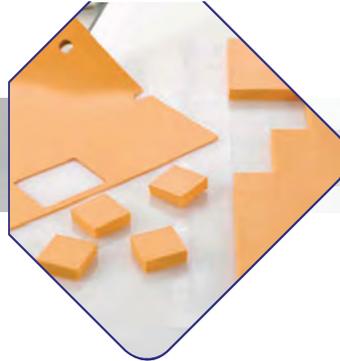
Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Attention

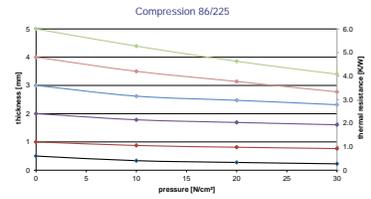
At maximum pressure Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



Gap Pads (Softtherm Films)



86/225 & 86/228 high elastic



Properties	Unit	22	22
Colour		orange	pink / orange
Assembly		single layer, fibre glass reinforcement up to 4.0 mm	double layer carrier film 86/52 in 0.125 mm
Thermal Properties*			
Thermal resistance R_{th}	K/W	1.2	1.2
Thermal impedance R_{th}	°Cmm /W	240	240
	Kin /W	0.3	0.3
Thermal conductivity λ	W/mK	2.0	2.0
Electrical Properties**			
Dielectric breakdown voltage $U_{br, ac}$	kV	6.0	6.0
Volume resistivity	Ωm	2.2×10^{11}	2.8×10^{10}
Dielectric loss factor $\tan \delta$		1.0×10^{-1}	1.0×10^{-1}
Dielectric constant ϵ_r		3.6	2.5
Mechanical Properties			
Hardness	Shore 00	30 - 45	30 - 45
Young's modulus	/cm	58	160
Physical Properties			
Application temperature	°C	-40 to +180	-40 to +180
Density	g/cm³	1.65	1.95
Total mass loss (TML)	Ma.-%	< 0.44	< 0.44
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.5 - 5.0	0.5 - 5.0

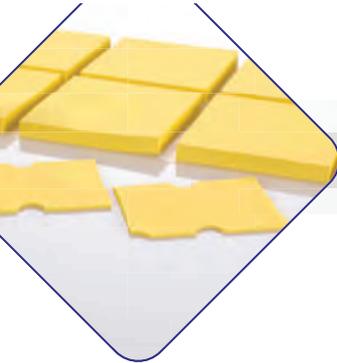
* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

Single layer Gap Pads (Softtherm Films) with graded thermal behavior. These films are partial fibreglass reinforced and an alternative to the two layer Gap Pads (Softtherm Films).

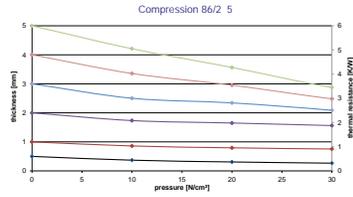
Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Attention

At maximum pressure Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



86/235 & 86/238 high elastic



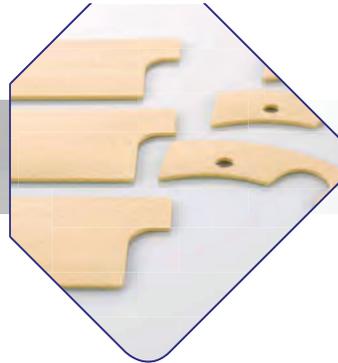
Properties	Unit	3	3
Colour		yellow	pink / yellow
Assembly		single layer, fibre glass reinforcement up to 2.0 mm	double layer carrier film 86/52 in 0.125 mm
Thermal Properties*			
Thermal resistance R_{th}	K/W	1.2	1.2
Thermal impedance R_{th}	°Cmm /W	240	240
	Kin /W	0.3	0.3
Thermal conductivity λ	W/mK	2.0	2.0
Electrical Properties**			
Dielectric breakdown voltage $U_{br, ac}$	kV	6.0	6.0
Volume resistivity	Ωm	$1. \times 10^{11}$	$4. \times 10$
Dielectric loss factor $\tan \delta$		2.0×10^{-2}	1.0×10^{-3}
Dielectric constant ϵ_r		3.	1.9
Mechanical Properties			
Hardness	Shore 00	25 - 40	25 - 40
Young's modulus	/cm	32	122
Physical Properties			
Application temperature	°C	-40 to +200	-40 to +200
Density	g/cm ³	1.65	1.65
Total mass loss (TML)	Ma.-%	< 0.10	< 0.05
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.5 - 5.0	0.5 - 5.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

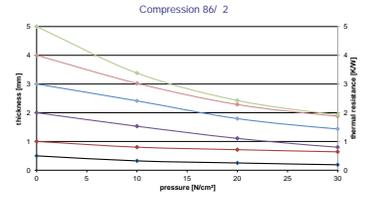
Innovative, customer-oriented development. Type 86/235 is a single layer, with good thermal, mechanical and dielectric properties. Volatile silicone (< 150 ppm).

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Attention
At maximum pressure, Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



86/320 high elastic



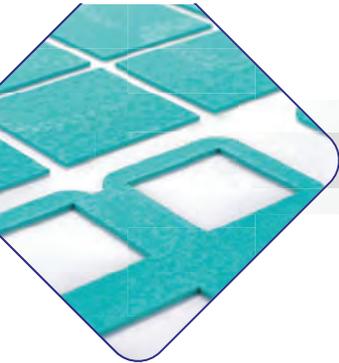
Properties	Unit	3	0
Colour		yellow	
Assembly		single layer, fibre-glass reinforcement up to 1.5 mm	
Thermal Properties*			
Thermal resistance R_{th}	K/W	1.0	
Thermal impedance R_{th}	°Cmm /W	147	
	Kin /W	0.23	
Thermal conductivity λ	W/mK	2.5	
Electrical Properties**			
Dielectric breakdown voltage $U_{br, ac}$	kV	5.0	
Volume resistivity	Ωm	6.8×10^{11}	
Dielectric loss factor $\tan \delta$		2.9×10^{-2}	
Dielectric constant ϵ_r		3.4	
Mechanical Properties			
Hardness	Shore 00	25 - 38	
Young's modulus	/cm	32	
Physical Properties			
Application temperature	°C	-40 to +180	
Density	g/cm ³	1.69	
Total mass loss (TML)	Ma.-%	0.46	
Flame rating	UL-94	V-0	
Possible thickness	mm	1.0 - 5.0	

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

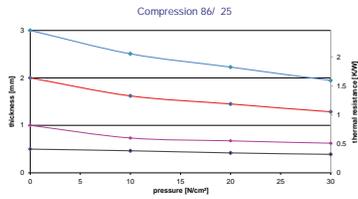
Single layer Gap Pads (Softtherm Films) with graded thermal behavior. These films are partially fibreglass reinforced and an alternative to the two layer Gap Pads (Softtherm Films).

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Attention
At maximum pressure, Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



86/325 compressibility & softness



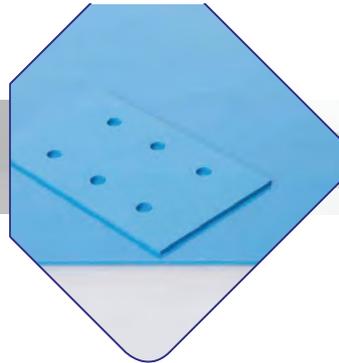
Properties	Unit	3
Colour		mint
Assembly		single layer, fibre-glass reinforcement up to 1.0 mm
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.82
Thermal impedance R_{th}	°Cmm /W	164
	Kin /W	0.25
Thermal conductivity λ	W/mK	3.0
Electrical Properties**		
Dielectric breakdown voltage $U_{d, ac}$	kV	6.0
Volume resistivity	Ω m	8.5×10^{10}
Dielectric loss factor $\tan \delta$		1.5×10^{-1}
Dielectric constant ϵ_r		3.8
Mechanical Properties		
Hardness	Shore 00	35 - 50
Young's modulus	/cm	64
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm ³	1.95
Total mass loss (TML)	Ma.-%	< 0.35
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 4.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

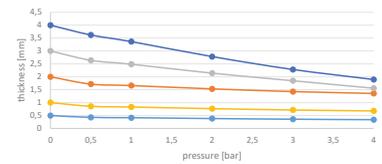
Graduated compressibility and softness along with good thermal behavior characterize this group of Gap Pads (Softtherm Films). These single layer films may be enhanced with fibreglass reinforcement up to a thickness of 1.0 mm.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Attention
At maximum pressure Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



Softtherm 3500 high thermal conductivity



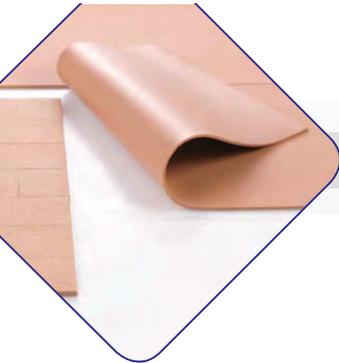
Properties	Unit	3 00
Colour		blue
Assembly		single layer
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.73
Thermal impedance R_{th}	°Cmm /W	144
	Kin /W	0.22
Thermal conductivity λ	W/mK	3.5
Electrical Properties**		
Dielectric breakdown voltage $U_{d, ac}$	kV	5.0
Volume resistivity	Ω m	8.1×10^{10}
Dielectric loss factor $\tan \delta$		0.3
Dielectric constant ϵ_r		3.3
Mechanical Properties		
Hardness	Shore 00	45 - 65
Physical Properties		
Application temperature	°C	-40 to +200
Density	g/cm ³	2.9
Total mass loss (TML)	Ma.-%	0.1
Flame rating	UL-94	V-0
Possible thickness	mm	1.0 - 4.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

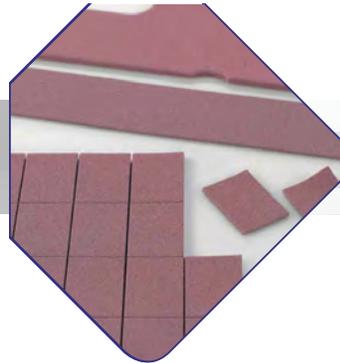
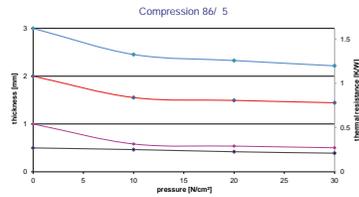
The Keratherm®-Softtherm® 3500 is characterized by very good thermal and dielectric properties. Due to its very good elastic and adaptable behaviour, the 3500 is also very suitable for pressure sensitive applications.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

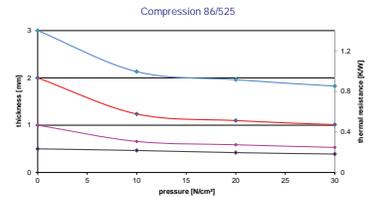
Attention
At maximum pressure Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



86/450 high thermal conductivity



86/525 high thermal conductivity



Properties	Unit	4 0
Colour		brown
Assembly		single layer
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.54
Thermal impedance R_{th}	°Cmm /W	108
	Kin /W	0.18
Thermal conductivity λ	W/mK	4.5
Electrical Properties**		
Dielectric breakdown voltage $U_{d, ac}$	kV	5.0
Volume resistivity	Ωm	3.6×10^{12}
Dielectric loss factor $\tan \delta$		3.0×10^{-3}
Dielectric constant ϵ_r		2.5
Mechanical Properties		
Hardness	Shore 00	65 - 5
Young's modulus	/cm	95
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm ³	1.32
Total mass loss (TML)	Ma -%	< 0.4
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 4.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

This group of Gap Pads (Softtherm Films) is characterized by its extremely high thermal conductivity. The single layer films with-out fibreglass reinforcement are soft and compressible. The good dimensional stability of these films ensures a controlled and automated processing.

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.

Properties	Unit	
Colour		violet
Assembly		single layer
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.44
Thermal impedance R_{th}	°Cmm /W	89
	Kin /W	0.14
Thermal conductivity λ	W/mK	5.5
Electrical Properties**		
Dielectric breakdown voltage $U_{d, ac}$	kV	1.25
Volume resistivity	Ωm	1.6×10^{13}
Dielectric loss factor $\tan \delta$		1.0×10^{-3}
Dielectric constant ϵ_r		2.7
Mechanical Properties		
Hardness	Shore 00	50 - 65
Young's modulus	/cm	99
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm ³	1.18
Total mass loss (TML)	Ma -%	0.35
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 3.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm

Group of highly thermoconductive Gap Pads (Softtherm Films). Low thermal resistance with good dielectric behavior and good compressibility characterize these Gap Pads (Softtherm Films).

Optional available with onside adhesive coating 86/525K

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.



Gap Pads (Softtherm Films)



Gap Pads (silicone free)

Softtherm 6000

high thermal conductivity

NEW

Applications

- ◆ DC-DC converter
- ◆ Power tools
- ◆ Electric vehicles
- ◆ High energy rechargeable batteries

Benefits

- ◆ high electrical isolation
- ◆ high thermal conductivity
- ◆ Good handling
- ◆ Elastic

Properties	Unit	6000
Colour		pink
Basic material		silicone
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.41
Thermal conductivity λ	W/mK	6.0
Electrical Properties**		
Dielectric breakdown voltage $U_{d,ac}$	kV	4.0
Mechanical Properties		
Hardness	Shore 00	55 - 5
Physical Properties		
Application temperature	°C	-40 to 200
Density	g/cm ³	3.18
Flame rating***	UL-94	V-0
Possible thickness	mm	0.5 - 3.0

* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm *** KERAFOL test according to UL

The SOFTTHERM® 6000 is characterized by very good thermal and dielectric properties. Due to its very good elastic and adaptable behaviour, the 6000 is also very suitable for pressure sensitive applications.

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention

At maximum pressure, Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.

U110

silicone free

NEW

Applications

- ◆ Silicone sensitive applications
- ◆ Electric vehicles
- ◆ High energy rechargeable batteries

Benefits

- ◆ Low hardness
- ◆ Elastic
- ◆ Good aging behavior

Properties	Unit	U 110
Colour		brown
Basic material		silicone free
Thermal Properties*		
Thermal resistance R_{th}	K/W	1.2
Thermal conductivity λ	W/mK	2.0
Electrical Properties**		
Dielectric breakdown voltage $U_{d,ac}$	kV	8.0
Mechanical Properties		
Hardness	Shore 00	60 - 75
Physical Properties		
Application temperature***	°C	-40 to 110
Density	g/cm ³	1.87
Flame rating****	UL-94	V-0
Possible thickness	mm	0.5 - 2.0

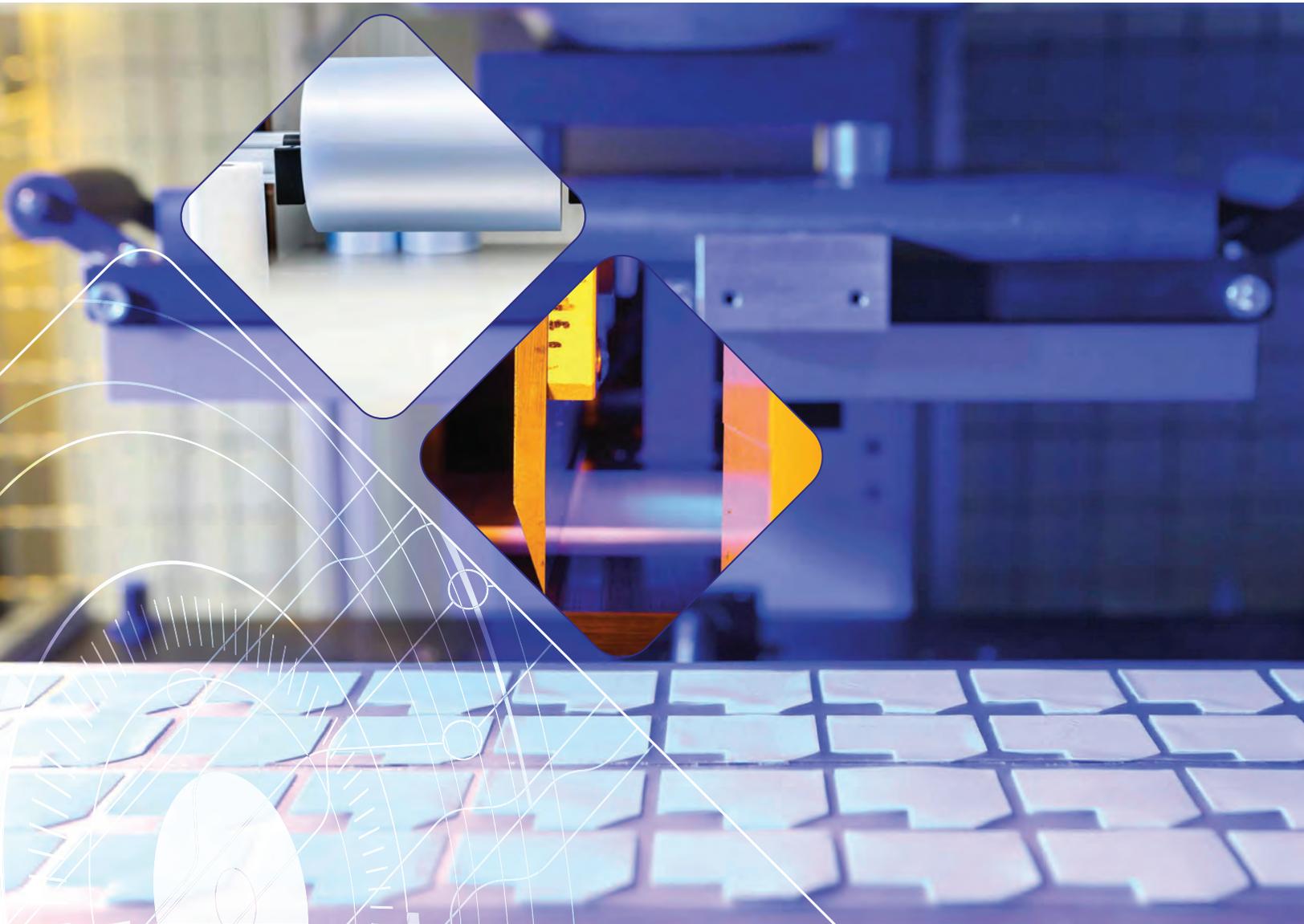
* Measured @ thickness 1 mm ** Measured @ thickness 0.5 mm *** may cause increase in hardness
**** KERAFOL test according to UL

Flexible ceramic, thermoconducting and insulating. U 110 is particularly suitable for silicone sensitive applications and an alternative to silicone based Gap Pads (Softtherm Films). The silicone free Gap Pads (Softtherm Films) offer high electrical insulation and very good thermal conductivity.

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention

At maximum pressure, Gap Pads (Softtherm Films) should not be compressed beyond 30% of the original thickness. In case the material should be compressed more than 30% the SOFTTHERM material may leak out.





Thermal Conductive Tapes are flexible and consist of a silicone elastomer, filled with various thermoconductive ceramic materials. All film types are electrically insulating. For increased mechanical strength, the films are also available with fibreglass reinforcement.

The Thermal Conductive Tapes adapt to the component surface. Small irregularities can be evened out by using only minimal contact pressures.

The good thermal properties of these films guarantee optimum heat transfer to the heat sink and at the same time achieving good electrical insulation properties.

Properties

- ◆ Good insulation properties
- ◆ Heat-conducting
- ◆ Good compressibility
- ◆ Fully crosslinked
- ◆ Flexible
- ◆ Environmentally friendly
- ◆ RoHS conforming
- ◆ REACH conforming

Benefits

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

Film Options

- ◆ Optional single-sided adhesive coating
- ◆ Special thicknesses available
- ◆ Can be supplied on roll or already punched
- ◆ Fibreglass reinforcement available

Applications

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

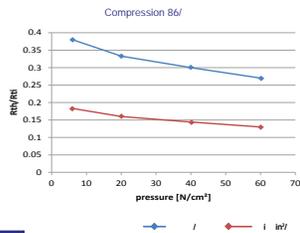


Thermal Conductive Tapes

86/30 KERATHERM® white

Applications

- ◆ Power supplies
- ◆ Audio and video components
- ◆ White goods
- ◆ Power converters (AC-DC, DC-DC)
- ◆ Engine controllers



Properties	Unit	30
Colour		white
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.22
Thermal impedance R_{th}	°Cmm /W	90
	Kin /W	0.13
Thermal conductivity λ	W/mK	2.5
Electrical Properties*		
Dielectric breakdown voltage $U_{d,ac}$	kV	1.5
Volume resistivity	Ω m	2.5×10^{10}
Dielectric loss factor $\tan \delta$		2.2×10^{-2}
Dielectric constant ϵ_r		3.0
Mechanical Properties		
Hardness	Shore A	70 - 80
Tensile strength	/mm	1.5
Elongation	%	31
Physical Properties		
Application temperature	°C	-60 to +250
Density	g/cm³	2.33
Flame rating	UL-94	V-0
Possible thickness	mm	0.125 - 0.5

*Measured @ thickness 0.225 mm

Options

Type	Film structure	Overall thickness	Tensile strength	Breakdown voltage $U_{d,ac}$ *	Thermal resistance
		mm	/mm	kV	K/W
86/10	with fibreglass	0.225	7.5	1.5	0.250
86/20	with fibreglass and adh. coating	0.250	7.5	1.5	0.300
86/40	with adh. coating	0.250	1.5	1.5	0.265

The highly thermal conductive white films, with its well-balanced thermal, electrical and dielectric behavior and very good self-adhesion characteristics, is created by filling a silicone elastomer base with aluminum oxide. An increase in mechanical strength can be achieved through fibreglass reinforcement. These film types can optionally be supplied with an additional adhesive coating.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

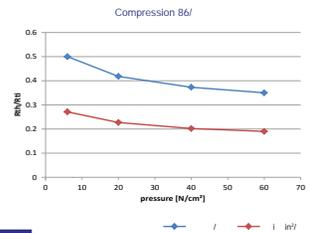


Thermal Conductive Tapes

86/37 KERATHERM® green

Applications

- ◆ Automotives
- ◆ Telecommunication units
- ◆ High voltage units
- ◆ DC-DC converters



Properties	Unit	3
Colour		green
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.32
Thermal impedance R_{th}	°Cmm /W	129
	Kin /W	0.20
Thermal conductivity λ	W/mK	1.8
Electrical Properties*		
Dielectric breakdown voltage $U_{d,ac}$	kV	8.0
Volume resistivity	Ω m	2.5×10^{10}
Dielectric loss factor $\tan \delta$		6.0×10^{-3}
Dielectric constant ϵ_r		2.9
Mechanical Properties		
Hardness	Shore A	65 - 5
Tensile strength	/mm	2.0
Elongation	%	5
Physical Properties		
Application temperature	°C	-60 to +250
Density	g/cm³	2.29
Flame rating	UL-94	V-0
Possible thickness	mm	0.125 - 0.5

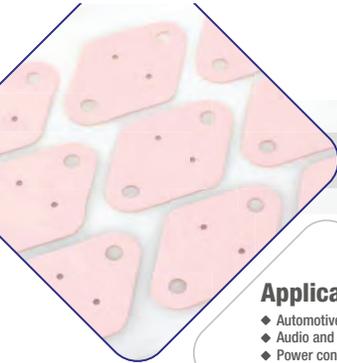
*Measured @ thickness 0.225 mm

Options

Type	Film structure	Overall thickness	Tensile strength	Breakdown voltage $U_{d,ac}$ *	Thermal resistance
		mm	/mm	kV	K/W
86/1	with fibreglass	0.225	.5	6.0	0.50
86/2	with fibreglass and adh. coating	0.250	.5	6.0	0.55
86/4	with adh. coating	0.250	2.0	8.0	0.39

This silicone elastomer film is characterized by its excellent electrical characteristics. It exhibits good thermal behavior. Optional fibreglass reinforcement leads to very good mechanical properties. These film types possess excellent mechanical stability along with good perforation strength. Because of its structure, KERATHERM® green has extremely good self-adhesive properties. Additional adhesive coatings available.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

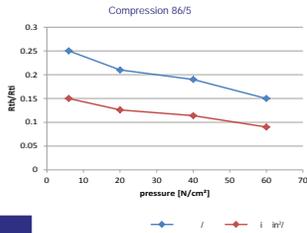


Thermal Conductive Tapes

86/50 KERATHERM® pink

Applications

- ◆ Automotives
- ◆ Audio and video components
- ◆ Power converters (AC-DC, DC-DC)
- ◆ Engine controllers
- ◆ LCD displays



KERATHERM® pink offers outstanding thermal conductivity, which is achieved by a specially filled silicone elastomer. The good electrical insulation properties are thereby retained. On request, these films can also be supplied with fibreglass reinforcement and with or without adhesive coating. The excellent thermal resistance of this film enables the optimum heat transfer to the heat sink.

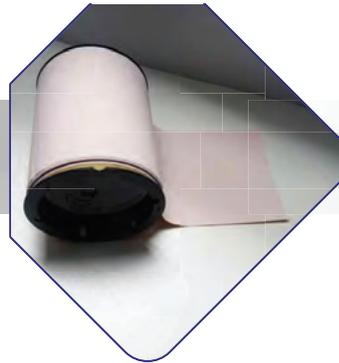
Properties	Unit	0
Colour		pink
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.16
Thermal impedance R_{th}	°Cmm /W	64
	Kin /W	0.09
Thermal conductivity λ	W/mK	3.5
Electrical Properties*		
Dielectric breakdown voltage $U_{g,dc}$	kV	1.5
Volume resistivity	Ωm	1.3×10^{14}
Dielectric loss factor $\tan \delta$		6.7×10^{-2}
Dielectric constant ϵ_r		2.3
Mechanical Properties		
Hardness	Shore A	70 - 80
Tensile strength	/mm	1.3
Elongation	%	25
Physical Properties		
Application temperature	°C	-60 to +250
Density	g/cm³	1.97
Flame rating	UL-94	V-0
Possible thickness	mm	0.125 - 0.5

*Measured @ thickness 0.225 mm

Options

Type	Film structure	Overall thickness mm	Tensile strength /mm	Breakdown voltage $U_{g,dc}$ *	Thermal resistance K/W
86/51	with adh. coating	0.250	1.3	1.5	0.26
86/52	with fibreglass	0.225	10.0	1.5	0.22
86/53	with fibreglass and adh. coating	0.250	10.0	1.5	0.27

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.



Thermal Conductive Tapes

L 86/50 – PEEK KERATHERM®

Properties	Unit	ert
Carrier material		PEEK Folie
Material thickness	μm	25
Carrier material color		amber
Temperature stability	°C	-50 bis +250 (momentarily 330°C)
Compression material		Keratherm 86/50
Thickness	μm	225
RoHS compliance		yes
Flammability	UL	94-V0
Laminate construction		86/50-PEEK-Folie
Colour		rosa / amber
Thermal conductivity*	W/mK	1.1
Thermal resistance R_{th}	K/W	0.51
Dielectric breakdown	KV/mm	8.0
Hardness	Shore A	0 - 80
Application temperature	°C	-40° bis +250°
Thermogravimetric Analysis weight loss	°C	<1% @ 300°C <15% @ 450°C
Tensile strenght	/mm2	8

*Measured @ thickness 0.25 mm

Customized, KERATHERM® Hybrid film with PEEK carrier film

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

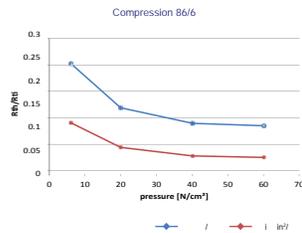


Thermal Conductive Tapes

86/60 KERATHERM®

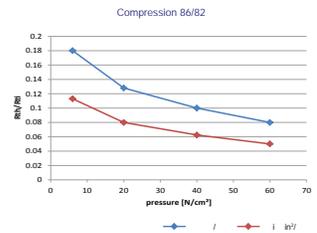
Applications

- ◆ Automotives
- ◆ White goods
- ◆ Audio and video components
- ◆ Power converters (AC-DC, DC-DC)
- ◆ Engine controllers
- ◆ LCD displays



Applications

- ◆ "High end" solution
- ◆ Control boards
- ◆ BGA applications
- ◆ Hard-disc-drives



Properties	Unit	0
Colour		pink
Thermal Properties*		
Thermal resistance R _{th}	K/W	0.14
Thermal impedance R _{th}	°Cmm /W	56
	Kin /W	0.0 9
Thermal conductivity λ	W/mK	4.5
Electrical Properties*		
Dielectric breakdown voltage U _{g ac}	kV	5.0
Volume resistivity	Ωm	6.0 x 10 ¹²
Dielectric loss factor tan δ		0.0
Dielectric constant ε _r		1.5
Mechanical Properties		
Hardness	Shore A	45 - 60
Tensile strength	/mm	0.5
Elongation	%	25
Physical Properties		
Application temperature	°C	-60 to +200
Density	g/cm ³	1.38
Flame rating	UL-94	V-0
Possible thickness	mm	0.25 - 0.5

*Measured @ thickness 0.25 mm

KERATHERM® 86/60 offers outstanding thermal conductivity, which is achieved by a specially filled silicone elastomer. The excellent electrical insulation properties are thereby retained. The excellent thermal resistance of this film enables the optimum heat transfer to the heat sink.

- ✓ Optional available with onside adhesive coating **86/60K**

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Properties	Unit	red
Colour		red
Assembly		fibreglass reinforcement
Thermal Properties*		
Thermal resistance R _{th}	K/W	0.09
Thermal impedance R _{th}	°Cmm /W	35
	Kin /W	0.05
Thermal conductivity λ	W/mK	6.5
Electrical Properties*		
Dielectric breakdown voltage U _{g ac}	kV	1.0
Volume resistivity	Ωm	2.0 x 10 ¹⁴
Dielectric loss factor tan δ		1.4 x 10 ⁻³
Dielectric constant ε _r		2.4
Mechanical Properties		
Hardness	Shore A	60 - 70
Tensile strength	/mm	13.0
Elongation	%	2
Physical Properties		
Application temperature	°C	-40 to +200
Density	g/cm ³	1.23
Flame rating	UL-94	V-0
Possible thickness	mm	0.25 - 0.3

*Measured @ thickness 0.25 mm

This film is especially suitable for high power applications. It has excellent thermal and electrical properties. Thanks to its good performance, KERATHERM® red can be used reliably in densely packed electronic applications.

- ✓ Optional available with adhesive coating as **86/82K**

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

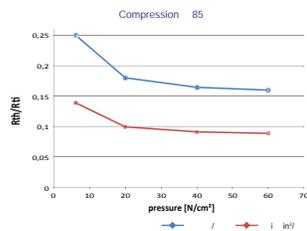


Thermal conductive tapes (silicone free)

U 85 KERATHERM® silicone free U-Film

Applications

- ◆ Medical applications
- ◆ Laser equipment
- ◆ Lighting systems
- ◆ CD-rom drives
- ◆ Aero units
- ◆ Space units

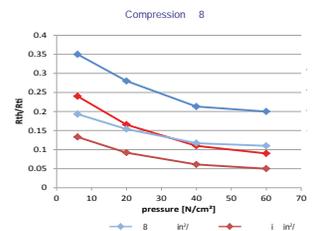


Thermal conductive tapes (silicone free)

U 80 & U 90 KERATHERM® silicone free U-Films

Applications

- ◆ Medical applications
- ◆ Laser equipment
- ◆ Lighting systems
- ◆ CD-rom drives
- ◆ Aero units
- ◆ Space units



Properties	Unit	U
Colour		light blue
Thermal Properties*		
Thermal resistance R _{th}	K/W	0.165
Thermal impedance R _{th}	°Cmm /W	60
	Kin /W	0.091
Thermal conductivity λ	W/mK	3.0
Electrical Properties*		
Dielectric breakdown voltage U _{d, ac}	kV	6.0
Volume resistivity	Ωm	4.1 x 10 ⁹
Dielectric loss factor tan δ		2.6 x 10 ⁻²
Dielectric constant ε _r		2.0
Mechanical Properties		
Hardness	Shore A	0 - 85
Tensile strength	/mm	1.0
Elongation	%	50
Physical Properties		
Application temperature	°C	-40 to +150
Density	g/cm ³	1.44
Flame rating	UL-94	V-0
Possible thickness	mm	0.2

*Measured @ thickness 0.2 mm

In case of concerns about using silicones, we offer you a ceramic-filled epoxy film as an alternative material. Besides good thermal and outstanding electrical properties, these films are characterized by very good perforation strength.

These good physical properties are matched with an excellent price-performance-ratio.

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Properties	Unit	U 0	U 0
Colour		blue	light blue
Thermal Properties			
Thermal resistance R _{th}	K/W	0.2*	0.082**
Thermal impedance R _{th}	°Cmm /W	73*	33**
	Kin /W	0.11*	0.05**
Thermal conductivity λ	W/mK	1.8*	6.0**
Electrical Properties			
Dielectric breakdown voltage U _{d, ac}	kV	4.0*	4.0**
Volume resistivity	Ωm	1.4 x 10 ¹⁴ **	2.0 x 10 ¹¹ **
Dielectric loss factor tan δ		1.3 x 10 ⁻² **	1.4 x 10 ⁻² **
Dielectric constant ε _r		3.2*	3.1**
Mechanical Properties			
Hardness	Shore A	80 - 90	70 - 85
Tensile strength	/mm	3.0	2.0
Elongation	%	130	150
Physical Properties			
Application temperature	°C	-40 to +125	-40 to +125
Density	g/cm ³	2.26	1.46
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.15 - 0.3	0.1 - 0.3

*Measured @ thickness 0.15 mm

**Measured @ thickness 0.2 mm

In case of concerns about using silicones, we offer you a ceramic-filled polyurethane film as an alternative material. Besides good thermal and outstanding electrical properties, these films are characterized by very good perforation strength.

These good physical properties are matched with an excellent price-performance-ratio.

Optional available with adhesive coating as U 80K / U 90K

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.



Adhesive Films

KL 95

KERATHERM® ceramic filled adhesive film

Applications

Thermal connection of

- ◆ MOSFETS
- ◆ CPUs, LEDs
- ◆ Flip Chips, DSPs
- ◆ BGAs, PPGAs on heat sinks

Representatives

- ◆ Power supplies and inverter modules
- ◆ Computers
- ◆ Telecommunication electronics
- ◆ Automotive electronic

Properties	Unit	L
Colour		grey
		Filled Acrylic Polymer
Thermal Properties*		
Thermal conductivity λ^{**}	W/mK	1.3
Thermal resistance R_{th}	K/W	0.32
Electrical Properties*		
Dielectric breakdown voltage $U_{0.5c}$	kV/mm	2
Volume resistivity	Ωm	2.0×10^{11}
Dielectric loss factor $\tan \delta$	(1KH)	2.4×10^{-1}
Dielectric constant ϵ_r	(1KH)	1.7
Mechanical Properties		
Hardness	Shore A	60
Tensile shear strength [†]	/cm	6.5
Tensile shear strength [†]	/cm	26.90
(temperature aging)		34.30
		48.80
Physical Properties		
Adhesion**** (bonding strength)	mm	0.5
Tack**** (surface Adhesiveness)	mm	1.0
Density	g/cm ³	2.24
Application temperature****	°C	-40 to +100
Possible thickness	mm	0.18 - 0.3

The KERATHERM® - KL 95 is a highly filled multifunctional adhesive tape. Characteristic are the 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.

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.



Adhesive Films

KL 90 & KL 91

KERATHERM® ceramic filled adhesive film

Applications

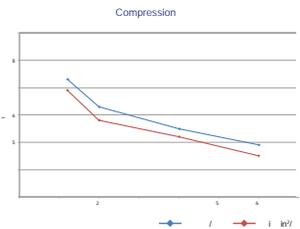
Thermal connection of

- ◆ MOSFETS
- ◆ CPUs, LEDs
- ◆ Flip Chips, DSPs
- ◆ BGAs, PPGAs on heat sinks

Representatives

- ◆ Power supplies and inverter modules
- ◆ Computers
- ◆ Telecommunication electronics
- ◆ Automotive electronic

Properties	Unit	L 0	L
Colour		black	black
Basic material		acrylate	acrylate
Reinforcement (fibreglass)		without	with
Thermal Properties*			
Thermal resistance R_{th}	K/W	0.52	0.55
Thermal impedance R_{th}	°Cmm /W	208	220
	Kin /W	0.32	0.34
Thermal conductivity λ	W/mK	1.40	1.35
Electrical Properties*			
Dielectric breakdown voltage $U_{0.5c}$	kV/mm	6.0	6.0
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			
Hardness	Shore A	45	59
Tensile strength	/mm	0.3	11.3
Physical Properties			
Application temperature	°C	-40 to +125	-40 to +125
Density	g/cm ³	1.98	1.8
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



Ceramic filled double-sided adhesive film - with or without fibreglass! KL 90 and KL 91 are double sided adhesive films. They have an excellent, permanent adhesive strength with high thermal conductivities and very good insulation characteristics at the same time.

Low thermal contact resistances can be achieved with a very reliable adhesive strength on different surfaces.

There is no mechanical fixation with clips or screws needed.

Due to the soft surface finish, tolerances can be compensated very well. Light weight, easy handling and high elasticity are further advantages.

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.



Specific film characteristics

Specific film characteristics	Unit	KL 90	KL 91
		(without fibreglass)	(with fibreglass)
Testing the reflow stability 10s/270°C		passed	passed
	µm	300	300
Shelf Life	month	12	12
Application conditions	[pressure/ time]	N/cm ² /sec.	10/10
Tensile shear strength		> 30	> 25
[25mmx25mm-adhesive area-180°		[DIN EN 1465]	
aluminum – adhesive film – aluminum]		[ASTM D 1002]	
Tensile shear strength	-20°C	N/cm ²	157.2
temperature-depending**	+20°C	[DIN EN 1465]	51.7
[25mmx25mm-adhesive area-180°	+60°C	[ASTM D 1002]	14.1
aluminum – adhesive film – aluminum]	+70°C		12.0
	+80°C		10.7
Tensile shear strength		N/cm ²	31.5
after vibration test (sinusoidal with temperature overlay at 60°C);			
vibration 10–500 Hz; 50 s/m ² (5g) test cycle 24h (8h per axis) [1]			
Tensile shear strength		N/cm ²	32.1
after vibration test (sinusoidal at RT);			
vibration 10–500 Hz; 100 s/m ² (10g) test cycle 24h (8h per axis) [2]			
Adhesion* (bonding strength)	N/mm	> 1.2	> 1.0
Tack* (surface adhesiveness)	mm	> 1.5	> 1.2
Peel strength [90°-on aluminum]	N/25mm	3 [adhesive]	9 [adhesive]

1. Processing and handling instructions

When the basic rules of processing and handling are followed, KL 90, KL 91 and KL 95 double-sided adhesive films display very good processing characteristics. They allow mechanical fastening aids, such as clamps, screws or rivets, to be dispensed with. In addition to the good thermal and dielectric characteristics, their outstanding adhesive strength and good plasticity ensure reliable processability.

2. Surface conditions

The surfaces must be dry and free of impurities, (such as oil, fat, dust, paint coatings and possible solvent contamination). Condensation (e.g. when changing from cold to warm) must be avoided. A clean surface guarantees that KL 90, KL 91 and KL 95 adhesive films provide best performance.

3. Cleaning the surfaces

Depending on the component's condition, its surface may need to be cleaned mechanically or chemically. Mechanical cleaning roughens the surface. Make sure that the surface roughness is not as deep as the adhesive tape's thickness. Chemical cleaning should be done with soft, clean cloths and solvents that are compatible with the material, such as alcohols, benzines, esters or ketones. These solvents' residues must not be left on the surfaces because they interfere with the tape's adhesion.

4. Adhesion

Naturally on plastics containing plasticizers and those of a nonpolar character, the bond is impaired. Besides appropriate adhesion tests on these materials, a chemical or physical surface treatment is, if necessary a prerequisite for improved bonding of the materials.

1. Processing temperatures and necessary transmission forces

The adhesive tapes processing temperature is between +18°C and +35°C with a relative air humidity of 50% – 70%. A different temperature or air humidity will change the initial strength (adhesion). Increased contact pressure improves the tape's adhesion on the surface of the component. For larger, flatter bonds, adhesion can be improved by using a pressure roller or a surface press (contact pressure about 10 – 15 N/cm²). The final, highest adhesive strength is reached about 24 to 72 hours after application. A moderate temperature treatment to a maximum of 80°C supports this process and shortens the time (dynamic cycle with 30 minutes hold time).

2. Protective sheets and application to the component

The KL 90, KL 91 and KL 95 adhesive films are covered with two different siliconized sheets. To apply the adhesive film, first the 70 µm thick PP sheet must be peeled off the tape (re-lease lightly!). Then the adhesive tape (or also stamping) is pressed onto the surface to be adhered to (as described above). This can be followed by direct further processing or interim storage. Before the final assembly, the second, 50 µm thick PETP protective sheet is removed and the intended surface is adhered.

3. Storage and Shelf Life

KL 90, KL 91 and KL 95 double-sided adhesive films must be stored at room temperature and normal humidity (room temp. = 18°C – 22°C; rel. humidity = 50% – 70%). Direct (effects of) sunlight or storage near heat sources must be absolutely avoided. To prevent pressure points, the rolls should also stand vertically in storage. When the storage conditions are met, the adhesive tapes remain stable for at least the indicated shelf life period. After this time, the adhesive tapes can continue to be used only if a test is made by the customer.

MT 320 & MT 103

KERATHERM® thermal conductive injection moulding compound

Benefits

- ◆ Available in soft and slightly harder variant
- ◆ Almost every 3D geometry possible
- ◆ Good thermal conductivity and high level of electrical isolating

Key-Facts

- ◆ Up to 2 W/mK
- ◆ Available as Injection moulding granulate
- ◆ Entire printed circuit boards and electronic components can be overmoulded directly
- ◆ Thermal conductivity: 3D instead of 2D
- ◆ Protection against dust & humidity
- ◆ Fast processing time
- ◆ Alternative to potting material

Properties	Unit	3 0	03
Colour		grey	red
Thermal Properties*			
Thermal resistance R_{th}	K/W	2.0	1.8
Thermal conductivity λ	W/mK		
Electrical Properties*			
Dielectric breakdown voltage $U_{b,ac}$	kV	12.5	12.5
Hardness	Shore A	15 - 30	70 - 80
Tensile strength	/mm	0.2	2.0
Application temperature	°C	-40 to +125	-40 to +125
Density	g/cm ³	1.91	1.88
Flame rating	UL-94	V-0	V-0
MF	g/10min	10-20	4-10
		170°C / 2 16kg	230°C / 12 16kg

* Measured @ thickness 0.5 mm

Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.



KP 97, 98, 99 & KP 12 KERATHERM® Thermal Grease

Applications

- ◆ Notebooks
- ◆ Desktop CPU's
- ◆ IGBT unit

Benefits

- ◆ Syringes: 5 ml
- ◆ Cartouche: 75 ml / 310 ml / 360 ml
- ◆ Cans: 0.5 kg / 1.0 kg

Properties	Unit	P	P	P	P silicone free
Colour		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_{th}	$^{\circ}\text{Cmm}/\text{W}$	4.5	4.1	2.7	2.2
	Kin/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 (according to D 51412-1)	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^3	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
Possible thickness	mm	← variable →			
Long term stability (1000h / 85°C / 85 % relative humidity)					
Thermal resistance 1000h	K/W	0.0120	0.0080	0.0068	0.0060

*Measured @ thickness 0.025 mm *** Shear rate 4s^{-1} / 25°C

KERATHERM® Thermal Greases are ceramic-filled single component silicones with a high thermal conductivity. The non-cross-linked thermal compounds do not dry out. The silicone components do not leak from the compound.

The thermal grease KP 99 is a high-quality thermal grease. The homogeneous and thixotropic grease shows a very good fluidity thanks to its good viscosity characteristics. An optimum surface adaptation is guaranteed.

The silicone free thermal compound KP 12 consists of synthetic, thermal polymers and is suitable for a fast and effective heat dissipation. The paste is particularly suitable for silicone sensitive applications.

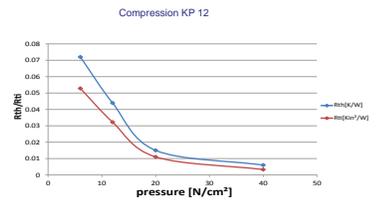
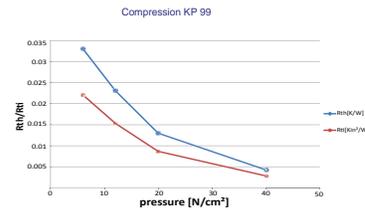
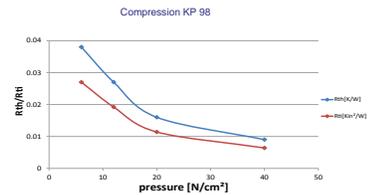
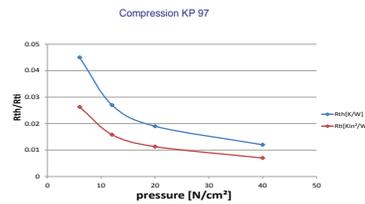
The KP's long-term stability guarantees full operability during the entire life time of the product. Under normal application conditions, KERATHERM® Thermal Grease does not cure, dry out or melt.

If any separation of the filler materials becomes evident, the KP's must be mixed thoroughly before use.

✔ Special packing on request!

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Comparison of pastes regarding thermal resistance in dependence on contact pressure

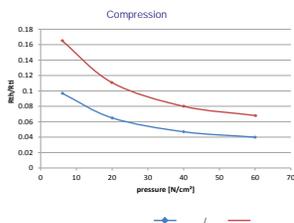




S 900 Interface Material

Applications

- ◆ Chipsets
- ◆ Memory chips
- ◆ Micro BGA



PCM 20 KERATHERM® phase-change

Applications

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

Benefits

- ◆ Filling of smallest irregularities between the power module and heat sink
- ◆ Improves the contact between the surfaces and increases the heat transfer
- ◆ Special design for easy use and storage



Properties	Unit	00
Colour		black
Thermal Properties*		
Thermal resistance R_{th}	K/W	0.08
Thermal impedance R_{th}	°Cmm /W	34
	Kin /W	0.04
Thermal conductivity λ z (x/y)	W/mK	7.5 (> 300)
Electrical Properties*		
Breakdown voltage $U_{g,ac}$	kV	conductive
Electrical resistance z (x/y)	$\Omega\mu\text{m}$	700 - 800 (7 - 9)
Mechanical Properties		
Hardness	Shore D	25 - 35
Tensile strength	/mm	10.0
Elongation	%	5
Physical Properties		
Application temperature	°C	-40 to +500
Density	g/cm³	> 1.6
Total mass loss (TML)	Ma.-%	0.01
Flame rating	UL-94	V-0
Possible thickness	mm	0.15 - 0.29

* Measured @ thickness 0.29 mm

Graphite S 900 is a highly dense, natural graphite without binding material, which is rolled or pressed into films or plates. S 900 has exceptional qualities and is therefore used particularly as a cost-effective alternative to conventional interface material. Especially, the anisotropy of the thermal properties (coupled with a possible weight saving of up to 30% compared to conventional materials made of copper or aluminum), makes the S 900 interesting for headspreader applications.

In addition, applications in vacuum or even at high temperatures (400 °C) are possible. Graphite S 900 has no electrical insulation and can be customized and applied with an adhesive coating.

Optional available with onside adhesive coating as S 900K

Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

Properties	Unit	P	0
Colour			dark grey
Compound			filled hot-setting wax
Thermal Properties*			
Thermal resistance R_{th}	K/W		0.5
Thermal conductivity λ	W/mK		2.0
Mechanical Properties			
Hardness	Shore A		55 - 65
Softening interval	°C		> 60
Physical Properties			
Application temperature	°C		up to 120°C
Density	g/cm³		1.4
Possible thickness	mm		in development

* Measured @ thickness 1 mm

Phase-Change-Materials smooth out even the smallest irregularities between the power module and heat sink, thereby improving surface contact and increasing the heat transfer.

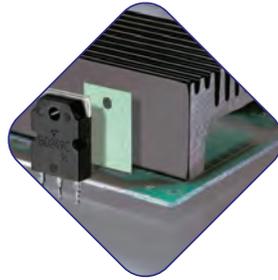
Data for engineer guidance only. Observed performance varies in application. Engineers are reminded to test the material in application.

KERATHERM® Films

KERATHERM® Films are mainly resistant to water, oils and their mixtures, organic solvents and chlorinated hydrocarbons, as well as the cleaning agents used to degrease and wash heat sinks, housings and printed circuit boards.

These materials merely cause swelling of exposed edges of the heat-conducting film, in which the degree of swelling depends on the contact period and the type of solvent applied.

After dry-out, the exposed edges return to their original state with no change in thermal or electrical properties. Due to the short contact times involved, KERATHERM® may be exposed to the conventional baths used in soldering processes.



The various KERATHERM® products are crosslinked and cured to elastomers during the manufacturing process. KERATHERM® products involve none of the substances specified on the VDA list of declarable substances. Our products do not require labeling in accordance with „ChemG/Gefahrstoff V“ (Act for the Protection against Hazard Substances / Hazardous substance V). KERATHERM® products contain no asbestos, lead, mercury, chromium-6, cadmium and/or halogenated hydrocarbons.

All listed products in our catalog meet the requirements of RoHS and REACH!

Delivery form

Besides a large number of standard shapes (TO, TIP, DO or other power housing shapes), we can supply punch parts in customized shapes of any arbitrary size based on customer drawings (max. 400x400 mm). Roll goods can be supplied in widths of 15 mm up to 500 mm. The Gap Pads (SOFTTHERM® Films) are supplied as sheets.

Tolerances

KERATHERM® Thermal Conductive Tapes: In terms of geometry, as well as position and shape of the parts or holes to be punched or relevant recesses and outlines, the tolerances are fixed at a minimum of 0.10 mm in accordance with DIN ISO 2768-m. Regarding the thickness, a deviation from the required dimension of +/- 10% of the total thickness is allowed.

KERATHERM® Gap Pads (SOFTTHERM® Films): the geometry, as well as position and shape of the parts are also fixed at a minimum of 0.10 mm in accordance with DIN ISO 2768-c. For holes or relevant recesses and outlines the following table applies.

KERATHERM® Graphit tolerances according DIN ISO 2768-c.

Thickness	Tolerance thickness	Tolerance holes
up to 1.000 mm	± 0.100 mm	± 0.500 mm
up to 2.000 mm	± 0.200 mm	± 1.000 mm
up to 3.000 mm	± 0.300 mm	± 1.500 mm
up to 4.000 mm	± 0.400 mm	± 2.000 mm
up to 5.000 mm	± 0.500 mm	± 2.500 mm

Dimensions are measured with a Quick-Scope (QSPAK 3.0) image processing measurement system, or using a dial gauge or measuring microscope. All tools and punched materials are qualified by means of the first sample inspection report.

Batchwise determination of thermal properties

An equi-area measurement sample (4 cm² base area) is placed between a heatable upper die and a cooled lower die. The lower die is pressed against the upper one by means of a pneumatic pressure cylinder. The pressure dependence of the thermal resistance of the samples is derived from the variation in contact pressure. After approx. 20 minutes, the resultant temperature gradient above the sample is determined via Pt-100 sensors. The thermal resistance (R_{th}) and the thermal conductivity (λ) are calculated on the basis of this temperature gradient, the heating power passed through the sample, and the sample geometry.



Storage conditions and preservation instructions for KERATHERM® products

For more information about the handling and storage conditions contact our team or our sales partner.

Determination of electrical properties

The electrical insulation effect of the heat-conducting films is characterized by their dielectric strength. The higher the breakdown voltage, the better the insulation behavior. Measurements are performed with an AC high-voltage detector.

Determination of mechanical properties

State-of-the-art equipment and measurement devices facilitate the batchwise determination of tensile strength and elongation of the films. In addition to this, the peel strength of adhesive coated materials is determined on the basis of the "Finat Test Method No.1" (180°).

Determination of flame rating

The available KERATHERM® products have been certified and categorized into classes with regard to their inflammability by the American institute "Underwriters Laboratories Inc." (UL). In addition to this, the company KERAFOL® endeavours to test its products on the basis of the latest findings in research and development.

YOUNGS MODULUS studies

KERAFOL® analyses the behavior of flexible films under pressure, using the method described in ASTM D 575-91, to determine the so-called YOUNG'S MODULUS. The sample geometry of the individual film types is 30x30 mm at 2.5 mm thickness, and pressure is applied with a constant traverse path of 1 mm/min (0.04 in/min). The pressure dependence of the films is shown on the graphs.

Further information regarding the UL identifiers of KERAFOL® products is available on the UL website. Visit <http://www.ul.com> and select the category "Online Certifications Directory". From there you can search for the KERAFOL® file under the following file number:

QMFZ2E140693: Plastics Component. This category contains all KERAFOL® products.



KERAFOl®
Keramische Folien GmbH & Co. KG
Koppe-Platz 1
D-92676 Eschenbach i.d. OPf.
Germany

Tel.: +49 (0) 96 45 - 88 300
Fax: +49 (0) 96 45 - 88 390

keratherm@kerafol.com
linktr.ee/kerafol_official
www.kerafol.com



Hill Technical Sales

50 North Brockway Street / Suite 3-2 • Palatine, IL 60067-5068
PH +1(847)255-4400 • FAX +1(847)255-0192
sales@hilltech.com • www.hilltech.com

Version 12-2022

Customized solutions.

We are looking forward to receiving your inquiry!

KERAFOl® products are applied in vehicle electronics, telecommunications, aerospace, computers and the semi-conductor industry – in fact, in all areas in which generated heat has to be dissipated from sensitive components to the heat sink.

Discover our broad range of products and take advantage of the diverse application possibilities!