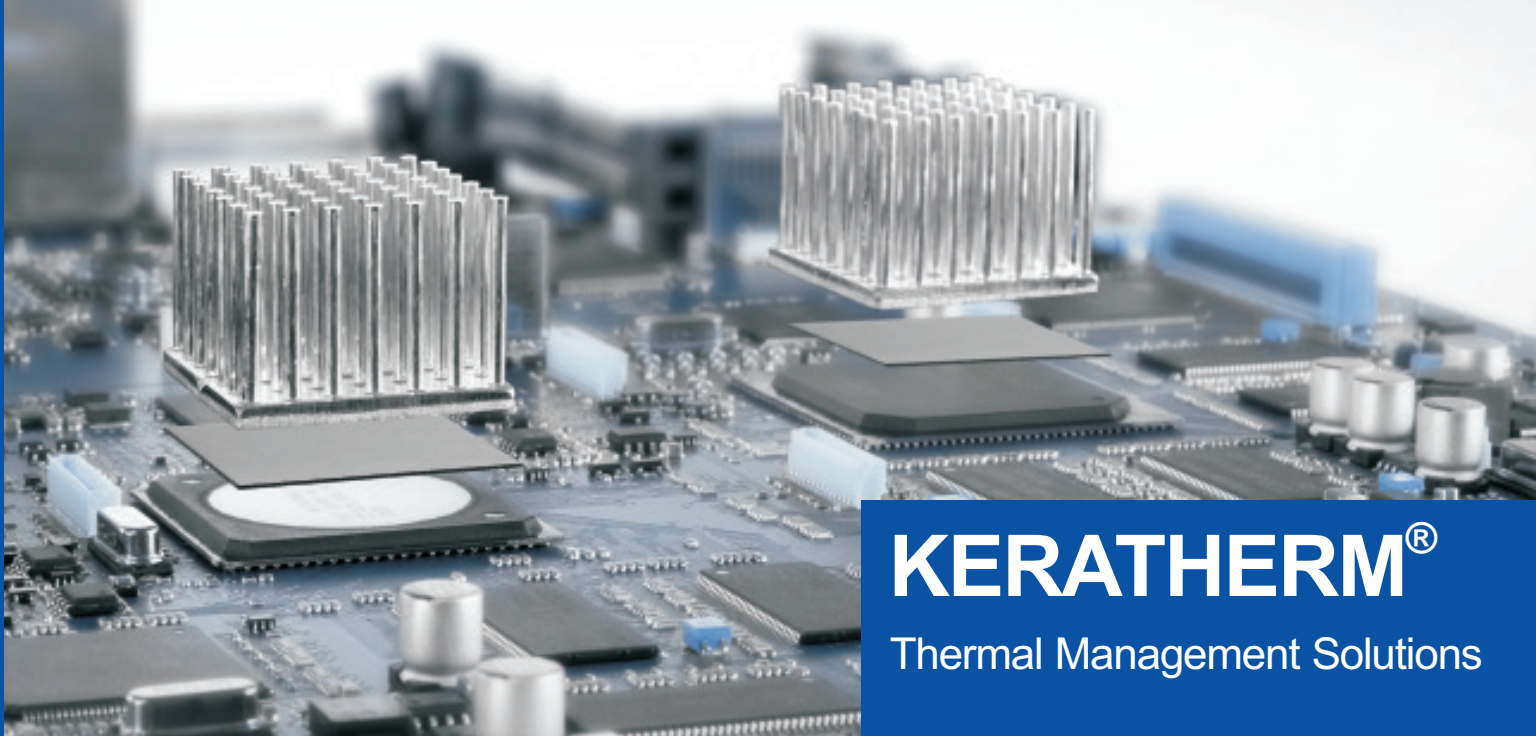




KERATHERM[®]

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

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The data presented in this leaflet are in accordance with the present state of our knowledge. All statements, technical information and recommendations herein are based on tests we believe to be reliable. The customer is thereby not absolved from carefully checking all supplies immediately on receipt. The recommendations made in this catalogue should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. Before using, user shall determine the suitability of the product for its intended use, and the user assumes all risks and liability whatsoever in connection there with. We reserve the right to alter product constants within the scope of technical process or new developments. The recommendations do not absolve the customer from the obligation of investigating the possibility of infringement of third parties right and, if necessary, clarifying the position. Sellers' and manufacturer' only obligation shall be to replace such quantity of the product proved to be defective. Neither seller nor manufacturer shall be liable either in tort or contract for any loss or damage, direct or incidental, or consequential, including loss of profits or revenue arising out of the use or the inability to use a product. No statement, purchase order or recommendations by seller or purchaser not contained herein shall have any force or effect unless in an agreement signed by the officers of the seller and manufacturer.

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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”.



**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 research, 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.

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 microelectronics, 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.

KERAFOL®
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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 fibreglass 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.

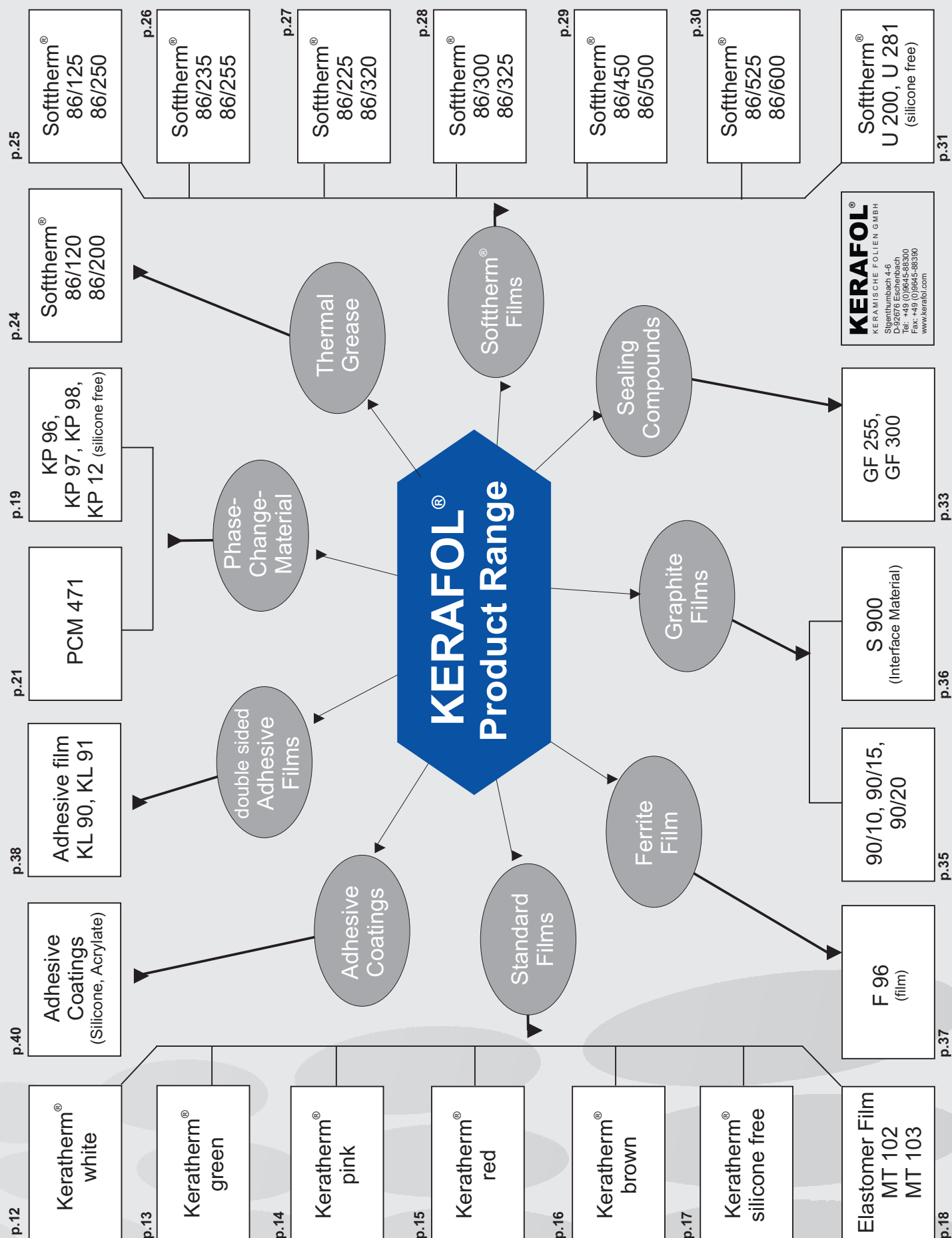
In contrast to discs made of mica, aluminum or polyamide, KERATHERM® can be used without a heat conducting compound.

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 selfadhesive 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 small 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-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 insulating 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.

Characteristics of Thermal Films

+ very good mechanical strength	⇒	up to 15.0 N/mm ²
+ 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)	⇒	22.0 up to 98.5 N/cm ²
+ very good dielectric properties	⇒	starting at 16 kV/mm
+ high thermal conductivity	⇒	up to 6.0 W/mK
+ very good plasticity and 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 3.0 W/mK
+ low shrinkage		
+ very good resistance to wetness, buck, acid and chemicals		
+ sealing of complicated geometries and components		

Characteristics of Phase Change Materials

+ very low thermal resistance	⇒	R _{th} at 0.07 K/W
+ electrical insulating	⇒	E _d 2.5 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	55 - 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
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
86/37	Keratherm® green basic film	1.8	0.32	8.0	0.225	65 - 75	high isolation	13
70/50	Kertherm® brown with fibre glass	1.4	0.44	5.0	0.250	80 - 90	good price-performance-ratio	16

KERATHERM® Standard Films silicone free

film		thermal conductivity W/mK	thermal resistance K/W	breakdown voltage kV	measured thickness mm	hard-ness Shore A	characteristics	page
U 90	Keratherm® silicone free	6.0	0.09	4.0	0.200	70 - 80	silicone free, high thermal conductivity	17
U 80	Keratherm® silicone free	1.8	0.20	4.0	0.150	80 - 90	silicone free	17
MT 103	Elastomer-film	1.8	0.39	10.0	0.280	70 - 80	silicone free, high isolation	18
U 23	Keratherm® silicone free	1.2	0.52	9.0	0.250	80 - 95	silicone free	17
MT 102	Elastomer-film	1.1	0.53	10.0	0.250	65 - 75	silicone free, high isolation	18

KERATHERM® PCM, 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	0.030	silicone free	19
KP 98	ceramic filled silicone component	6.0	0.01	conductive	0.030	silicone based, low thermal resistance	19
KP 97	ceramic filled silicone component	5.0	0.012	conductive	0.030	silicone based	19
PCM 471	filled hot setting wax	4.0	0.07	2.5	0.200	easy handling	21
KP 96	ceramic filled silicone component	2.4	0.038	conductive	0.030	no drying out, very thin to apply	19

KERATHERM Graphite Films

film		thermal conductivity W/mK	thermal resistance 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	36
90/10	Keratherm® Graphite basic film	5.5	0.09	not insulating	0.200	25 - 35	good thermal conductivity	35

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

KERATHERM® - Specific Values and Characteristics

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® film	6.0	0.20	1.5	0.5	60 - 75	highest thermal conductivity	30
86/525 Softtherm® film	5.5	0.22	1.25	0.5	50 - 65	excellent thermal conductivity, very good compressibility	30
86/500 Softtherm® film	5.0	0.25	1.0	0.5	65 - 75	high thermal conductivity	29
86/450 Softtherm® film	4.5	0.27	5.0	0.5	65 - 75	very good thermal and dielectric characteristics	29
86/300 Softtherm® film	3.0	0.41	7.0	0.5	60 - 75	flexible, high thermal conductivity	28
86/325 Softtherm® film	3.0	0.41	6.0	0.5	35 - 50	soft, high thermal conductivity	28
86/320 Softtherm® film	2.5	0.50	5.0	0.5	25 - 38	very soft, good dielectric properties	27
86/225 Softtherm® film	2.0	0.60	6.0	0.5	30 - 45	fiberglass-reinforced, good self-adhesive behaviour on both sides	27
86/255 Softtherm® film	2.0	0.60	8.0	0.5	25 - 40	soft, high thermal conductivity	26
86/235 Softtherm® film	2.0	0.60	6.0	0.5	30 - 45	soft, low volatile silicone < 150 ppm	26
86/125 Softtherm® film	1.5	0.80	6.0	0.5	10 - 20	soft, high compressibility	25
86/250 Softtherm® film	1.3	0.95	8.0	0.5	40 - 50	soft, average thermal conductivity	25
86/120 Softtherm® film	1.0	0.83	4.0	0.5	30 - 45	good compressibility	24
86/200 Softtherm® film (standard)	1.0	1.20	8.0	0.5	10 - 20	soft, highly compressible	24

KERATHERM® - Softtherm® silicone free

film	thermal conductivity W/mK	thermal resistance K/W	breakdown voltage kV	measured thickness mm	hard-ness Shore 00	characteristics	page
U 200 Softtherm® epoxide resin	2.0	0.60	7.0	0.5	55 - 70	good compressibility, silicone free	31
U 281 Softtherm® epoxide resin	2.0	0.60	7.0	0.5	55 - 65	good compressibility, silicone free	31

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	14.0	1.9	40 - 55	good compressibility	33
GF 255 2-component silicone elastomer	1.5	35 - 55	8.0	1.7	10 - 25	very good compressibility	33

KERATHERM® Ferrite Film

film	thermal conductivity W/mK	thermal resistance 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	37

KERATHERM® Adhesive Film

film	thermal conductivity W/mK	thermal resistance K/W	dielectric breakdown kV/mm	thickness mm	hard-ness Shore A	characteristics	page
KL 90 thermal conductive adhesive film without fibre glass	1.40	0.52	20.0	0.300	45	thermal conducting and isolating adhesive film	38
KL 91 thermal conductive adhesive film with fibre glass	1.35	0.55	20.0	0.300	59	thermal conducting and isolating adhesive film	38

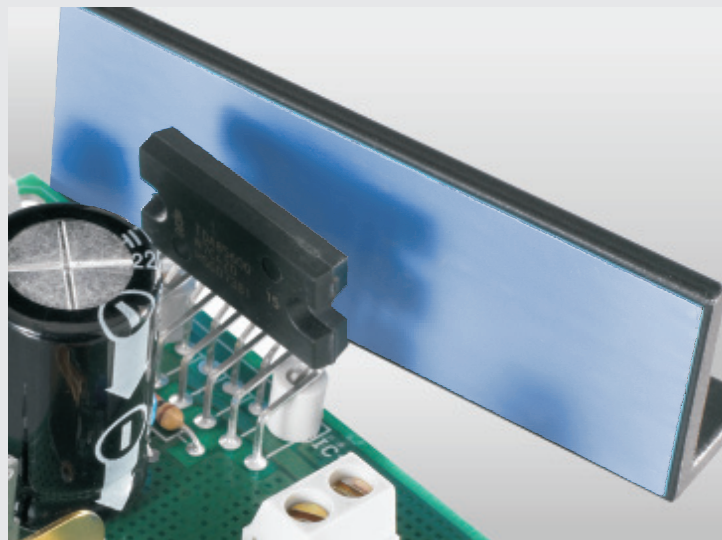
KERATHERM® Standard Films

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.



PROPERTIES

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

BENEFITS

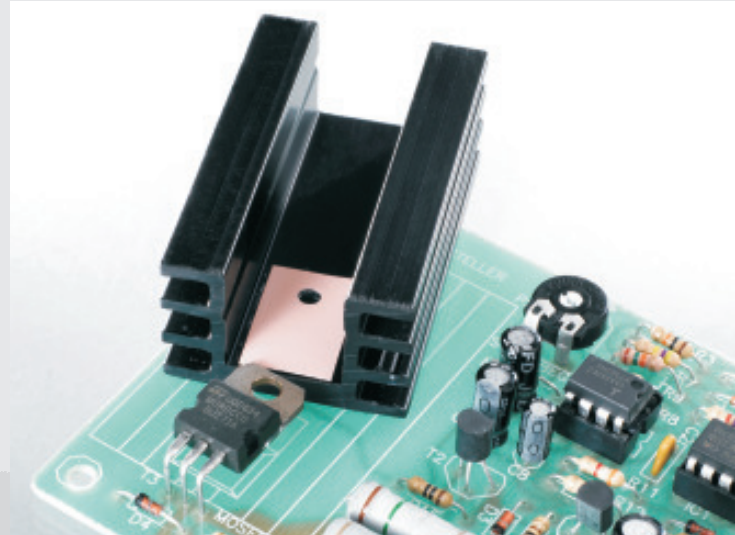
- smooth surface
- very good properties even at very low contact pressure
- low hardness
- high self-adhesion
- UL listed

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

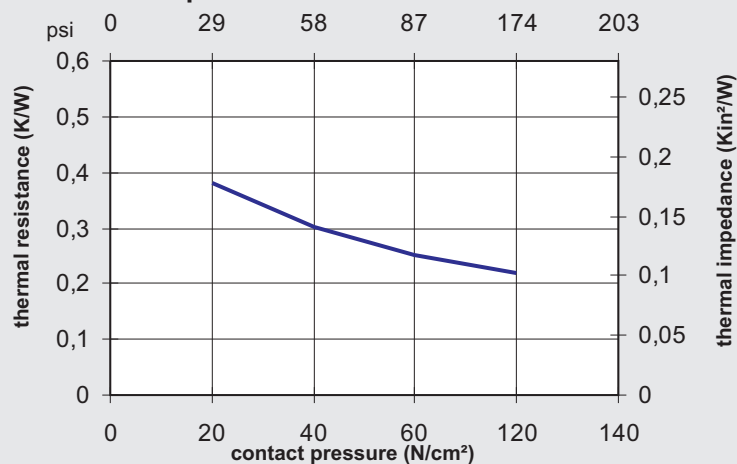


Properties	Unit	86/30 basic film
Colour		white
Thermal properties		
Thermal resistance R_{th}	K/W	0.22
Thermal impedance R_{ti}	°Cmm²/W	90
	Kin²/W	0.13
Thermal conductivity λ	W/mK	2.5
Electrical properties		
Breakdown voltage $U_{d; ac}$	kV	1.5
Dielectric breakdown $E_{d; ac}$	kV/mm	7.0
Volume resistivity	Ωm	2.5×10^{11}
Dielectric loss factor $\tan \delta$	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	1.5
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



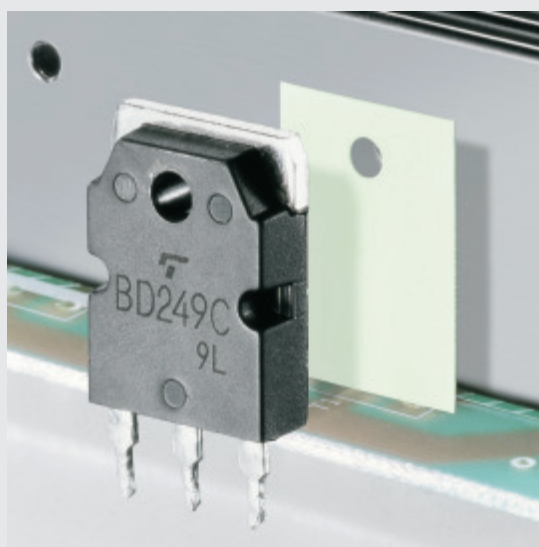
Options for Keratherm® -white

Type	Film structure	Overall thickness mm	Tensile strength N/mm²	Thermal resistance	
				K/W	Kin²/W
86/10	86/30 with fibre glass	0.225	>7.5	0.30	0.15
86/20	86/30 with fibre glass and adhesive coating	0.250	>7.5	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

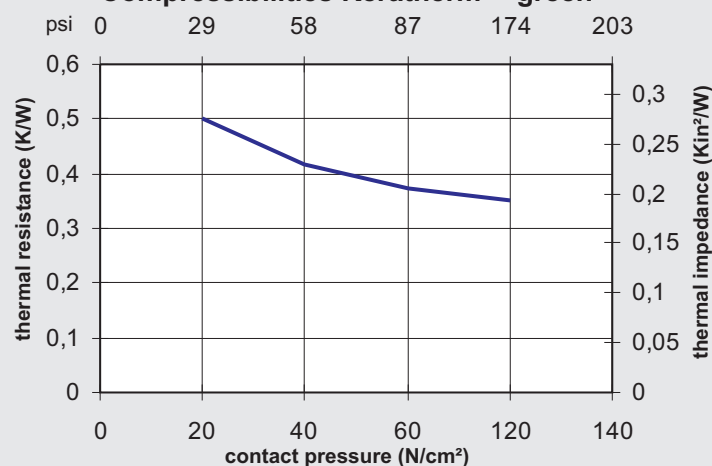


Properties	Unit	86/37 basic film
Colour		green
Thermal properties		
Thermal resistance R_{th}	K/W	0.32
Thermal impedance R_{ti}	°Cmm²/W	129
	Kin²/W	0.20
Thermal conductivity λ	W/mK	1.8
Electrical properties		
Breakdown voltage $U_{d; ac}$	kV	8.0
Dielectric breakdown $E_{d; ac}$	kV/mm	26
Volume resistivity	Ωm	2.5×10^{11}
Dielectric loss factor $\tan \delta$	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	2.0
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	Kin²/W
86/17	86/37 with fibre glass	0.225	>7.5	0.59	0.23
86/27	86/37 with fibre glass and adhesive coating	0.250	>7.5	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



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.

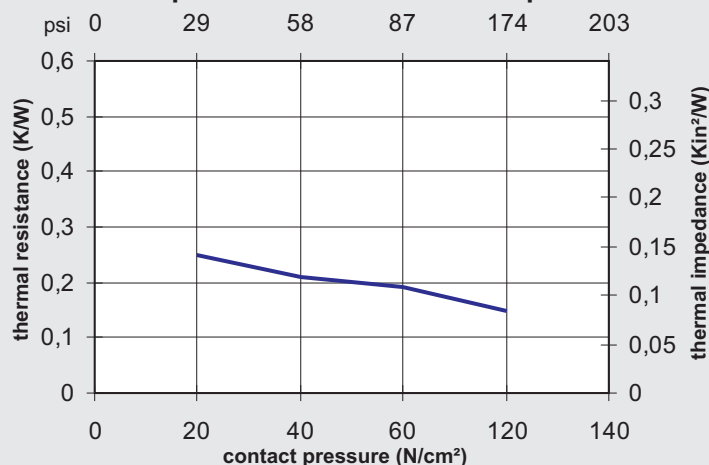
Options for Keratherm® -pink

Type	Film structure	Overall thickness mm	Tensile strength N/mm ²	Thermal resistance	
				K/W	Kin ² /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	>10	0.28	0.14
86/53	86/50 with fibre glass and adhesive coating	0.250	>10	0.31	0.15

Properties	Unit	86/50 basic film
Colour		pink
Thermal properties		
Thermal resistance R_{th}	K/W	0.16
Thermal impedance R_{ti}	°Cmm ² /W Kin ² /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 $\tan \delta$	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/mm ²	1.3
Elongation	%	25
Physical properties		
Application temperature	°C	-60 to +250
Density	g/cm ³	1.97
Flame rating	UL	94V-0
Possible thickness*	mm	0.125 – 0.500

*details see page 44

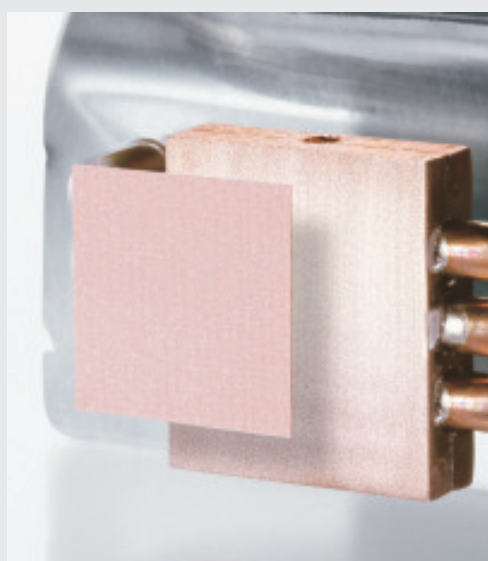
Compressibilities Keratherm® - pink



Keratherm® - red Standard Films

Applications:

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

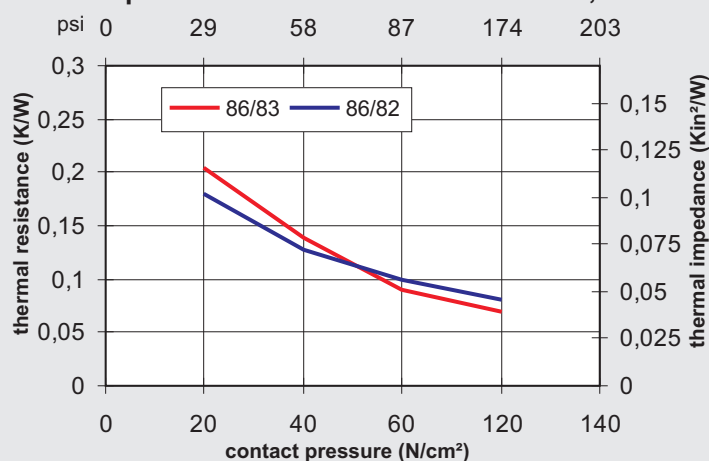


Properties	Unit	86/82 with fibre glass	86/83 with fibre glass
Colour		red	red
Thermal properties			
Thermal resistance R_{th}	K/W	0.09	0.07
Thermal impedance R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	35	31,2
	Kin^2/W	0.05	0.04
Thermal conductivity λ	W/mK	6.5	8.0
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	1.0	1.0
Dielectric breakdown $E_{d; ac}$	kV/mm	4.0	4.0
Volume resistivity	Ωm	2.0×10^{14}	5.9×10^{15}
Dielectric loss factor $\tan \delta$	1	1.4×10^{-3}	3.0×10^{-2}
Dielectric constant ϵ_r	1	2.4	1.83
Mechanical properties			
Measured thickness (+/-10%)	mm	0.250	0.250
Hardness	Shore A	60 - 70	55 - 70
Tensile strength	N/mm ²	13	10
Elongation	%	2	2
Physical properties			
Application temperature	$^{\circ}\text{C}$	-40 to +200	
Density	g/cm ³	1.23	1.10
Flame rating	UL	94V-0	-
Possible thickness*	mm	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 performance, the Keratherm red can be used reliably in densely packed electronic applications.

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



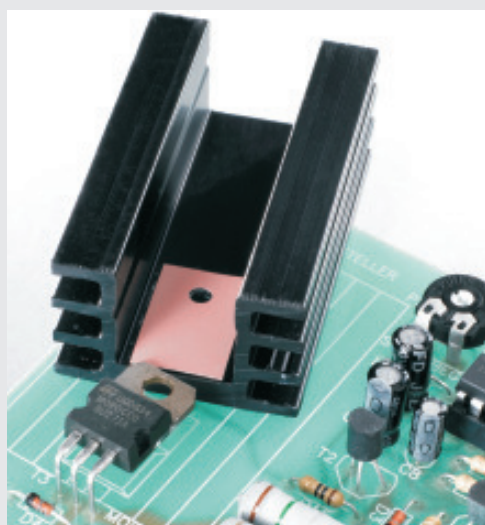
Options for Keratherm® -red

Type	Film structure	Overall thickness mm	TML Ma.-%	Tensile strength N/mm ²	Thermal resistance	
					K/W	Kin ² /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



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.

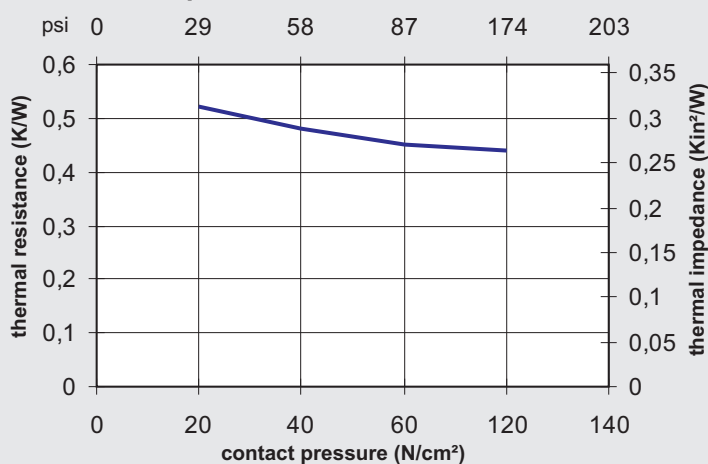
Options for Keratherm® -brown

Type	Film structure	Overall thickness mm	Tensile strength N/mm ²	Thermal resistance	
				K/W	Kin ² /W
70/60	70/50 with reinforcement and adhesive coating	0.275	10	0.52	0.34

Properties	Unit	70/50 with fibre glass
Colour		brown
Thermal properties		
Thermal resistance R_{th}	K/W	0.44
Thermal impedance R_{ti}	°Cmm ² /W	178
	Kin ² /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
Volume resistivity	Ωm	1.0×10^{13}
Dielectric loss factor $\tan \delta$	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/mm ²	10
Elongation	%	5.0
Physical properties		
Application temperature	°C	-40 to +200
Density	g/cm ³	2.18
Flame rating	UL	94V-1
Possible thickness*	mm	0.250

*details see page 44

Compressibilities Keratherm® - brown



Keratherm® - silicone-free U-Films U 23, U 80, U 90

Applications:

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



Optional available
with adhesive coating!

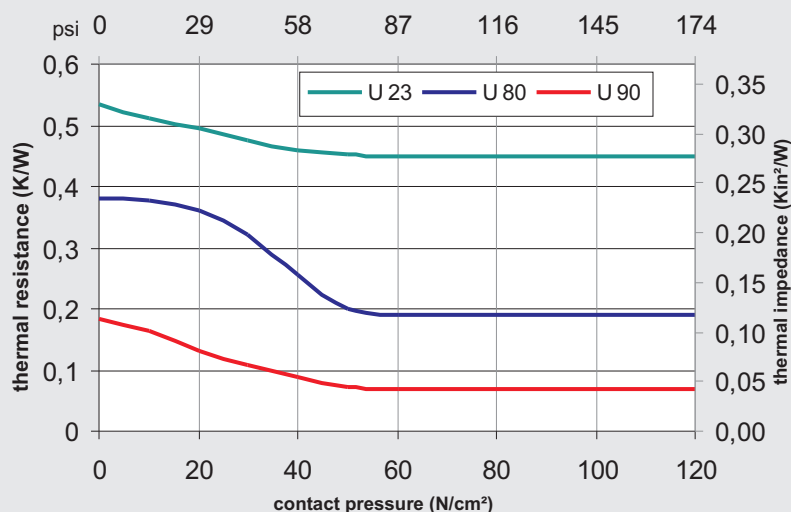
Properties	Unit	U 23	U 80	U 90
Colour		white	blue	light blue
Thermal properties				
Thermal resistance R_{th}	K/W	0.52	0.20	0.09
Thermal impedance R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	208	73	32.9
	Kin^2/W	0.32	0.11	0.05
Thermal conductivity λ	W/mK	1.2	1.8	6.0
Electrical properties				
Breakdown voltage $U_{d; ac}$	kV	9.0	4.0	4.0
Dielectric breakdown $E_{d; ac}$	kV/mm	25	25	25
Volume resistivity	Ωm	4.9×10^{11}	1.44×10^{14}	2.0×10^{11}
Dielectric loss factor $\tan \delta$	1	8.0×10^{-2}	13.0×10^{-3}	13.7×10^{-3}
Dielectric constant ϵ_r	1	1.7	3.2	3.1
Mechanical properties				
Measured thickness (+/-10%)	mm	0.250	0.150	0.200
Hardness	Shore A	80 - 95	80 - 90	70 - 80
Tensile strength	N/mm ²	4.5	3.0	2.0
Elongation	%	250	130	150
Physical properties				
Application temperature	$^{\circ}\text{C}$	-40 to +90	-40 to +125	
Density	g/cm ³	1.36	2.26	1.46
Flame rating	UL	-	94V-0	94V-0
Possible thickness*	mm	0.125 – 0.4	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 23, U 80, U 90



Keratherm® - silicone free MT-Films MT 102, MT 103

Applications:

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

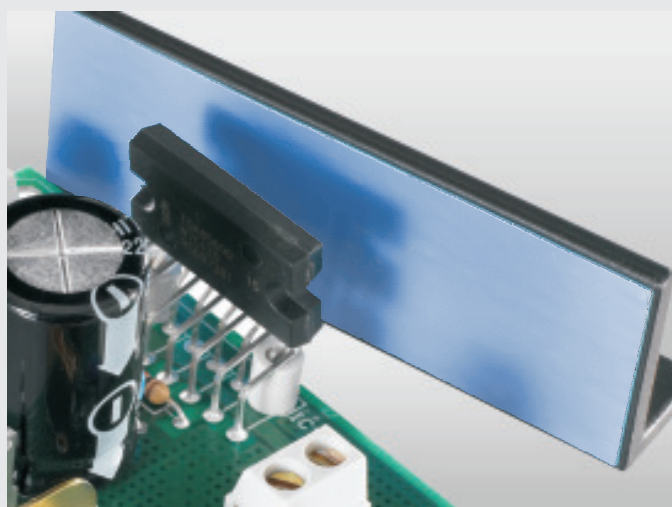
Advantages:

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

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

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	10
Dielectric breakdown $E_{d; ac}$	kV/mm	25	25
Volume resistivity	Ωm	2.2×10^{10}	4.7×10^{10}
Dielectric loss factor $\tan \delta$ (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

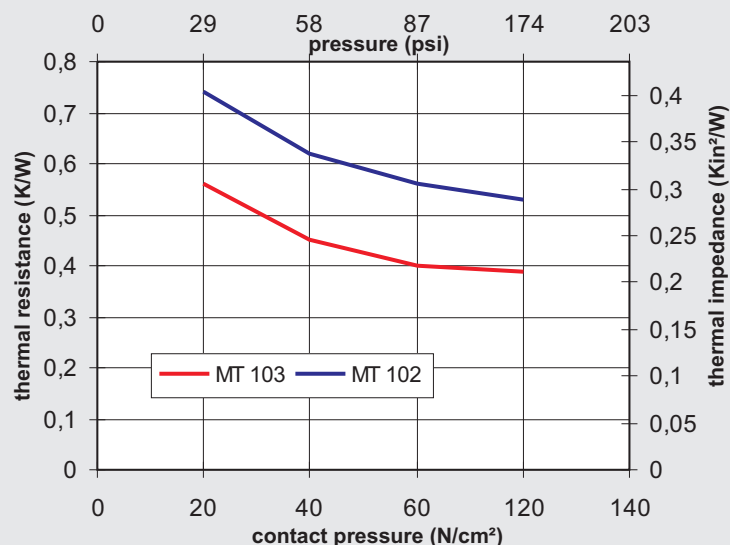
*details see page 44



Delivery forms:

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

Compressibilities Keratherm® - MT 102, MT 103

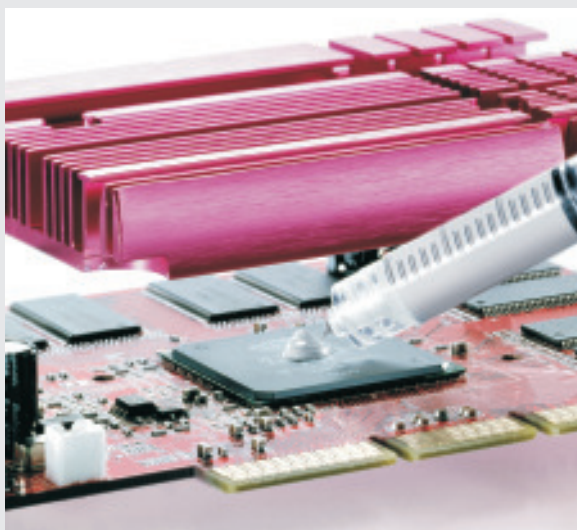


Keratherm® - Thermal Grease KP 96, KP 97, KP 98, KP 12 (silicone free)

Properties	Unit	KP 96	KP 97	KP 98	KP 12 silicone free
Colour		dark white	white	grey	silver
Compound		soft / pasty			
Thermal properties					
Thermal resistance R _{th}	K/W	0.038	0.012	0.01	0.006
Thermal impedance	°Cmm²/W	11	4,5	4,1	2,2
	KIN²/W	0.017	0.007	0.0064	0.0033
Thermal conductivity λ	W/mK	2.4	5.0	6.0	10.0
Elektrical properties					
Electrical conductivity (according to DIN 51412-1)	pS/m	8	0	0	53
Mechanical properties					
Measured thickness (+/-10%)	mm	0,030	0,030	0,030	0,030
Viscosity	Pas	25 - 35	80 - 120	90 - 130	30 - 50
Density	g/cm³	2.6	2.1	2.2	1.4
Application temperature	°C	-60 to +150			
TML	Ma. %	< 1.4	< 1.3	< 1.5	< 0.1
Possible thickness	mm	variable			
Long term stability (1000h / 85°C / 85% relative humidity)					
Thermal resistance R _{th}	K/W	0.038	0.012	0.008	0.006

Applications:

- Notebooks
- Desktop CPU's
- IGBT Units



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.

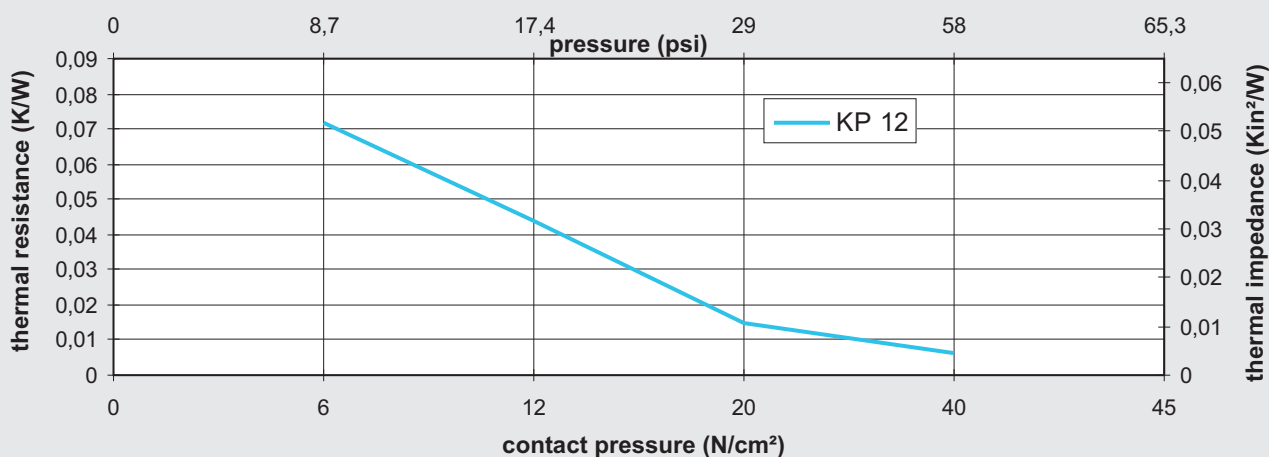
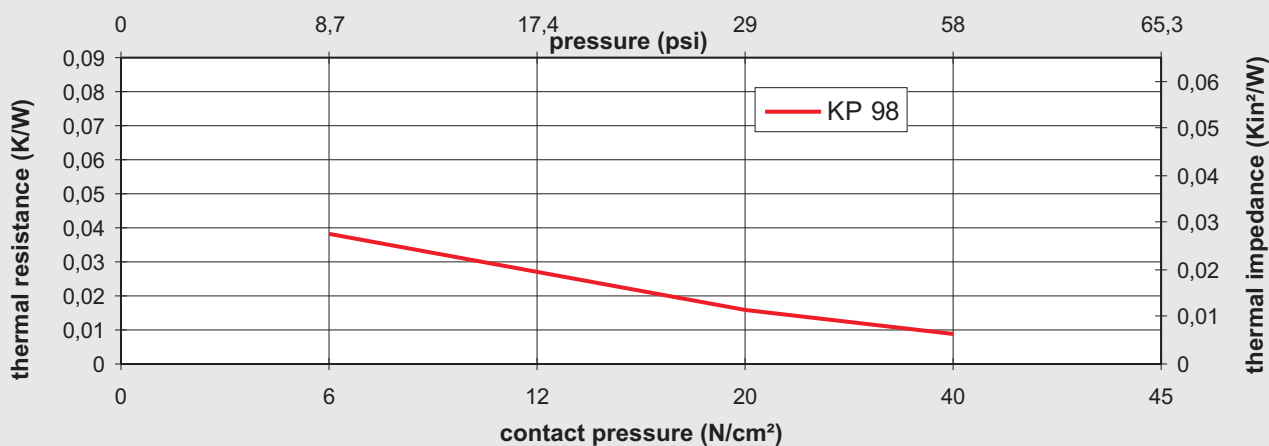
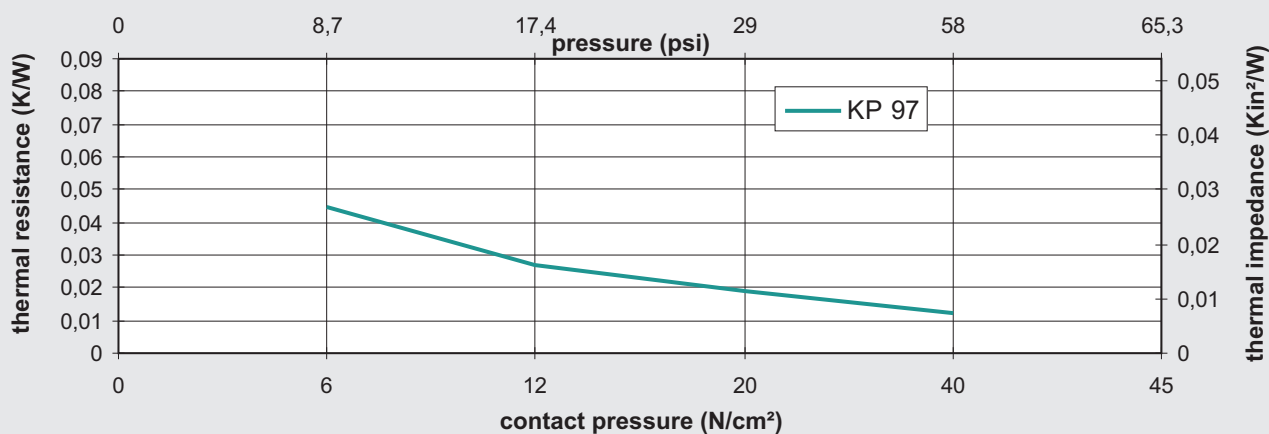
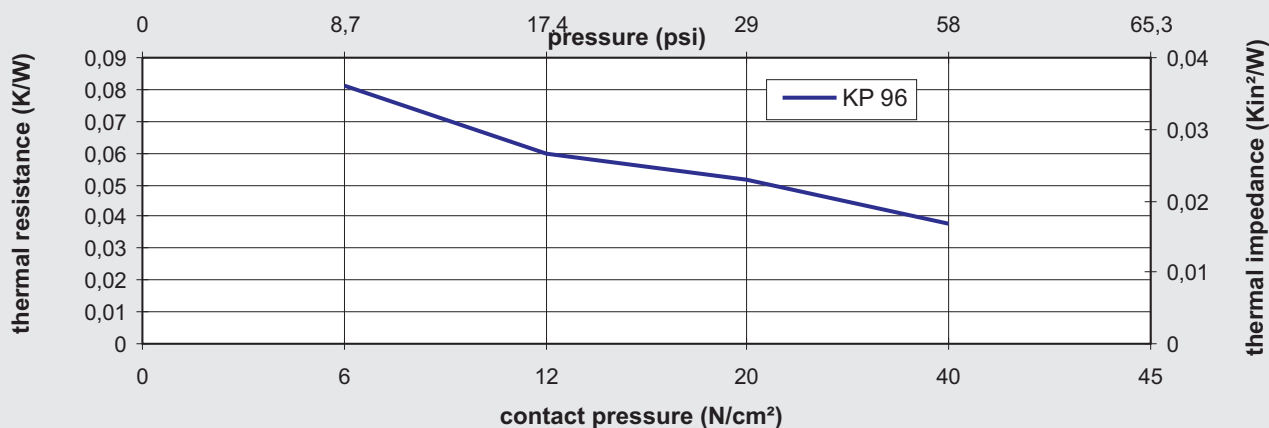
The silicone-free thermal compound KP 12 consists of synthetic, thermal polymer and is suitable for a fast and effective heat dissipation. The paste is particularly suitable for silicone sensitive applications.

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 thermal resistance of different pastes in dependence on the contact pressure



Keratherm® - Phase Change Material PCM 471

KERATHERM® - Phase-Change-Material is being produced on the basis of phase-changing properties. These film smoothes out even the smallest irregularities between the power module and heat sink and thereby improves the contact between the surfaces and increase the heat transfer.

Applications:

- Notebooks
- Desktop CPU's
- IGBT Units

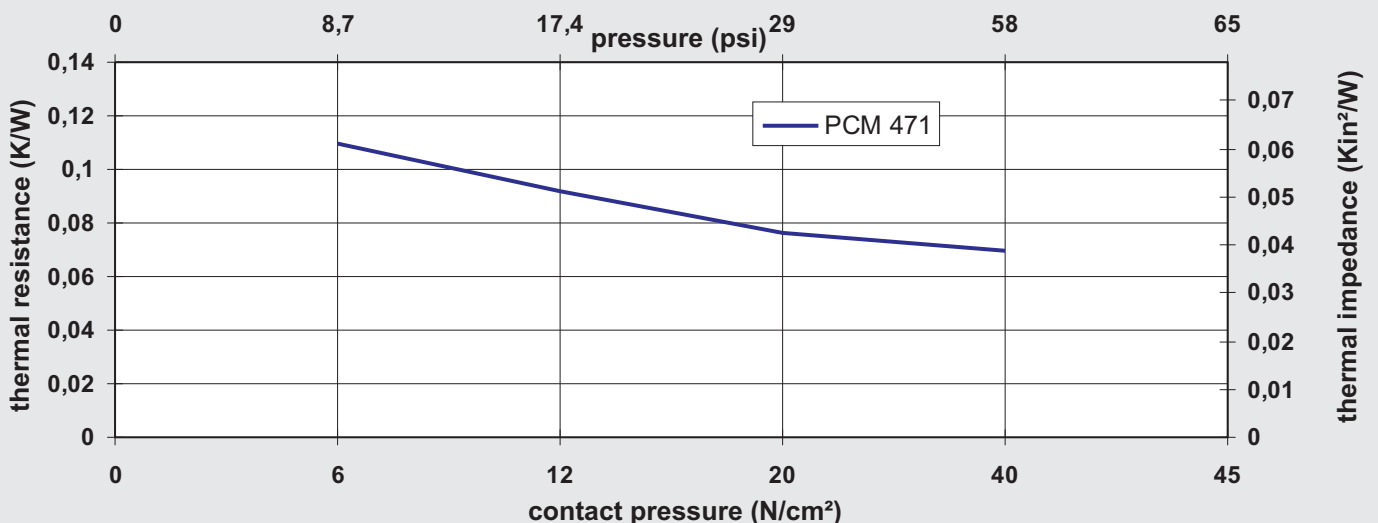
Vorteile des PCM-Materials:

- 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

Properties	Unit	PCM 471
Colour		grau
Compound		filled hot-setting wax
Thermal properties		
Thermal resistance R_{th}	K/W	0.07
Thermal impedance	°Cmm²/W	25.6
	Kin²/W	0.039
Thermal conductivity λ	W/mK	4.0
Electrical properties		
Breakdown voltage $U_{d; ac}$	kV	0.5
Dielectric breakdown $E_{d; ac}$	kV/mm	2.5
Mechanical properties		
Measured thickness (+/-10%)	mm	0.200
Hardness	Shore A	70 – 80
Softening interval	°C	46
Physical properties		
Density	g/cm³	1.82
Application temperature	°C	-40 to +125
Flame rating	UL	-
Possible thickness*	mm	0.200

*Details Seite 45

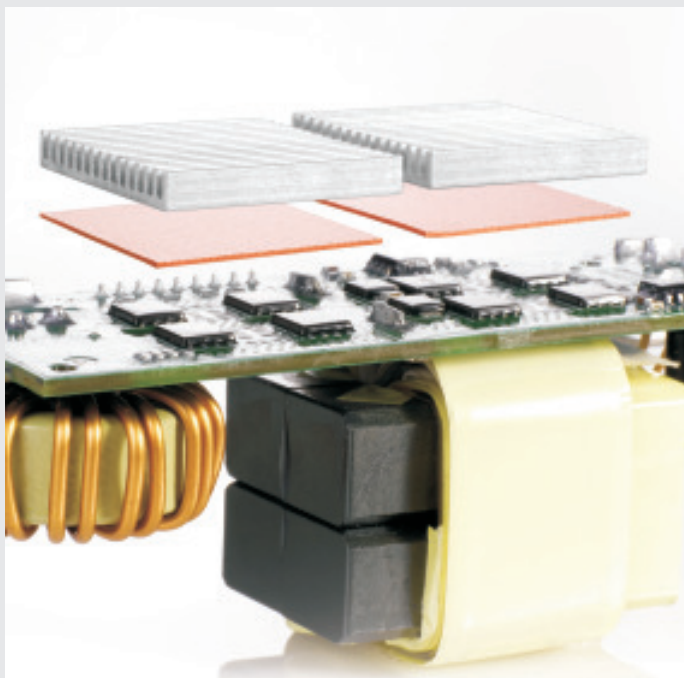
**Thermal resistance of PCM 471
in dependance on the contact pressure**



KERATHERM® Softtherm® Films highly elastic and compressible

Keratherm® - Softtherm® films are filled and highly elastic. Their good compression behavior and good forming capabilities guarantee that rather large component differences can be compensated. They are electrically insulating and possess gradual heat conductivity. Depending on the type, the films have varying self-adhesive behaviours. Softtherm® films should not be compressed beyond 30% of the original thickness, because this may cause the films to bleed out. Kerafol® offers two types of Softtherm® films:

Types 86/200, 86250 and 86/255 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 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 86/120, 86/225, 86/300, 86/320, 86/500, 86/600 and U 200 are reinforced by fiber glass fabric at thicknesses of 0.5 to 1.0 mm. Starting at a thickness of 1.5 mm, they are also offered without reinforcement. Except of 86/225 the films can additionally be offered with an adhesive application as an assembly aid. Other than for those films with an adhesive application, the mounting position does not to be specified. In case of an adhesive application make sure that the adhesive coating is always applied to the heat sink or the housing.

PROPERTIES

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

BENEFITS

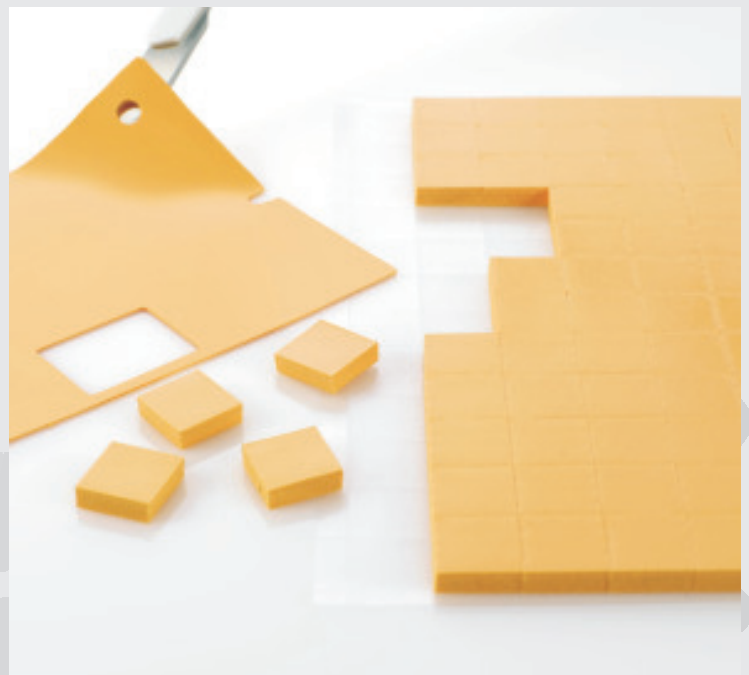
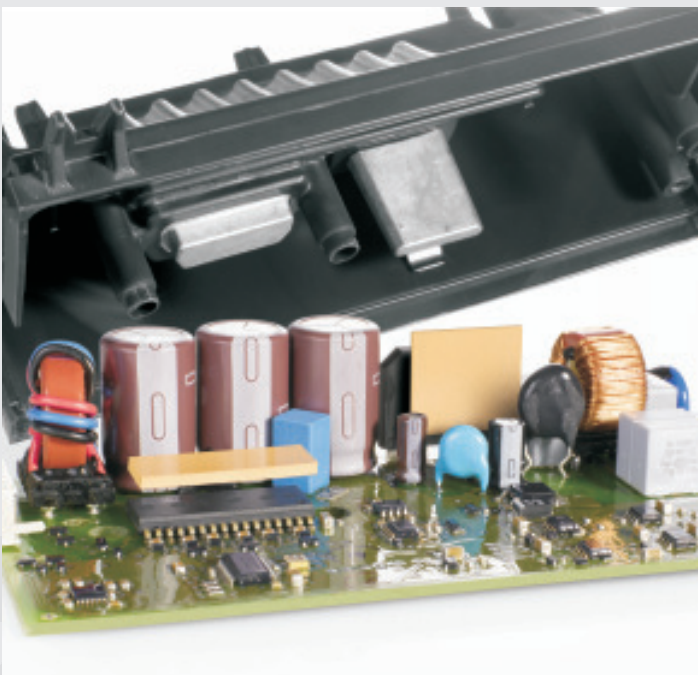
- compensates components size variations
- optimized thermal transition
- good compression behaviour
- UL-listed

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



Keratherm® - Softtherm® 86/120, 86/200

This highly elastic films are characterized by their excellent compressibility with moderate thermal and excellent dielectric behavior. While the type 86/200 is constructed in two layers, the single-layer type 86/120 has up to a thickness of 1.0 mm, a glass fiber reinforcement for improved handling. The Type 86/120 is characterized by an very good price-performance ratio.

Applications:

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

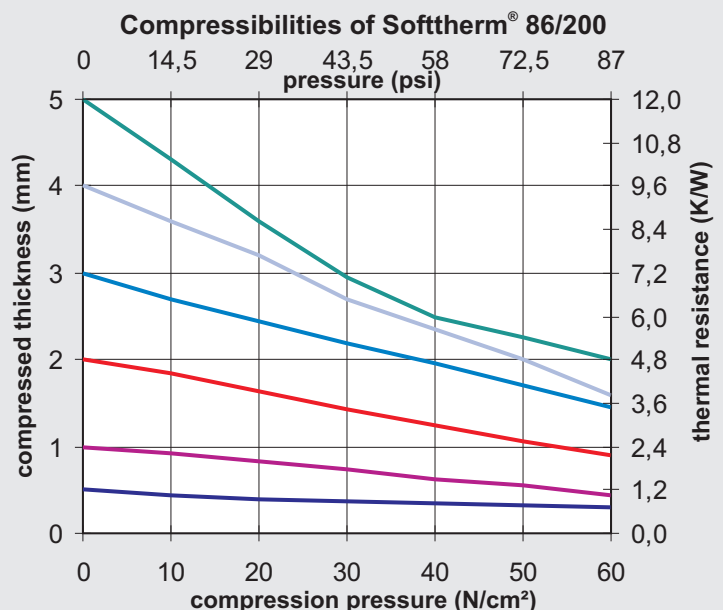
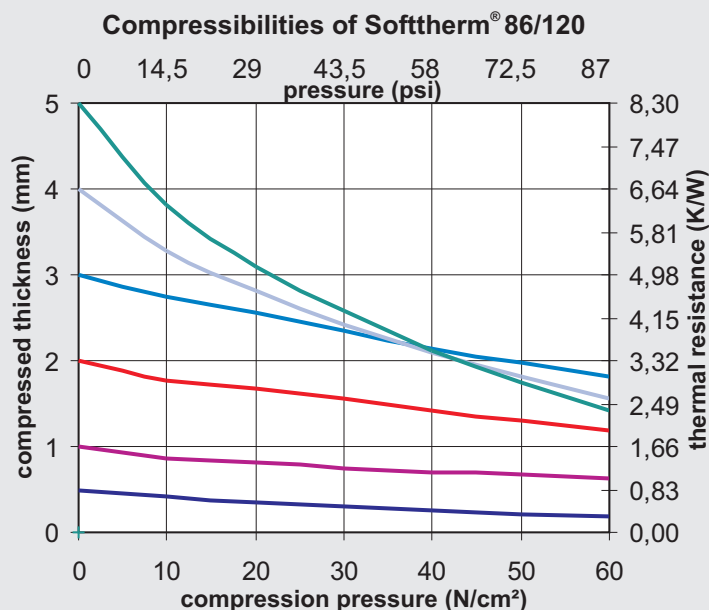
Optional available with adhesive coating!



Properties	Unit	86/120	86/200
Colour		green	pink/yellow
Assembling		single layer, fibre glass reinforcement up to 1.0 mm	double layer, carrier film 86/52 up to 1.0 mm
Thermal properties			
Thermal resistance R_{th}	K/W	0.83	1.20
Thermal impedance R_{ti}	°Cmm²/W	302	480
	Kin²/W	0.47	0.75
Thermal conductivity λ	W/mK	1.5	1.0
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	4.0	8.0
Dielectric breakdown $E_{d; ac}$	kV/mm	8.0	16
Volume resistivity	Ωm	1.0×10^{11}	1.0×10^{11}
Dielectric loss factor $\tan \delta$	1	8.0×10^{-3}	1.5×10^{-3}
Dielectric constant ϵ_r	1	3.5	3.9
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	30 - 45	10 - 20
Youngs modulus *	N/cm²	111	22
Physical properties			
Density	g/cm³	2.3	1.61
Application temperature	°C	-40 to +150	-60 to +200
TML	Ma.-%	< 1.20	< 0.40
Flame rating	UL	94V-0***	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

***Kerafol test according to UL
**details see page 45



Keratherm® - Softtherm® 86/125, 86/250

The Softtherm® - types 86/125 and 86/250 have an improved thermal performance without any affect on the dielectric and mechanical properties. While the type 86/125 is a single layer, and up to a thickness of 4.0 mm supported with a glass fiber reinforcement, the Type 86/250 is constructed in two layers.

Applications:

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

Optional available with
adhesive coating!

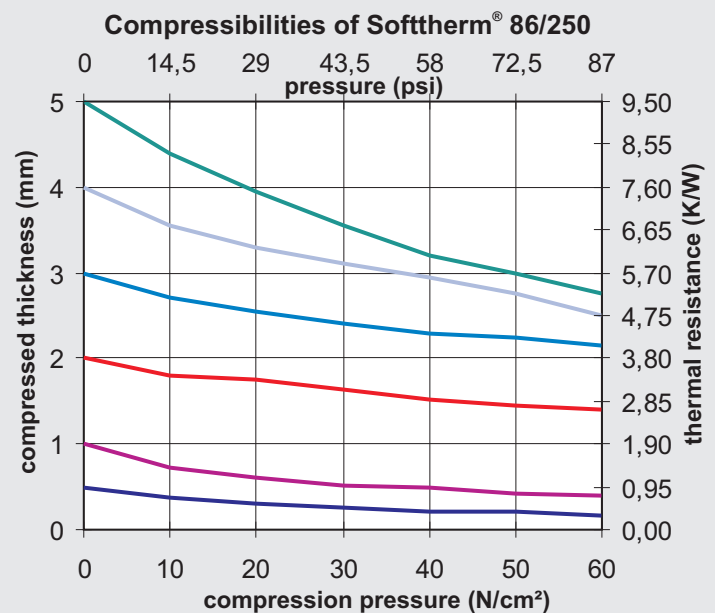
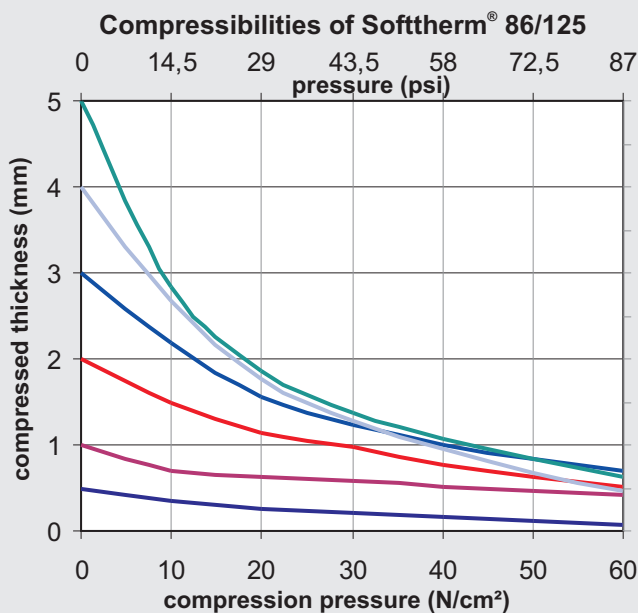


Properties	Unit	86/125	86/250
Colour		deep-orange	white/red
Assembling		single layer, fibre glass reinforcement up to 4.0 mm	double layer, carrier film 86/10 up to 0.125 mm
Thermal properties			
Thermal resistance R_{th}	K/W	0.80	0.95
Thermal impedance R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	322	385
	Kin^2/W	0.50	0.60
Thermal conductivity λ	W/mK	1.5	1.3
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	6.0	8.0
Dielectric breakdown $E_{d; ac}$	kV/mm	12	16
Volume resistivity	Ωm	61.3×10^9	1.0×10^{11}
Dielectric loss factor $\tan \delta$	1	0.153	2.5×10^{-3}
Dielectric constant ϵ_r	1	4.28	3.8
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	10 - 20	40 - 50
Youngs modulus*	N/cm ²	23.6	15
Physical properties			
Density	g/cm ³	2.0	1.76
Application temperature	$^{\circ}\text{C}$	-40 to +180	-60 to +200
TML	Ma.-%	< 0.29	< 0.42
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

***Kerafol test according to UL

**details see page 45



Keratherm® - Softtherm® 86/235, 86/255

Customer-oriented development determine the properties of Softtherm® - 86/235 and 86/255. The two-layer Type 86/255 is determined with good thermal, mechanical and dielectric properties. 86/235 is a single layer, and particularly optimized in its "siloxane" -behaviour (low volatile silicone <150 ppm).

Applications:

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

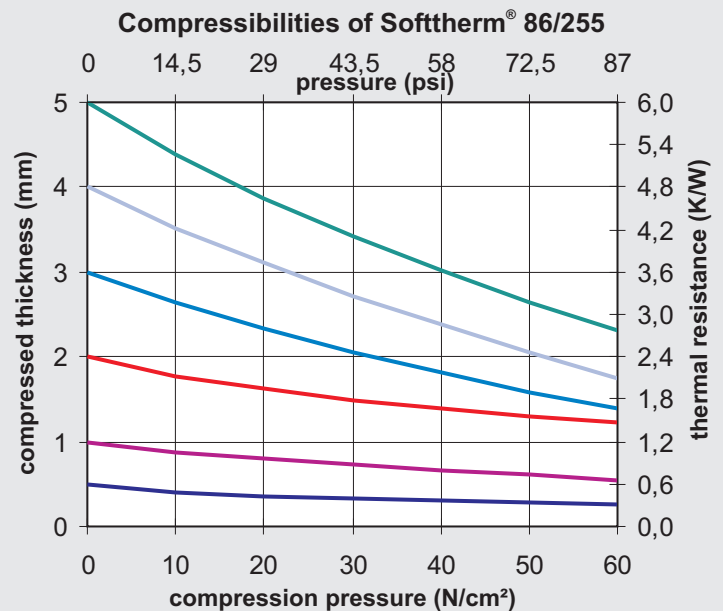
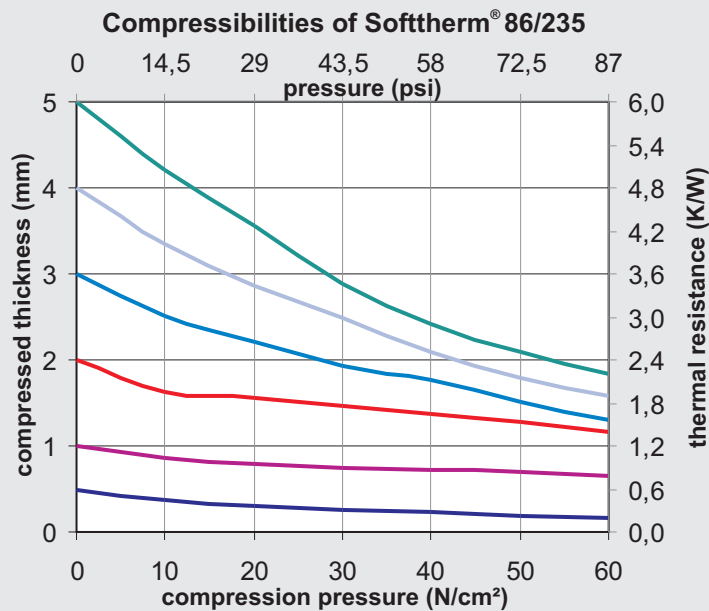
Optional available with
adhesive coating!



Properties	Unit	86/235	86/255
Colour		yellow-orange	white/red
Assembling		single layer, fibre glass reinforcement up to 1.5 mm	double layer, carrier film 86/10 up to 0.125 mm
Thermal properties			
Thermal resistance R_{th}	K/W	0.60	0.60
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	8.0
Dielectric breakdown $E_{d; ac}$	kV/mm	12	16
Volume resistivity	Ωm	176.1×10^9	1.0×10^{11}
Dielectric loss factor $\tan \delta$	1	0.0202	2.5×10^{-3}
Dielectric constant ϵ_r	1	3.7	3.8
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	30 - 45	25 - 40
Youngs modulus *	N/cm²	32	30
Physical properties			
Density	g/cm³	1.65	1.80
Application temperature	°C	-40 to +180	-60 to +200
TML	Ma.-%	< 0.15	< 0.44
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

***Kerafol test according to UL
**details see page 45



Keratherm® - Softtherm® 86/225, 86/320

Single layer Softtherm® - films with graded thermal behaviour. These films are partial glass fibre reinforced and a e low cost alternative to the two-layer Softtherm® - films.

Applications:

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

Optional available with
adhesive coating!

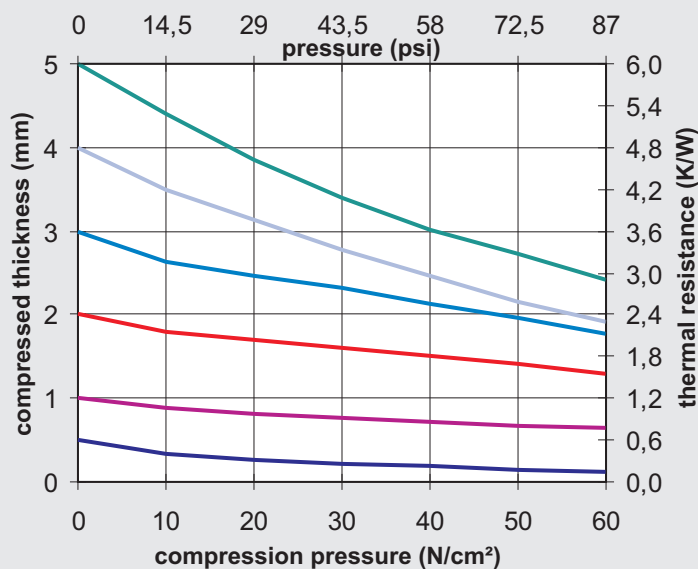


Properties	Unit	86/225	86/320
Colour		orange	mandarin
Assembling		single layer, fibre glass reinforcement up to 4.0 mm	single layer, fibre glass reinforcement up to 1.0 mm
Thermal properties			
Thermal resistance R_{th}	K/W	0.60	0.50
Thermal impedance R_{ti}	°Cmm²/W	240	147
	Kin²/W	0.37	0.23
Thermal conductivity λ	W/mK	2.0	2.5
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	6.0	5.0
Dielectric breakdown $E_{d; ac}$	kV/mm	12	10
Volume resistivity	Ωm	2.2×10^{11}	0.68×10^{12}
Dielectric loss factor $\tan \delta$	1	1.0×10^{-3}	2.9×10^{-2}
Dielectric constant ϵ_r	1	3.6	3.4
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	30 - 45	25 - 38
Youngs modulus*	N/cm²	58	32
Physical properties			
Density	g/cm³	1.65	1.69
Application temperature	°C	-40 to +180	-40 to +180
TML	Ma.-%	< 0.44	< 0.46
Flame rating	UL	94V-0	94V-0***
Possible thickness**	mm	0.5 – 5.0	1.0 – 5.0

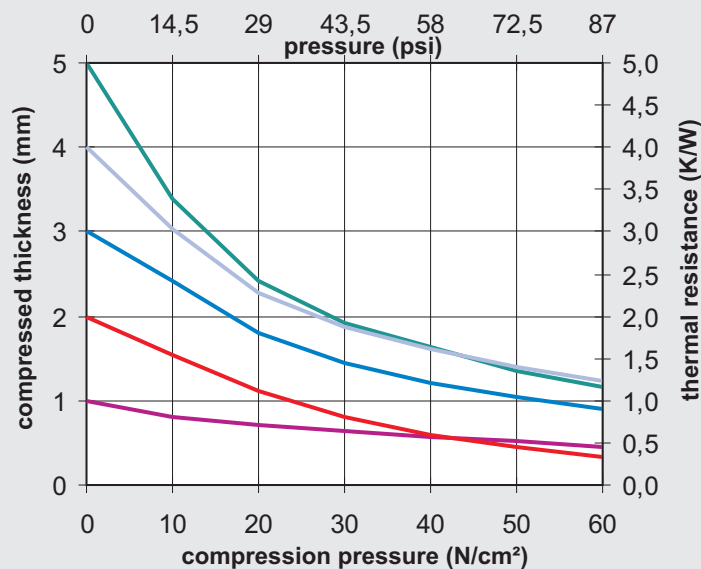
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

***Kerafol test according to UL
**details see page 45

Compressibilities of Softtherm® 86/225



Compressibilities of Softtherm® 86/320



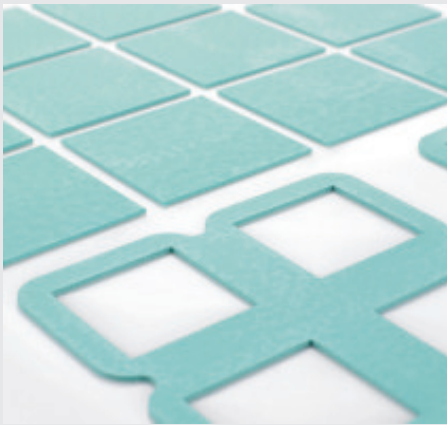
Keratherm® - Softtherm® 86/300, 86/325

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

Applications:

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

Optional available with
adhesive coating!

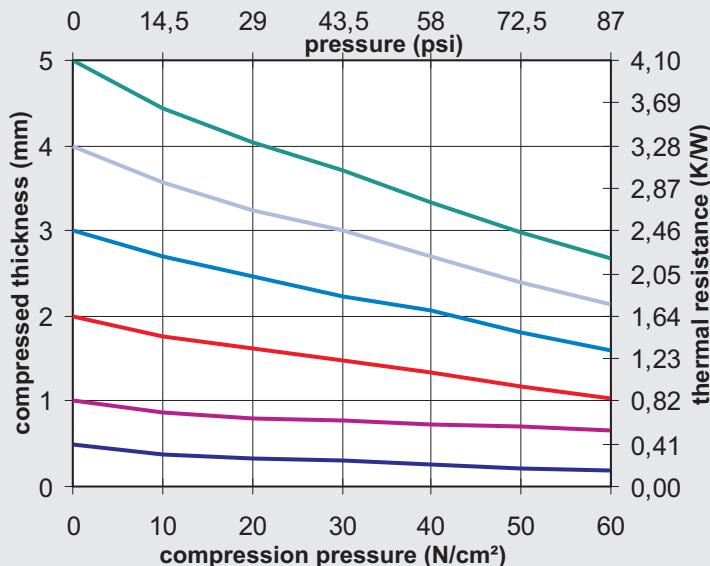


Properties	Unit	86/300	86/325
Colour		blue	mint
Assembling		single layer, fibre glass reinforcement up to 1.2 mm	single layer, fibre glass reinforcement up to 1.0 mm
Thermal properties			
Thermal resistance R_{th}	K/W	0.41	0.41
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	164 0.25	164 0.25
Thermal conductivity λ	W/mK	3.0	3.0
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	7.0	6.0
Dielectric breakdown $E_{d; ac}$	kV/mm	14	12
Volume resistivity	Ωm	1.0×10^{11}	85.4×10^9
Dielectric loss factor $\tan \delta$	1	5.0×10^{-3}	0.145
Dielectric constant ϵ_r	1	3.30	3.77
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	60 - 75	35 - 50
Youngs modulus *	N/cm²	24	64
Physical properties			
Density	g/cm³	1.71	1.95
Application temperature	°C	-60 to +200	-40 to +180
TML	Ma.-%	< 0.35	< 0.35
Flame rating	UL	94V-0	94V-0***
Possible thickness**	mm	0.5 – 5.0	0.5 – 3.0

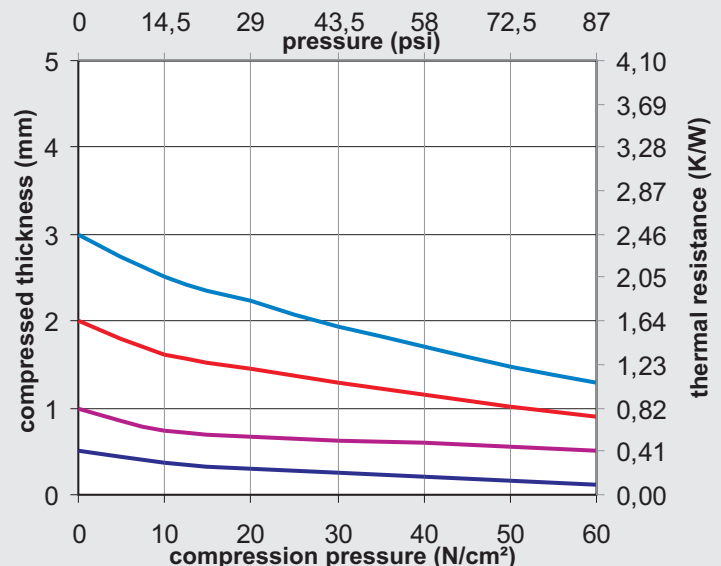
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

***Kerafol test according to UL
**details see page 45

Compressibilities of Softtherm® 86/300



Compressibilities of Softtherm® 86/325



Keratherm® - Softtherm® 86/450, 86/500

This group of Softtherm® - films are characterized by their extremely high thermal conductivity. The single-layer films without glass fibre reinforcement have good compressibility and softness. The good dimensional stability of these films ensures a controlled and automated processing.

Applications:

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

Optional available with adhesive coating!

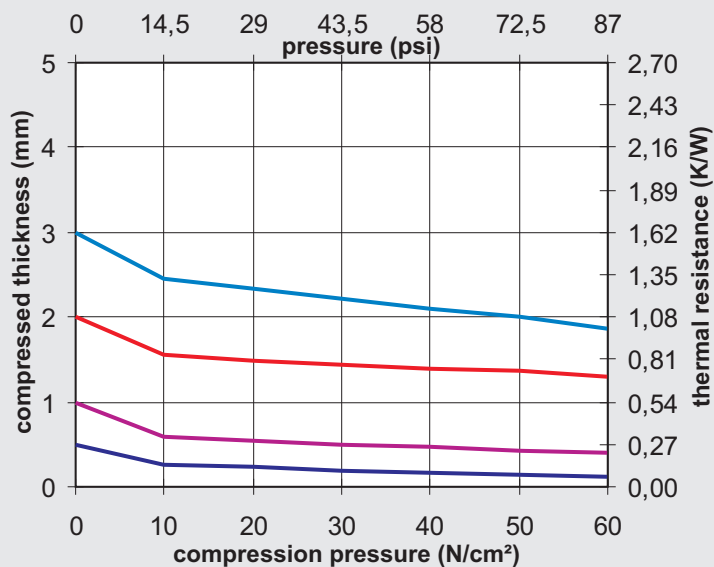


Properties	Unit	86/450	86/500
Colour		chocolate	brown
Assembling		single layer, without fibre glass reinforcement	single layer, without fibre glass reinforcement
Thermal properties			
Thermal resistance R_{th}	K/W	0.27	0.25
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	108 0.18	100 0.15
Thermal conductivity λ	W/mK	4.5	5.0
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	5.0	1.0
Dielectric breakdown $E_{d; ac}$	kV/mm	10	2.0
Volume resistivity	Ωm	3.6×10^{12}	1.0×10^{11}
Dielectric loss factor $\tan \delta$	1	3.0×10^{-3}	1.5×10^{-2}
Dielectric constant ϵ_r	1	2.5	3.9
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	65 - 75	65 - 75
Youngs modulus*	N/cm²	94.5	70
Physical properties			
Density	g/cm³	1.32	1.33
Application temperature	°C	-40 to +180	-60 to +200
TML	Ma.-%	< 0.40	< 0.24
Flame rating	UL	94V-0***	94V-0
Possible thickness**	mm	0.5 – 4.0	0.5 – 2.0

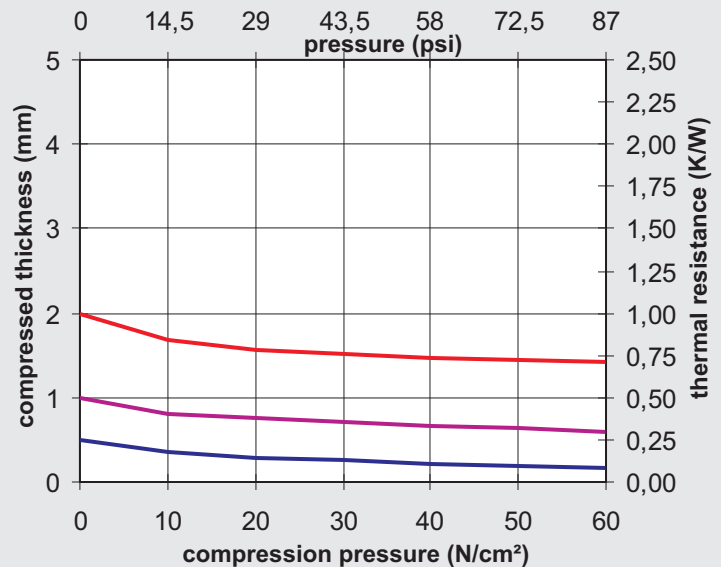
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

***Kerafol test according to UL
**details see page 45

Compressibilities of Softtherm® 86/450



Compressibilities of Softtherm® 86/500



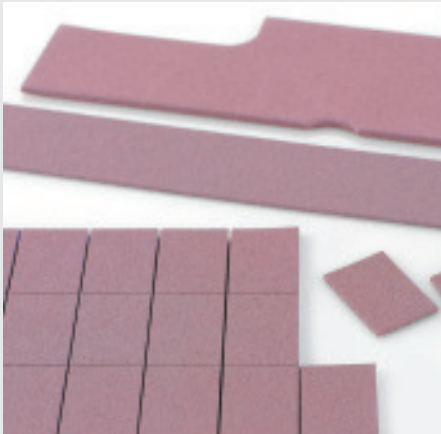
Keratherm® - Softtherm® 86/525, 86/600

Group of highly thermally conductive Softtherm® - films. Low thermal transitions with good dielectric behaviour and a good compressibility characterize this Softtherm® - films.

Applications:

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

Optional available with
adhesive coating!

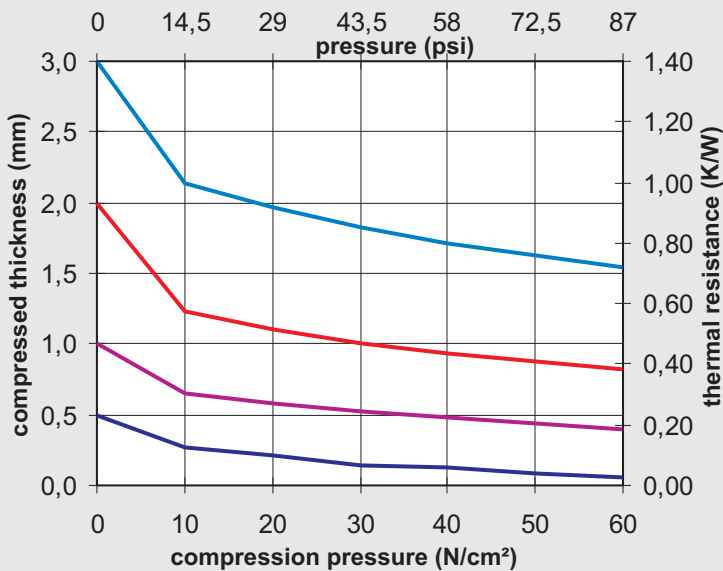


Properties	Unit	86/525	86/600
Colour		violet	grey
Assembling		single layer, without fibre glass reinforcement	single layer, without fibre glass reinforcement
Thermal properties			
Thermal resistance R_{th}	K/W	0.22	0.20
Thermal impedance R_{ti}	°Cmm²/W	89	80
	Kin²/W	0.14	0.12
Thermal conductivity λ	W/mK	5.5	6.0
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	1.25	1.5
Dielectric breakdown $E_{d; ac}$	kV/mm	2.5	3.0
Volume resistivity	Ωm	16×10^{12}	1.7×10^{10}
Dielectric loss factor $\tan \delta$	1	1.0×10^{-3}	2.0×10^{-3}
Dielectric constant ϵ_r	1	2.70	2.5
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	50 - 65	60 - 75
Youngs modulus *	N/cm²	98.5	77
Physical properties			
Density	g/cm³	1.18	1.28
Application temperature	°C	-40 to +180	-60 to +180
TML	Ma.-%	< 0.35	< 0.40
Flame rating	UL	94V-0	94V-0***
Possible thickness**	mm	0.5 – 4.0	0.5 – 1.5

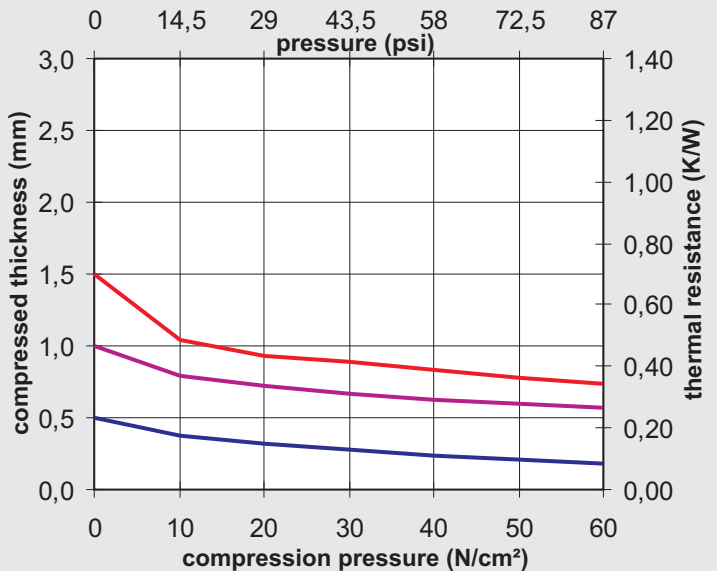
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

***Kerafol test according to UL
**details see page 45

Compressibilities of Softtherm® 86/525



Compressibilities of Softtherm® 86/600



Keratherm® - Softtherm® silicone free U 200, U 281

Flexible ceramic thermal-conducting and insulating films. Softtherm® U 200 and U 281 are particularly suitable for silicone-sensitive applications and an alternative to silicone-based Softtherm® - films.

The silicone-free Softtherm® - films have high electrical insulation and very good thermal conductivity.

Applications:

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

Optional available with
adhesive coating!

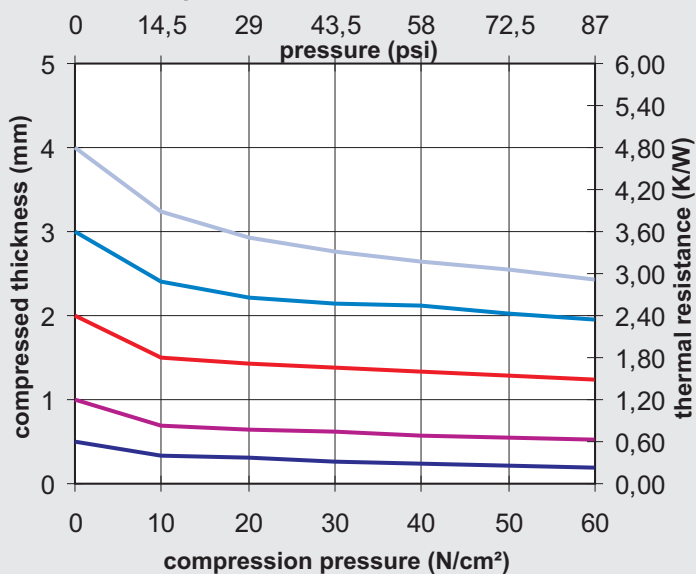


Properties	Unit	U 200	U 281
Colour		brown	grey
Assembling		single layer, without fibre glass reinforcement	single layer, without fibre glass reinforcement
Thermal properties			
Thermal resistance R_{th}	K/W	0.60	0.60
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	240 0.37	240 0.37
Thermal conductivity λ	W/mK	2.0	2.0
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	7.0	7.0
Dielectric breakdown $E_{d; ac}$	kV/mm	14	14
Volume resistivity	Ωm	5.1×10^9	5.32×10^9
Dielectric loss factor $\tan \delta$	1	3.9×10^{-2}	7.8×10^{-2}
Dielectric constant ϵ_r	1	8.1	5.57
Mechanical properties			
Measured thickness (+/-10%)	mm	0.5	0.5
Hardness	Shore 00	55 - 70	55 - 65
Youngs modulus*	N/cm²	197	244
Physical properties			
Density	g/cm³	2.1	2.6
Application temperature	°C	-40 to +130	-40 to +130
TML	Ma.-%	< 0.8	< 0.9
Flame rating	UL	94V-0	94V-0***
Possible thickness**	mm	0.5 – 4.0	0.5 – 3.0

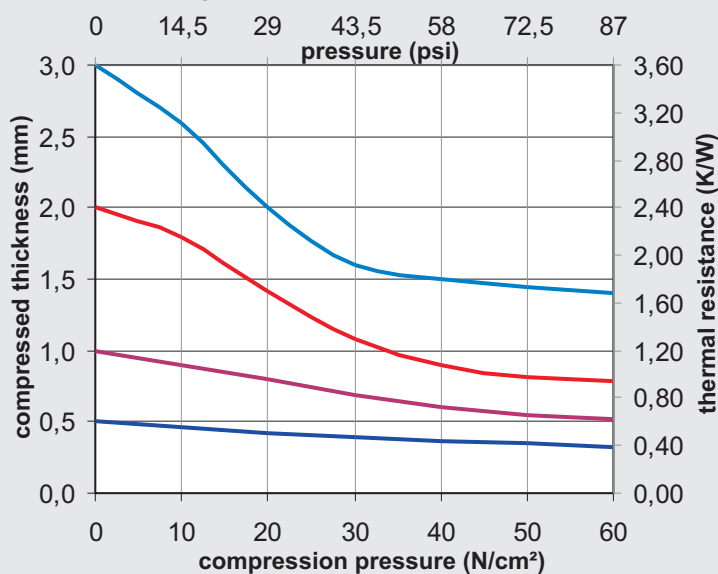
*Youngs modulus sample size 30mmx30mmx2.5mm; variable contact pressure; compression 50% of the measured thickness

***Kerafol test according to UL
**details see page 45

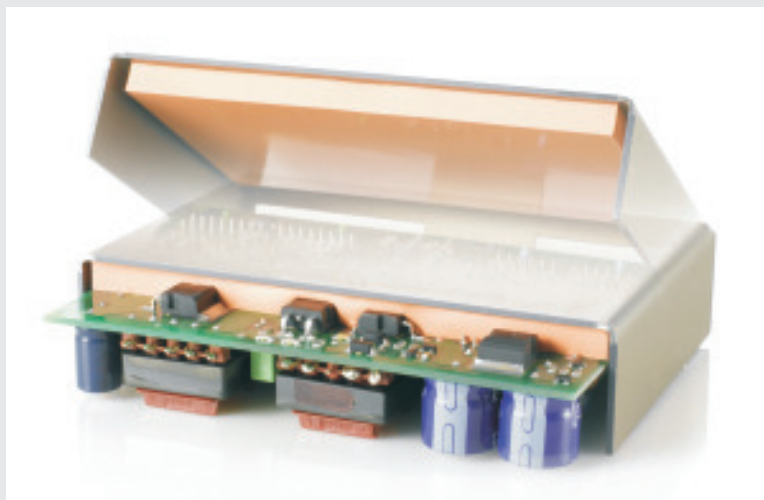
Compressibilities of Softtherm® U 200



Compressibilities of Softtherm® U 281



Keratherm® - Softtherm® - Application Notes



Softtherm® -materials are highly elastic, perfectly conformable low-tension gap filler. They achieve a very good balance of different surface mounting heights such as component differences, housing irregularities, gap-bridging in mechanical or electronic components, disortions of PCBs, etc.

First remove the covering on the soft, compressible side (yellow at 86/200, red at 86/250 and 86/255). With all other Softtherm® -films the installation position can be ignored except the film has an adhesive coating. Then apply the film to the component and remove the second cover from the back.

When applying, make sure that the softer side of the film covering the component and thus compensates for the different heights. When using an adhesive film 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 "removeliner" the film is applied with the adhesive side to the heat sink or the housing. The cover on the soft side is removed prior to the application. Assemble your application and apply a mounting pressure, so that the material adapts well to the parts. At maximum pressure, the compressibility of the film should not be more than 30% of the original thickness. If using more pressure the material can leak out.

Carrier film decoding of Softtherm® - films

	86/200	86/120	86/125	86/250	86/255	86/235	86/225	86/320
upper cover	PP	PP	PP	PP	PP	PP	PP	LDPE-b
lower cover	PET	PP	PP	PET	PET	PP	PP	LDPE-g
adhesive cover	PP	LDPE-b	xx	PP	PP	xx	xx	xx

	86/300	86/325	86/450	86/500	86/525	86/600	U200	U281
upper cover	PP	PP	PP(x)	PP(x)	PP(x)	PP(x)	LDPE-g	PET-s
lower cover	PP	PP	PP	PP	PP	PP	LDPE-g	PET-s
adhesive cover	LDPE-b	xx	LDPE-b	LDPE-b	LDPE-b	LDPE-b	P-s	P-s

xx - no adhesive assembling possible (self-adhesion to high)

PP(x) - no cover with precuts

		identification
cover	PP - transparent (100µm)	PP
	LDPE - green grained structure (90µm)	LDPE-g
	LDPE - blue large grained structure (120µm)	LDPE-b
	LDPE-siliconized (100µm)	LDPE-s
	Papier - siliconized (80µm)	P-s
	PET - siliconized (37/50/100 µm)	PET-s

Keratherm® - Thermal Compounds GF 255, GF 300

Applications:

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

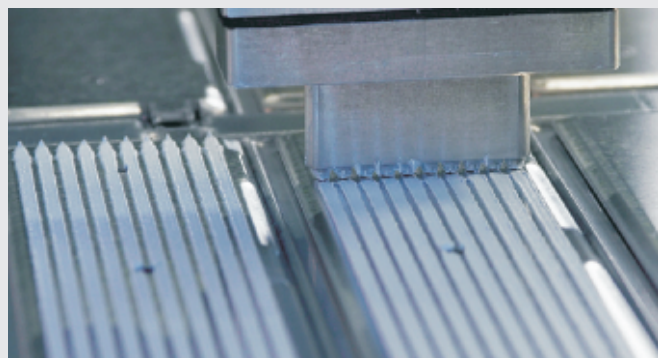
Ceramic-filled, two-component silicone elastomers. Because of their various thermal conductivities and differing compressibility behaviour, their good dielectric properties and being free of solvents, these materials are ideally suitable for encapsulating or dispensing. A wide range of different material viscosities makes them suitable for "wet-in-wet" production. Customer-specific solutions for the compound and processing technology are our strength.

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	4.0	7.0
Dielectric breakdown E _{d; ac}	kV/mm	8.0	14.0
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 48

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, viscosity of the sealing compound, etc.).

Curing conditions: For specific curing times please refer to the data sheets. 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

Applications:

- Chipsets
- Memory chips
- Micro BGA



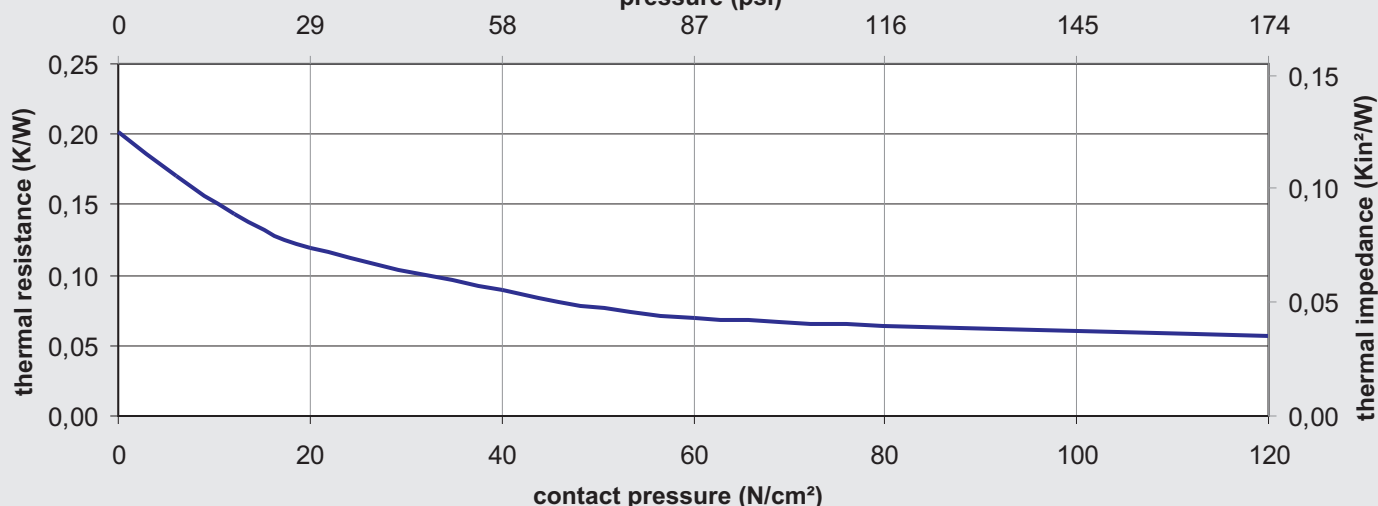
Properties	Unit	90/10 basic film
Colour		black
Thermal Properties		
Thermal resistance R_{th}	K/W	0.09
Thermal impedance R_{ti}	°Cmm²/W Kin²/W	36 0.05
Thermal conductivity λ (x-y)	W/mK	5.5 (200)
Electrical Properties		
Electrical resistance z (x/y)	$\Omega\mu m$	650-700 (6 – 8)
Breakdown voltage $U_{d; ac}$	kV	conductive
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
Flame rating	UL	94V-0
TML	Ma. %	0.01
Possible thickness*	mm	0.150 – 0.200

Keratherm® graphite films are based on 100% pure graphite.

*details see page 45

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.

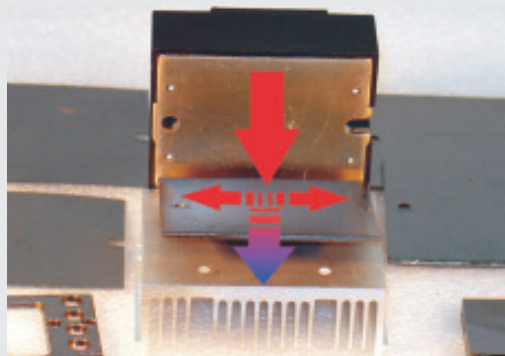
Compressibility of Keratherm® - Graphite Film 90/10



Options for Keratherm® - Graphite

Type	Tape assembling	Thickness mm	Tensile strength N/mm²	Thermal resistance	
				K/W	Kin²/W
90/15	90/10 with filled adhesives	0.200	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)

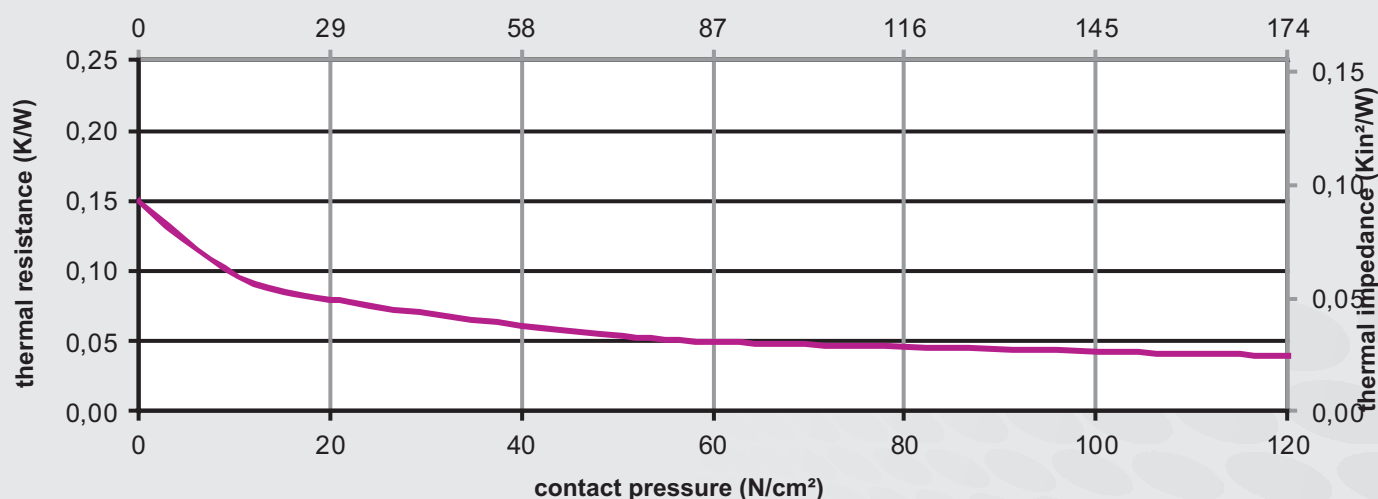


Properties	Unit	S 900
Colour		black
Thermal properties		
Thermal resistance R_{th}	K/W	0.08
Thermal impedance R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	34
	Kin^2/W	0.047
Thermal conductivity λ_z (x/y)	W/mK	7.5 (>300)
Electrical properties		
Electrical resistance z (x/y)	$\Omega\mu\text{m}$	700 – 800 (7 – 9)
Breakdown voltage $U_{d; ac}$	kV	conductive
Mechanical properties		
Measured thickness (+/-10%)	mm	0.29
Hardness	Shore D	25 - 35
Tensile strength	N/mm ²	10
Elongation	%	5
Physical properties		
Application temperature	$^{\circ}\text{C}$	-40 to +500
Density	g/cm ³	> 1.6
Flame rating	UL	94V-0
TML	Ma. %	0.01
Possible thickness*	mm	0.150 / 0.290

*details see page 45

Keratherm® - Graphite S 900 is a highly compressed 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 heat spreader applications. In addition, applications in vacuum or at high temperatures (400 $^{\circ}\text{C}$) are possible. Graphite S 900 has no electrical insulation and can be customized and applied with an adhesive coating.

Compressibility of Keratherm® - Graphite Film S 900
pressure (psi)



Keratherm® - Ferrite F 96

Applications:

- EMC - absorbtion
- flexible PCB
- LED - arrays

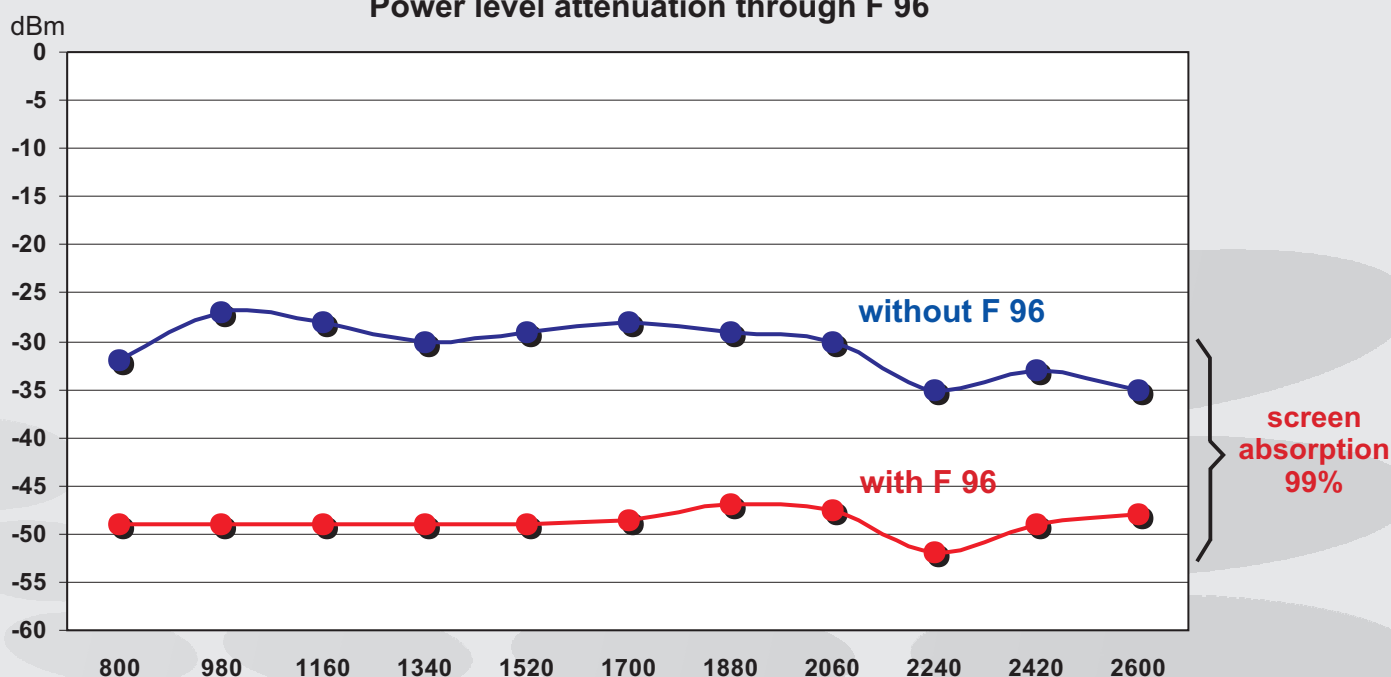


A new material made from soft magnetic ferrite for electromagnetic shielding, flexible coils or other magnetic applications. The film has a very good shielding efficiency and a high EMC absorption capacity! Its high initial permeability ensures good magnetic properties. The high flexibility allows preforms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

Properties	Unit	F 96
Colour		black
Initial permeability μ_i		$14 \pm 20\%$
Relative loss factor ($\tan \delta/\mu_i$)		
1,0 KHz		0.20
0,1 MHz		0.01
Dielectric constant ϵ_r		
1,0 KHz		2.80
0,1 MHz		0.20
Thermal properties		
Thermal resistance	K/W	0,56
Thermal impedance	$^{\circ}\text{Cmm}^2/\text{W}$	238
	Kin^2/W	0,329
Thermal conductivity λ	W/mK	1.0
Electrical properties		
Breakdown voltage $U_{d,ac}$	kV	> 200
Dielectric breakdown $E_{d,ac}$	kV/mm	1.0
Mechanical properties		
Measured thickness (+/-10%)	mm	0.225
Hardness	Shore A	82
Tensile strength	N/mm ²	0.7
Elongation	%	40
Physical properties		
Application temperature	$^{\circ}\text{C}$	-40 to +200
Density	g/cm ³	3.02
Flame rating	UL	94V-0
Possible thickness*	mm	0.225 – 0.500

*details see page 45

Power level attenuation through F 96



Keratherm® - KL 90, KL 91

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

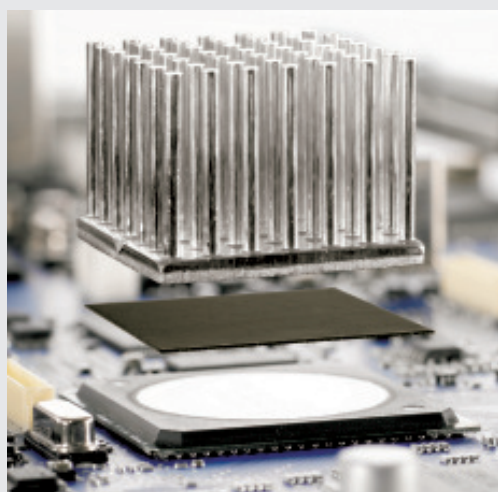
Applications:

Thermal connection of

- CPUs, LEDs
- Flip Chips, DSPs, BGAs, PPGAs
- 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)		without	with
Thermal properties			
Thermal resistance* R_{th}	K/W	0.52	0.55
Thermal impedance* R_{ti}	$^{\circ}\text{Cmm}^2/\text{W}$	208	220
	Kin^2/W	0.32	0.34
Thermal conductivity*	W/mK	1.40	1.35
Electrical properties			
Breakdown voltage $U_{d; ac}$	kV	6.0	6.0
Dielectric breakdown $E_{d; ac}$	kV/mm	20.0	20.0
Volume resistivity	Ωm	2.6×10^4	2.6×10^4
Dielectric loss factor $\tan \delta$	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/cm^3	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	94V-0***
Possible thickness*	mm	0.15 – 0.5	0.3

*details see page 45

***Kerafol test according to UL

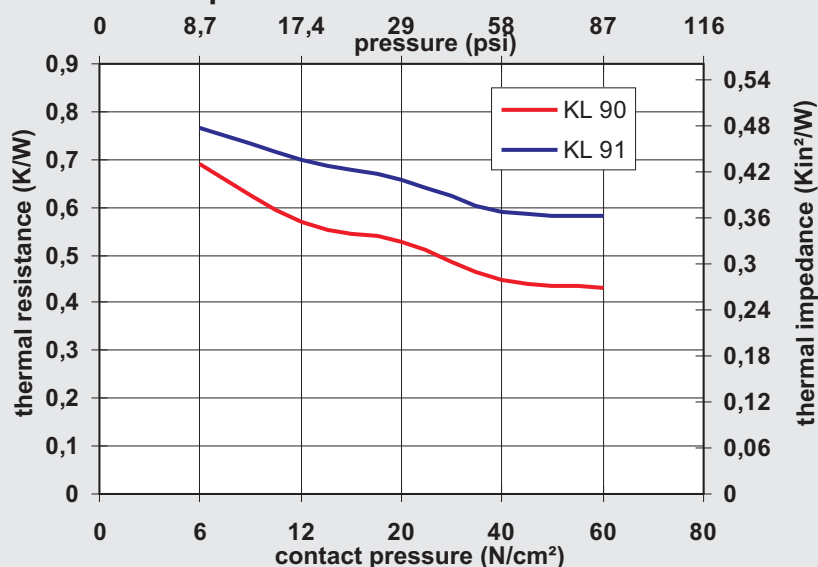
Kertherm® KL 90 and KL 91 are thermal conducting, electrical insulating double sided adhesive films. They have an excellent, permanent adhesive strength with high thermal conductivities and at the same time very good insulation characteristics.

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 (continuous)	°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/cm ² /sec.	10/10	10/15
Tensile shear strength [25mmx25mm-adhesive area-180° aluminum – adhesive film – aluminum]	N/cm ² [DIN EN 1465] [ASTM D 1003]	>30	>25
Tensile shear strength temperature-dependending** [25mmx25mm-adhesive area-180° aluminum – adhesive film – aluminum]	N/cm ² [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/m ² (5g) test cycle 24h (6h per axis) [1]	N/cm ²	31.5	32.5
Tensile shear strength after vibration test (sinusoidal at RT); vibration 10–500 Hz; 100 s/m ² (10g) test cycle 24h (8h per axis) [2]	N/cm ²	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 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.

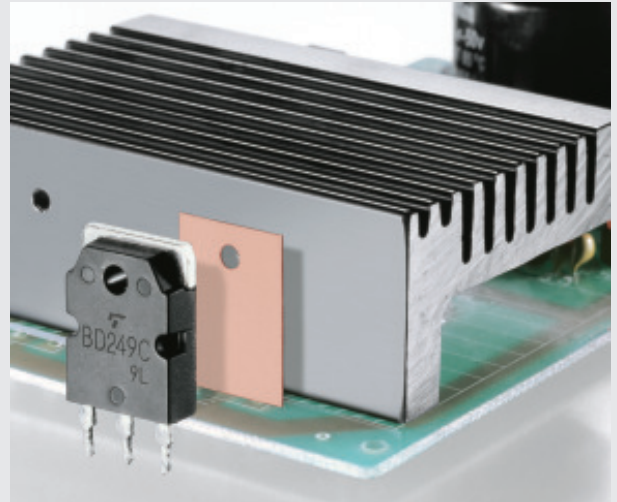
² **Shelf Life:** Silicone adhesive: eight (8) months from date of manufacture provided the material has been stored in its original packaging and at max. 21°C (70°F) and 50% relative humidity. Acrylate adhesive: twelve (12) months from date of manufacture provided the material has been stored in its original packaging and at max. 21°C (70°F) and 50% relative humidity.

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

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 labelling 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!

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 Softtherm®-Films 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 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 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 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 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 Methodes

Description	Unit	Test Methode	
Thermal resistance R_{th}^{*1}	K/W	Kerafol® - test methode	
Thermal conductivity λ^{*1}	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 53482 - 3	ASTM D 257-3
Dielectric loss factor $\tan \delta$	1	DIN 53483	ASTM D 150
Dielectric constant ϵ_r	1	DIN 53483	ASTM D 150
Electrical conductivity	pS/m	DIN 51412-1	
Measured 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
Compressibility ^{*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 Kerafol internal	UL 94 / E140693 Kerafol Test according to UL	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} (4 cm²)
2. Compressibility and "Youngs modulus" (3.0 cm x 3.0 cm = 9 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

KERATHERM® - List of available thicknesses

Keratherm® Thicknesses in mm

Thickness	0,125	0,200	0,225	0,250	0,275	0,300	0,325	0,400	0,425	0,500	0,525	max available dimensions mm x meter	setup/ options
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	glassweave
86/10								x		x		470 x meter	glassweave
86/20				x			x					500 x meter	adh+glassweave
86/20									x		x	470 x meter	adh+glassweave
86/37	x		x			x						500 x meter	standard
86/37								x		x		470 x meter	standard
86/47				x								500 x meter	adhesive
86/47									x		x	470 x meter	adhesive
86/17	x		x			x						500 x meter	glassweave
86/17								x		x		470 x meter	glassweave
86/27				x			x					500 x meter	adh+glassweave
86/27									x		x	470 x meter	adh+glassweave
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	glassweave
86/52								x		x		470 x meter	glassweave
86/53				x			x					500 x meter	adh+glassweave
86/53									x		x	470 x meter	adh+glassweave
86/81		x										500 x meter	standard
86/82				x		x						500 x meter	glassweave
86/82								x		x		470 x meter	glassweave
86/82 K					x		x					500 x meter	adh+glassweave
86/82 K									x		x	470 x meter	adh+glassweave
86/82 lb				x		x						500 x meter	glassweave
86/82 lb								x		x		470 x meter	glassweave
86/83				x		x						500 x meter	glassweave
86/83								x		x		470 x meter	glassweave
70/50				x								500 x meter	glassweave
70/60					x							500 x meter	adh+glassweave
U 23												380 x meter	
U 23	x			x		x				x		400 x meter	standard
U 23 K	0,150				x							380 x meter	
U 23 K									x		x	380 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

KERATHERM® - List of available thicknesses

Keratherm® Thicknesses in mm

Thickness	0,125	0,200	0,225	0,250	0,275	0,300	0,325	0,400	0,425	0,500	0,525	max available dimensions	setup/ options
MT 102				x								mm x meter	
MT 103				0,280								230 x meter	standard
MT 102 K					x							230 x meter	standard
MT 103 K						0,305						220 x meter	adhesive
PCM 471		x										220 x meter	adhesive
Thickness	0,100	0,125	0,150	0,175	0,200	0,225	0,250	0,275	0,300	0,400	0,500	150 x meter	
90/10			x		x							mm x meter	
90/15					x		x					500 x Meter	standard
90/20												460 x Meter	filled adhesive
F 96						x			x	x	x	460 x Meter	acrylic adhesive
F 96 K							x		0,325	0,425	0,525	340 x Meter	
KL 90									x			330 x Meter	adhesive
KL 91									x			400 x Meter	
Dicke	0,150	0,290	0,550	0,830	1,080	1,550						400 x Meter	glassweave
S 900		x		available on request								mm x meter	
S 900	x											500 x 500	standard
Thickness	0,175	0,315	0,575	0,855	1,105	1,750						500 x 1000	
S 900 K		x		available on request								mm x meter	
S 900 K	x											500 x 500	adhesive
Thickness	0,500	0,800	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000	480 x 1000	adhesive
86/120	x		x	x	x	x	x	x	x	x	x	mm x meter	
86/125	x		x	x	x	x	x	x	x	x	x		standard
86/200	x	x	x	x	x	x	x	x	x	x	x	450 x 250	standard
86/200 K	x		x	x	x	x	x	x	x	x	x	450 x 250	adhesive
86/225	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/235	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/250	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/250 K	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
86/255 K	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
86/325	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/450	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/500	x		x	x	x	x	x	x	x	x	x	450 x 250	standard
86/525	x		x	x	x	x	x	x	x	x	x	452 x 250	standard
86/600	x		x	x								450 x 250	standard
U 200	x		x	x	x	x	x	x	x				silicone free
U 281	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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