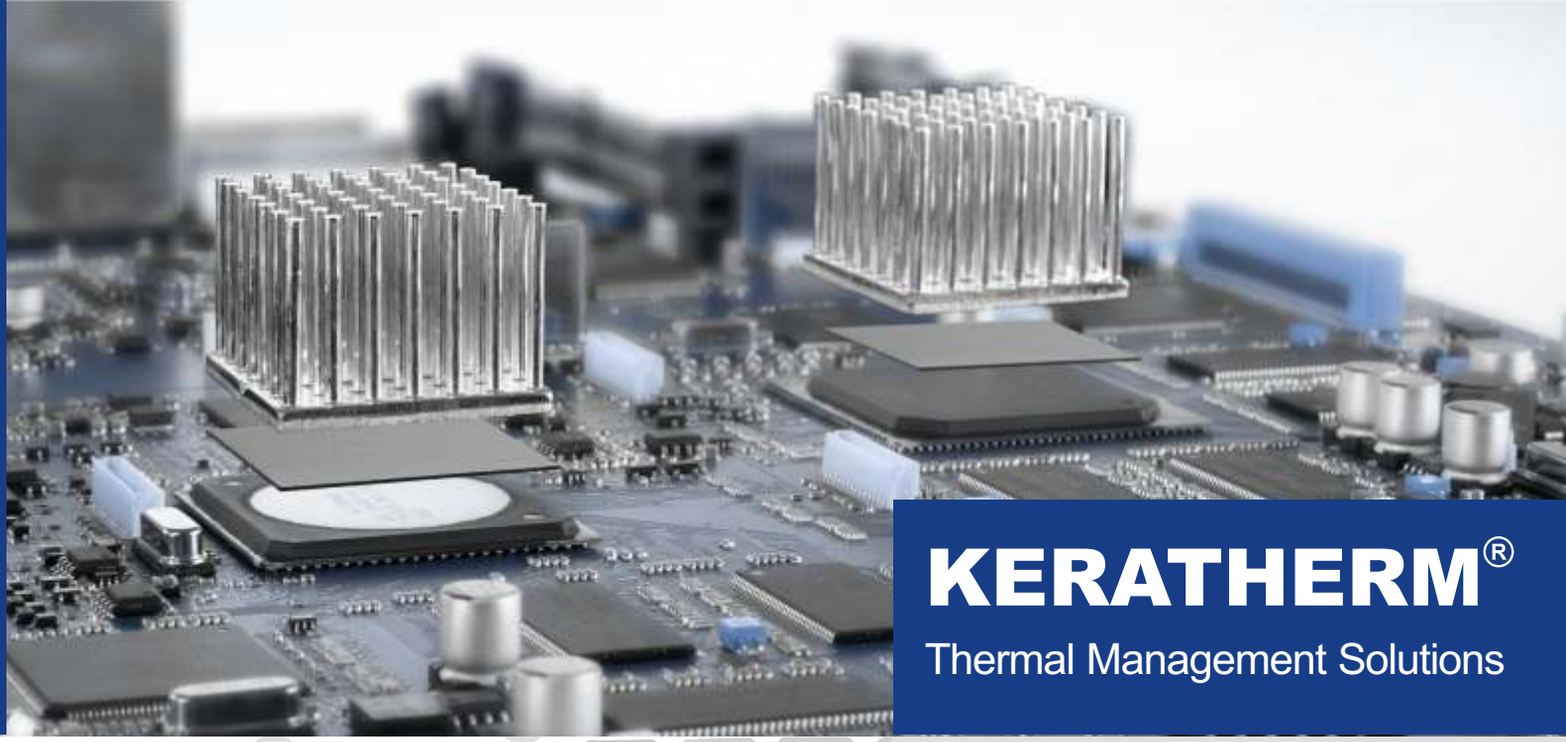

KERATHERM®

Thermal Management Solutions

Standard Films

Thermal Grease

Phase-Change-Material

Softtherm® Films

Thermal Compounds

Graphite Films

Ferrite Films

Adhesive Films

Adhesive Coatings

KERAFOL®

KERAMISCHE FOLIEN GMBH

Innovation in Technology and Environmental Protection

KERAFOL®
KERAMISCHE FOLIEN GMBH

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KERAFOL®
KERAMISCHE FOLIEN GMBH

KERAFOL® - Your partner for Thermal Solutions and Development Services

Quality Assurance

Research & Development

International Distribution Network

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 films 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 broad range of innovative solutions makes Kerafol your essential partner in the field of “Thermal Management”.

KERATHERM® - Innovation in Technology and Environmental Protection

Optimum Price-Performance-Ratio

Environmental-Friendly Products

Future-Oriented

Development, quality control and environmental compatibility

In order to offer our customers competent, customized advice and individual problem solutions, our engineers and staff are continually carrying out reasearch, development and tests on new, innovative and high quality materials in our in-house 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.

Kerafol® - Customer satisfaction in all areas

Kerafol® offers a wide range of products, suitable for diverse applications, as for example in microelectronics, Power supply, White Goods, tele-communication 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.

KERAFOL®
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KERATHERM® - Thermal Management Material

Why “Thermal Solutions”

The continuously increasing technical demands placed by the electronics industry on electronic and electrical devices has 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 very good performance, stability and durability over the long term. Heat sinks, cooling plates and ventilators are often used to dissipate the heat and reduce the temperature of the electrical circuits to a minimum.

The thermal coupling of suitable heat 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.

What is KERATHERM®

KERATHERM® are highly flexible products comprising thermally conductive and electrically insulating single or multicomponent polymers filled with ceramic or heat conducting materials.

KERATHERM®, when mechanically reinforced by the incorporation of fiberglass or other materials, offers the user a versatile product that is superior in many aspects 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 the thermal compounds still frequently used, KERATHERM® does not dry out during continuous use hence 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® facilitates component mounting thanks to their self-adhesive properties.

An optionally available single-sided adhesive coating also allows long term attachment, even up-side down.

KERATHERM® Products

KERATHERM® **Standard Films white, green, pink, red, brown and the MT-films** 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 smooths out microscopic irregularities in the contact surfaces which improves the thermal interface and therefore increases the heat dissipation.The MT-films are new developed thermoplastic elastomere films with very good insulating behaviour and excellent mechanical and thermal characteristics.

KERATHERM® **Silicone-free Standard Films** are used wherever the use of silicone can lead to problems. Besides good thermal and outstanding electrical properties, these films are characterized by their good cut-through resistance.

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

KERATHERM® **Phase-Change-Elastomer** films do not consist of wax material. Because of there outstanding phase changing characteristics these special elastomers are also suitable for the automatic production - easy automatic assembly.

KERATHERM® **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 and thereby improve the contact between the surfaces and increase the heat transfer.

KERATHERM® **Softtherm®** is the ideal material for smoothing out even large component irregularities. Thanks to their outstanding compressibility, they produce an optimum thermal contact at the same time being electrically insulating. The supplied thicknesses range from 0.5 - 5.0 mm. Other thicknesses or shapes are available on request.

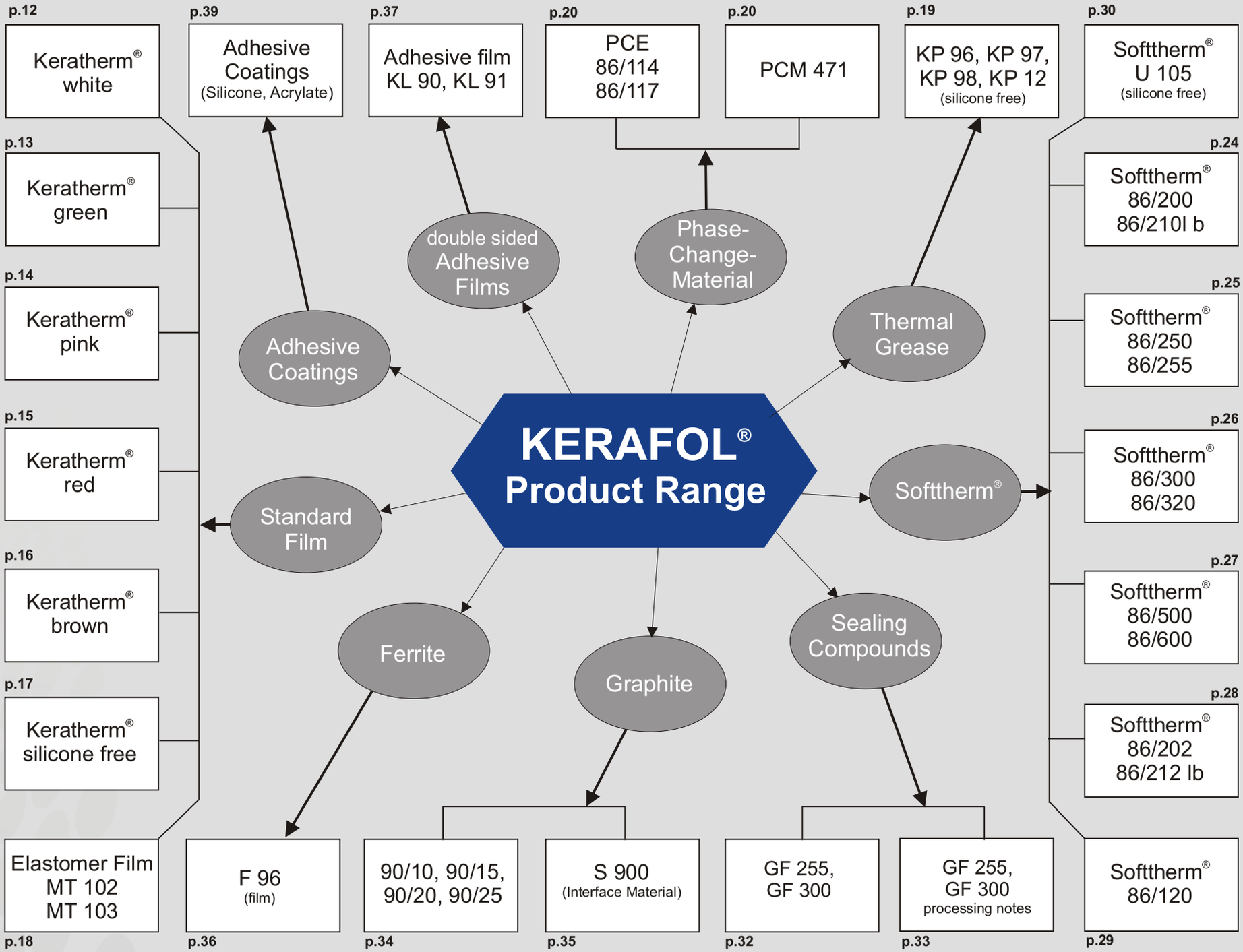
KERATHERM® **Sealing Compounds** can be used for encapsulating whole applications and dispensing housing lids or heat sinks. Thanks to its ease-of-use, it allows even the most complicated geometries to be encapsulated.

KERATHERM® **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.

KERATHERM® **Ferrite F 96 Film** comprises soft ferrite and, on account of its good magnetic properties, is especially suitable for electromagnetic shielding, flexible coils or other magnetic applications.

KERATHERM® **Adhesive Films KL 90** und **KL 91** are thermal conducting, electrical isolating double sided adhesive films. They have an excellent, permanent adhesive strength with high thermal conductivities and at the same time very good insulation characteristics.

KERATHERM® **Adhesive Coating**: every film type requires its own special adhesive system. Besides flexible adhesives with low adhesive strength, Kerafol® offers adhesives with high adhesive strength or with various fillings for improved heat transfer.


KERAFOL®
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double sided Adhesive Films
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Thermal Grease
Softtherm®
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KERATHERM® - Characteristics of different Thermal Management Material

Characteristics of Thermal Films

· very good mechanical strength	from 2.0 to 20.0 N/mm²
· very good electrical insulation	up to 26 kV/mm
· very good thermal conductivity	up to 8.0 W/mK
· very good flexibility and temperature resistance	from -60 to +250 °C
· low hardness thereby low contact pressure	starting at 60 Shore A

Characteristics of Softtherm®

· low hardness	starting at 10 Shore 00
· very good compressibility (youngs modulus)	starting at 138 N/cm²
· very good dielectric properties	starting at 10 kV/mm
· high thermal conductivity	up to 6.0 W/mK
· very good resilience	

Characteristics of Thermal Compounds (silicone basis)

· elastic to very inelastic behaviour	starting at 10 Shore 00
· high temperature resistance	up to 200 °C
· very good thermal conductivity	up to 5.0 W/mK
· low shrinkage	
· very good resistance to wetness, buck, acid and chemicals	
· sealing of complicated geometries and components	
· ferrite sealing compounds for EMC-applications	

Characteristics of Phase Change Materials

· very low thermal resistance	R_{th} at 0.05 K/W
· electrical insulating	E_d 5.0 kV/mm
· very good compressibility	up to 80%
· single sided adhesive	

KERATHERM® - Specific Values and Characteristics

KERATHERM® Standard Films

film		thermal conductivity W/mK	thermal resistance K/W	breakdown voltage kV	measured thickness mm	hard-ness Shore A	characteristics	page
86/83	Kertherm® red with fibre glass	8.0	0.07	1.0	0.250	50 - 60	highest thermal conductivity	15
86/82	Kertherm® red with fibre glass	6.5	0.09	1.0	0.250	60 - 70	very high thermal conductivity	15
U 90	Keratherm® silicone free	6.0	0.09	4.0	0.200	65 - 75	silicone free, high thermal conductivity	17
86/81	Kertherm® red basic film	5.5	0.10	1.0	0.200	25 - 35	high thermal conductivity	15
86/50	Keratherm® pink basic film	3.5	0.16	1.5	0.225	70 - 80	high thermal conductivity	14
86/30	Keratherm® white basic film	2.5	0.22	1.5	0.225	70 - 80	good thermal conductivity / isolation	12
U 80	Keratherm® silicone free	1.8	0.20	4.0	0.150	80 - 90	silicone free	17
86/37	Keratherm® green basic film	1.8	0.35	8.0	0.225	65 - 75	high isolation	13
MT 103	Elastomer-film	1.8	0.39	10	0.280	70 - 80	silicone free, high isolation	18
70/50	Kertherm® brown with fibre glass	1.4	0.44	4.0	0.250	80 - 90	good price-performance-ratio	16
U 23	Keratherm® silicone free	1.2	0.52	9.0	0.250	80 - 90	silicone free	17
MT 102	Elastomer-film	1.1	0.53	10	0.250	65 - 75	silicone free, high isolation	18

KERATHERM® PCM, PCE, Thermal Grease

film		thermal conductivity W/mK	thermal resistance K/W	dielectric breakdown kV/mm	measured thickness mm	characteristics	page
KP 12	silicone free thermal compound	10.0	0.006	conductive	0.025	silicone free	19
PCM 471	filled hot setting wax	4.0	0.07	5.0	0.200	easy handling	20
KP 98	ceramic filled silicone component	6.0	0.01	conductive	0.025	silicone based, low thermal resistance	19
KP 97	ceramic filled silicone component	5.0	0.012	conductive	0.025	silicone based	19
PCE 86/114	thermoplastic silicone elastomer	4.0	0.15	5.0	0.250	equated softening interval, good compressibility, low thermal resistance	20
PCE 86/117	thermoplastic silicone elastomer	3.0	0.06	4.0	0.250	equated softening interval, good compressibility, low thermal resistance	20
KP 96	ceramic filled silicone component	2.4	0.038	conductive	0.035	no drying out, very thin to apply	19

KERATHERM® - Softtherm®

film		thermal conductivity W/mK	thermal resistance K/W	breakdown voltage kV	measured thickness mm	hard-ness Shore 00	characteristics	page
86/600	Softtherm® highest thermal conductivity	6.0	0.20	1.5	0.5	60 - 70	highest thermal conductivity	27
86/500	Softtherm® highest thermal conductivity	5.0	0.25	1.0	0.5	70 - 80	high thermal conductivity	27
86/300	Softtherm® highest thermal conductivity	3.0	0.41	8.0	0.5	60 - 70	flexible, high thermal conductivity	26
86/320	Softtherm® film highly filled, very soft	2.5	0.50	5.0	0.5	30 - 35	very soft, good dielectric properties	26
86/255	Softtherm® high thermal conductiviy	2.0	0.85	10.0	0.5	30 - 40	soft, high thermal conductivity	25
86/120	Softtherm® copolymer	1.5	0.83	4.0	0.5	30 - 45	easy to compress, good compressibility	29
86/202	Softtherm® low cost	1.4	0.90	2.5	0.5	20 - 30	good price-performance-ratio	28
86/212 lb	Softtherm® low cost	1.4	0.90	2.0	0.5	25 - 35	low bleeding behaviour	28
86/250	Softtherm® average thermal conductiviy	1.3	0.95	8.0	0.5	45 - 55	soft, average thermal conductivity	25
U 105	Softtherm® Ethylen-Copolymer	1.3	0.96	8.0	0.5	60 - 70	good compressibility	30
86/200	Softtherm® standard	1.0	1.5	8.0	0.5	10 - 20	soft, highly compressible	24
86/210 lb	Softtherm® standard	1.0	1.5	8.0	0.5	15 - 25	low bleeding behaviour	24

KERATHERM® - Specific Values and Characteristics

KERATHERM® Thermal Compounds

film		thermal conductivity W/mK	viscosity Pas	dielectric breakdown kV/mm	density g/ml	hard-ness Shore 00	characteristics	page
GF 300	2-component silicone elastomer	3.0	60 - 85	1.0	1.9	40 - 55	good compressibility	32
GF 255	2-component silicone elastomer	1.5	35 - 55	1.5	1.7	10 - 25	very good compressibility	32

KERATHERM Graphite Films

film		thermal conductivity W/mK	thermal resitance K/W	breakdown voltage kV	thickness mm	hard-ness Shore D	charcteristics	page
S 900	highly compressed Graphite film	7.5	0.08	not insulating	0.290	25 - 35	highest thermal conductivity	35
90/25	Keratherm® Graphite film	7.0	0.05	not insulating	0.125	25 - 35	very good thermal conductivity	34
90/10	Keratherm® Graphite basic film	5.5	0.09	not insulating	0.200	25 - 35	good thermal conductivity	34

90/15 and 90/20: Graphite films with adhesive coating

KERATHERM® Ferrite Film

film		thermal conductivity W/mK	thermal resitance K/W	dielectric breakdown kV/mm	thickness mm	hard-ness Shore A	application	page
F 96	thermal conductive film from soft-magnetic ferrite	1.0	0.56	1.0	0.225	82	for electromagnetic absorbtion	36

KERATHERM® Adhesive Film

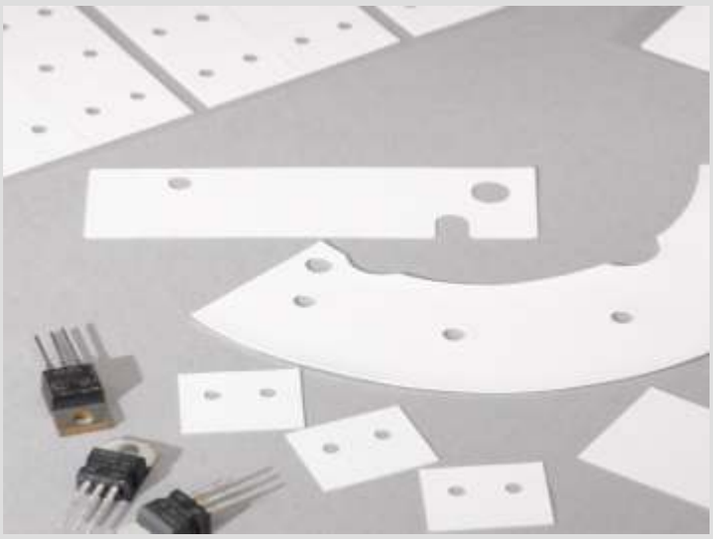
film		thermal conductivity W/mK	thermal resitance K/W	dielectric breakdown kV/mm	thickness mm	hard-ness Shore A	characteristics	page
KL 90	thermal conductive adhesive film without fibre glass	1.4	0.52	10.0	0.300	45	thermal conducting and isolating adhesive film	37
KL 91	thermal conductive adhesive film with fibre glass	1.35	0.55	10.0	0.300	59	thermal conducting and isolating adhesive film	37

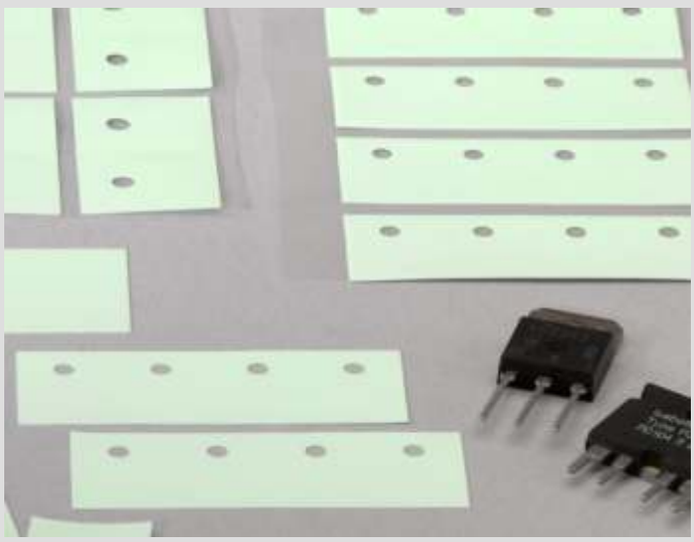
KERATHERM® Standard Films cost effective standard solutions

KERATHERM® standard films are flexible and consist of a silicone elastomer filled with various thermally conductive ceramic materials. All film types are electrically insulating. For increased mechanical strength, the films are also available with fibre glass 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. All KERATHERM® standard films are UL tested.





Properites

- good insulation properties
- heat-conducting
- good compressibility
- fully crosslinked
- flexible
- environmental friendly
- RoHS conform

Benefits

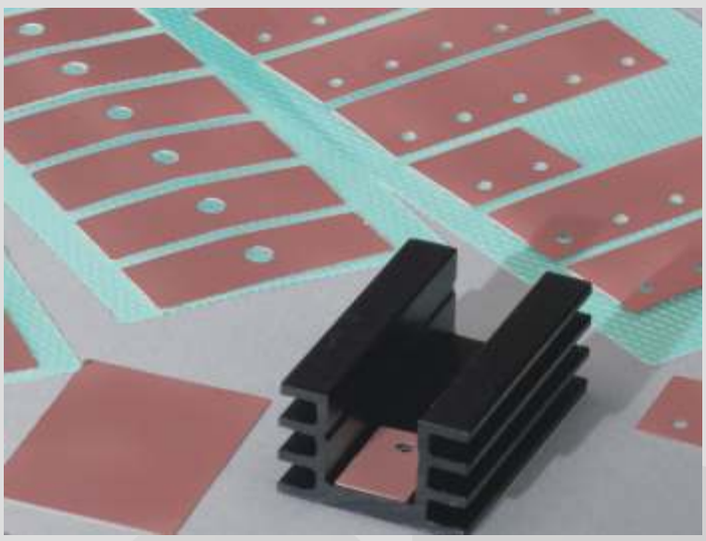
- smooth surface
- very good properties even at very low contact pressure
- low hardness
- high self-adhesion
- UL listed

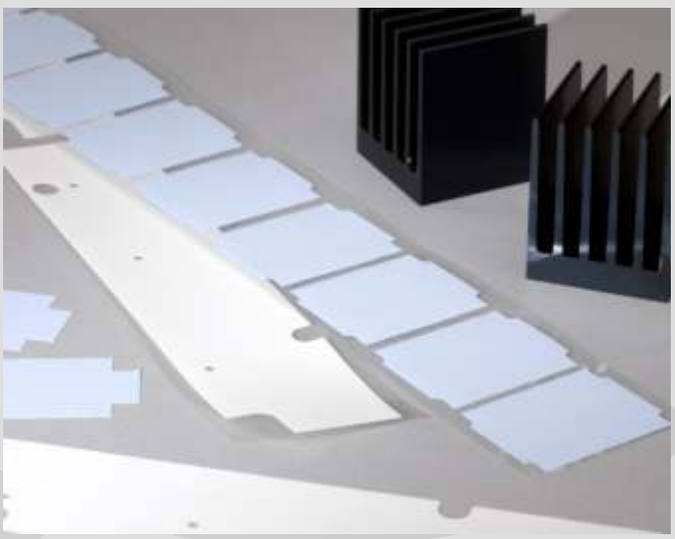
Film Options

- optional single-sided adhesive coating
- special thicknesses available
- can be supplied on roll or already punched
- fibre glass reinforcement available

Applications

- power supplies
- automotive, engine controllers
- LCD displays
- white goods
- audio- and video components
- power converters





KERAFOL®
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Keratherm® - white
Standard Films

Applications:

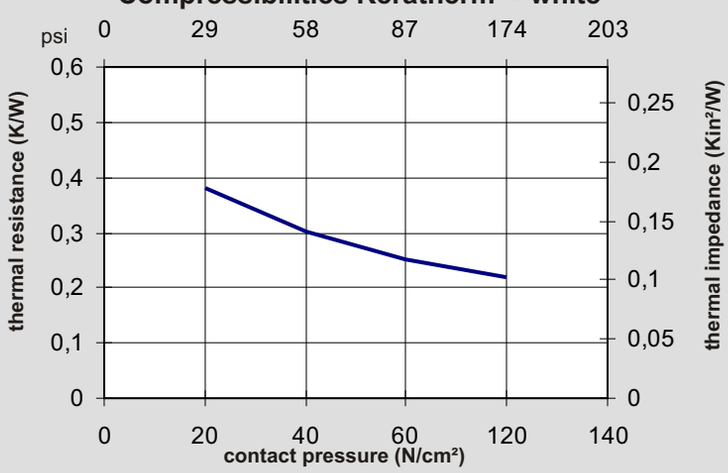
- Power supplies
- Audio- and video components
- White Goods
- Power Converters (AC-DC, DC-DC)
- Engine controllers

Properties	Unit	86/30 basic film
Colour		white
Thermal properties		
Thermal resistance R_{th}	K/W	0.22
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	90 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	1	2.2×10^{-2}
Dielectric constant ε_r	1	3.0
Mechanical properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	70 - 80
Tensile strength	N/mm²	2.0
Elongation	%	31
Physical properties		
Application temperature	°C	-60 to +250
Density	g/cm³	2.33
Flame rating	UL	94V-0
Possible thickness*	mm	0.125 – 0.500

*details see page 44

The highly thermal conductive white group, with its well-balanced thermal, electrical and dielectric behaviour, is created by filling a silicone elastomer base with aluminum oxide. An increase in mechanical strength can be achieved by fibre glass reinforcement. Both unreinforced and reinforced film types can optionally be supplied with an adhesive coating. In general however, the very good self-adhesion of the film will be sufficient for most mounting required.

Compressibilities Keratherm® - white



Options for Keratherm® -white

Type	Film structure	Overall thickness mm	Tensile strength N/mm²	Thermal resistance K/W	Thermal resistance Kin²/W
86/10	86/30 with fibre glass	0.225	15	0.30	0.15
86/20	86/30 with fibre glass and adhesive coating	0.250	15	0.49	0.19
86/40	86/30 with adhesive coating	0.250	2.0	0.37	0.17

Keratherm® - green
Standard Films

Applications:

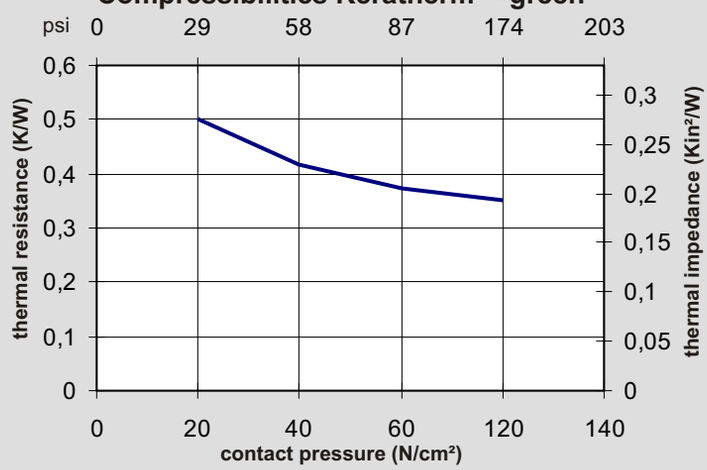
- Automotives
- Telecommunication units
- High voltage units
- DC-DC converters

Properties	Unit	86/37 basic film
Colour		green
Thermal properties		
Thermal resistance R_{th}	K/W	0.35
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	125 0.19
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
Volume resistivity	Ωm	2.5×10^{11}
Dielectric loss factor tan δ	1	6.0×10^{-3}
Dielectric constant ε_r	1	2.9
Mechanical properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	65 - 75
Tensile strength	N/mm²	3.0
Elongation	%	75
Physical properties		
Application temperature	°C	-60 to +250
Density	g/cm³	2.29
Flame rating	UL	94V-0
Possible thickness*	mm	0.125 – 0.500

*details see page 44

This silicone elastomer film is characterized by its excellent electrical characteristics. It exhibits good thermal behaviour. Optional fibre glass 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. Adhesive coatings are available.

Compressibilities Keratherm® - green



Options for Keratherm® -green

Type	Film structure	Overall thickness mm	Tensile strength N/mm²	Thermal resistance K/W	Thermal resistance Kin²/W
86/17	86/37 with fibre glass	0.225	15	0.59	0.23
86/27	86/37 with fibre glass and adhesive coating	0.250	15	0.61	0.26
86/47	86/37 with adhesive coating	0.250	3.0	0.56	0.20

Keratherm® - pink
Standard Films

Applications:

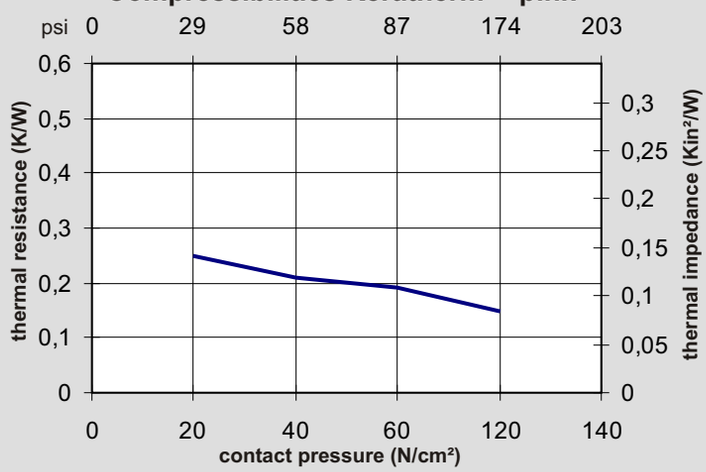
- Automotives
- Audio and video components
- White Goods
- Power converters (AC-DC, DC-DC)
- Engine controllers
- LCD displays

Properties	Unit	86/50 basic film
Colour		pink
Thermal properties		
Thermal resistance R_{th}	K/W	0.16
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	64 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	1	6.7×10^{-2}
Dielectric constant ε_r	1	2.3
Mechanical properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	70 - 80
Tensile strength	N/mm²	2.0
Elongation	%	25
Physical properties		
Application temperature	°C	-60 to +250
Density	g/cm³	1.97
Flame rating	UL	94V-0
Possible thickness*	mm	0.125 – 0.500

*details see page 44

Keratherm®- pink has 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 fibre glass reinforcement and with or without adhesive coating. The excellent thermal resistance of this film enables the optimum heat transfer to the heat sink.

Compressibilities Keratherm® - pink



Options for Keratherm® -pink

Type	Film structure	Overall thickness mm	Tensile strength N/mm²	Thermal resistance K/W	Thermal resistance Kin²/W
86/51	86/50 with adhesive coating	0.250	2.1	0.25	0.13
86/52	86/50 with fibre glass	0.225	15	0.28	0.14
86/53	86/50 with fibre glass and adhesive coating	0.250	15	0.31	0.15

Keratherm® - red
Standard Films

Applications:

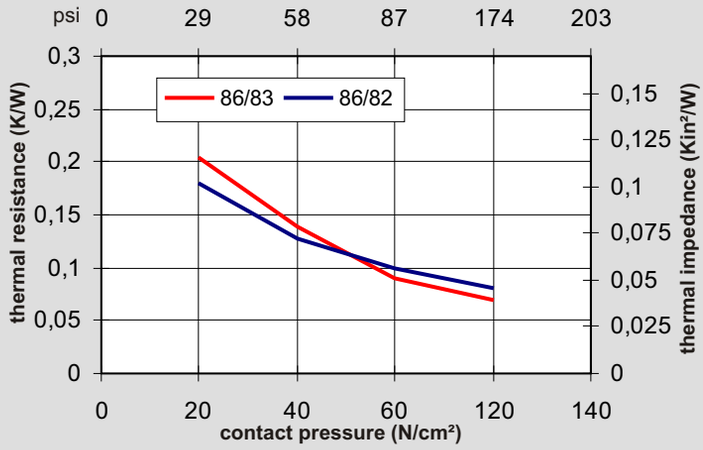
- "High End" solutions
- Controll boards
- BGA applications
- Hard-disc-drives

Properties	Unit	86/81	86/82 with fibre glass	86/83 with fibre glass
Colour		red/brown	red	red
Thermal properties				
Thermal resistance R_{th}	K/W	0.10	0.09	0.07
Thermal impedance R_{ti}	°Cmm²/W	39	35	31,2
	Kin²/W	0.07	0.05	0.04
Thermal conductivity λ	W/mK	5.5	6.5	8.0
Electrical properties				
Breakdown voltage $U_{d;\ ac}$	kV	1.0	1.0	1.0
Dielectric breakdown $E_{d;\ ac}$	kV/mm	4.0	4.0	4.0
Volume resistivity	Ωm	2.0×10^{14}	2.0×10^{14}	5.9×10^{15}
Dielectric loss factor tan δ	1	1.9×10^{-3}	1.4×10^{-3}	3.0×10^{-2}
Dielectric contant ε_r	1	2.3	2.4	1.83
Mechanical properties				
Measured thickness (+/-10%)	mm	0.200	0.250	0.250
Hardness	Shore A	25 - 35	60 - 70	50 - 60
Tensile strength	N/mm²	0.6	20	10
Elongation	%	20	2	2
Physical properties				
Application temperature	°C	-40 to +200		
Density	g/cm³	1.36	1.23	1.10
Flame rating	UL	-	94-V0	-
Possible thickness*	mm	0.15 – 0.25	0.25 – 0.5	0.25 – 0.5

***details see page 44**

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

Compressibilities Keratherm® - red 86/82, 86/83



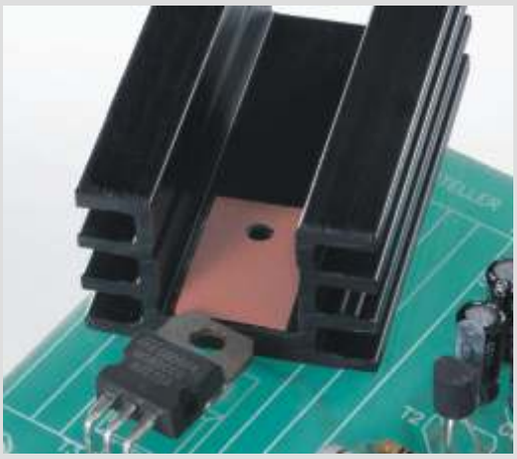
Options for Keratherm® -red

Type	Film structure	Overall thickness mm	TML Ma.-%	Tensile strength N/mm²	Thermal resistance K/W	Thermal resistance Kin²/W
86/82lb	86/82 with fibre glass as low bleeding	0.250	**< 0.29**	10	0.14	0.09

Keratherm® - brown
Standard Films

Applications:

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

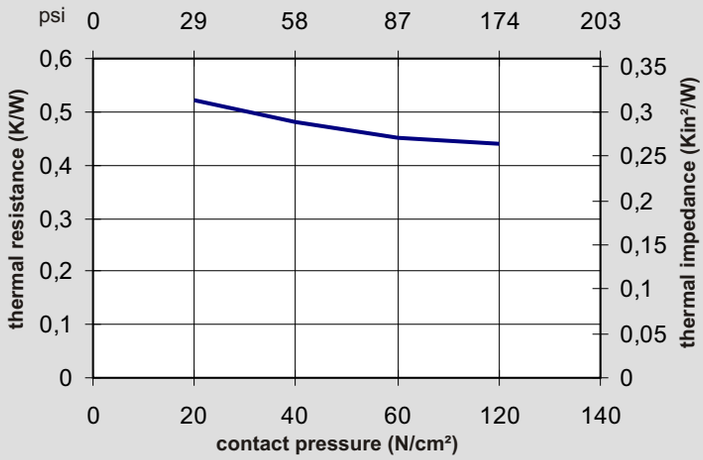


Properties	Unit	70/50 with fibre glass
Colour		brown
Thermal properties		
Thermal resistance R_{th}	K/W	0.44
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	178 0.27
Thermal conductivity λ	W/mK	1.4
Electrical properties		
Breakdown voltage $U_{d;\,ac}$	kV	4.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	16
Volume resistivity	Ωm	1.0×10^{13}
Dielectric loss factor tan δ	1	7.3×10^{-3}
Dielectric constant ε_r	1	3.6
Mechanical properties		
Measured thickness (+/-10%)	mm	0.250
Hardness	Shore A	80 - 90
Tensile strength	N/mm²	10
Elongation	%	5
Physical properties		
Application temperature	°C	-40 to +200
Density	g/cm³	2.18
Flame rating	UL	94V-1
Possible thickness*	mm	0.250 – 0.500

*details see page 44

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 has very good thermal resistance with a high insulation capacity at low mounting pressures.

Compressibilities Keratherm® - brown



Options for Keratherm® -brown

Type	Film structure	Overall thickness mm	Tensile strength N/mm²	Thermal resistance K/W	Thermal resistance Kin²/W
70/60	70/50 with reinforcement and adhesive coating	0.275	10	0.52	0.34

Keratherm® - silicone-free
Standard Films

Applications:

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

Optional available with adhesive coating!

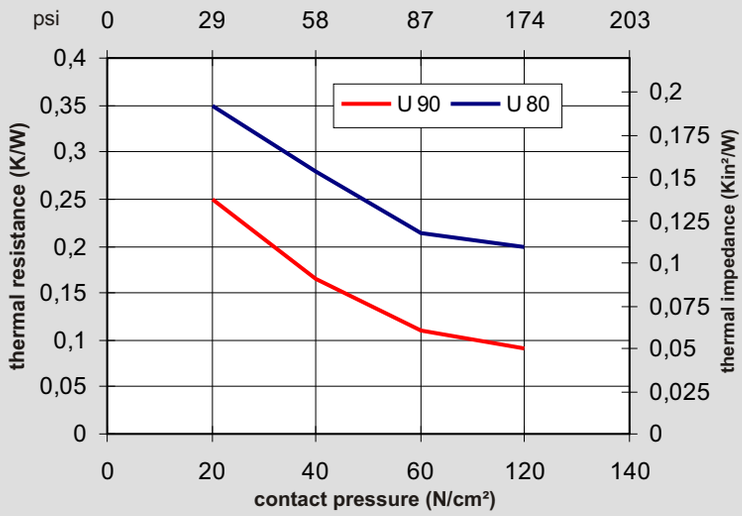
Properties	Unit	U 23	U 80	U 90
Colour		white	blue	light blue
Thermal properties				
Thermal resistance R_{th}	K/W	0.52	0.20	0.09
Thermal impedance R_{ti}	°Cmm²/W	208	73	32.9
	Kin²/W	0.32	0.11	0.05
Thermal conductivity λ	W/mK	1.2	1.8	6.0
Electrical properties				
Breakdown voltage $U_{d;\ ac}$	kV	9.0	4.0	4.0
Dielectric breakdown $E_{d;\ ac}$	kV/mm	> 30	25	25
Volume resistivity	Ωm	4.9×10^{11}	1.44×10^{14}	2.0×10^{11}
Dielectric loss factor tan δ	1	8.0×10^{-2}	13.0×10^{-3}	13.7×10^{-3}
Dielectric contant ε_r	1	1.7	3.2	3.10
Mechanical properties				
Measured thickness (+/-10%)	mm	0.250	0.150	0.200
Hardness	Shore A	80 - 90	80 - 90	65 - 75
Tensile strength	N/mm²	5.0	3.0	2.5
Elongation	%	250	130	150
Physical properties				
Application temperature	°C	-40 to +90	-40 to +125	
Density	g/cm³	1.36	2.26	1.46
Flame rating	UL	-	-	-
Possible thickness*	mm	0.125 – 0.3	0.15 – 0.3	0.1 – 0.3

*details see page 44

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.

Compressibilities Keratherm® - silicone-free U 80, U 90



Keratherm® - MT-Films
MT 102, MT 103

Applications:

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

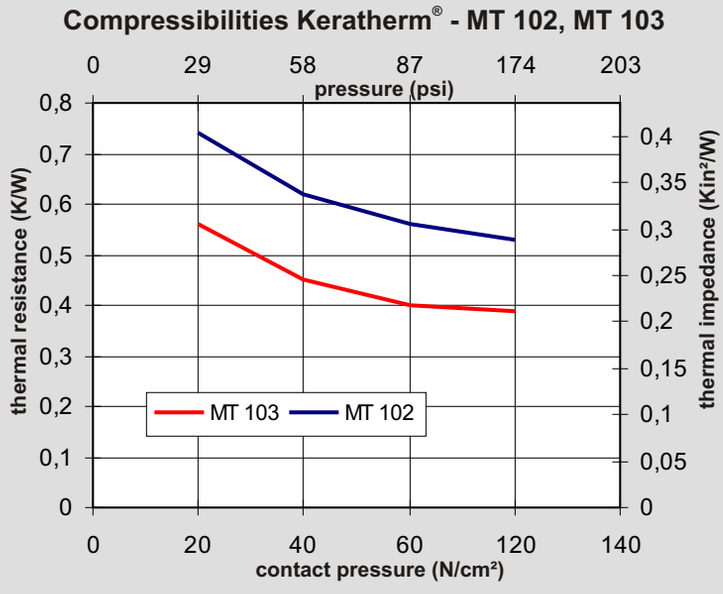
Advantages:

- very good mechanical properties
- very good insulating properties
- silicone free

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 Kin²/W	212 0.29	156 0.21
Thermal conductivity λ	W/mK	1.1	1.8
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	10	10
Dielectric breakdown $E_{d;\,ac}$	kV/mm	>30	>30
Volume resistivity	Ωm	2.2×10^{10}	4.7×10^{10}
Dielectric loss factor tan δ (1kHz)	1	1.0×10^{-3}	1.0×10^{-3}
Dielectric constant ε_r (1kHz)	1	2.68	2.61
Mechanical properties			
Measured thickness (+/-10%)	mm	0.250	0.280
Hardness	Shore A	65 - 75	70 - 80
Tensile strength	N/mm²	2	2
Elongation	%	> 1000	> 200
Physical properties			
Density	g/cm³	1.87	1.88
Application temperature	°C	-40 to +125	-40 to +125
Flame rating	UL	94V-0	94V-0
Possible thickness*	mm	0.250	0.280

*details see page 44

Thermoplastic elastomer tape with very good isolating behaviour and excellent mechanical properties with at the same time good thermal characteristics.



Delivery forms:

Bulk good, optional with single sided adhesive coating
On rolls only with adhesive

Keratherm® - Thermal Grease

KP 96, KP 97, KP 98, KP 12 (silicone free)

Applications:

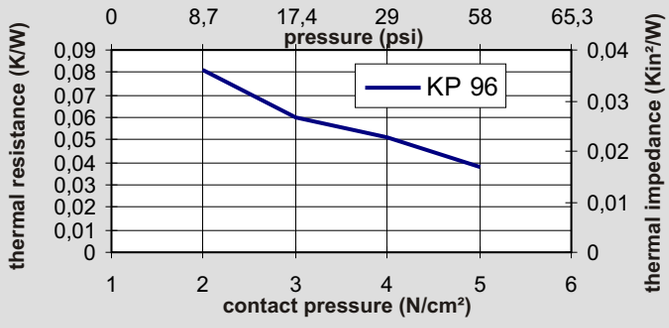
- Notebooks
- Desktop CPU´s
- IGBT Units

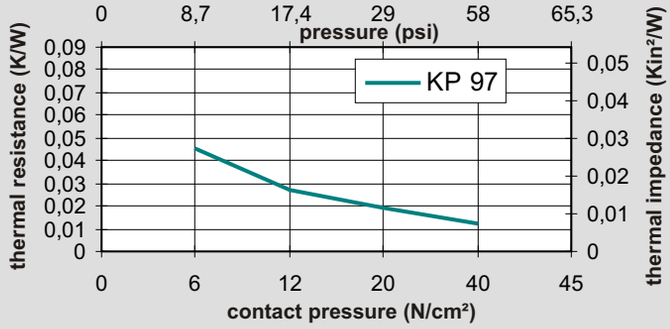
Technical data for KP 77, KP 92 on request!

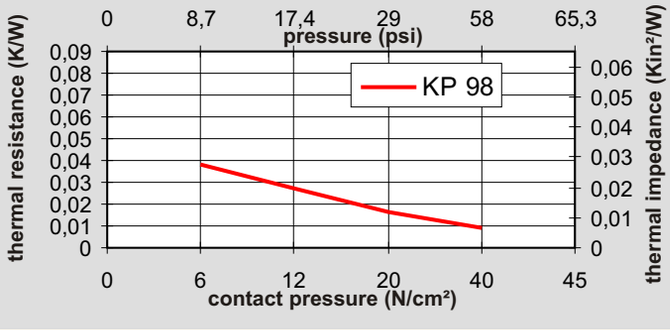
Properties	Unit	KP 96	KP 97	KP 98	KP 12 silicone free
Colour		dark white	white	grey	silver
Copound		soft / pasty			
Thermal properties					
Thermal resistance R_{th}	K/W	0.038	0.012	0.01	0.006
Thermal impedance	°Cmm²/W KIN²/W	11 0.017	4,5 0.007	4,1 0.0064	2,2 0.0033
Thermal conductivity λ	W/mK	2.4	5.0	6.0	10.0
Elektrical properties					
Dielectric breakdown $E_{d;\,ac}$	kV/mm	conductive			
Mechanical properties					
Measured thickness (+/-10%)	mm	0.035	0.025	0.025	0.025
Viscosity	Pas	25 - 35	90 - 120	110 - 130	60 - 90
Density	g/cm³	2.6	2.1	2.2	1.4
Application temperature	°C	-60 to +150		-60 to +150	
TML	Ma.%	< 1.4	< 1.3	< 1.5	< 0.1
Long term stability (1000h / 85°C / 85% relative humidity)					
Thermal resistance R_{th}	K/W	0.038	0.012	0.008	0.006

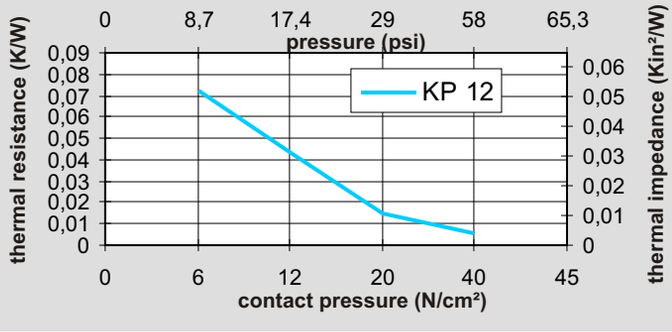
Keratherm® Thermal Greases are ceramic-filled single-component silicones with a high thermal conductivity. The non-crosslinked thermal compounds do not dry out. The silicone components do not leak out of the compound. The silicone-free thermal compound KP 12 consists of synthetic, thermal polymer and 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 a full operability during the entire life time of the product. Under normal application conditions Keratherm® Thermal Grease does not cure, dry out or melt. Special storage of Keratherm "Thermal Grease" is not required, therefore they can be stored under normal climate conditions for up to 12 months. If any separation of the filler materials becomes evident, the KP´s must be mixed thoroughly before use.

Comparison of the thermal resistance in relation with the contact pressure









Keratherm® - PCE and PCM
PCE 86/114, PCE 86/117, PCM 471

Properties	Unit	86/114	86/117	PCM 471
Colour		grey	grey	grey
Compound		Elastomer	Elastomer	filled hot-setting wax
Thermal properties				
Thermal resistance R_{th}	K/W	0.15	0.06	0.07
Thermal impedance	°Cmm²/W Kin²/W	61 0.089	21.9 0.033	25.6 0.039
Thermal conductivity λ	W/mK	4.0	3.0	4.0
Electrical properties				
Breakdownvoltage $U_{d;\,ac}$	kV	1.2	1.0	1.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	5.0	4.0	5.0
Volume resistivity	Ωm	0.2×10^{10}	3.2×10^{10}	-
Dielectric loss factor tan δ (1kHz)	1	12×10^{-3}	21×10^{-3}	-
Dielectric constant (1kHz)	1	2.0	3.19	-
Mechanical properties				
Measured thickness (+/-10%)	mm	0.250	0.250	0.200
Hardness	Shore	70 – 90 (00)	55 – 75 (00)	70 – 80 (A)
Softening interval	°C	70 - 95	65 - 85	46
Physical properties				
Density	g/cm³	1.25	1.38	1.82
Application temperature	°C	-40 to +125	-40 to +125	-40 to +125
Flame rating	UL	-	94V-0	-
Possible thickness*	mm	0.250	0.250	0,200

***details see page 44**

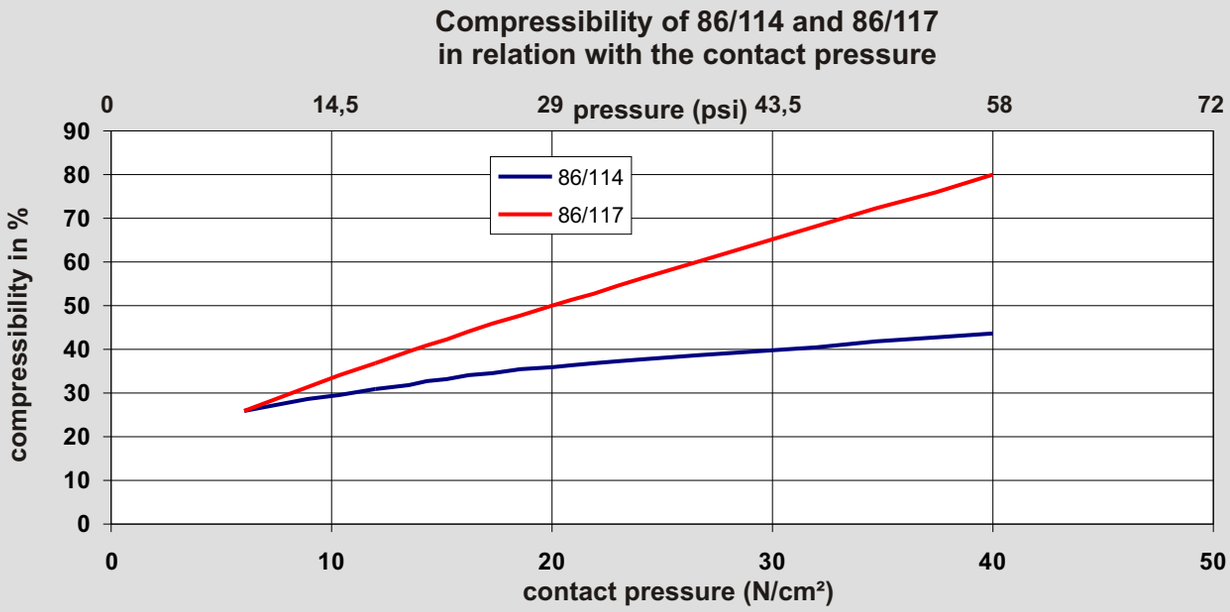
Applications: • Notebooks • Desktop CPU´s • IGBT Units

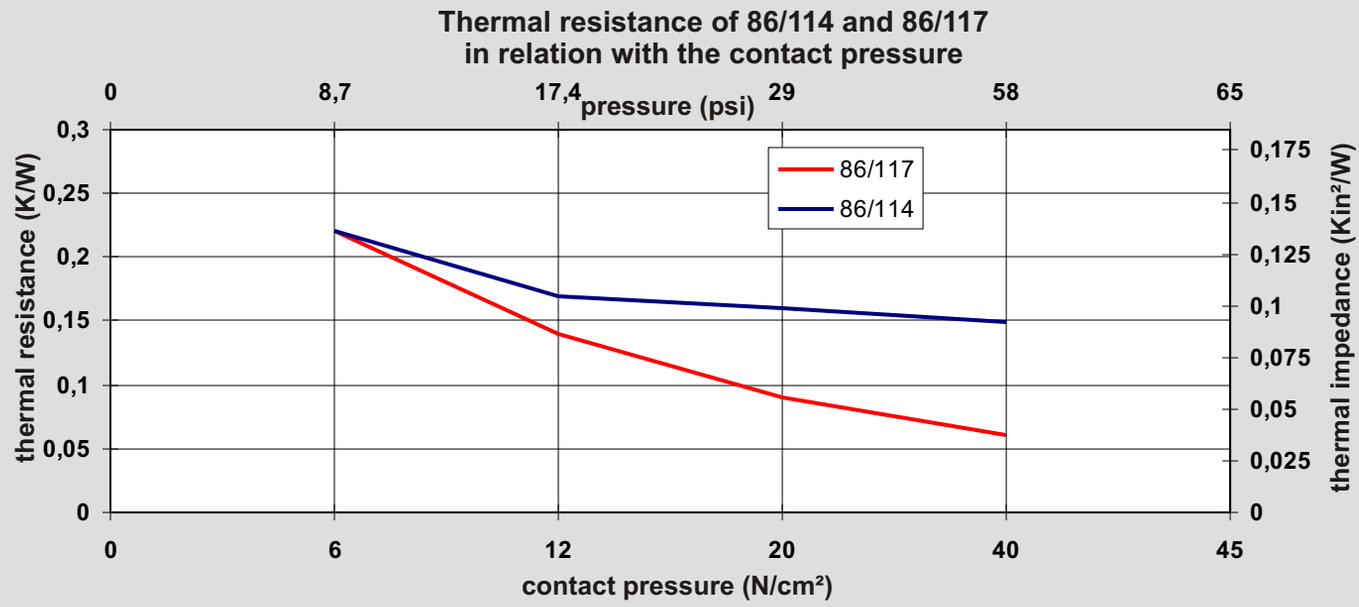
Advantages of PCE-material:

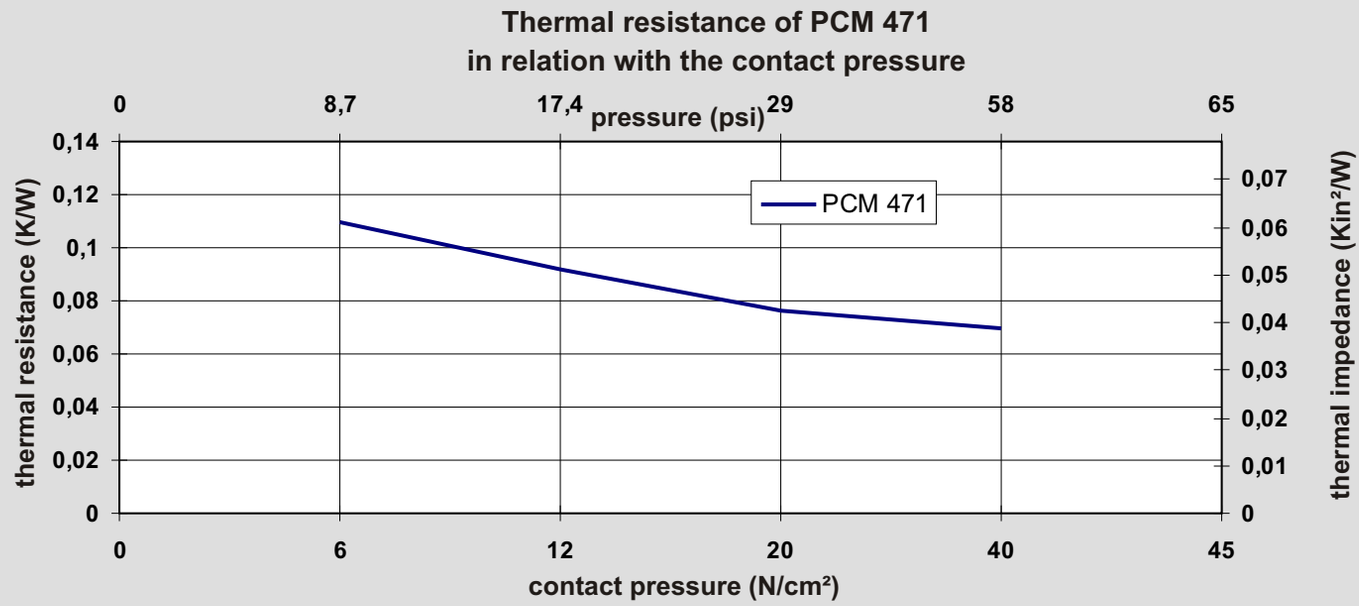
- Very good compressibility
- Phase-change characteristic without containing wax material
- No melting point but softening interval
- Electrical insulating
- Excellent reworkability
- Can be used for automatic production
- Single-sided adhesive
- RoHS / environmently friendly
- Also suitable for dispensing

Advantages of PCM-material:

- combination of hot-melt waxes with or without support
- filling of smallest irregularities between the power module and heat sink
- melts at various temperatures
- improves the contact between the surfaces and increases the heat transfer
- special design for easy use and storage


Compressibility of 86/114 and 86/117
in relation with the contact pressure
0
14,5
29
pressure (psi)
43,5
58
72
90
80
70
60
50
40
30
20
10
0
compressibility in %
86/114
86/117
0
10
20
30
40
50
contact pressure (N/cm²)


Thermal resistance of 86/114 and 86/117
in relation with the contact pressure
0
8,7
17,4
pressure (psi)
29
58
65
0,3
0,25
0,2
0,15
0,1
0,05
0
thermal resistance (K/W)
0,175
0,15
0,125
0,1
0,075
0,05
0,025
0
thermal impedance (Kin²/W)
86/117
86/114
0
6
12
20
40
45
contact pressure (N/cm²)


Thermal resistance of PCM 471
in relation with the contact pressure
0
8,7
17,4
pressure (psi)
29
58
65
0,14
0,12
0,1
0,08
0,06
0,04
0,02
0
thermal resistance (K/W)
0,07
0,06
0,05
0,04
0,03
0,02
0,01
0
thermal impedance (Kin²/W)
PCM 471
0
6
12
20
40
45
contact pressure (N/cm²)

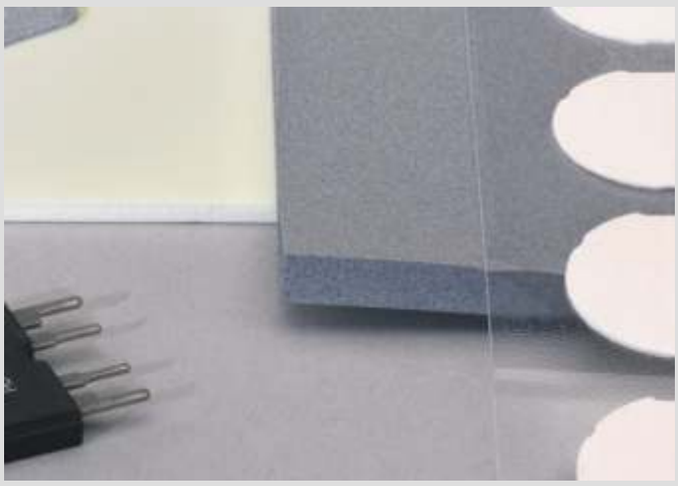
KERATHERM® Softtherm® Films highly elastic and compressible

Keratherm® and Softtherm® sheets are filled and highly elastic. Their good compression behavior and good forming capabilities guarantee that rather large component differences can be compensated for. They are electrically insulating and possess gradual heat conductivity. Depending on the type, the sheets have varying self-adhesive behaviors. These types of sheets should not be compressed beyond 40% of the original thickness, because this increases the possibility of these pads reverse oiling.

Kerafol® offers two types of Softtherm® sheets. One is based on a fiber glass-reinforced carrier sheet, while the other type contains the fiber glass reinforcement directly in the sheet.

Types 86/200, 86/210, 86/255 and 86/250 have a fiber glass-reinforced carrier sheet with very good thermal characteristics. A Softtherm® application guarantees outstanding compressibility and formability. These Softtherm® types can be provided with an adhesive application on the carrier sheet side. These sheets' mounting position 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® sheets 86/202, 86/212, 86/225, 86/300, 86/320, 86/500 and 86/600 are reinforced by fiber glass fabric at thicknesses of 0.5 to 1.0 mm. From a thickness of 1.5 mm, they are also offered without reinforcement. In addition to types 86/202 and 86/212, these sheets can also be offered with an adhesive application as an assembly aid. Other than for those with an adhesive application, for these types of sheets the mounting position need not be specified. Here make sure that the adhesive coating is always applied to the heat sink or the housing.



KERATHERM® - Softtherm®

Properties

- highly flexible tapes
- outstanding flexibility
- graduated thermal conductivity
- good electrical insulation
- high temperature stability

Benefits

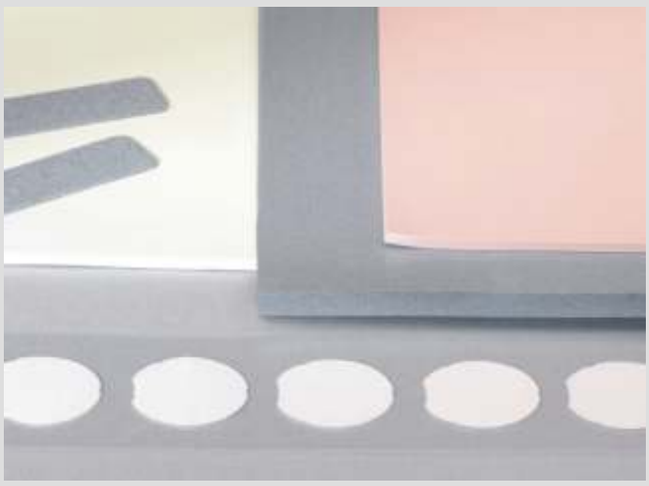
- compensates components size variations
- optimized thermal transition
- good compression behavoiur
- UL-listed

Film Options

- single-sided adhesive surface
- single-sided adhesive coating possible
- can be supplied as sheets or punched

Applications

- RD-RAM memory model
- Heat pipe thermal solutions
- automotive engines
- control units
- plasma supply panels



KERAFOL®
KERAMISCHE FOLIEN GMBH

Keratherm® - Softtherm®
86/200, 86/210 lb

A group of highly elastic, ceramic-filled films. They are characterized by their excellent compressibility, their optimum plasticity with good thermal conductivity and good electrical properties. These films are especially suitable for compensating differences in planarity of the components or pressure-sensitive applications. The film type 86/210lb is also characterized by its optimized outgassing and low bleeding behaviour.

Applications:

- RD-RAM memory modules
- Heat pipe thermal solutions
- Automotive engine
- Control units
- Plasma supply console

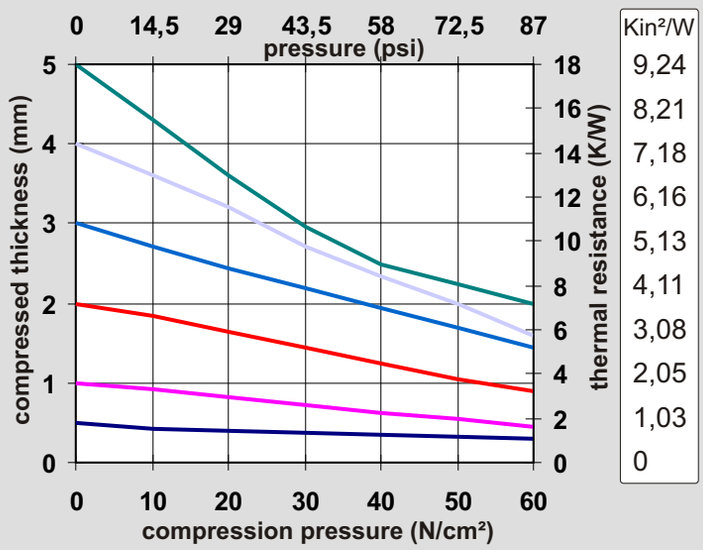
Optional available with adhesive coating!

Properties	Unit	86/200	86/210 lb (low bleeding)
Colour		pink/yellow	pink/yellow
Thermal properties			
Thermal resistance R_{th}	K/W	1.50	1.50
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	500 0.77	500 0.77
Thermal conductivity λ	W/mK	1,0	1.0
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	8.0	8.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	16	16
Volume resistivity	Ωm	1.0×10^{11}	1.0×10^{11}
Dielectric loss factor tan δ	1	1.5×10^{-3}	1.5×10^{-3}
Dielectric constant ε_r	1	3.9	3.9
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	10 - 20	15 - 25
Youngs modulus *	N/cm²	22	77
Physical properties			
Density	g/cm³	1.61	1.62
Application temperature	°C	-60 to +200	-60 to +200
TML	Ma.-%	< 0.40	< 0.24
Flame rating	UL	94V-0	94V-1
Possible thickness**	mm	0.5 – 5.0	0.5 – 5.0

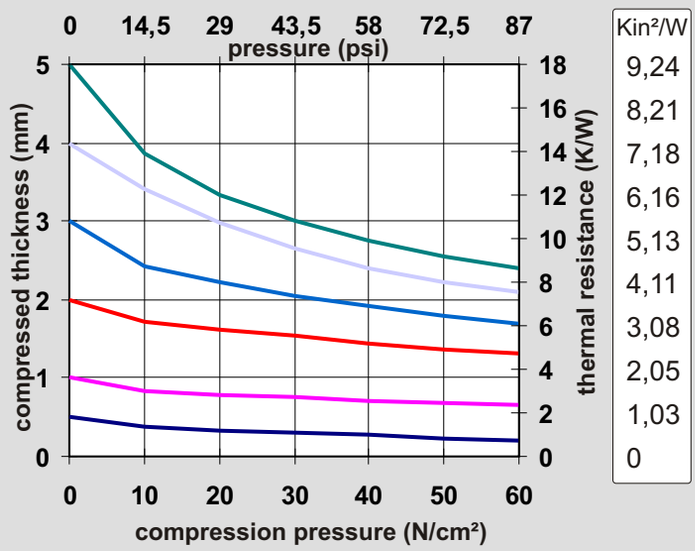
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibilities of Softtherm® 86/200



Compressibilities of Softtherm® 86/210 lb



Keratherm® - Softtherm®
86/250, 86/255

This group of Softtherm® was created as a result of intensive collaboration with our customers. The films are characterized by their high thermal conductivity and the varying levels of hardness of the materials.

Applications:

- RD-RAM memory modules
- Heat pipe thermal solutions
- Automotive engine
- Control units
- Plasma supply console

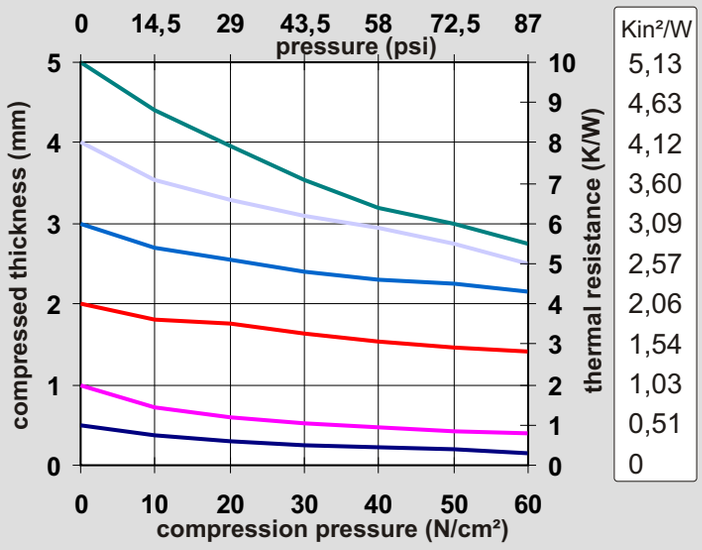
Optional available with adhesive coating!

Properties	Unit	86/250	86/255
Colour		white/red	white/red
Thermal properties			
Thermal resistance R_{th}	K/W	0.95	0.85
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	385 0.6	250 0.39
Thermal conductivity λ	W/mK	1.3	2.0
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	8	10
Dielectric breakdown $E_{d;\,ac}$	kV/mm	16	20
Volume resistivity	Ωm	1.0×10^{11}	1.0×10^{11}
Dielectric loss factor tan δ	1	2.5×10^{-3}	2.5×10^{-3}
Dielectric constant ε_r	1	3.8	3.8
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	45 - 55	30 - 40
Youngs modulus *	N/cm²	15	30
Physical properties			
Density	g/cm³	1.76	1.8
Application temperature	°C	-60 to +200	-60 to +180
TML	Ma.-%	< 0.42	< 0.44
Flame rating	UL	-	94V-1
Possible thickness**	mm	0.5 – 5.0	0.5 – 5.0

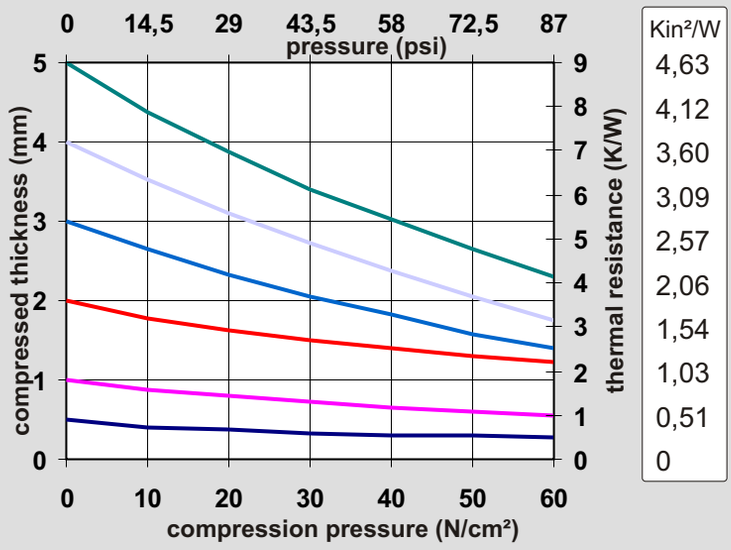
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibilities of Softtherm® 86/250



Compressibilities of Softtherm® 86/255



Keratherm® - Softtherm®
86/300, 86/320

This group of Softtherm® films has a very good thermal behavior. The films are characterized by low thermal resistance and best heat dissipation, as well as good dielectric strength. Good compressibility and low shore hardness ensure reliable and simple processability.

Applications:

- RD-RAM memory modules
- Heat pipe thermal solutions
- Automotive engine
- Control units
- Plasma supply console

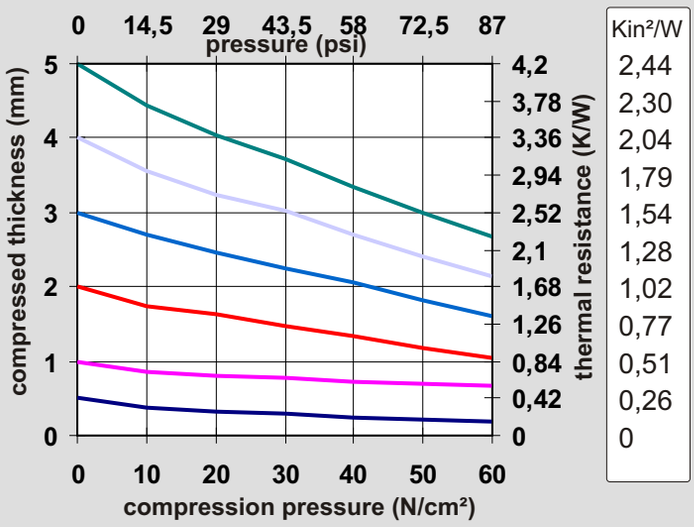
Optional available with adhesive coating!

Properties	Unit	86/300	86/320
Colour		blue	mandarin
Thermal properties			
Thermal resistance R_{th}	K/W	0.41	0.5
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	166 0.25	147 0.23
Thermal conductivity λ	W/mK	3.0	2.5
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	8.0	5.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	16.0	10.0
Volume resistivity	Ωm	1.0×10^{11}	0.68×10^{12}
Dielectric loss factor tan δ	1	5.0×10^{-3}	2.9×10^{-2}
Dielectric constant ε_r	1	3.3	3.4
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	60 - 70	30 - 35
Youngs modulus *	N/cm²	24	32
Physical properties			
Density	g/cm³	1.71	1.69
Application temperature	°C	-60 to +200	-40 to +180
TML	Ma.-%	< 0.35	< 0.46
Flame class	UL	94V-0	-
Possible thickness**	mm	0.5 -5.0	1.0 - 5.0

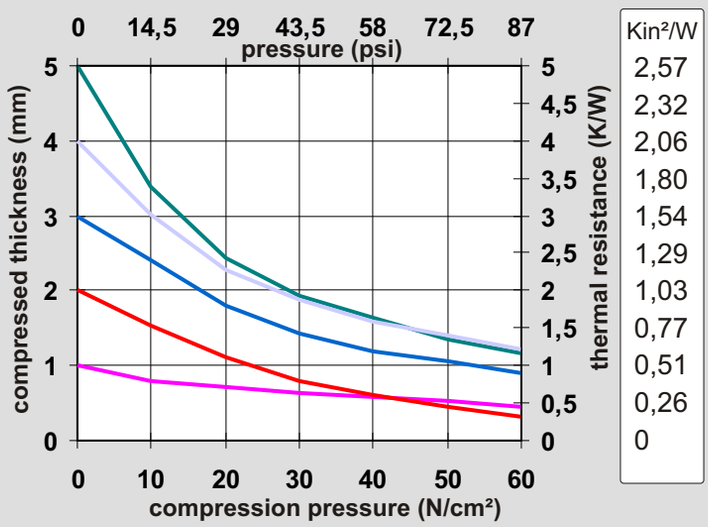
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibilities of Softtherm® 86/300



Compressibilities of Softtherm® 86/320



Keratherm® - Softtherm®
86/500, 86/600

This group of Softtherm® films has the best thermal behavior. The films are characterized by low thermal resistance and best heat dissipation, as well as good dielectric strength. Compressibility and low shore hardness ensure reliable and simple processability.

Applications:

- Heat pipe thermal solutions
- RD-RAM memory modules
- Automotive engine
- Control units
- Plasma supply console

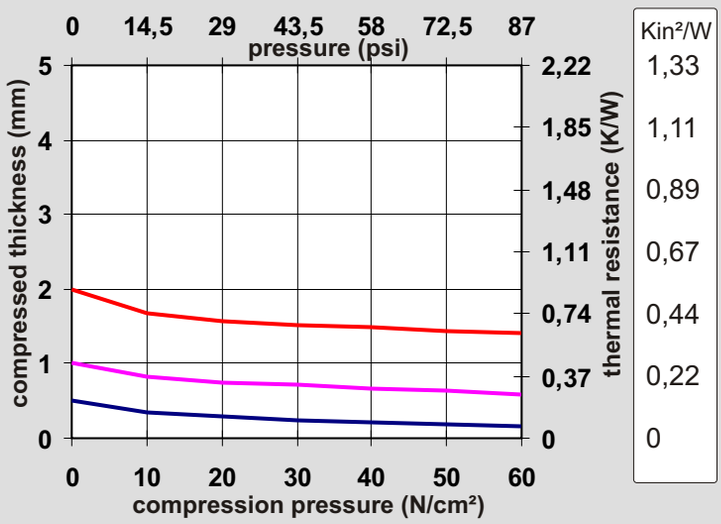
Optional available with adhesive coating!

Properties	Unit	86/500	86/600
Colour		brown	grey
Thermal properties			
Thermal resistance R_{th}	K/W	0.25	0.20
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	100 0.15	80 0.12
Thermal conductivity λ	W/mK	5.0	6.0
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	1	1.5
Dielectric breakdown $E_{d;\,ac}$	kV/mm	2	3
Volume resistivity	Ωm	1.0×10^{11}	1.7×10^{10}
Dielectric loss factor tan δ	1	1.5×10^{-3}	2.0×10^{-3}
Dielectric constant ε_r	1	3.9	2.5
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	70 - 80	60 - 70
Youngs modulus *	N/cm²	70	77
Physical properties			
Density	g/cm³	1.33	1.28
Application temperature	°C	-60 to +200	-60 to +180
TML	Ma.-%	< 0.24	< 0.40
Flame class	UL	-	-
Possible thickness**	mm	0.5 – 2.0	0.5 – 1.5

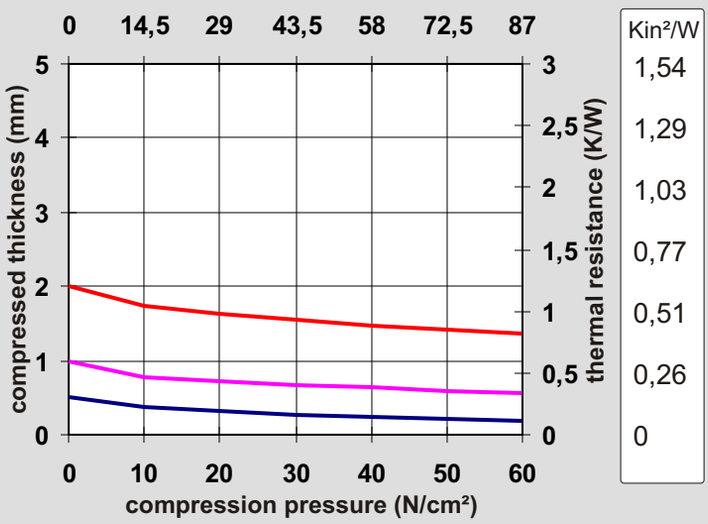
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibilities of Softtherm® 86/500



Compressibilities of Softtherm® 86/600



Keratherm® - Softtherm®
86/202, 86/212

These films offer a cost-effective alternative to the standard films in the Softtherm®- 200 series. The films are characterized by their thermal and electrical properties and good plasticity.

Applications:

- RD-RAM memory modules
- Heat pipe thermal solutions
- Automotive engines
- Control units
- Plasma supply console

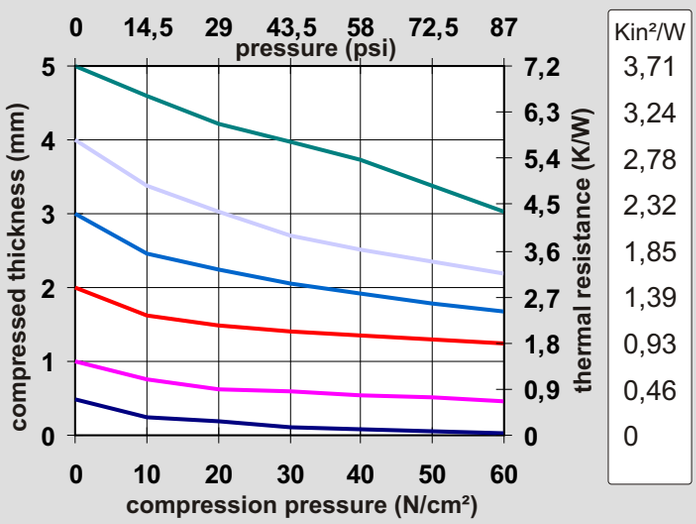
Optional available with adhesive coating!

Properties	Unit	86/202	86/212
Colour		grey	grey
Thermal properties			
Thermal resistance R_{th}	K/W	0.9	0.9
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	357 0.55	357 0.55
Thermal conductivity λ	W/mK	1.4	1.4
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	2.5	2.0
Dielectric breakdown $E_{d;\,ac}$	kV/mm	5	4
Volume resistivity	Ωm	2.7×10^{12}	1.2×10^{15}
Dielectric loss factor tan δ	1	6.0×10^{-3}	4.5×10^{-4}
Dielectric constant ε_r	1	4.2	2.68
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	20 - 30	25 - 35
Youngs modulus *	N/cm²	47	39
Physical properties			
Density	g/cm³	1.46	1.46
Application temperature	°C	-60 to +200	-60 to +200
TML	Ma.-%	< 0.5	< 0.25
Flame rating	UL	94V-0	-
Possible thickness**	mm	0.5 -5.0	0.5 - 5.0

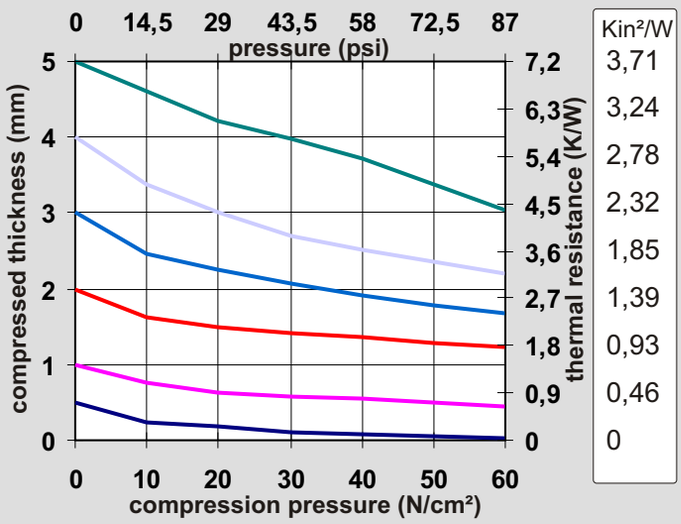
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibilities of Softtherm® 86/202



Compressibilities of Softtherm® 86/212



Keratherm® - Softtherm®
86/120

This Softtherm® material is a good alternative if you are looking for a high insulation, a very good compressibility and a good thermal conductivity.

Applications:

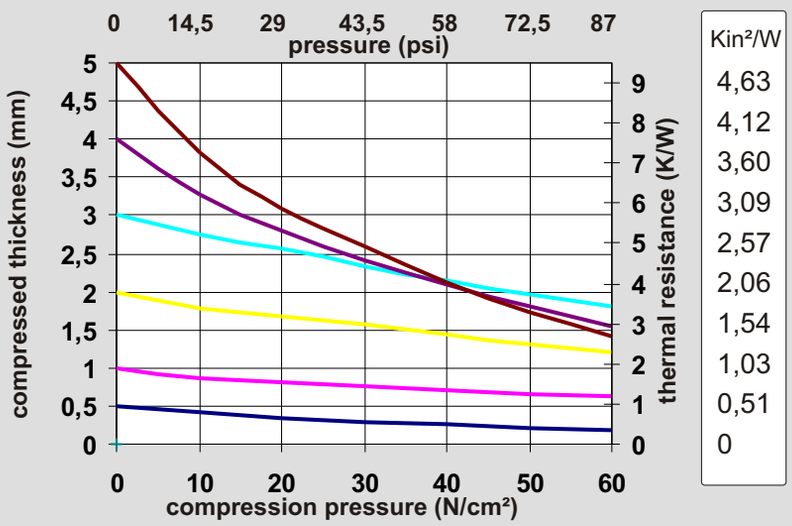
- RD-RAM memory modules
- Heat pipe thermal solutions
- Automotive engines
- Control units
- Plasma supply console

Properties	Unit	86/120
Colour		green
Thermal properties		
Thermal resistance R_{th}	K/W	0.83
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	302 0.47
Thermal conductivity λ	W/mK	1.5
Electrical properties		
Breakdown voltage $U_{d;\,ac}$	kV	4
Dielectric breakdown $E_{d;\,ac}$	kV/mm	8
Volume resistivity	Ωm	1.0×10^{11}
Dielectric loss factor tan δ	1	8.0×10^{-3}
Dielectric constant ε_r	1	3.5
Mechanical properties		
Measured thickness (+/-10%)	mm	0.5
Hardness	Shore 00	30 - 45
Youngs modulus *	N/cm²	111
Physical properties		
Density	g/cm³	2.3
Application temperature	°C	-40 to +150
TML	Ma.-%	< 0.18
Flame rating	UL	-
Possible thickness**	mm	0.5 - 5.0

*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibilities of Softtherm® 86/120



Keratherm® - Softtherm®
U 105

Flexible ceramic thermal conductive and isolating film. Softtherm U 105 is especially designed for silicone sensitive applications and is an alternative material to the silicone based Softtherm films. The U 105 has an excellent electrical isolation and a very good thermal conductivity.

Applications:

- RD-RAM memory modules
- Heat pipe thermal solutions
- Automotive engines
- Control units
- Plasma supply console

Advantages:

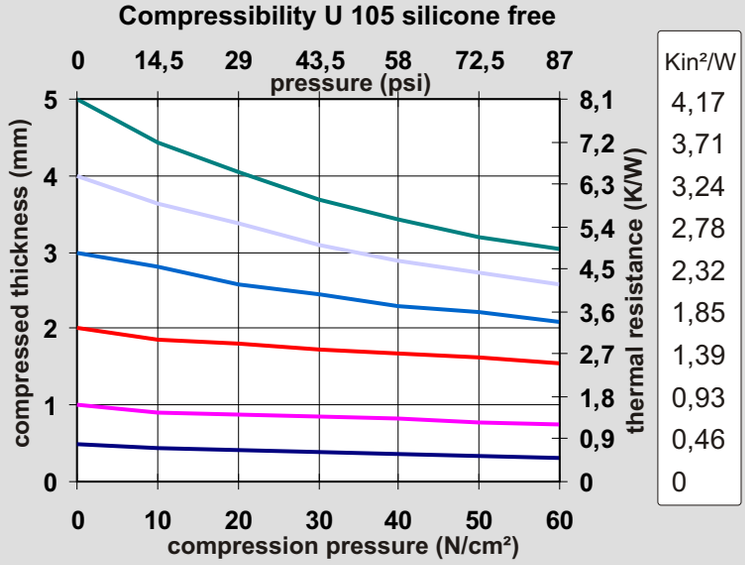
- silicone free
- good compressibility
- high isolation

Properties	Unit	U 105
Colour		brown
Thermal properties		
Thermal resistance (Thickness 0,5 mm)	K/W	0.96
Thermal impedance	°Cmm²/W Kin²/W	351 0.53
Thermal conductivity	W/mK	1.3
Electrical properties		
Breakdown voltage $U_{d;\,ac}$	kV	8
Dielectric breakdown $E_{d;\,ac}$	kV/mm	16
Volume resistivity	Ωm	1.7×10^{10}
Dielectric loss factor tan δ	1	1.3×10^{-2}
Dielectric constant ε_r	1	4.6
Mechanical properties		
Measured thickness (+/-10%)	mm	0.5
Hardness	Shore A	60 - 70
Youngs Modulus*	N/cm²	98
Physical properties		
Density	g/cm³	2.07
Application temperature	°C	-40 to +110
TML	Ma.%	0.55
Flame rating	UL	-
Available thicknesses**	mm	0.5 – 5.0

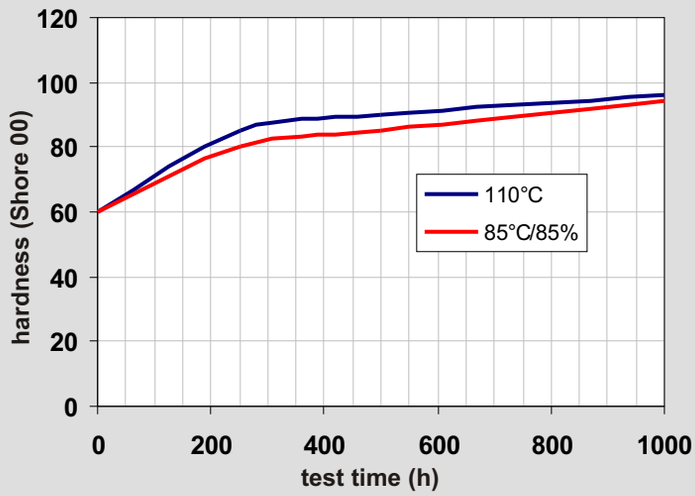
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

**details see page 44

Compressibility U 105 silicone free

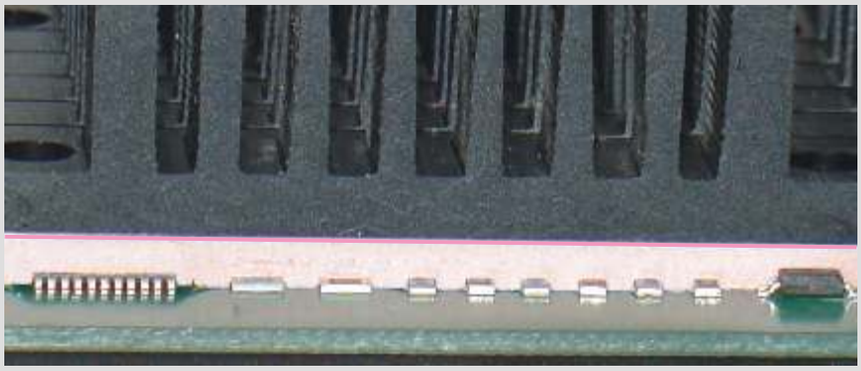


Aging behaviour U 105



Application Note for Keratherm® - Softtherm® Films

Softtherm® materials are highly compressible, best conformable, low-stress Gap-Filler



Keratherm® Softtherm® films are a combination of two basic materials:

1. 86/200 and 86/210: light pink side is the carrier for the conformable gel itself (pink should face to the flat cover or case)
   86/250 and 86/255: white side is the carrier for the conformable gel itself (white should face to the flat cover or case)

2. 86/200 and 86/210: yellow is the compressible and conformable soft side (SMD-side / rough surface side)
   86/250 and 86/255: pink-red side is the compressible and conformable soft side (SMD-side / rough surface side)

Handling:

Remove liner from soft conformable side (yellow on 86/200 , 86/210, pink-red on 86/250 , 86/255), and place Softtherm on the rough uneven or SMD-board side to conform arround the parts

Remove liner from carrier side (pink on 86/200 , 86/210, white on 86/250 , 86/255) and install case, cover or top plate.

If you use the K-Version with adhesive either on light –pink (86/200 , 86/210) or white (86/250, 86/255) side you might remove this adhesive protection liner first, place the carrier side to the case, flat cover side and before installing your application box you remove the liner on the GEL soft side.

Assembly your application and apply mounting pressure to make the material conforming around the parts, max compression should not exceed 40 % of original material thickness

Keratherm® - Thermal Compounds
GF 255, GF 300

Applications:

- RD-RAM modules
- Memory chips
- Chipsets
- Micro BGA
- Heat pipe thermal solutions
- high voltage electronics components

Properties	Unit	GF 255	GF 300
Basic material		silicone	silicone
Colour		red	blue
Mixing ratio		1 : 1	1 : 1
Viscosity	Pas	30 - 55	60 - 85
Curing	T [°C]	½ h;120°C	
Technical properties			
Thermal resistance	K/W	0.83	0.41
Thermal impedance	°Cmm²/W Kin²/W	243 0.39	120 0.19
Thermal conductivity λ	W/mK	1.5	3.0
Breakdown voltage $U_{d;\,ac}$	kV	-	-
Dielectric breakdown $E_{d;\,ac}$	kV/mm	1,5	1,0
Measured thickness	mm	0.5	0.5
Hardness	Shore 00	10 - 25	40 - 55
Density	g/ml	1.7	1.9
Application temperatur	°C	-40 bis +200	
Possible thickness*	mm	0.2 – 4.0	0.2 – 3.0

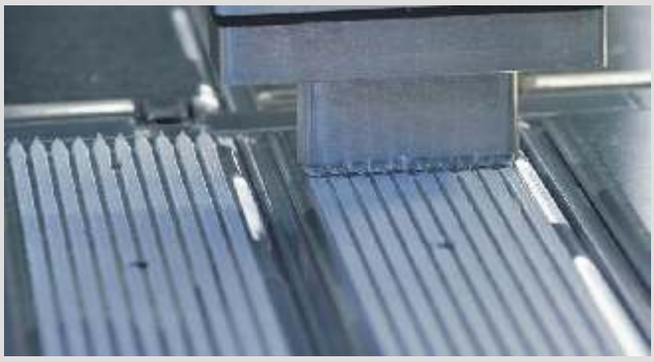
*details see page 44

Ceramic-filled, two-component silicone elastomers. Because of their various thermal conductivities and differing compressibility behavior, their good dielectric properties and being free of solvents, these materials are ideally suitable for encapsulating or dispensing.

The wide range of different material viscosities available makes them of interest for "wet-in-wet" production. Customer-specific solutions for the compound technology and processing technology are our strength.

Dispensing technology as a service: consulting, development and production

As a specialist for dispensing technology we offer consulting, developing and production services for the application of thermal material to different heat sinks or to customized components. Using the latest dispensing systems for sample production or prototyping and fully automated, robotcontrolled manufacturing lines for serial production, we produce in fully air-conditioned clean rooms.



Advantages of dispensing:

- outstanding adaptability and compressibility
- low mechanical stress
- high thermal conductivity
- long term stability
- compatible with industrial production sequences
- good electrical insulation

You benefit from:
- **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**

We look forward to receiving your inquiry!

Processing of Keratherm® GF 255 and GF 300 Thermal Compounds

General information:

- Silicone thermal compounds are physiologically safe
- Silicone hardeners / curing agents are physiologically safe
- We recommend the use of protective industrial lotion
- Avoid contact with skin
- No irritation to the respiratory system when using thermal compounds

Pre-treatment: The parts to be sealed should be dry, clean and grease-free.

Preparation: The silicone thermal compounds contain filler materials which may show sedimentation, depending on the storage temperature. It is therefore necessary to stir the compound thoroughly before the actual mixing process.

Mixing: Kerafol's silicone thermal compounds and their silicone curing agents (component B) must be mixed in the prescribed proportions. After intensive mixing with a suitable stirrer, the compound is immediately ready for use.

The use of cartridges is not recommended, since mixing of the components by a static mixer can no longer be performed. During the mixing process, ensure that no air is brought into the material. Avoid long standby times. Pay attention to the specified processing times. Silicone thermal compounds are moisture-sensitive. After mixing, sealing compounds should always be evacuated for a period of at least 10 minutes at < 100mbar.

Applications: The processing time ranges from approx. 25 minutes up to 3 hours! The viscosity will increase slightly during this time, so you should only prepare as much material as you can process within this time. If the silicone thermal compound will be processed by means of dosing equipment, then it is possible to adjust the processing time with the aid of accelerators. Processing of the compound beyond this time should be avoided since the processing conditions will continuously change due to the curing process (viscosity increase, viscidity of the sealing compound, etc.).

Curing conditions: For specific curing times please refer to the datasheets. The heating regime from room temperature onwards should not climb faster than 5 K/min. When tempering or post-curing incompletely cured thermal compound, entrapped air can expand and cause smoke formation. It is therefore important to ensure that no bubbles are formed during dispensing. When curing at room temperature, please note that heat treatment can change the hardness slightly. Silicone thermal compounds that have been cured at room temperature should not be fully stressed mechanically and electrically before approx. 4 days waiting time.

Suitability for storage: At least 6 months in original packaging. When opened, the contents should be used as soon as possible since, due to the influence of humidity, the reactivity of the material can diminish.

Keratherm® - Graphite
90/10, 90/15, 90/20, 90/25

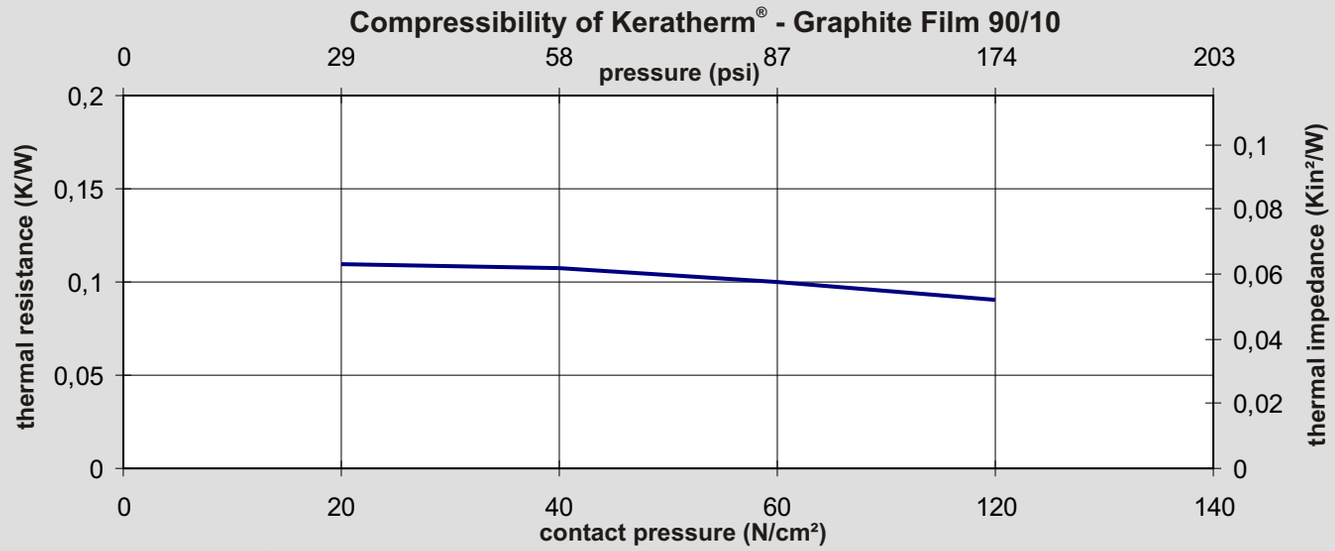
Applications:

- Chipsets
- Memory chips
- Micro BGA

Properties	Unit	90/10 basic film	90/25
Colour		black	black
Thermal Properties			
Thermal resistance R_{th}	K/W	0.09	0.05
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	36 0.05	21 0.03
Thermal conductivity z (x-y)	W/mK	5.5 (55)	7.0 (150)
Electrical Properties			
Electrical resistance z (x/y)	Ωµm	6 – 8 (650-700)	6 – 8 (650-700)
Breakdown voltage $U_{d;\,ac}$	kV	conductive	conductive
Volume resistiviy	Ωm	0.07	0.05
Mechanical Properties			
Measured thickness (+/-10%)	mm	0.200	0.125
Hardness	Shore D	25 - 35	25 - 35
Tensile strength	N/mm²	5.5	4.0
Elongation	%	10	10
Physical Properties			
Application temperature	°C	-40 to +500	-40 to +500
Density	g/cm³	>1.0	>1.2
Flame rating	UL	94V-0	94V-0
TML	Ma.%	0.01	0.01
Possible thickness*	mm	0.15 – 0.30	0.125

*details see page 44

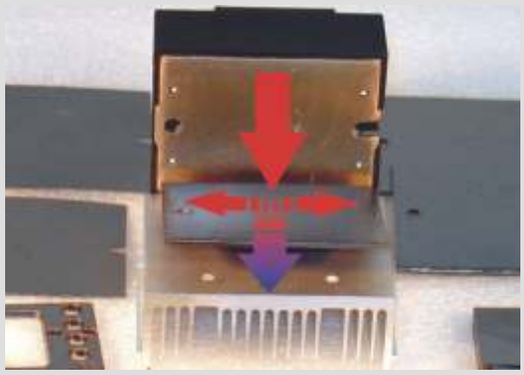
Keratherm® graphite films are based on 100% pure graphite. The films are available as uncoated types and for specific applications, with filled adhesive or standard adhesives. Because of their high thermal conductivity they are used e.g. in the CPU sector.



Options for Keratherm® - Graphite

Type	Tape assembling	Thickness mm	Tensile strength N/mm²	Thermal resistance K/W	Thermal resistance Kin²/W
90/15	90/10 with filled adhesives	0.175	6.0	0.07	0.04
90/20	90/10 with standard-adhesives	0.250	5.5	0.23	0.10

Keratherm® - Graphite
S 900 (Interface Material)



Properties	Unit	S 900
Colour		black
Thermal properties		
Thermal resistance R_{th}	K/W	0.08
Thermal imdedance R_{ti}	°Cmm²/W Kin²/W	34 0.047
Thermal conductivity λ z (x/y)	W/mK	7.5 (>450)
Electrical properties		
Electrical resistance z (x/y)	Ωµm	6 – 9 (700-800)
Breakdown voltage $U_{d;\,ac}$	kV	conductive
Mechanical properties		
Measured thickness (+/-10%)	mm	0.29
Hardness	Shore D	25 - 35
Tensile strength	N/mm²	10
Elongation	%	5
Physical properties		
Application temperature	°C	-40 to +500
Density	g/cm³	> 1.6
Flame rating	UL	94V-0
TML	Ma.%	0.01
Possible thickness*	mm	0.15 – 0.29

***details see page 44**

Keratherm® - 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.

Keratherm® - Ferrite
F 96 (Film)

Applications:

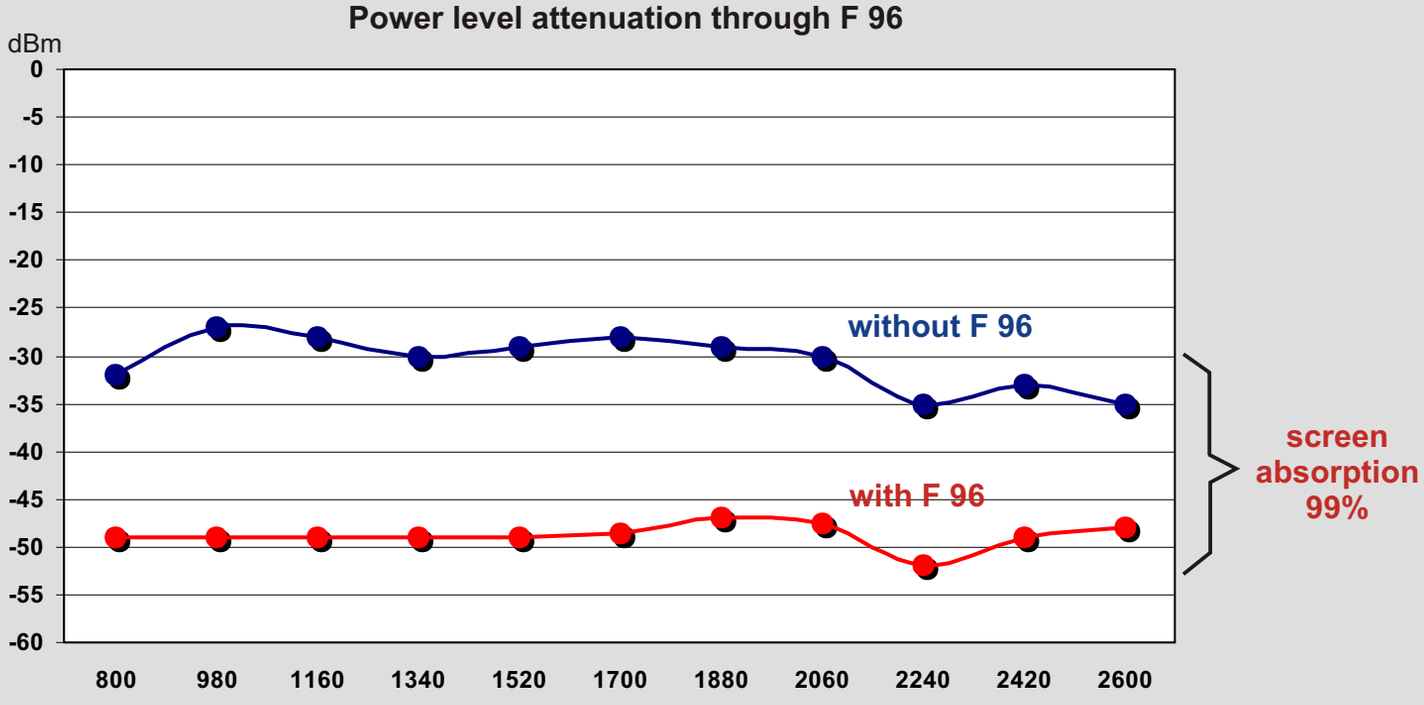
- EMC - absorbtion
- flexible PCB
- LED - arrays

Properties	Unit	F 96
Colour		black
Initial permeability μi		14 ± 20%
Relative loss factor (tan δ/μi) 1,0 KHz 0,1 MHz		 0.20 0.01
Dielectric constant εr 1,0 KHz 0,1 MHz		 2.80 0.20
Measured thickness (+/-10%)	mm	0.225
Density	g/cm³	3.02
Breakdown voltage $U_{d,ac}$	k/V	>200
Dielectric breakdown $E_{d,ac}$	kV/mm	1.0
Thermal conductivity λ	W/mK	1.0
Thermal impedance	°Cmm²/W Kin²/W	238 0,329
Thermal resistance	K/W	0,56
Tensile strength	N/mm²	0.7
Elongation	%	40
Hardness	Shore A	82
Application temperature	°C	-40 to +200
Flame rating	UL	94V-0
Possible thickness*	mm	0.2 – 0.6

***details see page 44**

A new material made from soft magnetic ferrite for electromagnetic shielding, flexible coils or other magnetic applications. The film has a very good shielding efficiency and a high EMC absorption capacity! Its high initial permeability ensures good magnetic properties. Its high flexibility allows preforms and customer-specific punching in all kinds of shapes.

Power level attenuation through F 96



Keratherm® - KL 90, KL 91

Ceramic filled double-sided adhesive film - with or without fibre glass

Applications:

Thermal connection of

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

For example in:

- power supplies and inverter modules
- computers
- telecommunication electronics
- automotive electronics

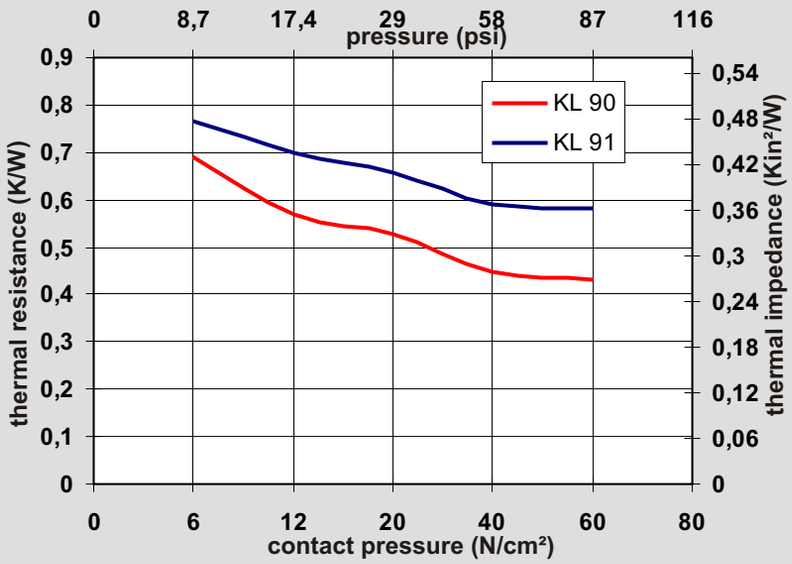
Properties	Unit	KL 90	KL 91
Color		black	black
Basis		acrylate	acrylate
Reinforcement (fibre glass)		N/A	standard
Thermal properties			
Thermal resistance* R_{th}	K/W	0.52	0.55
Thermal impedance* R_{ti}	°Cmm²/W Kin²/W	208 0.32	220 0.34
Thermal conductivity*	W/mK	1.4	1.35
Electrical properties			
Breakdown voltage $U_{d;\,ac}$	kV	3	3
Dielectric breakdown $E_{d;\,ac}$	kV/mm	10.0	10.0
Volume resistivity	Ωm	2.6×10^{4}	2.6×10^{4}
Dielectric loss factor tan δ	1	30.5×10^{-2}	30.5×10^{-2}
Dielectric constant ε_r	1	18.5	18.5
Mechanical properties			
Measured thickness	mm	0.300	0.300
Density	g/cm³	1.98	1.87
Hardness	Shore A	45	59
Tensile strength (single adhesive film)	MPa	0.25	11.28
TML	Ma.%	0.15	0.15
Flame rating	UL	94V-0	-
Possible thickness*	mm	0.3	0.3

***details see page 44**

Kertherm® KL 90 and KL 91 are thermal conducting, electrical isolating double sided adhesive films. They have an excellent, permanent adhesive strength with high thermal conductivities and at the same time very good insulation characteristics.

Low thermal contact resistances can be achieved with a very reliable adhesive strength on different surfaces. There are no mechanical fixation with clips, screws or rivets needed. Due to the soft surface finish tolerances can be compensated very good. Light weight, easy handling and high elasticity are further advantages.

Compressibilities of KL 90 and KL 91



KERATHERM® - Adhesive Films KL 90 and KL 91

Specific film characteristics	Unit	KL 90 (without fibre glass)	KL 91 (with fibre glass)
Application temperature (continous)	°C	-40 to +125	-40 to +125
Testing the reflow stability 10s/270°C		passed	passed
Adhesive film thickness (+/- 10%)	µm	300	300
Shelf Life	month	12	12

Specific film characteristics		Unit	KL 90 (without fibre glass)	KL 91 (with fibre glass)
Application	[pressure/time]	N/cm²/sec.	10/10	10/15
Tensile shear strength [25mmx25mm-adhesive area-180° aluminum – adhesive film – aluminum]		N/cm² [DIN EN 1465] [ASTM D 1003]	>30	>25
Tensile shear strength temperature-depending** [25mmx25mm-adhesive area-180° aluminum – adhesive film – aluminum]	-20°C +20°C +60°C +70°C +80°C	N/cm² [DIN EN 1465] [ASTM D 1003]	157.2 51.7 14.1 12.0 10.7	146.8 50.3 13.6 10.7 9.5
Tensile shear strength 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]		N/cm²	31.5	32.5
Tensile shear strength after vibration test (sinusoidal at RT); vibration 10–500 Hz; 100 s/m² (10g) test cycle 24h (8h per axis) [2]		N/cm²	32.1	35.9
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 25x25 mm² (1inch²); glued on an AlCuMg1-substrate, stored at room temperature for 62 hours.
[1], [2]: sinusoidal vibration test - Fc gem. DIN EN 60068-2-6 and DIN EN 60068-2-2; VDE 0468-2-2

Processing and handling instructions for KL 90 and KL 91 double-sided adhesive film

When these simple, general, basic rules are followed for our KL90 and KL91 double-sided adhesive films, they display very good processing characteristics. They allow mechanical fastening aids, such as clamps, screws or rivets to be dispensed with. In addition to the adhesive tapes' good thermal and dielectric characteristics, their outstanding adhesive strength and good plasticity ensure reliable processability.

Surface conditions

On the components to be adhered, the surfaces must be dry and free of impurities, such as oil, fat, dust, paint coatings and possible solvent contamination. Condensation humidity must also be prevented (e.g., when changing from cold to warm).
A clean surface guarantees that KL90 and KL91 adhesive films stick their best!

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.

Adhesion

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

KERATHERM® - Adhesive Coatings

Processing temperatures and necessary transmission forces
The adhesive tapes' processing temperature lies 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).

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 placed pressed onto the surface to be adhered (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.

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 prevented. 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 12 months. After this time, the adhesive tapes can continue to be used only if a test is made by the customer.

Keratherm® - 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–A2	Acryl–A3
Colour		transparent	transparent		transparent	transparent	milky white
Film type		PSA silicone	Gel silicone		Acrylate	Acrylate removable	filled Acrylate
Suitable for film types		standard silicone films with reinforcement	standard silicone films with/without reinforcement		for all silicone free films	for all silicone free films	for all silicone free films
Application temperature	°C	-60 to +250	-60 to +250		-40 to +180	-40 to +180	-40 to +180
Coating thickness	µm	20 - 50	30 - 75		15 - 25	20 - 50	40 - 60
Suitable for reflow process	(10sec.-270°C)	yes	yes		no	no	yes
Peel resistance [1]	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 [2]	month	8	8		12	12	12

[1] **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.

[2] **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.

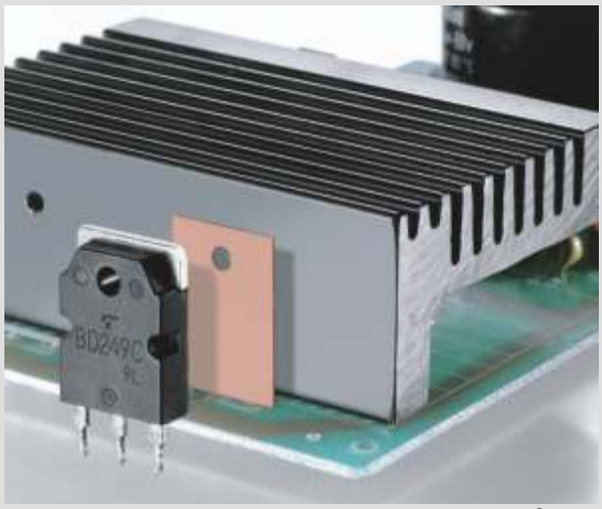
Notice: By using adhesives as single-sided coating for Keratherm® thermal conductivity films the thermal impedance increases.

KERATHERM® - Good to Know...

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, whereat 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.



Standard application of KERATHERM®

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!

see page 45

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. All formats can also be ordered as bulk material. All flexible films - Softtherm® - can be delivered in thicknesses up to 1.0 mm or as roll goods up to 500 mm in width. Above a thickness of 1.5 mm, the Softtherm® films are supplied as sheets in sizes up to a maximum of 250 x 450 mm².

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:

Thickness	Tolerances
up to 1.0 mm	± 0.5 mm
up to 2.0 mm	± 1.0 mm
up to 3.0 mm	± 1.5 mm
up to 4.0 mm	± 2.0 mm
up to 5.0 mm	± 2.5 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 punching are qualified by means of the first piece inspection report.

KERAFOL® - Good to Know...

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 dependance 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 of 18°C – 22°C, rel. humidity 50-70%, 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/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 behaviour. Measurements are performed with an AC high-voltage detector.

Determination of mechanical properties

State-of-the-art equipment and measurement devices facilitate the batch-wise 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°).

YOUNGS MODULUS studies

Kerafol® analyses the behaviour of flexible films under pressure, using the method described in ASTM D 575-91, to determine the so-called YOUNGS MODULUS. The sample geometry of the individual film types is 30x30mm at 2.5 mm thickness, and pressure is applied with a constant traverse path of 1mm/min (0.04 in/min). The pressure dependence of the films is shown on the graphs.

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.

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® - Test Methods and RoHS - Test Report

Keratherm®-Test Methodes

Description	Unit	Test Method	
Thermal resistance R_{th} *1	K/W	Kerafol®-test method	
Thermal conductivity λ *1	W/mK	Kerafol®-test method	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 53482 - 3	ASTM D 257-3
Dielectric loss factor tan δ	1	DIN 53483	ASTM D 150
Dielectris constant ε_r	1	DIN 53483	ASTM D 150
Overall thickness	mm	DIN 53370	ASTM D 734
Tensile strength	N/mm^2	DIN 53455	ASTM D 412
Elongation	%	DIN 53455	ASTM D 412
Hardness	Shore (A,D) Shore 00	DIN 53505	ASTM D 2240
Compressibilitiy *2	mm	DIN 2039/ 53512 / 53517	ASTM D395/ASTM D695/M 1054
Youngs Modulus *2	N/cm^2	-	ASTM D 575-91
Flame rating	UL	UL 94 / E140693	UL 94 / E140693
Total mass loss (TML)	Ma.-%	-	ASTM E 595

*** modified test geometry:**

1. Thermal conductivity , thermal resistance R_{th} and thermal impedance R_{ti} (4cm²)
2. Compressibility and “Youngs modulus” (3.0cm x 3.0cm = 9cm²)

Conversion

Shape: 1000 mil = 1 inch (1”) = 2.54 cm = 25.4 mm
Area: 1 $inch^2$ = 6.45 cm^2 = 645 mm^2
Pressure: 100 N/cm^2 = 1MPa = 10 bar = 145.037 psi

RoHS - Test Report

Test Methods:

RoHS - screening by means of RFA, (Cd), (Pb),(Hg), and (Br) by means of X-ray analysis.
contant of heavy metals - Decomposition; ICP-OES
Chromiom(VI); Following DIN 53314

Flame retardants - Extraction, GC-MSD - PBB:

Tribrombiphenyl, Pentabrombiphenyl, Hexabrombiphenyl, Heptabromdiphenylether, Octabrombiphenyl, Nanobrombiphenyl, Decabrombiphenyl

Flame retardants - Extraction, GC-MSD - PBDE:

Tribromdiphenylether, Tetrabromdiphenylether, Pentabromdiphenylether, Hexabromdiphenylether, Heptabromdiphenylether, Octabromdiphenylether, Nanobromdiphenylether

Declaration on the possible use of fungicides
The raw materials and consumables used by Kerafol® contain no antimicrobial substances (fungicides). Even during the production, processing and packaging of Keratherm® and Softtherm® products, these substances are not used and do not occur.

Declaration on possible use of perfluorooctane sulfonates (PFOS)
The raw materials and consumables used by Kerafol® contain no perfluorooctane sulfonates (PFOS). Even during the production, processing and packaging of Keratherm® and Softtherm® products, perfluorooctane sulfonates (PFOS) do not occur.

KERATHERM® - RoHS - Test Report

Film Type	Heavy Metal				Flame protection agent		Chlorine-/ Bromine-concentration		Evaluation
	Cd mg/Kg	Cr(IV) mg/Kg	Hg mg/Kg	Pb mg/Kg	PBB mg/Kg	PBDE mg/Kg	Cl- mg/Kg	Br- mg/Kg	
Keratherm® white	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	63	< 20	passed
Keratherm® green	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	36	< 20	passed
Keratherm® pink	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	45	< 20	passed
Keratherm® red	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	130	< 20	passed
Keratherm® brown	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	58	< 20	passed
Keratherm® Graphite	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	< 20	n.b.	passed
Keratherm® Ferrite	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	60	< 20	passed
Keratherm® FTC	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	73	< 20	passed
Keratherm® U-Series	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	49/58	< 20	passed
Keratherm® MT-Series	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	155	< 20	passed
Keratherm® PCM	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	170	< 20	passed
Keratherm® PCE	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	190	< 20	passed
Softtherm® 200 Series	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	22	< 20	passed
Softtherm® 300 Series	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	35	< 20	passed
Softtherm® 500 Series	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	160	41	passed
Thermal compound GF 255	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	74	< 20	passed
Thermal compound GF 300	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	97	< 20	passed
Keratherm® KL 90 / K L91	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	109	< 20	passed
Keratherm®- Grease	< 100	< 1000	< 1000	< 1000	< 1000	< 1000	< 20/150	< 20	passed

KERATHERM® - List of available standard thicknesses

Keratherm® Standard Thicknesses in mm

	0.125	0.200	0.225	0.250	0.275	0.300	0.325	0.400	0.425	0.500	0.525	max available	*setup / option*
												Dimensions	
86/30	x		x			x						500 x meter	standard
86/30								x		x		470 x meter	standard
86/40				x			x					500 x meter	adhesive
86/40									x		x	470 x meter	adhesive
86/10	x		x			x						500 x meter	glassw eave
86/10								x		x		470 x meter	glassw eave
86/20				x			x					500 x meter	adh + glassw
86/20									x		x	470 x meter	adh + glassw
86/37	x		x			x						500 x meter	standard
86/37								x		x		470 x meter	standard
86/47				x			x					500 x meter	adhesive
86/47									x		x	470 x meter	adhesive
86/17	x		x			x						500 x meter	glassw eave
86/17								x		x		470 x meter	glassw eave
86/27				x			x					500 x meter	adh + glassw
86/27									x		x	470 x meter	adh + glassw
86/50	x		x			x						500 x meter	standard
86/50								x		x		470 x meter	standard
86/51				x			x					500 x meter	adhesive
86/51									x		x	470 x meter	adhesive
86/52	x		x			x						500 x meter	glassw eave
86/52								x		x		470 x meter	glassw eave
86/53				x			x					500 x meter	adh + glassw
86/53									x		x	470 x meter	adh + glassw
86/81		x										500 x meter	standard
86/82				x		x						500 x meter	glassw eave
86/82								x		x		470 x meter	glassw eave
86/82 K					x		x					500 x meter	adh + glassw
86/82 K									x		x	470 x meter	adh + glassw
86/82 lb				x		x						500 x meter	glassw eave
86/82 lb								x		x		470 x meter	glassw eave
86/83				x								500 x meter	glassw eave
86/83								x		x		470 x meter	glassw eave
70/50				x								500 x meter	glasw eave
70/60					x							500 x meter	adh + glassw eave
U 23	x			x		x		x		x		420 x meter	standard
U 23K					x				x		x	400 x meter	adhesive
U 80	0.150					x						470 x meter	standard
U 80 K		0.175										460 x meter	standard
U 90	0.100	x				x						470 x meter	standard
U 90 K	x		x				x					460 x meter	adhesive
MT 102				x								230 x meter	standard
MT 103				0.280								230 x meter	standard
MT 102 K					x							220 x meter	adhesive
MT 103 K						0.305						220 x meter	adhesive
86/114				x								500 x meter	
86/117				x								500 x meter	
PCM 471		x										150 x meter	

KERATHERM® - List of available standard thicknesses

	0.100	0.125	0.150	0.175	0.200	0.225	0.250	0.275	0.300	0.400	0.500	max available	*setup / option*
												Dimensions	
90/10			x		x		x					500 x meter	standard
90/15					x		0.230					460 x meter	filled adhesive
90/20							x					460 x meter	acrylic adhesive
90/25		x										500 x meter	standard
F 96						x			x	x	x	340 x meter	
F 96 K							x		0.325	0.425	0.525	330 x meter	adhesive
	0.150	0.290	0.55	0.83	1.08	1.55							
S 900	x	x	available on request									500 x 500	standard
	0.175	0.315	0.575	0.855	1.105	1.575							
S 900 K	x	x	available on request									500 x 500	adhesive
	0.500	0.800	1.000	1.500	2.000	2.500	3.000	3.500	4.000	4.500	5.000		
86/200	x	x	x	x	x	x	x	x	x	x	x	450 x 250	standard
86/200K	x		x	x	x	x	x	x	x	x	x	450 x 250	adhesive
86/210 lb	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/210 lb K	x		x	x	x	x	x	x	x	x	x	450 x 250	adhesive
86/250	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/250K	x		x	x	x	x	x	x	x	x	x	450 x 250	adhesive
86/255	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/255K	x		x	x	x	x	x	x	x	x	x	450 x 250	adhesive
86/300	x	x	x	x	x	x	x	x	x	x	x	450 x 250	standard
86/300 K	x		x	x	x	x	x	x	x	x	x	450 x 250	adhesive
86/320			x	x	x	x	x	x	x	x	x	450 x 250	standard
86/500	x		x	x	x							450 x 250	standard
86/600	x		x	x								450 x 250	standard
86/202	x	x	x	x	x	x	x	x	x	x	x	450 x 250	standard
86/212	x	x	x	x	x	x	x	x	x	x	x	450 x 250	low bleeding
86/120	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
U 105	x		x	x	x	x	x	x	x	x	x	450 x 250	silicone free

Customized solutions.

We look 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!

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