KERAFOL®
Keramische Folien GmbH & Co. KG

KERATHERM®

Thermal Management Solutions

Innovation in Technology and Environmental Protection

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KERAFOL®
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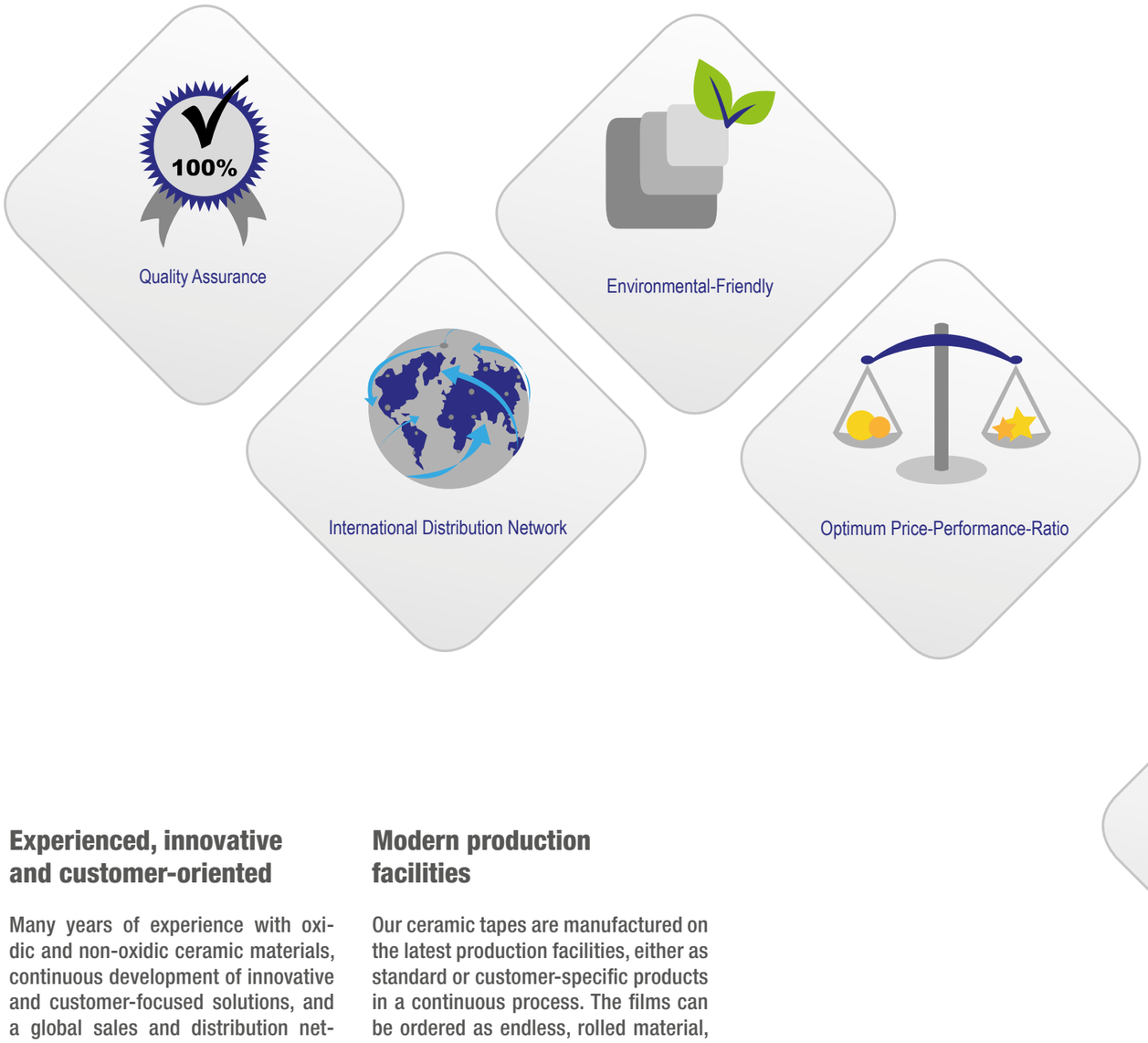


Development, quality control and evironmental compatibility

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.

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.

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.

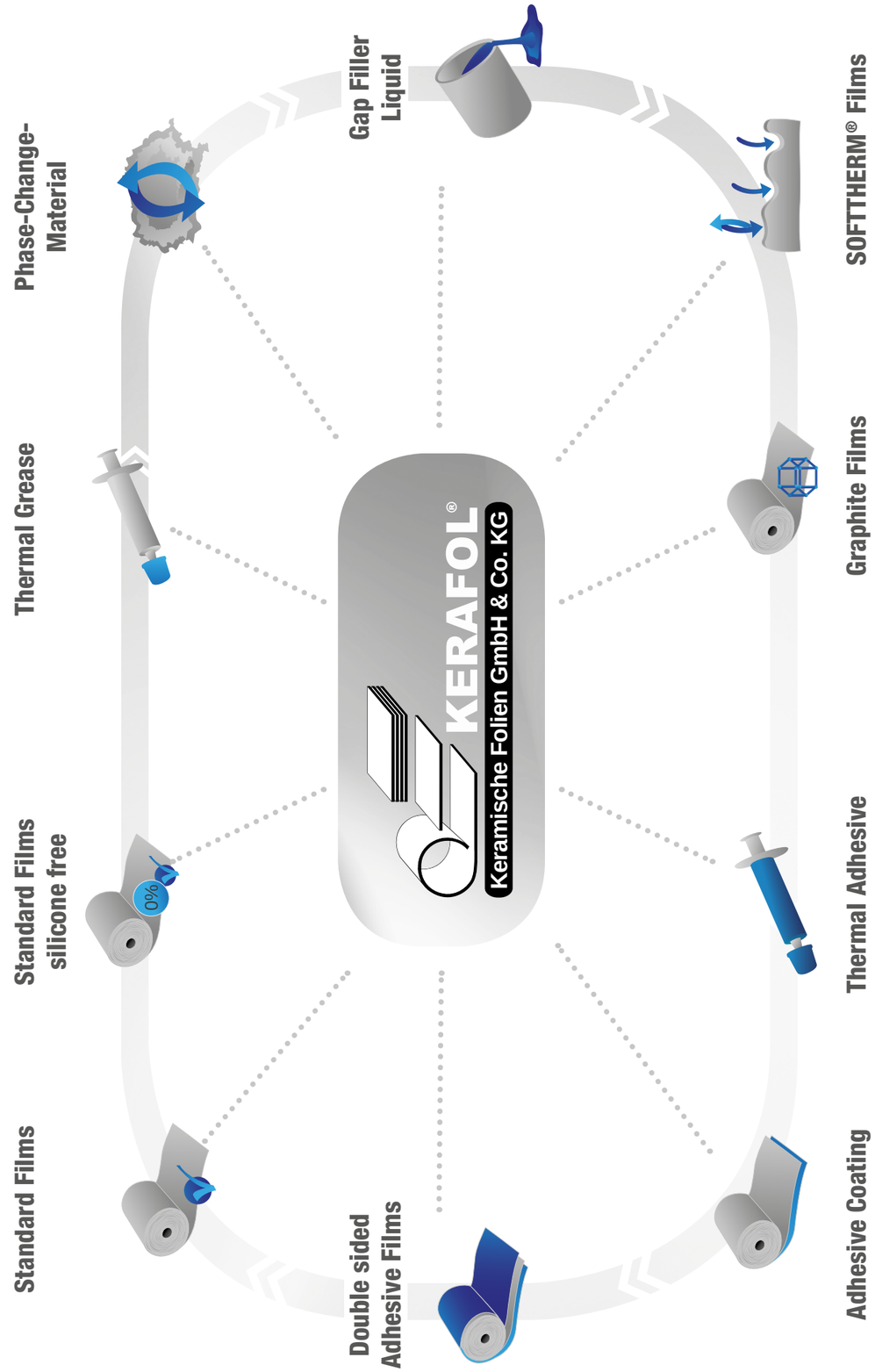
About KERATHERM®

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

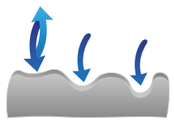
Standard Films

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

The thermoplastic elastomere MT-films provide very good insulating behavior, excellent mechanical and thermal characteristics.

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.

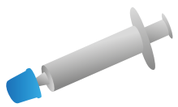


Gap Filler Liquid

Thermal Compounds can be used for encapsulating whole applications and dispensing housing lids or heat sinks. Thanks to its ease of use, it allows even the most complicated geometries to be encapsulated.

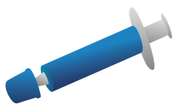
Thermal Grease

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.



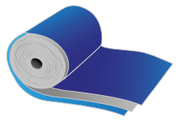
Thermal Adhesive

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



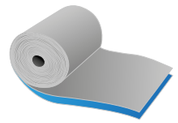
Adhesive Films

The Adhesive Films KL 90 und KL 91 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.



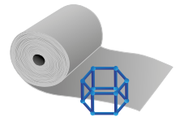
Adhesive Coating

Adhesive Coating: Every film type requires its own special adhesive system. KERAFOL® offers a variety of adhesives with various adhesive strength (from low to high) and fillings for improved heat transfer.



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.



Phase-Change-Material

Phase-Change-Material comprises a combination of hot-melt waxes with or without support. These films smooth out even the smallest irregularities between the power module and heat sink, thereby optimizing the contact between the surfaces and increasing the heat transfer.

Standard Films

Film		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV	mm	Shore A		
86/82	red with fibreglass	6.5	0.09	1.0	0.250	60 - 70	very high thermal conductivity	20
86/60	pink	4.5	0.14	5.0	0.250	45 - 60	high thermal conductivity, high insulation	19
86/50	KERATHERM® pink	3.5	0.16	1.5	0.225	70 - 80	high thermal conductivity	18
86/30	KERATHERM® white	2.5	0.22	1.5	0.225	70 - 80	good thermal conductivity / insulation	16
86/37	KERATHERM® green	1.8	0.32	8.0	0.225	65 - 75	high insulation	17
70/50	brown with fibreglass	1.4	0.44	5.0	0.250	80 - 90	good price-performance-ratio	21

Standard Films silicone free

Film		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV	mm	Shore A		
U 90	silicone free	6.0	0.08*	4.0	0.200	70 - 85	silicone free, high thermal conductivity	23
U 85	silicone free	3.0	0.17*	6.0	0.200	70 - 85	silicone free, high thermal conductivity and high insulation	22
U 80	silicone free	1.8	0.20	4.0	0.150	80 - 90	silicone free	23
MT 103	Elastomer-Film	1.8	0.39	10.0	0.280	70 - 80	silicone free, high insulation	24
MT 102	Elastomer-Film	1.1	0.53	10.0	0.250	65 - 75	silicone free, high insulation	24

Thermal Grease

Film		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	46
KP 99	ceramic filled silicone component	9.2	0.0068	0.025	very low thermal resistance	46
KP 98	ceramic filled silicone component	6.0	0.0100	0.025	silicone based, low thermal resistance	46
KP 97	ceramic filled silicone component	5.0	0.0120	0.025	silicone based	46

*rounded value

Specific Values and Characteristics

SOFTTHERM® Films

Film		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		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	38
86/525	SOFTTHERM® Film	5.5	0.22	1.3*	0.500	50 - 65	high thermal conductivity, very good compressibility	37
86/500	SOFTTHERM® Film	5.0	0.25	1.0	0.500	65 - 75	high thermal conductivity	36
86/450	SOFTTHERM® Film	4.5	0.27	5.0	0.500	65 - 75	very good thermal and dielectric properties	35
86/325	SOFTTHERM® Film	3.0	0.41	6.0	0.500	35 - 50	soft, high thermal conductivity	34
86/300	SOFTTHERM® Film	3.0	0.41	7.0	0.500	60 - 75	flexible, high thermal conductivity	32
86/320	SOFTTHERM® Film	2.5	0.50	5.0	0.500	25 - 38	very soft, good dielectric properties	33
86/235	SOFTTHERM® Film	2.0	0.60	6.0	0.500	25 - 40	soft, high thermal conductivity	31
86/238	SOFTTHERM® Film	2.0	0.60	6.0	0.500	25 - 40	double layer	31
86/225	SOFTTHERM® Film	2.0	0.60	6.0	0.500	30 - 45	fibreglass-reinforced, good self-adhesive behavior on both sides	30
86/228	SOFTTHERM® Film	2.0	0.60	6.0	0.500	30 - 45	double layer	30
86/125	SOFTTHERM® Film	1.5	0.80	6.0	0.500	10 - 25	soft, high compressibility	28
86/200	SOFTTHERM® Film	1.0	1.20	8.0	0.500	10 - 20	soft, high compressibility	29

SOFTTHERM® Films silicone free

Film		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV	mm	Shore 00		
U 281	SOFTTHERM® epoxide resin	2.0	0.60	7.0	0.500	55 - 65	high compressibility, silicone free	39

Gap Filler Liquid

Film	thermal conductivity	viscosity	dielectric breakdown	density	hardness	characteristics	page
	W/mK	Pas	kV/mm	g/cm³	Shore 00		
GFL 3040	4.3	55 - 85	10	3.1	65 - 85	liquid Gap Filler	43
GFL 3030	3.0	50 - 80	12	2.9*	65 - 85	liquid Gap Filler	43
GFL 3025	2.5	30 - 60	16	2.83	65 - 85	liquid Gap Filler	42
GFL 3020	1.8	45 - 70	20	2.3	45 - 60	liquid Gap Filler	42

*rounded value

Graphite Films

Film		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	53
90/10	Graphite Film	5.5	0.09	not insulating	0.200	25 - 35	good thermal conductivity	52

Adhesive Films

Film		thermal conductivity	thermal resistance	breakdown voltage	measured thickness	hardness	characteristics	page
		W/mK	K/W	kV/mm	mm	Shore A		
KL 90	thermal conductive, adhesive film without fibreglass	1.40	0.52	20.0	0.300	45	thermal conductivity insulating adhesive	49
KL 91	thermal conductive, adhesive film with fibreglass	1.35	0.55	20.0	0.300	59	thermal conductivity insulating adhesive	49

PCM

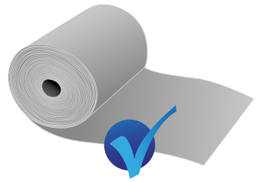
Film		thermal conductivity	thermal resistance	measured thickness	characteristics	page
		W/mK	K/W	mm		
PCM 471	filled hot setting wax	4.0	0.07	0.200	high thermal conductivity	54

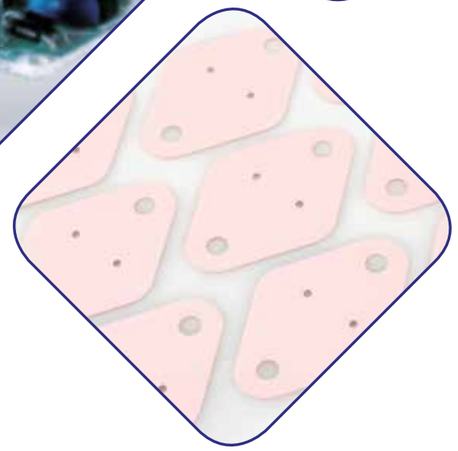
Thermal Adhesive

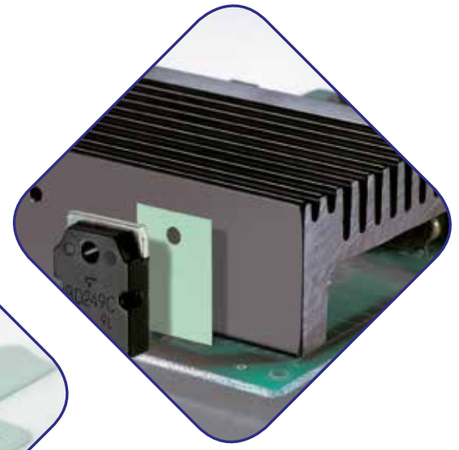
Film	thermal conductivity	viscosity	dielectric breakdown	density	hardness	characteristics	page
	W/mK	Pas	kV/mm	g/cm³	Shore A		
KERATHERM® Bond 100 RT	1.5	20 - 40	12	2.1	20 - 35	Thermal Adhesive	48

Made in Germany

Cost effective standard solutions







Standard films 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 standard films 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.

Benefits

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

Properties

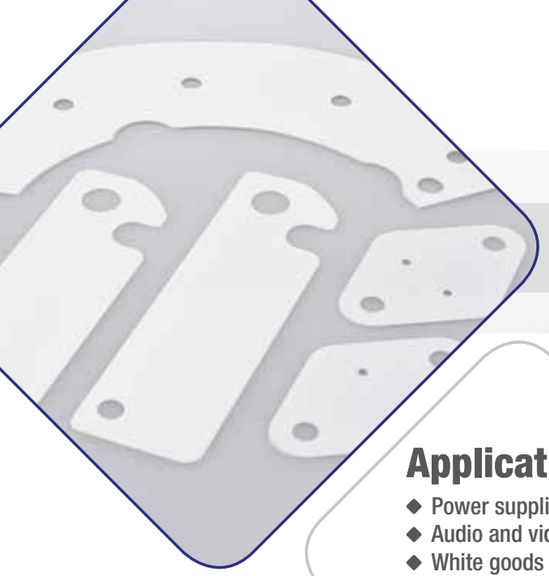
- Good insulation properties
- Heat-conducting
- Good compressibility
- Fully crosslinked
- Flexible
- Environmentally friendly
- RoHS conforming
- REACH conforming

Applications

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

Film Options

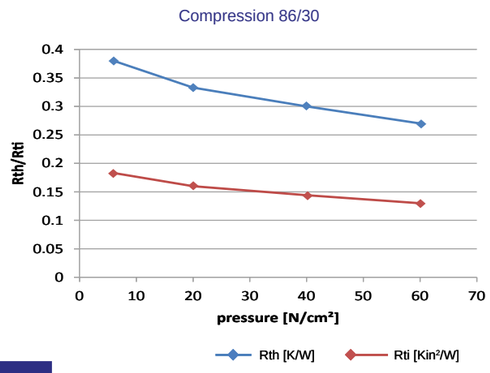
- Optional single-sided adhesive coating
- Special thicknesses available
- Can be supplied on roll or already punched
- Fibreglass reinforcement available



86/30
KERATHERM® white

Applications

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



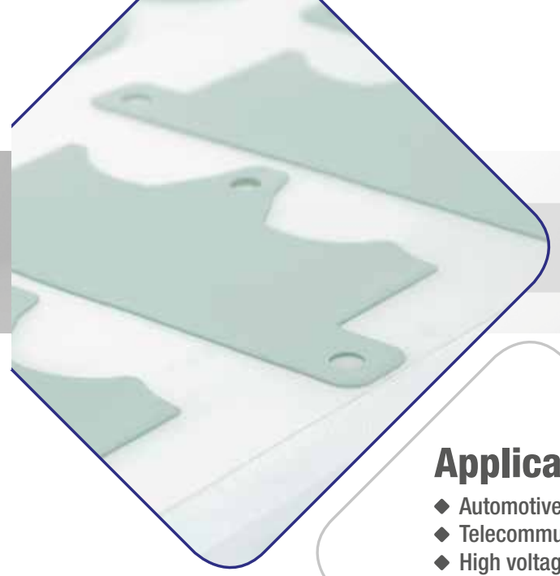
Properties	Unit	86/30
Colour		white
Thermal Properties		
Thermal resistance R_{th}	K/W	0.22
Thermal impedance R_{ti}	°Cmm²/W	90
	Kin²/W	0.13
Thermal conductivity λ	W/mK	2.5
Electrical Properties		
Breakdown voltage $U_{d; ac}$	kV	1.5
Dielectric breakdown $E_{d; ac}$	kV/mm	7.0
Volume resistivity	Ωm	2.5×10^{11}
Dielectric loss factor tan δ		2.2×10^{-2}
Dielectric constant ε_r		3.0
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	70 - 80
Tensile strength	N/mm²	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

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.

Options

Type	Film structure	Overall thickness	Tensile strength	Breakdown voltage $U_{d; ac}$	Thermal resistance
		mm	N/mm²	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

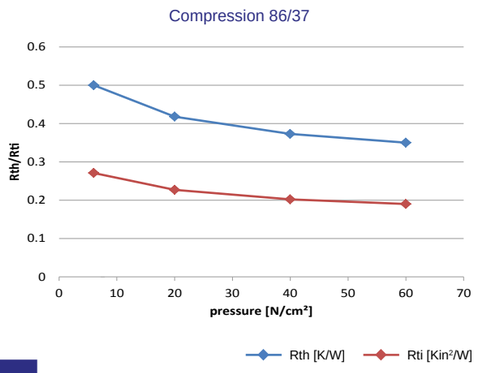
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.



86/37
KERATHERM® green

Applications

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



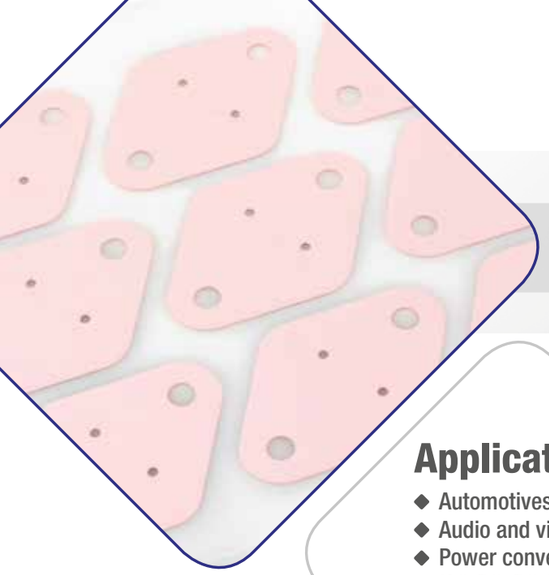
Properties	Unit	86/37
Colour		green
Thermal Properties		
Thermal resistance R_{th}	K/W	0.32
Thermal impedance R_{ti}	°Cmm²/W	129
	Kin²/W	0.20
Thermal conductivity λ	W/mK	1.8
Electrical Properties		
Breakdown voltage $U_{d; ac}$	kV	8.0
Dielectric breakdown $E_{d; ac}$	kV/mm	26.0
Volume resistivity	Ωm	2.5×10^{11}
Dielectric loss factor tan δ		6.0×10^{-3}
Dielectric constant ε_r		2.9
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	65 - 75
Tensile strength	N/mm²	2.0
Elongation	%	75
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

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.

Options

Type	Film structure	Overall thickness	Tensile strength	Breakdown voltage $U_{d; ac}$	Thermal resistance
		mm	N/mm²	kV	K/W
86/17	with fibreglass	0.225	7.5	6.0	0.50
86/27	with fibreglass and adh. coating	0.250	7.5	6.0	0.55
86/47	with adh. coating	0.250	2.0	8.0	0.39

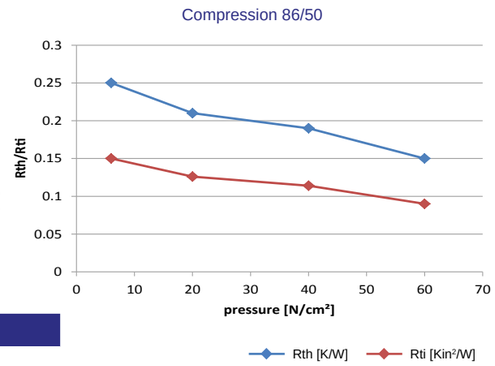
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.



86/50
KERATHERM® pink

Applications

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



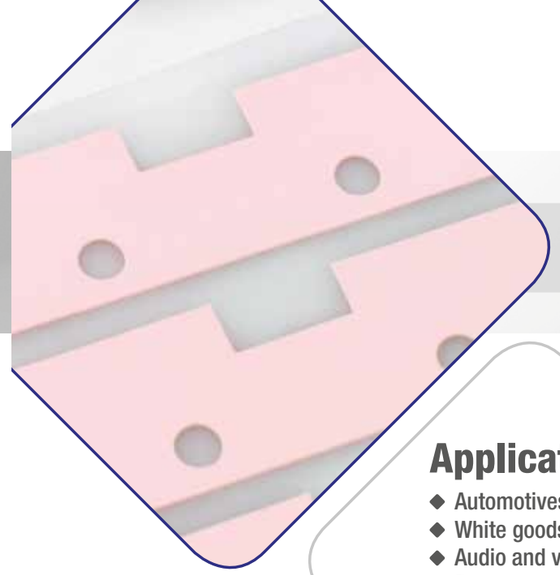
Properties	Unit	86/50
Colour		pink
Thermal Properties		
Thermal resistance R_{th}	K/W	0.16
Thermal impedance R_{ti}	°Cmm²/W	64
	Kin²/W	0.09
Thermal conductivity λ	W/mK	3.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	1.5
Dielectric breakdown $E_{d;\,ac}$	kV/mm	7.0
Volume resistivity	Ωm	1.3×10^{14}
Dielectric loss factor tan δ		6.7×10^{-2}
Dielectric constant ε_r		2.3
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	70 - 80
Tensile strength	N/mm²	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

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.

Options

Type	Film structure	Overall thickness	Tensile strength	Breakdown voltage $U_{d;\,ac}$	Thermal resistance
		mm	N/mm²	kV	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

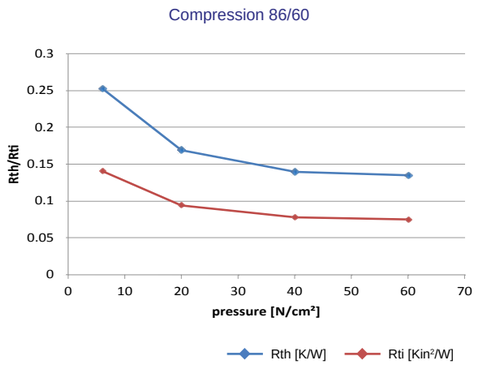
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.



86/60
KERATHERM®

Applications

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

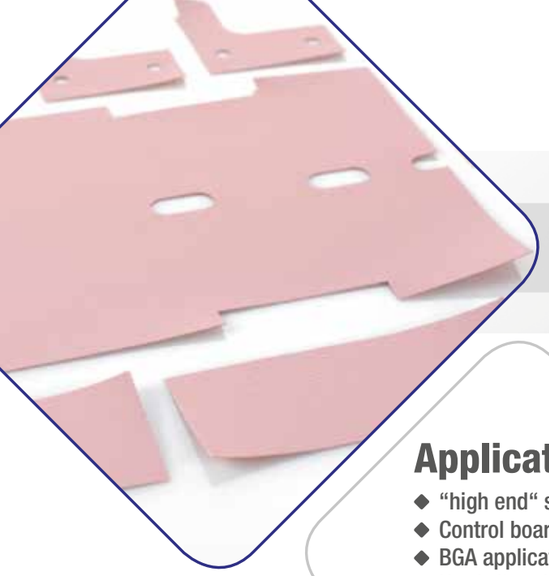


Properties	Unit	86/60
Colour		pink
Thermal Properties		
Thermal resistance R_{th}	K/W	0.14
Thermal impedance R_{ti}	°Cmm²/W	56
	Kin²/W	0.079
Thermal conductivity λ	W/mK	4.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	5.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	20.0
Volume resistivity	Ωm	$> 6.0 \times 10^{12}$
Dielectric loss factor tan δ		0.0
Dielectric constant ε_r		1.5
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.250
Hardness	Shore A	45 - 60
Tensile strength	N/mm²	0.5
Elongation	%	25
Physical Properties		
Application temperature	°C	-60 to +200
Density	g/cm³	1.38
Flame rating	UL-94	V-0
Possible thickness	mm	0.15 - 0.5

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 oneside adhesive coating **86/60K**

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

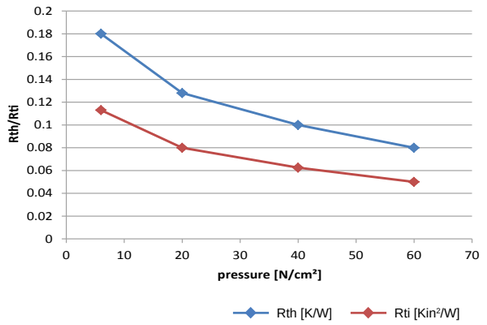


86/82
KERATHERM® red

Applications

- “high end“ solution
- Control boards
- BGA applications
- Hard-disc-drives

Compression 86/82

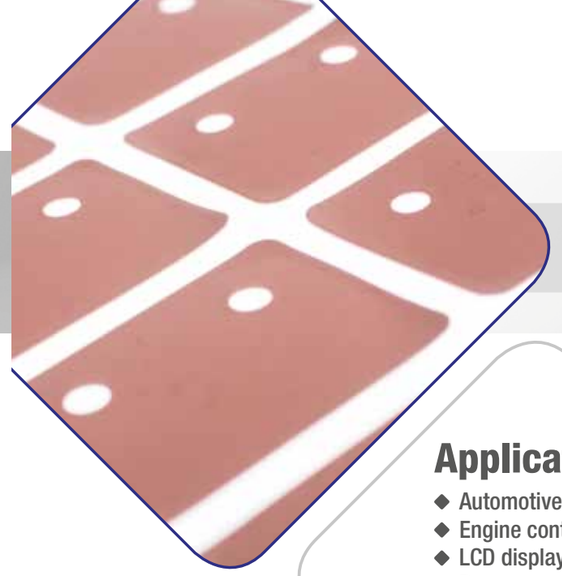


Properties	Unit	86/82
Colour		red
Assembly		fibreglass reinforcement
Thermal Properties		
Thermal resistance R_{th}	K/W	0.09
Thermal impedance R_{ti}	°Cmm²/W	35
	Kin²/W	0.05
Thermal conductivity λ	W/mK	6.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	1.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	4.0
Volume resistivity	Ωm	2.0×10^{14}
Dielectric loss factor tan δ		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/mm²	13.0
Elongation	%	2
Physical Properties		
Application temperature	°C	-40 to +200
Density	g/cm³	1.23
Flame rating	UL-94	V-0
Possible thickness	mm	0.25 - 0.3

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.

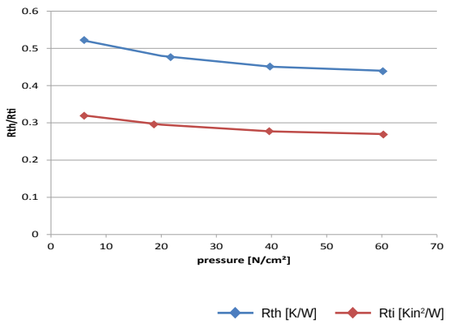


70/50
KERATHERM® brown

Applications

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

Compression 70/50



Properties	Unit	70/50
Colour		brown
Assembly		fibreglass reinforcement
Thermal Properties		
Thermal resistance R_{th}	K/W	0.44
Thermal impedance R_{ti}	°Cmm²/W	178
	Kin²/W	0.27
Thermal conductivity λ	W/mK	1.4
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	5.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	20.0
Volume resistivity	Ωm	1.0×10^{13}
Dielectric loss factor tan δ		7.3×10^{-3}
Dielectric constant ε_r		3.6
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.250
Hardness	Shore A	80 - 90
Tensile strength	N/mm²	10.0
Elongation	%	5
Physical Properties		
Application temperature	°C	-40 to +200
Density	g/cm³	2.18
Flame rating	UL-94	V-1
Possible thickness	mm	0.25 - 0.5

KERATHERM® brown, with its very good thermal properties, is an excellent choice for cost-effective solutions. These fibreglass reinforced films, along with their very smooth surface, have very good thermal resistance with a high insulation capacity at low mounting pressures.

Options

Type	Film structure	Overall thickness	Tensile strength	Breakdown voltage $U_{d;\,ac}$	Thermal resistance
		mm	N/mm²	kV	K/W
70/60	with adh. coating	0.275	10.0	5.0	0.53

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

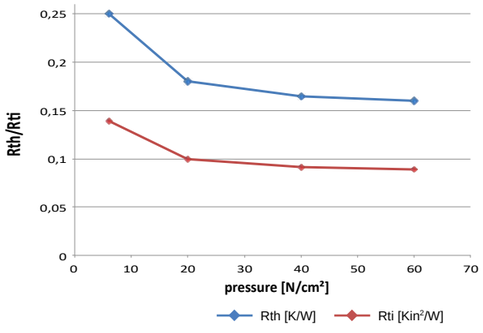
U 85

KERATHERM® silicone free U-Film

Applications

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

Compression U 85



Properties	Unit	U 85
Colour		light blue
Thermal Properties		
Thermal resistance R_{th}	K/W	0.165
Thermal impedance R_{ti}	°Cmm²/W	60
	Kin²/W	0.091
Thermal conductivity λ	W/mK	3.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	6.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	30.0
Volume resistivity	Ωm	4.1×10^{9}
Dielectric loss factor tan δ		2.6×10^{-2}
Dielectric constant ε_r		2.0
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.200
Hardness	Shore A	70 - 85
Tensile strength	N/mm²	1.0
Elongation	%	> 50
Physical Properties		
Application temperature	°C	-40 to +150
Density	g/cm³	1.44
Flame rating	UL-94	V-0
Possible thickness	mm	0.2

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.

Optional available with adhesive coating as **U 85K**

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

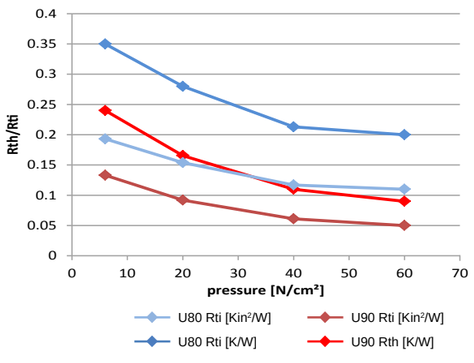
U 80 & U 90

KERATHERM® silicone free U-Films

Applications

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

Compression U 80 & U 90



Properties	Unit	U 80	U 90
Colour		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 δ		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

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.

MT 102 & MT 103

KERATHERM® silicone free MT-Films

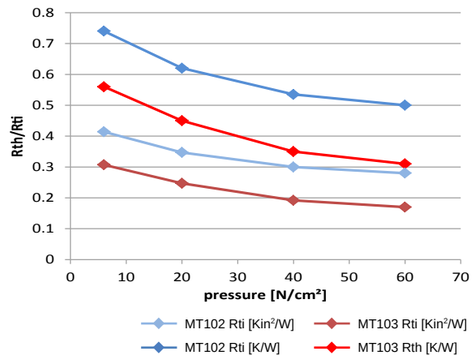
Applications

- Automotives
- High voltage technology
- Power converters (AC-DC, DC-DC)

Benefits

- Very good mechanical properties
- Liquid assembly
- Silicone free

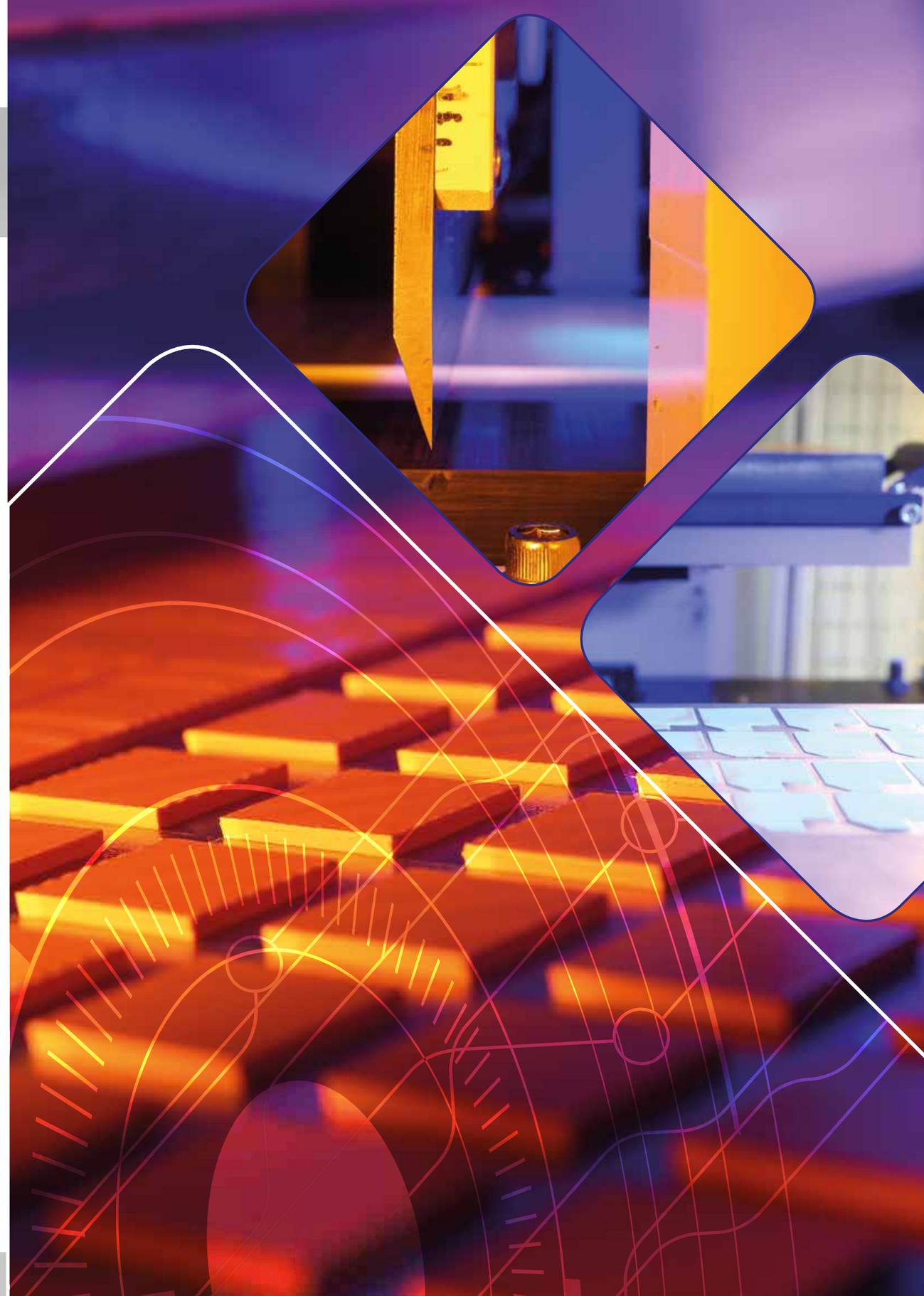
Compression MT 102 & MT 103



Properties	Unit	MT 102	MT 103
Colour		blue	red
Thermal Properties			
Thermal resistance R_{th}	K/W	0.53	0.39
Thermal impedance R_{ti}	°Cmm²/W	200	156
	Kin²/W	0.28	0.21
Thermal conductivity λ	W/mK	1.1	1.8
Electrical Properties			
Breakdown voltage $U_{d;\,ac}$	kV	10.0	10.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	25.0	25.0
Volume resistivity	Ωm	2.2×10^{10}	4.7×10^{10}
Dielectric loss factor tan δ		1.0×10^{-3}	1.0×10^{-3}
Dielectric constant ε_r		2.7	2.6
Mechanical Properties			
Measured thickness (+/-10%)	mm	0.250	0.280
Hardness	Shore A	65 - 75	70 - 80
Tensile strength	N/mm²	2.0	2.0
Elongation	%	> 1000	200
Physical Properties			
Application temperature	°C	-40 to +125	-40 to +125
Density	g/cm³	1.87	1.88
Flame rating	UL-94	V-0	V-0
Possible thickness	mm	0.25	0.28

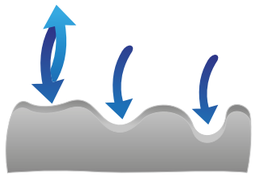
Thermoplastic elastomer tape with very good insulating behavior and excellent mechanical and good thermal characteristics.

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

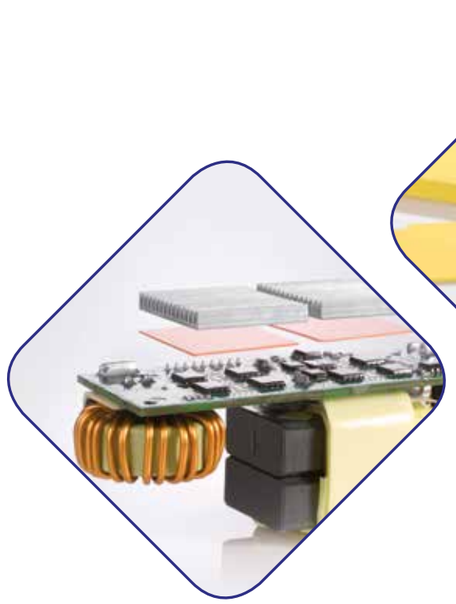


SOFTTHERM® Films

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 SOFTTHERM® Films

Types 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.

SOFTTHERM® Films 86/225, 86/300, 86/320, 86/325, 86/500 and 86/600 are reinforced by fibreglass fabric at thicknesses of 0.5 to 1.0 mm. These films can additionally be offered with an adhesive application as an assembly aid (except for type 86/125, 86/225 and 86/235).

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 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.

Benefits

- Compensates for size variations for components
- Optimized thermal transition
- Good compression behavoiur
- UL listed

Properties

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

Applications

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

Film Options

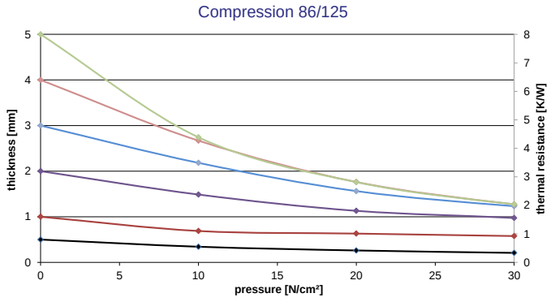
- Optional single-sided adhesive surface
- Single-sided adhesive coating possible
- Can be supplied as sheets or already punched

Attention

At maximum pressure, 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.

86/125
high elastic

Compression 86/125



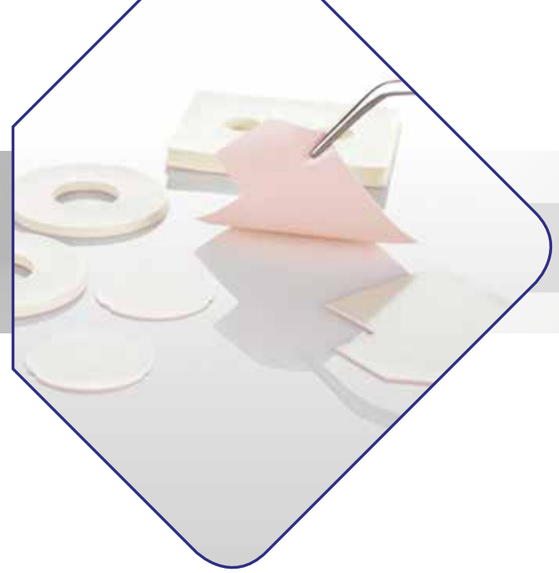
Properties	Unit	86/125
Colour		dark orange
Assembly		single layer, fibre-glass reinforcement up to 4.0 mm
Thermal Properties		
Thermal resistance R_{th}	K/W	0.8
Thermal impedance R_{ti}	°Cmm²/W	322
	Kin²/W	0.5
Thermal conductivity λ	W/mK	1.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	6.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	12.0
Volume resistivity	Ωm	6.1×10^{10}
Dielectric loss factor tan δ		1.5×10^{-1}
Dielectric constant ε_r		4.3
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	10 - 25
Young´s modulus	N/cm²	24
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm³	2.0
Total mass loss (TML)	Ma.-%	< 0.29
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 5.0

*KERAFOL® test according to UL

SOFTTHERM® 86/125 has an improved thermal performance without influencing the dielectric and mechanical properties. 86/125 is a single layer, supported with fibreglass reinforcement.

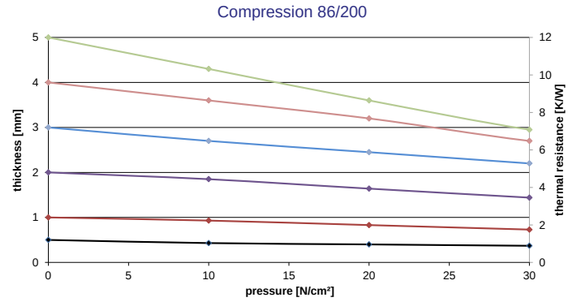
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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.



86/200
high elastic

Compression 86/200



Properties	Unit	86/200
Colour		pink/yellow
Assembly		double layer, carrier film 86/52 in 0.125 mm
Thermal Properties		
Thermal resistance R_{th}	K/W	1.2
Thermal impedance R_{ti}	°Cmm²/W	480
	Kin²/W	0.75
Thermal conductivity λ	W/mK	1.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	8.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	16.0
Volume resistivity	Ωm	1.0×10^{11}
Dielectric loss factor tan δ		1.5×10^{-3}
Dielectric constant ε_r		3.9
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	10 - 20
Young´s modulus	N/cm²	22
Physical Properties		
Application temperature	°C	-60 to +200
Density	g/cm³	1.61
Total mass loss (TML)	Ma.-%	< 0.22
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 5.0

*KERAFOL® test according to UL

These high elastic films are characterized by their excellent compressibility with moderate thermal and excellent dielectric behavior. Type 86/200 is constructed in two layers.

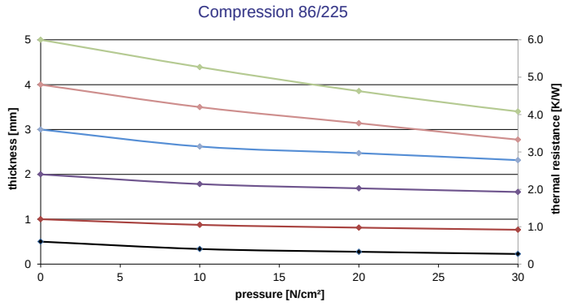
Optional available with adhesive coating as **86/200K**

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

Attention
At maximum pressure, 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.

86/225 & 86/228

high elastic



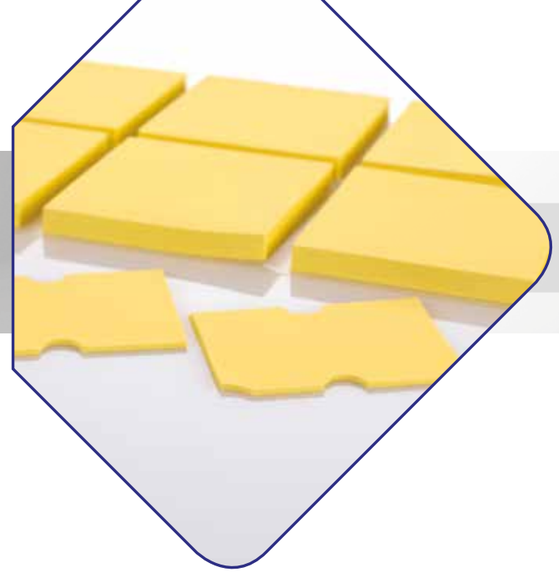
Properties	Unit	86/225	86/228
Colour		orange	pink / orange
Assembly		single layer, fibre-glass reinforcement up to 4.0 mm	double layer carrier film 86/52 in 0.125 mm
Thermal Properties			
Thermal resistance R_{th}	K/W	0.6	0.6
Thermal impedance R_{ti}	°Cmm²/W	240	240
	Kin²/W	0.37	0.37
Thermal conductivity λ	W/mK	2.0	2.0
Electrical Properties			
Breakdown voltage $U_{d;\,ac}$	kV	6.0	6.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	12.0	12.0
Volume resistivity	Ωm	2.2×10^{11}	2.8×10^{11}
Dielectric loss factor tan δ		1.0×10^{-3}	1.0×10^{-3}
Dielectric constant ε_r		3.6	2.5
Mechanical Properties			
Measured thickness (+/-10%)	mm	0.500	0.500
Hardness	Shore 00	30 - 45	30 - 45
Young´s modulus	N/cm²	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

*KERAFOL® test according to UL

Single layer SOFTTHERM® Films with graded thermal behavior. These films are partial fibreglass reinforced and an alternative to the two layer SOFTTHERM® Films.

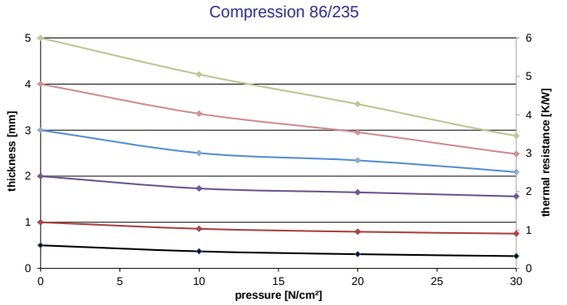
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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

low bleeding



Properties	Unit	86/235	86/238
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	0.6	0.6
Thermal impedance R_{ti}	°Cmm²/W	240	240
	Kin²/W	0.37	0.37
Thermal conductivity λ	W/mK	2.0	2.0
Electrical Properties			
Breakdown voltage $U_{d;\,ac}$	kV	6.0	6.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	12.0	12.0
Volume resistivity	Ωm	1.8×10^{11}	4.7×10^{11}
Dielectric loss factor tan δ		2.0×10^{-2}	1.0×10^{-3}
Dielectric constant ε_r		3.7	1.9
Mechanical Properties			
Measured thickness (+/-10%)	mm	0.500	0.500
Hardness	Shore 00	25 - 40	25 - 40
Young´s modulus	N/cm²	32	122
Physical Properties			
Application temperature	°C	-40 to +200	-40 to +200
Density	g/cm³	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

*KERAFOL® test according to UL

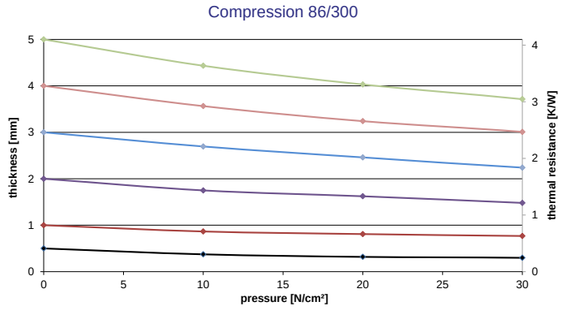
Innovative, customer-oriented development. Type 86/235 is a single layer, with good thermal, mechanical and dielectric properties. Volatile silicone (< 150 ppm).

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

Attention
At maximum pressure, 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.

86/300
compressibility & softness

Compression 86/300



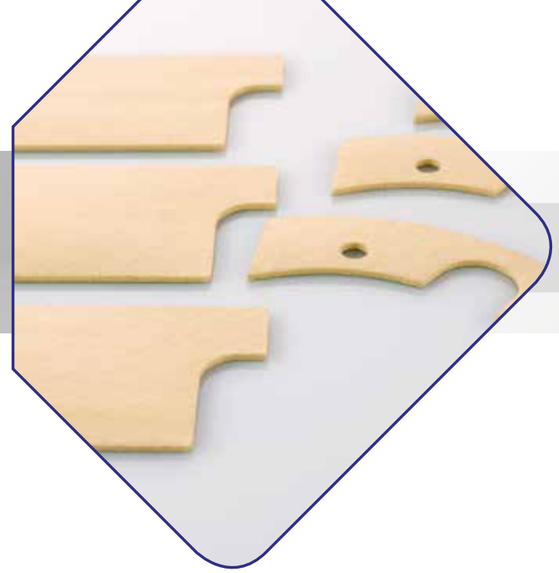
Properties	Unit	86/300
Colour		blue
Assembly		single layer, fibreglass reinforcement up to 1.0 mm
Thermal Properties		
Thermal resistance R_{th}	K/W	0.41
Thermal impedance R_{ti}	°Cmm²/W	164
	Kin²/W	0.25
Thermal conductivity λ	W/mK	3.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	7.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	14.0
Volume resistivity	Ωm	1.0×10^{11}
Dielectric loss factor tan δ		5.0×10^{-3}
Dielectric constant ε_r		3.3
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	60 - 75
Young´s modulus	N/cm²	24
Physical Properties		
Application temperature	°C	-60 to +200
Density	g/cm³	1.71
Total mass loss (TML)	Ma.-%	< 0.35
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 5.0

Graduated compressibility and softness, with good thermal behavior characterize this group of SOFTTHERM® Films. These single layer films may be enhanced with fibreglass reinforcement up to a thickness of 1.0 mm.

Optional available with adhesive coating as 86/300 K

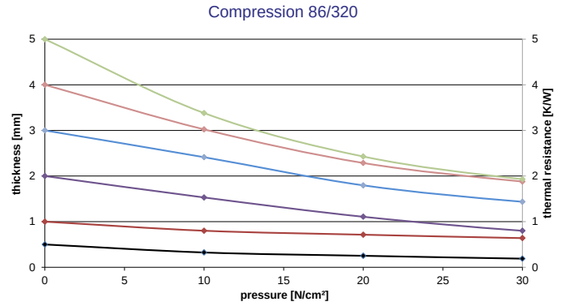
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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

Compression 86/320



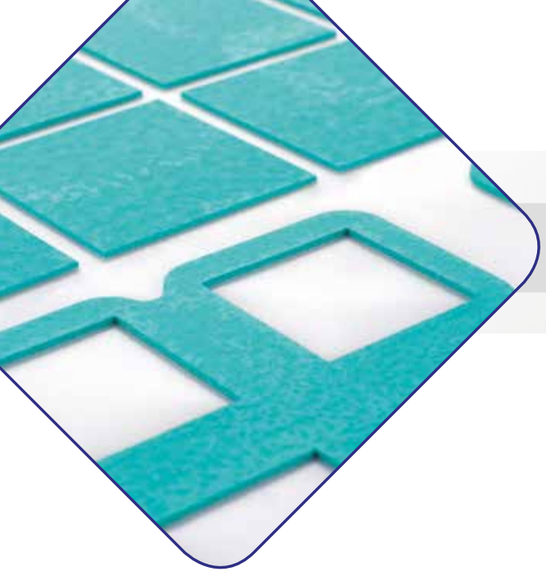
Properties	Unit	86/320
Colour		yellow
Assembly		single layer, fibreglass reinforcement up to 1.5 mm
Thermal Properties		
Thermal resistance R_{th}	K/W	0.5
Thermal impedance R_{ti}	°Cmm²/W	147
	Kin²/W	0.23
Thermal conductivity λ	W/mK	2.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	5.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	10.0
Volume resistivity	Ωm	6.8×10^{11}
Dielectric loss factor tan δ		2.9×10^{-2}
Dielectric constant ε_r		3.4
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	25 - 38
Young´s modulus	N/cm²	32
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm³	1.69
Total mass loss (TML)	Ma.-%	< 0.46
Flame rating	UL-94	V
Possible thickness	mm	1.0 - 5.0

*KERAFOL® test according to UL

Single layer SOFTTHERM® Films with graded thermal behavior. These films are partially fibreglass reinforced and an alternative to the two layer SOFTTHERM® Films.

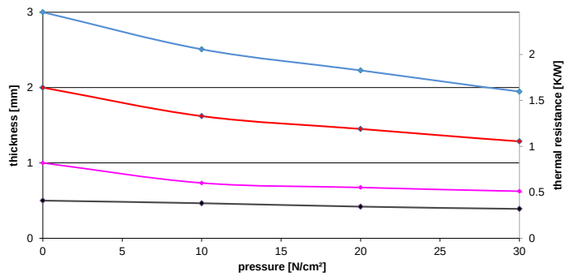
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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

Compression 86/325



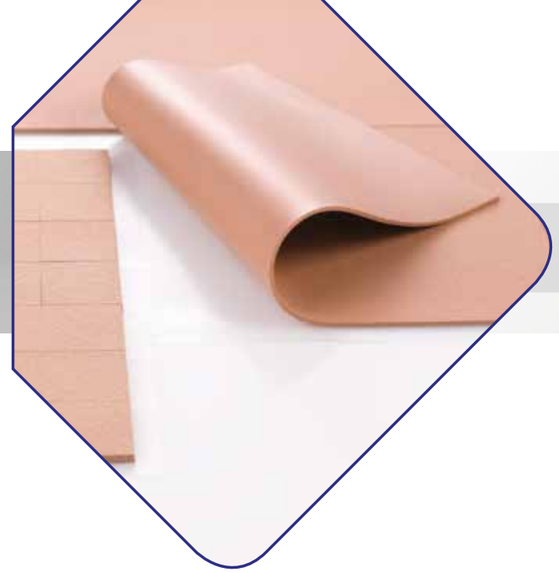
Properties	Unit	86/325
Colour		mint
Assembly		single layer, fibre-glass reinforcement up to 1.0 mm
Thermal Properties		
Thermal resistance R_{th}	K/W	0.41
Thermal impedance R_{ti}	°Cmm²/W	164
	Kin²/W	0.25
Thermal conductivity λ	W/mK	3.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	6.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	12.0
Volume resistivity	Ωm	8.5×10^{10}
Dielectric loss factor tan δ		1.5×10^{-1}
Dielectric constant ε_r		3.8
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	35 - 50
Young´s modulus	N/cm²	64
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm³	1.95
Total mass loss (TML)	Ma.-%	< 0.35
Flame rating	UL-94	V-0*
Possible thickness	mm	0.5 - 4.0

*KERAFOL® test according to UL

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

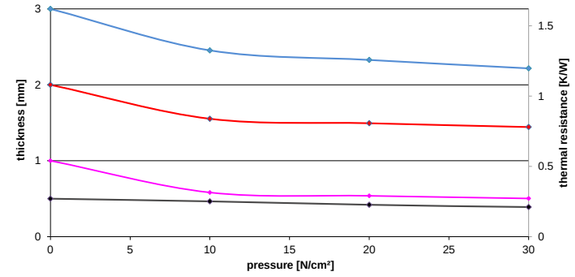
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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

Compression 86/450



Properties	Unit	86/450
Colour		brown
Assembly		single layer
Thermal Properties		
Thermal resistance R_{th}	K/W	0.27
Thermal impedance R_{ti}	°Cmm²/W	108
	Kin²/W	0.18
Thermal conductivity λ	W/mK	4.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	5.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	10.0
Volume resistivity	Ωm	3.6×10^{12}
Dielectric loss factor tan δ		3.0×10^{-3}
Dielectric constant ε_r		2.5
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	65 - 75
Young´s modulus	N/cm²	95
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm³	1.32
Total mass loss (TML)	Ma.-%	< 0.4
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 3.0

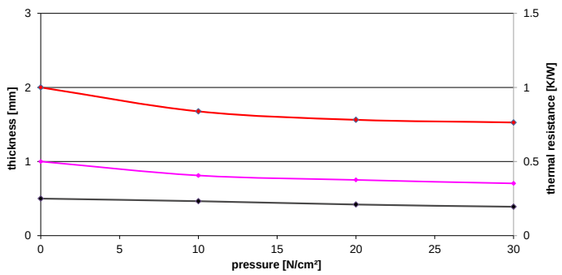
This group of SOFTTHERM® Films is characterized by its extremely high thermal conductivity. The single layer films without fibreglass reinforcement are soft and compressable. The good dimensional stability of these films ensures a controlled and automated processing.

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

Attention
At maximum pressure, 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.

86/500
high thermal conductivity

Compression 86/500



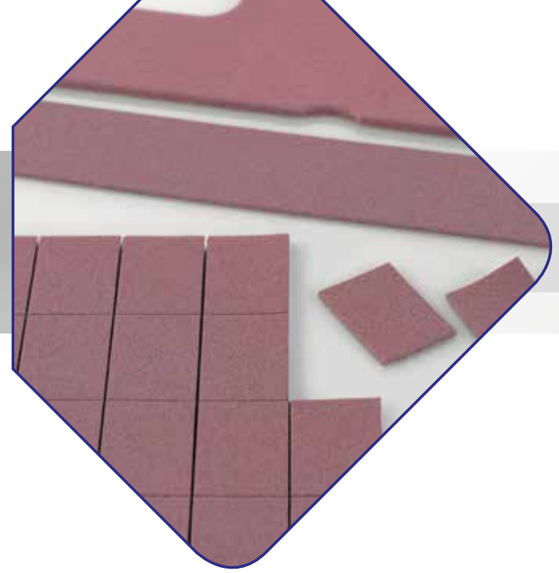
Properties	Unit	86/500
Colour		brown
Assembly		single layer
Thermal Properties		
Thermal resistance R_{th}	K/W	0.25
Thermal impedance R_{ti}	°Cmm²/W	100
	Kin²/W	0.15
Thermal conductivity λ	W/mK	5.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	1.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	2.0
Volume resistivity	Ωm	1.0×10^{11}
Dielectric loss factor tan δ		1.5×10^{-3}
Dielectric constant ε_r		3.9
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	65 - 75
Young´s modulus	N/cm²	70
Physical Properties		
Application temperature	°C	-60 to +200
Density	g/cm³	1.33
Total mass loss (TML)	Ma.-%	< 0.24
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 2.0

This group of SOFTTHERM® Films is characterized by their extremely high thermal conductivity. The single layer films without fibreglass reinforcement are soft and compressable. The good dimensional stability of these films ensures a controlled and automated processing.

Optional available with adhesive coating as **86/500K**

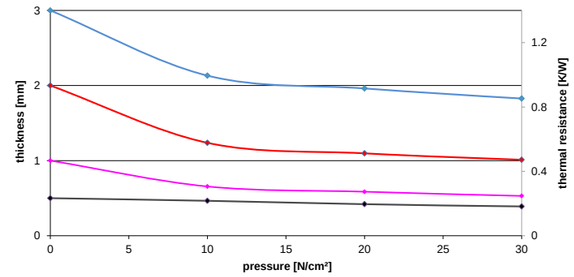
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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.



86/525
high thermal conductivity

Compression 86/525



Properties	Unit	86/525
Colour		violet
Assembly		single layer
Thermal Properties		
Thermal resistance R_{th}	K/W	0.22
Thermal impedance R_{ti}	°Cmm²/W	89
	Kin²/W	0.14
Thermal conductivity λ	W/mK	5.5
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	1.25
Dielectric breakdown $E_{d;\,ac}$	kV/mm	2.5
Volume resistivity	Ωm	1.6×10^{13}
Dielectric loss factor tan δ		1.0×10^{-3}
Dielectric constant ε_r		2.7
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	50 - 65
Young´s modulus	N/cm²	99
Physical Properties		
Application temperature	°C	-40 to +180
Density	g/cm³	1.18
Total mass loss (TML)	Ma.-%	< 0.35
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 3.0

Group of highly thermoconductive SOFTTHERM® Films. Low thermal transitions with good dielectric behavior and good compressibility characterize these SOFTTHERM® Films.

Optional available with oneside adhesive coating **86/525K**

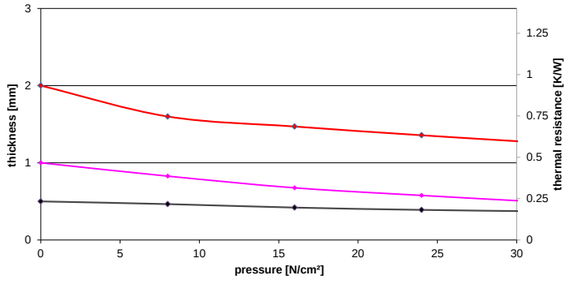
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Attention
At maximum pressure, 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.

86/600

high thermal conductivity

Compression 86/600



Properties	Unit	86/600
Colour		grey
Assembly		single layer
Thermal Properties		
Thermal resistance R_{th}	K/W	0.2
Thermal impedance R_{ti}	°Cmm²/W	80
	Kin²/W	0.12
Thermal conductivity λ	W/mK	6.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	1.5
Dielectric breakdown $E_{d;\,ac}$	kV/mm	3.0
Volume resistivity	Ωm	1.7×10^{10}
Dielectric loss factor tan δ		2.0×10^{-3}
Dielectric constant ε_r		2.5
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	60 - 75
Young´s modulus	N/cm²	77
Physical Properties		
Application temperature	°C	-60 to +180
Density	g/cm³	1.28
Total mass loss (TML)	Ma.-%	< 0.40
Flame rating	UL-94	V-0*
Possible thickness	mm	0.5 - 1.5

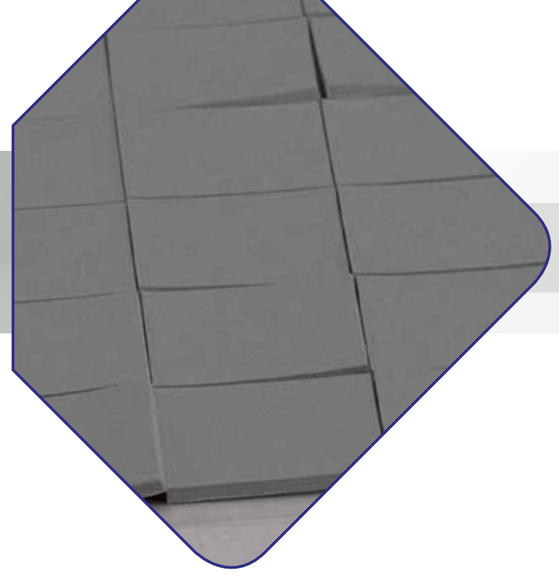
*KERAFOL® test according to UL

This group of SOFTTHERM® Films is characterized by its extremely high thermal conductivity. The single layer films without fibreglass reinforcement are soft and compressable. The good dimensional stability of these films ensures a controlled and automated processing.

Optional available with adhesive coating as **86/600K**

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

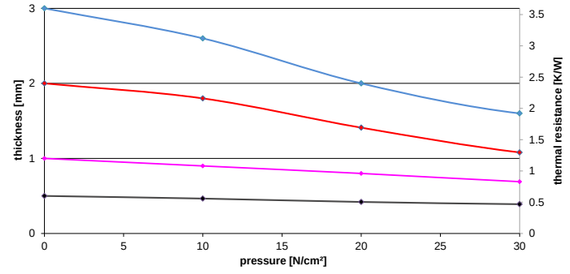
Attention
At maximum pressure, SOFTTHERM® Films should not be compressed beyond 30% of the original thickness.
In case the material should be compressed more than 30%, the SOFTTHERM® material may leak out.



U 281

silicone free

Compression U 281



Properties	Unit	U 281
Colour		grey
Assembly		single layer
Thermal Properties		
Thermal resistance R_{th}	K/W	< 0.6
Thermal impedance R_{ti}	°Cmm²/W	240
	Kin²/W	0.37
Thermal conductivity λ	W/mK	2.0
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	7.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	14.0
Volume resistivity	Ωm	5.3×10^{9}
Dielectric loss factor tan δ		7.8×10^{-2}
Dielectric constant ε_r		5.6
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.500
Hardness	Shore 00	55 - 65
Young´s modulus	N/cm²	244
Physical Properties		
Application temperature	°C	-40 to +130
Density	g/cm³	1.5
Total mass loss (TML)	Ma.-%	< 0.9
Flame rating	UL-94	V-0
Possible thickness	mm	0.5 - 2.0

Flexible ceramic, thermoconducting and insulating. SOFTTHERM® U 281 is particularly suitable for silicone sensitive applications and an alternative to silicone based SOFTTHERM® Films.

The silicone free Sofftherm Film offers high electrical insulation and very good thermal conductivity.

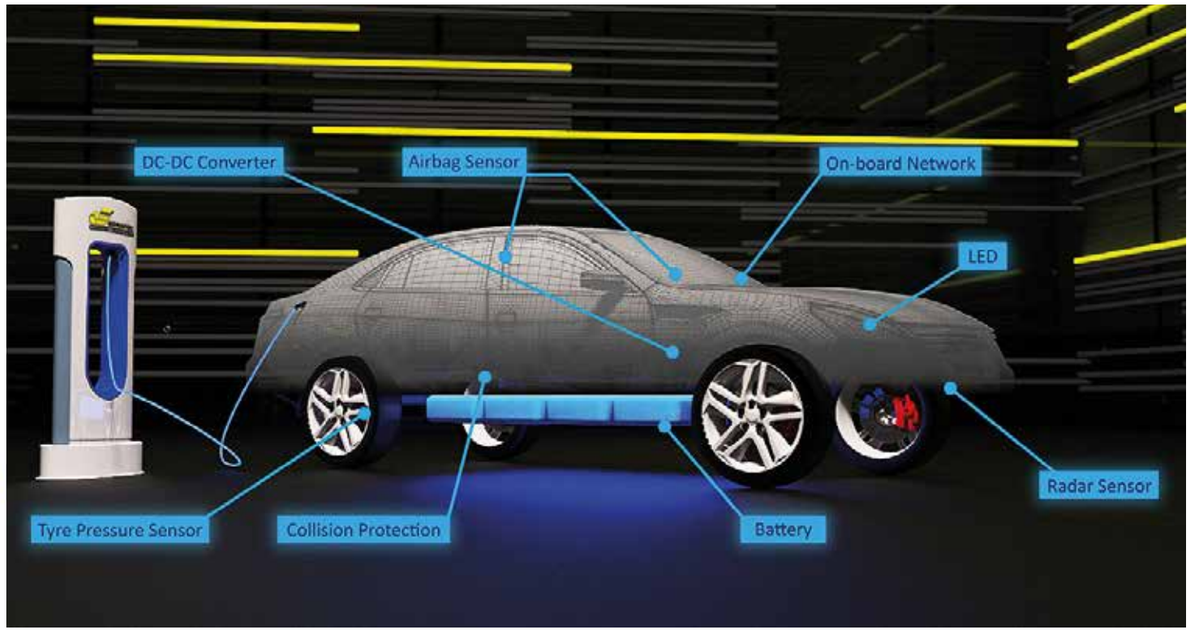
Optional available with PET-Film!

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

Attention
At maximum pressure, 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 Management - Challenges for electric vehicles

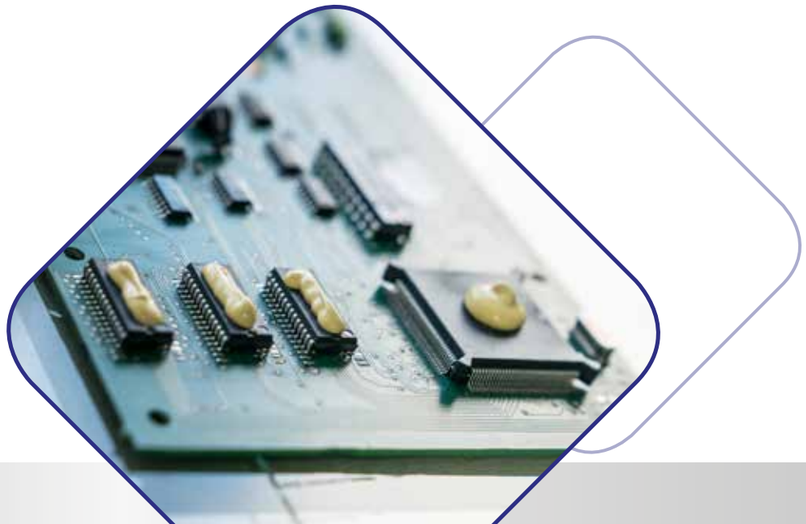
The change to electric powertrains and the increasing importance of autonomous driving imply a variety of new challenges. Thermal management or rather thermal connectivity and cooling of electrical components have an important role to play. While there is a large number of Thermal Interface Materials, 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.



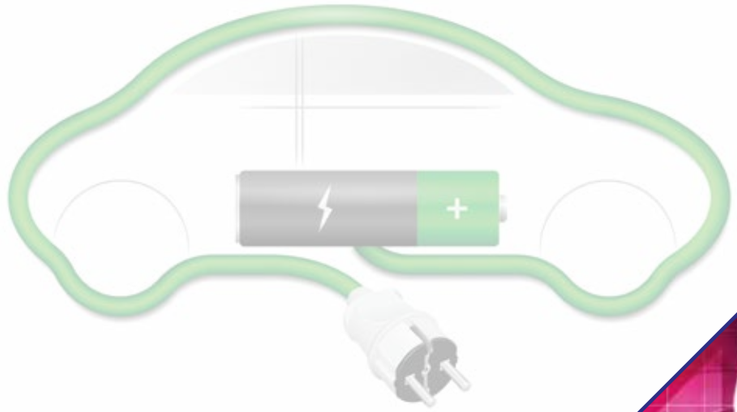
The change to electric drive systems as well as the increasing importance of autonomous driving imply completely new applications and challenges in the field of "Thermal Management." The functional relationship between the operating temperature of a battery stack and its maximum achievable number of 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.



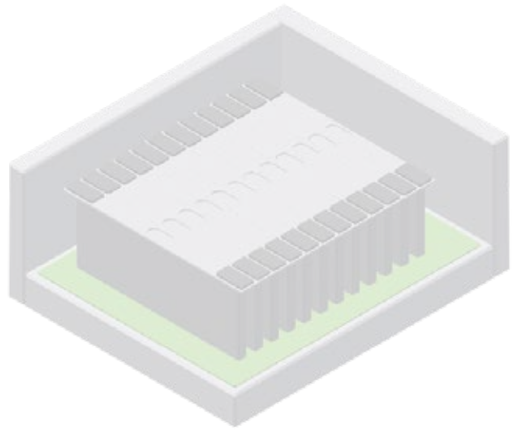
Optimized thermal management for **e-mobility** and performance electronics through - Gap Filler "Liquids".



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, GFL 3020, GFL 3025, GFL 3030 and GFL3040, 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 Liquid

GFL 3020 & GFL 3025

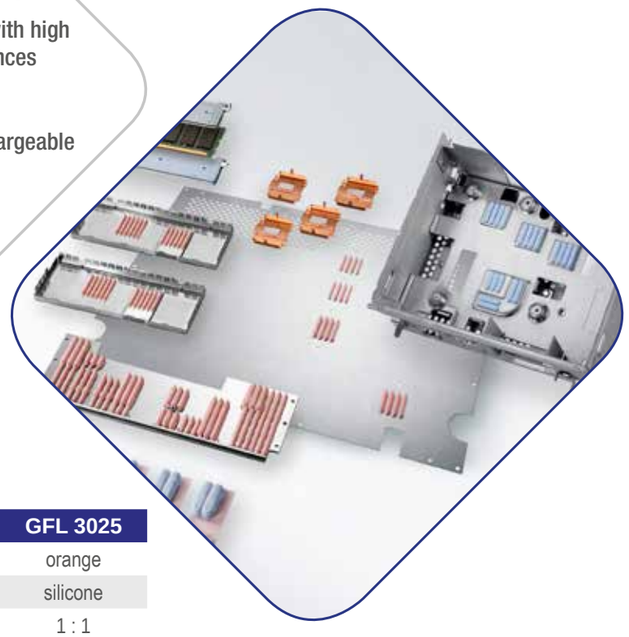
Gap Filler Liquid

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



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.

Properties	Unit	GFL 3020	GFL 3025
Colour		yellow	orange
Basic material		silicone	silicone
Mixing ratio		1 : 1	1 : 1
Curing		1h ;RT	1h ;RT
Thermal Properties			
Thermal resistance R_{th}	K/W	0.7	0.5
Thermal conductivity λ	W/mK	1.8	2.5
Electrical Properties			
Breakdown voltage $U_{d;\,ac}$	kV	10.0	8.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	20.0	16.0
Mechanical Properties			
Measured thickness (+/-10%)	mm	0.500	0.500
Hardness	Shore 00	45 - 60	65 - 85
Physical Properties			
Application temperature	°C	-40 to +200	-40 to +200
Density	g/cm³	2.30	2.83
Viscosity*	Pas	45 - 70	30 - 60
Total mass loss (TML)	Ma. -%	0.19	< 0.09
Flame rating	UL-94	V-0	V-0**
Possible thickness	mm	0.200 - 5.000	0.200 - 5.000

*Shear rate $4s^{-1}$ / 25°C

**KERAFOL® test according to UL

Gap Filler Liquid

GFL 3030 & GFL 3040

Gap Filler Liquid

For high volumes in particular, two-component GFL are an efficient and cost-oriented solution. For this purpose, the two components of the ceramic filled silicone elastomers are blended by a mixing tube and can be directly applied to the component (e.g. metal housing) by a dispensing system.

In the next step, the electronic components (e.g. IGBTs, capacitors, etc.) are attached under slight pressure to the still uncured mass, thus creating an even distribution of the mass and consequently a defined thickness as well as reproducible electrical and thermal parameters. The cross-linking or curing of the mass takes place under room temperature and lasts about an hour, but can be customized at the customer's request. Primarily the GFL with lower thermal conductivity has a high self-adhesion, which can be very useful for the assembly.

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

Properties	Unit	GFL 3030	GFL 3040
Colour		green	lilac
Basic material		silicone	silicone
Mixing ratio		1 : 1	1 : 1
Curing		1h ;RT	1h ;RT
Thermal Properties			
Thermal resistance R_{th}	K/W	0.41	0.29
Thermal conductivity λ	W/mK	3.0	4.3
Electrical Properties			
Breakdown voltage $U_{d;\,ac}$	kV	6.0	5.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	12.0	10.0
Mechanical Properties			
Measured thickness (+/-10%)	mm	0.500	0.500
Hardness	Shore 00	65 - 85	65 - 85
Physical Properties			
Application temperature	°C	-40 to +200	-40 to +200
Density	g/cm³	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	0.200 - 5.000	0.200 - 5.000

*Shear rate $4s^{-1}$ / 25°C

**KERAFOL® test according to UL

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

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

KP 97, 98, 99 & KP 12

KERATHERM® Thermal Grease

Applications

- Notebooks
- Desktop CPU´s
- IGBT unit

Benefits

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

KERATHERM® Thermal Greases are ceramic-filled single component silicones with a high thermal conductivity. The non-crosslinked 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!

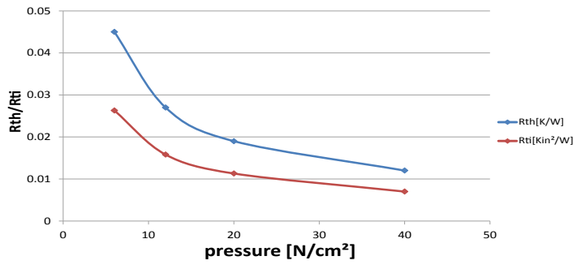
Properties	Unit	KP 97	KP 98	KP 99	KP 12 silicone free
Colour		white	grey	anthracite	silver
		◄ soft/pasty ►			
Thermal Properties					
Thermal resistance R_{th}	K/W	0.0120	0.0100	0.0068	0.0060
Thermal impedance R_{ti}	°Cmm²/W	4.5	4.1	2.7	2.2
	Kin²/W	0.007	0.0064	0.0042	0.0033
Thermal conductivity λ	W/mK	5.0	6.0	9.2	10.0
Electrical Properties					
Electrical conductivity (according to DIN 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	°C	-60 to +200	-60 to +200	-60 to +200	-60 to +150
Density	g/cm³	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 therm stability (1000h / 85°C / 85 % relativ humidity)					
Thermal resistance 1000h	K/W	0.0120	0.0080	0.0068	0.0060

*Shear rate $4s^{-1}$ / 25°C

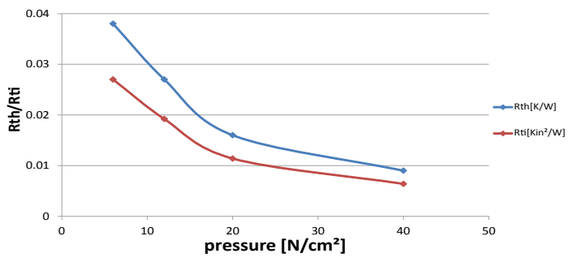
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

Comparison of pastes regarding thermal resistance in dependence on contact pressure

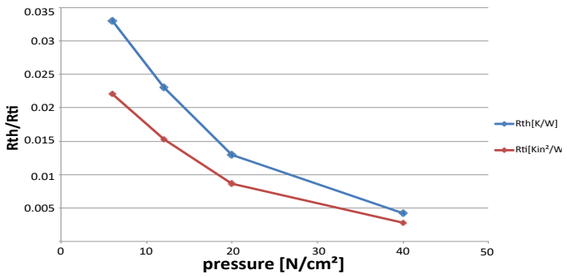
Compression KP 97



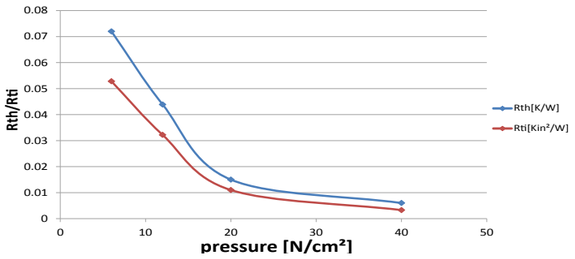
Compression KP 98

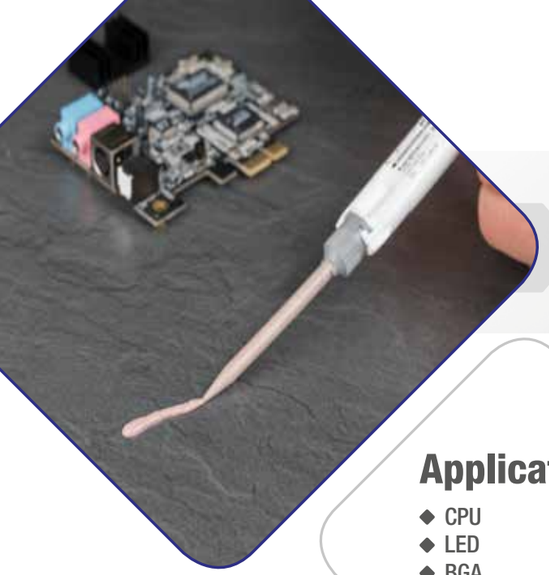


Compression KP 99



Compression KP 12





KERATHERM® Bond 100 RT

KERATHERM® Thermal Adhesive

Applications

- CPU
- LED
- BGA
- Heat sinks

Benefits

- High bond strength
- Room temperature curing
- Thixothropic and filling surface structures

Properties	Unit	100 RT
Colour		brown
Mixing ratio		1 : 1
Curing	T [°C]	20 min RT
Thermal conductivity λ *	W/mK	1.5
Thermal resistance Rth *	K/W	0.83
Measured thickness	mm	0.5
Hardness	Shore A	20 - 35
Tensile sheer strength	MPa	>15
Dielectric breakdown	kV/mm	12
Density	g/cm³	2.1
Viscosity	Pas	20 - 40
Application temperature	°C	-40 - 180

*Shear rate $4s^{-1}$ / 25°C

Packing units:

- syringe: 5 ml
- double cartusche: 50 ml
- can: 1.0 kg
- shelf life 6 months

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.).
- Screw emulsion tube onto the cartridge.
- 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.

KL 90 & KL 91

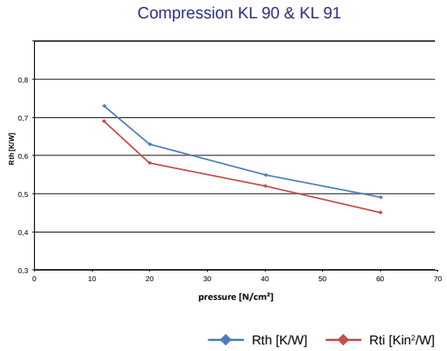
ceramic filled adhesive film

Applications

Thermal connection of

- MOSFETS
- CPUs, LEDs
- Flips Chips, DSPs
- BGAs, PPGAs

on heat sinks



Representatives

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

Properties	Unit	KL 90	KL 91
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_{ti}	°Cmm²/W	208	220
	Kin²/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 δ		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/mm²	0.3	11.3
Physical Properties			
Application temperature	°C	-40 to +125	-40 to +125
Density	g/cm³	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

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		Unit	KL 90	KL 91
			(without fibreglass)	(with fibreglass)
Testing the reflow stability 10s/270°C			passed	passed
Adhesive film thickness (+/-10%)		µm	300	300
Shelf Life		month	12	12
Application conditions	[pressure/ time]	N/cm²/sec.	10/10	10/15
Tensile shear strength		N/cm²	> 30	> 25
[25mmx25mm-adhesive area-180°		[DIN EN 1465]		
aluminum – adhesive film – aluminum]		[ASTM D 1002]		
Tensile shear strength	-20°C	N/cm²	157.2	146.8
temperature-depending**	+20°C	[DIN EN 1465]	51.7	50.3
[25mmx25mm-adhesive area-180°	+60°C	[ASTM D 1002]	14.1	13.6
aluminum – adhesive film – aluminum]	+70°C		12.0	10.7
	+80°C		10.7	9.5
Tensile shear strength		N/cm²	31.5	32.5
after vibration test (sinusoidal with temperature overlay at 60°C);				
vibration 10–500 Hz; 50 s/m² (5g) test cycle 24h (6h per axis) [1]				
Tensile shear strength		N/cm²	32.1	35.9
after vibration test (sinusoidal at RT);				
vibration 10–500 Hz; 100 s/m² (10g) test cycle 24h (8h per axis) [2]				
Adhesion* (bonding strength)		Nmm	> 1.2	> 1.0
Tack* (surface adhesiveness)		mm	> 1.5	> 1.2
Peel strength [90° -on aluminum]		N/25mm	3 [adhesive]	9 [adhesive]

*used measurement - Texture Analyser (TA.XT-plus) **according to test standard DIN EN 1465; test speed 0.5 inch/min; adhesion area of 25x25mm^2 (1inch^2); glued on an AlCuMg1-substrate, stored at room temperature of 62 hours. [1], [2]: sinusoidal vibration test - Fc gem. DIN EN 60068-2-6 and DIN EN 60068-2-2; VDE 0468-2-2

1. Processing and handling instructions

When the basic rules of processing and handling are followed, KL 90 and KL 91 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 and KL 91 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 and KL 91 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 (release 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 and KL 91 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.

Adhesive Coatings

Always a good option

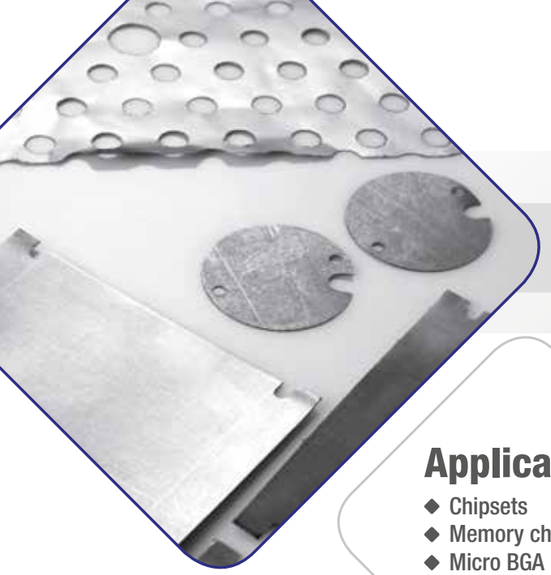
Each film type requires its own special adhesive system. Besides flexible adhesives with low adhesive strength, KERAFOL® also offers adhesives with high adhesive strength or with various fillings for improved heat transfer.

Properties	Unit	Sil-S1	Sil-S2	Acryl-A1	Acryl-2	Acryl-3
Colour		transparent	transparent	transparent	transparent	milky white
Film type		PSA silicone	Gel silicone	Acrylate	Acrylate removable	filled Acrylate
Suitable for film types		70/60 86/82K 86/300K 86/500K 86/600K	86/20 86/27 86/40 86/47 86/51 86/53 86/60K S900	90/20 U80K U85K U90K	86/525K	90/15
Application temperature	°C	-60 to +250	-60 to +250	-40 to +180	-40 to +180	-40 to +180
Suitable for reflow process	(10sec. - 270°C)	yes	yes	no	no	yes
Peel resistance*	N/25mm	2 - 10	1 - 5	5 - 12	2 - 5	2 - 5
Bonding strength	Nmm	> 0.15	> 0.2	> 0.3	> 0.2	> 0.2
Tack (surface adhesiveness)	mm	> 0.5	< 1.0	> 1.0	> 0.8	> 0.5
Shelf Life**	month	8	8	12	12	12

*Peel resistance: peeling at 180°, peel speed: 300 mm/min.; Width of test strip: 25 mm; length of test strip: 220 mm;
Finat test method in accordance with DIN 53375, 53282, 53283.

**Shelf Life: Silicone adhesive: eight (8) months from date of manufacture provided the material has been stored in its original packaging and at max. 21°C (70°F) and 50% relative humidity. Acrylate adhesive: twelve (12) months from date of manufacture provided the material has been stored in its original packaging and at max. 21°C (70°F) and 50% relative humidity.

Notice: By using adhesives as single-sided coating for KERATHERM® thermal conductive films the thermal impedance increases.

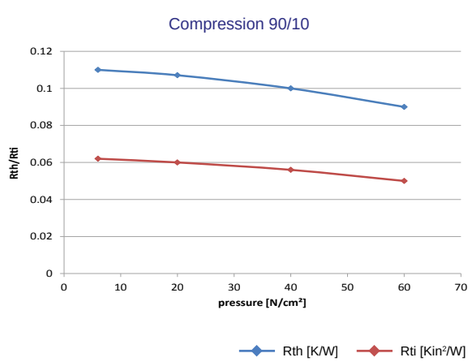


90/10, 90/15 & 90/20

100% pure graphite

Applications

- Chipsets
- Memory chips
- Micro BGA



Properties	Unit	90/10
Colour		black
Thermal Properties		
Thermal resistance R_{th}	K/W	0.09
Thermal impedance R_{ti}	°Cmm²/W	36
	Kin²/W	0.05
Thermal conductivity λ z (x/y)	W/mK	5.5 (200)
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	conductive
Electrical resistance z (x/y)	Ωµm	650 - 700 (6 - 8)
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.200
Hardness	Shore D	25 - 35
Tensile strength	N/mm²	5.5
Elongation	%	10
Physical Properties		
Application temperature	°C	-40 to +500
Density	g/cm³	> 1.0
Total mass loss (TML)	Ma. -%	0.01
Flame rating	UL-94	V-0
Possible thickness	mm	0.15 - 0.2

Graphite Films are based on 100% pure graphite. The films are available as uncoated types and, for specific applications, with filled adhesive or standard adhesives. Due to their high thermal conductivity they are used in the CPU sectors for example.

Options

Type	Film structure	Overall thickness	Tensile strength	Thermal resistance	
		mm	N/mm²	K/W	Kin²/W
90/15	90/10 with filled adhesive	0.200	6.0	0.07	0.04
90/20	90/10 with standard adhesive	0.250	5.5	0.16	0.10

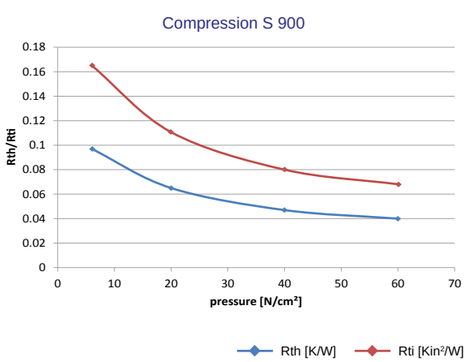
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

S 900

Interface Material

Applications

- Chipsets
- Memory chips
- Micro BGA



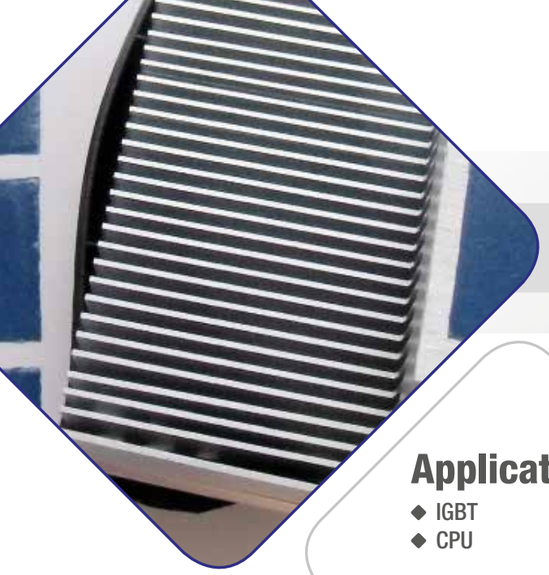
Properties	Unit	S 900
Colour		black
Thermal Properties		
Thermal resistance R_{th}	K/W	0.08
Thermal impedance R_{ti}	°Cmm²/W	34
	Kin²/W	0.047
Thermal conductivity λ z (x/y)	W/mK	7.5 (> 300)
Electrical Properties		
Breakdown voltage $U_{d;\,ac}$	kV	conductive
Electrical resistance z (x/y)	Ωµm	700 - 800 (7 - 9)
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.290
Hardness	Shore D	25 - 35
Tensile strength	N/mm²	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

Graphite S 900 is a highly densed, 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 oneside adhesive coating as **S 900K**

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



Phase-Change-Material

PCM 471

KERATHERM® phase-change

Applications

- IGBT
- CPU

Benefits

- Very good thermal performance through optimized softening
- Easy application through increased tack

Properties	Unit	PCM 471
Colour		grey
Compound		filled hot-setting wax
Thermal Properties		
Thermal resistance R_{th}	K/W	0.070
Thermal impedance R_{ti}	°Cmm²/W	25.6
	Kin²/W	0.039
Thermal conductivity λ	W/mK	4.0
Mechanical Properties		
Measured thickness (+/-10%)	mm	0.200
Hardness	Shore A	70 - 80
Softening interval	°C	> 46
Physical Properties		
Application temperature	°C	-40 to +125
Density	g/cm³	1.82
Possible thickness	mm	0.2

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.

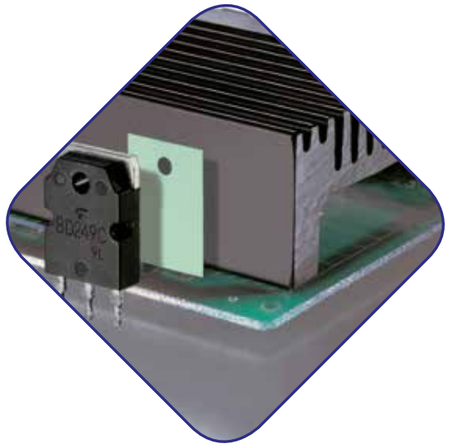
Data for engineer guidance only.
Observed performance varies in application.
Engineers are reminded to test the material in application.

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 SOFTTHERM® Films are supplied as sheets.

Tolerances

KERATHERM® Standard Films: 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® 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.

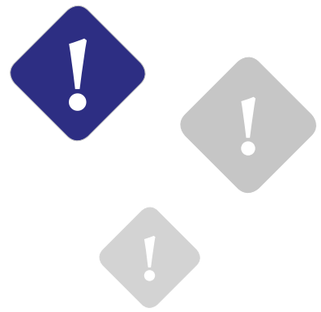
KERATHERM® Graphit tolerances according DIN ISO 2768-c.

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

All KERATHERM® and SOFTTHERM® products that are not adhesive lined generally have unlimited shelf life and usability when appropriately stored under standard conditions (room temperature, no direct sunlight) in their original closed packaging. Exceptions to this are KERATHERM® heat transfer compounds, PCM and PCE - materials that should be refrigerated (10°C - 15°C) when stored.Variant or limited shelf lives exist for double-sided adhesive tapes and adhesive lined films. KERAFOL® offers various types of adhesives for different KERATHERM® and SOFTTHERM® products. For their respective shelf life data, please see the separate KERATHERM® data sheet – adhesive coating or processing and handling instructions for KL 90 and KL 91.

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.

KERATHERM®

Discription	Unit	Test Methode	
Thermal resistance R_{th}*	K/W	KERAFOL - test methode	
Thermal conductivity*	W/mK	KERAFOL - test methode	ASTM D 5470
Breakdown voltage ($U_{d;\,ac}$)	kV	IEC 243 1+2	ASTM D 149
Dielectric breakdown ($E_{d;\,ac}$)	kV/mm	IEC 243 1+2	ASTM D 149
Volume resistivity	Ωm	DIN 53483-3	ASTM D 257
Dielectric loss factor tan δ		DIN 53483	ASTM D 150
Dielectric constant ε_r		DIN 53483	ASTM D 150
Electrical conductivity	pS/m	DIN 51412-1	
Measured thickness	mm	DIN 53370	ASTM E 252
Tensile strength	N/mm2	DIN EN ISO 527-3	ASTM D 412a
Elongation	%	DIN EN ISO 527-3	ASTM D 412a
Hardness	Shore (A,D) Shore 00	DIN 53505	ASTM D 2240
Compressibility**	mm	DIN ISO 815-1	ASTM D 395
Youngs Modulus**	N/cm²	-	ASTM D 575
Flame rating	UL (KERAFOL internal)	UL 94 / E140693 (KERAFOL Test according to UL)	UL 94 / E140693
Total mass loss (TML)	Ma.-%		ASTM E 595

Modified test geometry

* Thermal conductivity λ, thermal resistance R_{th} and thermal impedance R_{ti} (4 cm²)

** Compressibility and "Young´s Modulus" (3.0 cm x 3.0 cm = 9.0 cm²)

Conversion

Shape: 1000 mil = 1 inch (1") = 2.54 cm = 25.4 mm

Area: 1 inch² = 6.45 cm² = 645 mm²

Pressure: 100 N/cm² = 1MPa = 10 bar = 145.037 psi

All information in catalogue, data sheets and website of KERAFOL® Keramische Folien GmbH is without guarantee. KERAFOL® does not assume responsibility for misprints and reserves the right to make technical changes.

Version 08-2019

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Version 08-2019

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!