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to cool to protect to connect

The right contact!

f.tim.e

Thermally conductive material

made in Germany

AEO

TÜVRheinland CERTIFIED

Management System
ISO 9001:2015
ISO 14001:2015
ISO 27001:2013
www.tuv.com
ID 0091004274

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f.tim.e 03-2022
1.000

Innovative thermal conductive foils

very good thermal properties • silicone containing and silicone-free versions • optimal contacting between device and heatsink • easy fitting by means of adhesive coating • 24 h sample cut service • individual cuts according to customer specifiations

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Quality-Management System ISO 9001

We are certified to ISO 9001.
This process-directed quality management system implies a constant focus on satisfying the demands of customers, and this is the major objective of our company.

The implementation and further development of our quality management system demonstrably ensures
- guaranteed customer satisfaction and thus the success of our company,
- compliance with customers' requirements at all times through defined processes,
- early detection and prevention of errors, and
- checking of both process effectiveness and efficiency on a regular basis together with steady improvement.

It is through constant vigilance and the provision of evidence that we deliver flawless products, which fully comply with quality requirements, that we maintain our quality certification.
In order to secure lasting company success and to meet our customers' expectations now and in the future, we define measurable objectives within the framework of our quality system, which are regularly checked and developed.
We are committed to constant measurement and improvement of our performance.

Our quality management system applies to all processes carried out by our company.

Certificate

Standard **ISO 9001:2015**

Certificate Registr. No. **09 100 4274**

Certificate Holder:

Fischer Elektronik GmbH & Co. KG
Nottebohmstr. 28
58511 Lüdenscheid
Germany

Scope: Design/construction, manufacture, assembly and technical advice for heatsinks, sockets, connectors, mounting parts, cases, 19" assembly systems, computer accessories

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2021-11-01 until 2024-10-31.
First certification 1994

2021-09-09

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

www.tuv.com

Certificate

Standard **ISO 14001:2015**

Certificate Registr. No. **01 104 8209**

Certificate Holder:

Fischer Elektronik GmbH & Co. KG
Nottebohmstr. 28
58511 Lüdenscheid
Germany

Scope: Design/construction, manufacture, assembly and technical advice for heatsinks, sockets, connectors, mounting parts, cases, 19" assembly systems, computer accessories

Proof has been furnished by means of an audit that the requirements of ISO 14001:2015 are met.

Validity: The certificate is valid from 2021-10-09 until 2024-10-08.
First certification 1998

2021-09-09

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

www.tuv.com

Environmental Management System ISO 14001

We consider protection of the environment and saving of natural resources entrepreneurial tasks of high priority.

Aware of this, our company was the first German heat-sink manufacturer to implement, the environmental management system in accordance with ISO 14001 in 1998.

Our entrepreneurial responsibility comprises preventing accidents, safeguarding against occupational diseases, designing workplaces to suit human requirements, developing products which are safe to use, saving resources and avoiding environmental impact to the maximum extent possible.

We already consider environmental compatibility in the product and process development stage. The environmental impact of our activities is documented, assessed and in a continuous improvement process reduced to a minimum.

Implementation and consistent working on and with the environmental management system is a vital process and a constant challenge but finally it will always lead to better results.

Information management norm DIN EN ISO/IEC 27001

Information security is becoming more important. For the success of our business information are essential values. Administrating and protecting those has our top priority.

The information security management system to ISO/IEC 27001 considers three kinds of information: availability, confidentiality and integrity.

This information security management system is the basis for continuous monitoring and optimisation processes.
It also ensures the scrupulous handling with information. A protection against attacks on the corporate network and theft is ensured.

Within the information security management system the risk evaluation such as human misconduct takes place by means of error-possibility-influence-analysis.

Certificate

Standard **ISO/IEC 27001:2013**

Certificate Registr. No. **01 153 101878**

Certificate Holder: fischer elektronik

Fischer Elektronik GmbH & Co. KG
Nottebohmstr. 28
58511 Lüdenscheid
Germany

Scope: Design/construction, manufacture, assembly and sales for heatsinks, sockets, connectors, mounting parts, cases, 19" assembly systems, PCB accessory

SoA Version 2.2 dated 14.02.2020

Proof has been furnished by means of an audit that the requirements of ISO/IEC 27001:2013 are met.

Validity: The certificate is valid from 2020-12-23 until 2023-09-30.

2021-01-12

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

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IAF DAkkS Deutsche Akkreditierungsstelle D-ZM-16031-01-00 TÜVRheinland® Precisely Right.

AEO

Europäische Gemeinschaft

AEO-Zertifikat

DE AEOC 101367
(Nummer des Zertifikats)

1. Inhaber des AEO-Zertifikats	2. Erteilende Behörde
Fischer Elektronik GmbH & Co KG EORI-Nummer: DE 2499770 Nr. der amtl. Eintragung: HRA 2836 UST-IDNr(n).: DE 125797501	Hauptzollamt Dortmund Kronenburgallee 7 DE-44139 Dortmund

HAUPTZOLLAMT DORTMUND

Der in Feld 1 genannte Inhaber ist

Zugelassener Wirtschaftsbeteiligter

"AEOC (zollrechtliche Vereinfachungen)"

3. Tag, ab dem das Zertifikat wirksam ist:

16.03.2010

The authorised economic operator AEO-certificate

Since 1st January 2008 companies based in the European Union and involved in customs activities have been able to apply for the status of Authorised Economic Operator (AEO). The status entitles a benefit of safety-relevant custom controls and/or simplification according to custom regulations.

The goal is here to ensure an uninterrupted global supply chain from the producer to the end user. The status of an authorised economic operator is valid in all Member States and is not limited in time.

Our company has the status AEO-C (customs simplification).

The legal requirements of an authorised economic operator are essentially the result of:
Article 5a community custom code (ZK)
Article 14a - 14x community custom code implementing provision (ZK-DVO)

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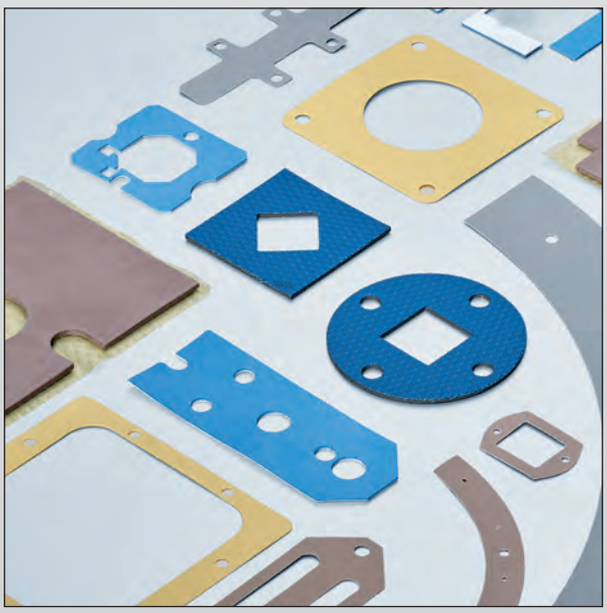
Thermal contact materials
Thermal conductive materials
Innovative thermal conductive foils
Efficient thermal conductive materials

Thermal contact materials
- aluminium oxide-, Kapton- and mica discs
- high dielectric strength at very good thermal conductivity
- best mechanical properties
- easy and clean handling
- wide operating temperature range
- cuts and special designs acc. to customer's requirement

Thermal conductive materials
- with high long-term stability and thermal conductivity
- smallest heat transfer resistances
- excellent compensation of unevennesses
- electrical conductive and insulating
- as sheet material or rolled goods
- customised cuts by means of 24 h sample delivery service



Innovative thermal conductive foils
- very good thermal properties
- silicone containing and silicone-free versions
- optimal contacting between device and heat sink
- easy fitting by means of adhesive coating
- 24 h sample cut service
- individual cuts according to customer specifiations

Efficient thermal conductive materials
- fluid GEL thermal conductive material, thermal conductive paste and glue
- optimum balance of roughnesses and unevennesses
- good performance and processing properties
- automatic dispensable
- containing silicone and silicone-free
- other packaging seizes and container types upon request

High quality thermal interface materials

The connection of the device to be dissipated to the heat sink is especially important as for a poor heat transfer, i.e. from the device to the heatsink, the heat conduction respectively the heat transition is reduced and the device temperature will be significantly increased. Beside functional restrictions an uncontrolled temperature increase or even a device destruction is also possible. An optimal heat transfer can only be achieved if the inevitable tolerances, unevennesses and roughnesses of the surfaces to be connected which occur by production processes will be equalised. Suitable thermal conductive foils matching to the application provide excellent solutions for the thermotechnical contact optimization.

Our wide range of products contains i.e. silicon-containing and silicone-free thermal conductive foils, one sided and double sided adhesive thermal conductive foils, high thermal conductive graphite foils, thermal conductive silicone foam foils, silicone-containing and silicone-free GEL thermal conductive foils, dispensable GEL thermal conductive foils, kapton insulating washers, aluminium oxide and mica washers, phase change thermal conductive materials, silicone-containing and silicone-free thermal conductive pastes as well as various thermal conductive glues.

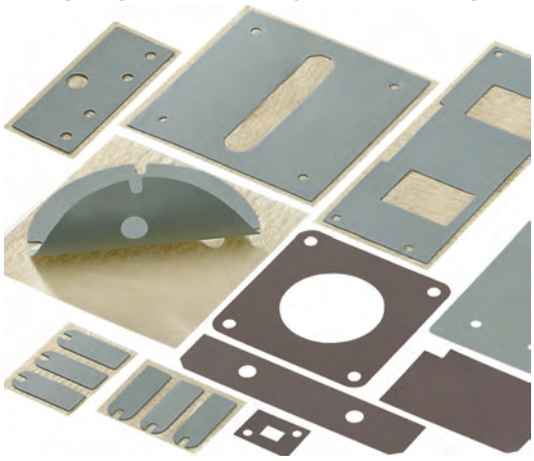
The different thermal conductive foils can be produced individually out of plate- or roll material according to customer specific drawings. Please also use our **24 hour sample service** for individual cuts of our standard thermal conductive materials according to your specification.

Production process:

Drawing parts with digital cutter

CAD data as a dxf file can be realised directly in ready and zero-toleranced exact cut templates without tooling costs. The outstanding production speed and a cutting technology perfected to the last detail provide an optimal result.

Stamped parts according to customer specific requirements



We produce contour die-cutting according to your drawing specification flexibly and fast for you.
The fully automised punching machine with the associated steel strip blanking die is particularly suitable for smaller, but also for higher quantities. Beside contour- and kiss-cut parts the possibility of cutting roll material to size or machining according to customer's requirements is also given.

The thermal data in the catalogue refers to an area of 1 inch^2 (6.45 cm^2) if not indicated otherwise.

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Overview thermal interface material

art. no.	thermal conductivity [W/m*K]	material thickness [mm]	page
WLFT 404 ... / WLFT 414 ... (double sided)	0,400	0,127	E 37
WLFT 405 ... (double sided)	0,500	0,15	E 37
WLPF ...	0,500	-	E 69
WSF(S) ...	0,460 @ 1,6 mm 0,520 @ 3,2 mm	0,8 / 1,6 / 2,4 / 3,2 / 4,8 / 6,35	E 41
WLFT 88 ... (double sided)	0,600	0,13 / 0,25 / 0,38 / 0,5	E 39
WLP ...	0,610	-	E 69
WLK ...	0,836	-	E 71
FSF 52 P	0,900	0,127	E 66
WFPK 09	0,900	0,152	E 26
WFS 09 ...	0,900	0,178 / 0,229	E 14
WFP 09	0,900	0,229	E 27
WK ... (one sided)	0,920	0,2	E 12
WLK DK ...	1,000	-	E 72
WG ...	1,130	0,2	E 12
WS ...	1,220	0,3	E 12
WFPK 13	1,300	0,152	E 28
WLFT 412 ... (double sided)	1,400	0,23	E 37
WB ...	1,430	0,15	E 12
FSF 15 P ...	1,500	0,114 / 0,127 / 0,140	E 67
WLFT 8926 ... (double sided)	1,500	0,2 / 0,25 / 0,5	E 40
GEL (G) ...	1,500	0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0 / 4,5 / 5,0	E 45
WFG 15 ...	1,500	0,508 / 1,016 / 1,524 / 2,032 / 2,54 / 3,175 / 4,064 / 5,08	E 46
GEL F 15 (G) ...	1,500	1,0 / 1,5 / 2,0	E 42
FSF 16 P ...	1,600	0,102 / 0,114 / 0,127	E 68
WFS 16	1,600	0,229	E 15
WFKF 18 ...	1,800	0,150 / 0,175 / 0,325	E 29
WFS 18	1,800	0,203	E 16
WFK 18 ...	1,800	0,225 / 0,25	E 17
GEL S 18 (liquid)	1,800	-	E 59
GEL S 20 (liquid)	1,800	-	E 60
FSF 20 P	2,000	0,200	E 66
WFKF 20 ...	2,000	0,5 / 1,0	E 43
WLK SK 50	2,000	-	E 73
WFQ 25	2,500	0,152	E 32
WFK 25 ...	2,500	0,225 / 0,25	E 18
GEL 28 (G) ...	2,500	0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0 /4,5 / 5,0	E 47
GEL 28 S ...	2,500	1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0 /4,5 / 5,0	E 53
FSF 30 P	3,000	0,12	E 66
WLFT 30 ... (one sided)	3,000	0,15 / 0,23	E 35

Explanation of the colours:

Thermally conductive foils containing silicone	Silicone-free thermally conductive foils	Aluminium and graphite foils	Adhesive thermally conductive foils	GAP Filler thermally conductive foils	GAP Fillers for extreme compressions	Phase Change thermally conductive foils	Thermally conductive pastes	Thermally conductive glues

Overview thermal interface material

art. no.	thermal conductivity [W/m*K]	material thickness [mm]	page
WFKF 30 02	3,000	0,2	E 30
WFSA 30 ...	3,000	0,381 / 0,508	E 19
GEL F 30 ...	3,000	0,5 / 1,0 / 1,5	E 44
WFGH 30 ...	3,000	0,508 / 1,016 / 1,524 / 2,032 / 2,54 / 3,175	E 48
GEL 30 S ...	3,000	0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0	E 54
GEL S 30 (liquid)	3,000	-	E 60
WFF 33 ...	3,300	0,2 / 0,3	E 20
WFS 34 ...	3,400	0,2 / 0,3 / 0,45	E 21
WFK 35 ...	3,500	0,125 / 0,225 / 0,25	E 22
GEL S 35 ... (liquid)	3,500	-	E 61
WLFT 40 023 (one sided)	4,000	0,23	E 36
GEL S 40 (liquid)	4,300	-	E 60
GEL 45 (G) ...	4,500	0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0 /4,5 / 5,0	E 49
WFC 50 ...	5,000	0,2 / 0,3 / 0,45 / 0,8	E 23
WFGH 50 ...	5,000	0,508 / 1,016 / 1,524 / 2,032 / 2,54 / 3,175	E 50
GEL 50 S ...	5,000	0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0	E 55
WFK 60 ...	6,000	0,1 / 0,2 / 0,225 / 0,3	E 31
GEL 60 (G) ...	6,000	0,5 / 1,0 / 1,5 / 2,0 / 2,5	E 51
GEL 60 S ...	6,000	1,5 / 2,0 / 2,5	E 56
WFK 65 ...	6,500	0,25 / 0,275	E 24
GEL 70 S ...	7,000	1,0 / 1,5 / 2,0 / 2,5 / 3,0 / 3,5 / 4,0	E 57
WLFG S 900 ...	7,500	0,15 / 0,175	E 33
WLFG 98 ...	8,000	0,13 / 0,25 / 0,5	E 34
WFS 80 ...	8,000	0,2 / 0,3 / 0,45	E 25
WLPK ...	10,000	-	E 70
GEL 80 (G) ...	13,000	0,3 / 0,5 / 1,0 / 1,5 / 2,0 / 2,5 / 3,0	E 52
GEL 130 S ...	13,000	0,5 / 1,0 / 1,5 / 2,0	E 58

Explanation of the colours:

Thermally conductive foils containing silicone	Silicone-free thermally conductive foils	Aluminium and graphite foils	Adhesive thermally conductive foils	GAP Filler thermally conductive foils	GAP Fillers for extreme compressions	Phase Change thermally conductive foils	Thermally conductive pastes	Thermally conductive glues

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Thermal conductive foils for semiconductors

– thermal conductive foils cut to size for IGBT, DC/DC converters and Solid State Relais
– other thermal conductive materials and cuts according to to customer's specifications

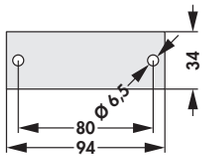
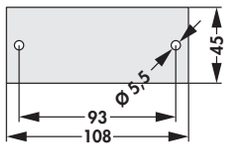
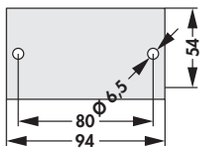
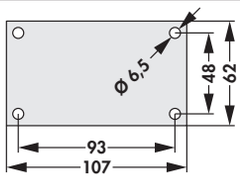
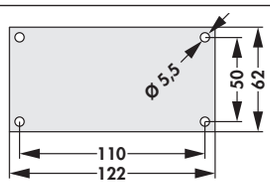
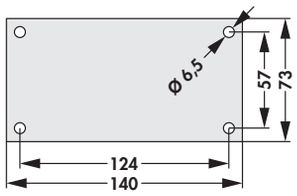
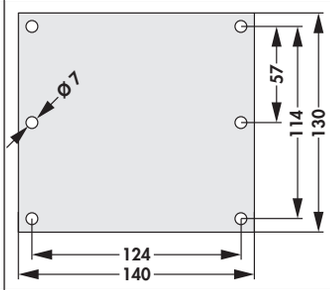
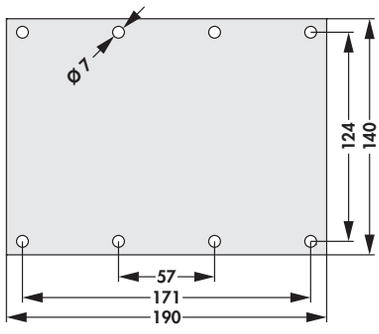
art. no.	page	thermal conductivity [W/m·k]	material thickness [mm]	type
WFQ 25 ...	E 32	2.5	0.152	aluminium foil
WLFG S 900	E 33	7.5	0.150	graphite foil
WLFG S 900 K	E 33	7.5	0.175	
WLFG 9813	E 34	8.0	0.130	
WLFG 9825	E 34	8.0	0.250	
WLFG 9850	E 34	8.0	0.500	
FSF 15 P 011	E 67	1.5	0.114	phase-change thermal conductive foil
FSF 15 P 012	E 67	1.5	0.127	
FSF 15 P 014	E 67	1.5	0.140	
FSF 20 P	E 66	2.0	0.200	

Order example

WLFG 9010 — **Thermally conductive foil**

54 x 94 — **dimension**

IGBT

dimension [mm]	blanks	manufacturer	component
34 x 94		Infineon MCC IXYS Semikron	Int-A-Pak (New) / 34mm Module MF … F2 / MT … T2 / MD … D2 Y4-M6 SEMITRANS 2 / SEMIPACK 2
45 x 108		Infineon IXYS	Econo 2 / Econo PIM 2 / Econo PACK 2 / Econo BRIDGE / Iso PACK 2 E2-Pack
54 x 94		Infineon MCC IXYS Semikron	MTC / Iso PACK 54 MD … M3 / MD … M5 PWS-E Flat / PWS-E SEMIPOINT 4
62 x 107		Infineon MCC IXYS Semikron	Dual Int-A-Pak / 62 mm Module MT … L2 E3-Pack SEMITRANS 3 / SEMITRANS 4
62 x 122		Infineon IXYS Semikron	Econo 3 / Econo DUAL + / Econo PIM 3 / Econo PACK 3 SimBus F SEMIX 3p / SEMIX 3Ip
73 x 140		Infineon	IHV
130 x 140		Infineon	IHM / IHV
140 x 190		Infineon	IHM / IHV

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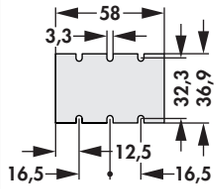
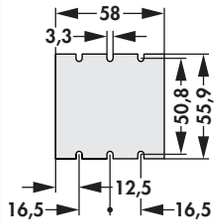
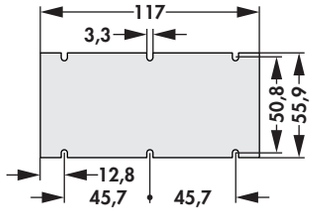
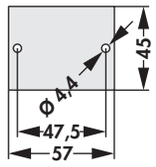
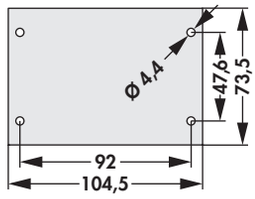
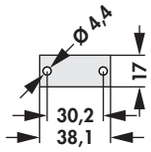
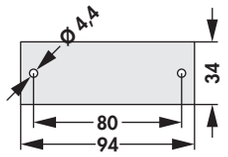
Thermal conductive foils for semiconductors

DC/DC converter

dimension [mm]	blanks	component
36.9 x 58		Micro DC/DC-converter
55.9 x 58		Mini DC/DC-converter
55.9 x 117		Maxi DC/DC-converter

Solid State Relais

dimension [mm]	blanks	component
45 x 57		SSR 1
73.5 x 104.5		SSR 2
17 x 38.1		SSR 3
34 x 94		SSR 4

Thermal conductive foils for LED

– thermal conductive foils cut to size for LEDs
– other thermal conductive materials and cuts according to to customer's specifications

art. no.	page	thermal conductivity [W/m·k]	material thickness [mm]	type
WFQ 25 ...	E 32	2.5	0.152	aluminium foil
WLFG S 900	E 33	7.5	0.150	graphite foil
WLFG S 900 K	E 33	7.5	0.175	
WLFG 9813	E 34	8.0	0.130	
WLFG 9825	E 34	8.0	0.250	
WLFG 9850	E 34	8.0	0.500	
WLFT 404	E 37	0.4	0.127	double-sided adhesive thermal conductive foil
WLFT 405	E 37	0.5	0.150	
WLFT 8805	E 39	0.6	0.130	
WLFT 8810	E 39	0.6	0.250	
WLFT 8815	E 39	0.6	0.380	
WLFT 8820	E 39	0.6	0.500	
WLFT 8926	E 40	1.5	0.2 / 0.25 / 0.5	
WLFT 30	E 35	3.0	0.15 / 0.23	one-side adhesive thermal conductive foil
FSF 15 P 011	E 67	1.5	0.114	phase-change thermal conductive foil
FSF 15 P 012	E 67	1.5	0.127	
FSF 15 P 014	E 67	1.5	0.140	
FSF 20 P	E 66	2.0	0.200	

Order example

WLFT 8810 **20 x 24**

Thermally conductive foil **dimension**

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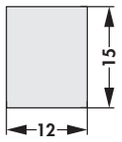
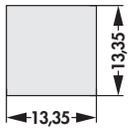
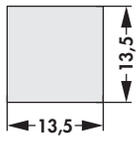
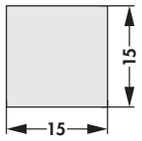
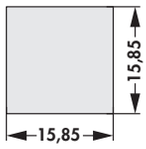
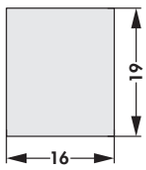
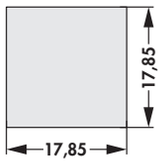
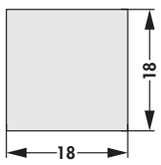
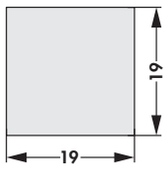
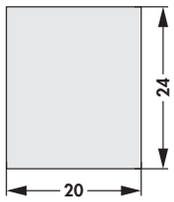
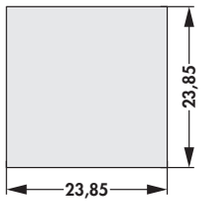
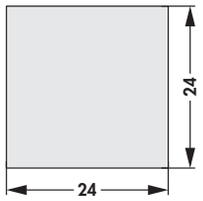
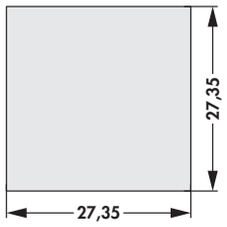
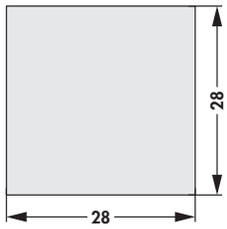
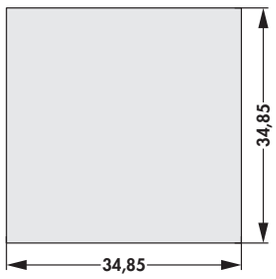
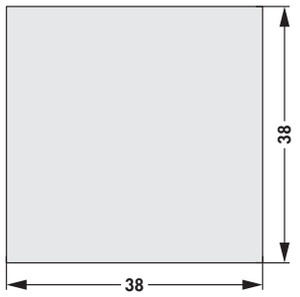
Thermal conductive foils for LED

dimension [mm]	blanks	manufacturer	LED package
12 x 15		Lumileds Luxeon Sharp Nichia LG Innotec	CoB 1202S Mini ZENIGATA / GW6BMG / GW6BGG / GW6BMW / GW6BGW / GW6NGW NTCWT / NTCWS / NVNWS / NJCWS LEMWM12480 / LEMWM12490
13.35 x 13.35		Cree Seoul Semiconductor	CXA13XX / CXB13XX SAW 806 / SAW810 / SAW906 / SAW910
13.5 x 13.5		Citizen	CLU026 / CLU027 / CLU028 / CLU700 / CLU701
15 x 15		Osram	Soleriq P9
15.85 x 15.85		Cree	CXA15XX / CXB15XX
16 x 19		Lumileds Luxeon Nichia LG Innotec	CoB 1202 / CoB 1203 NFCWL / NVEWL / NVCWL LEMWM19480 / LEMWM19490 / LEMWM19680 / LEMWM19690
17.85 x 17.85		Cree	CXA18XX / CXB18XX
18 x 18		Osram	Soleriq S13
19 x 19		Citizen Seoul Semiconductor	CLU036 / CLU038 / CLU710 / CLU711 / CLU720 / CLU721 SAW815 / SAW915
20 x 24		Lumileds Luxeon Sharp LG Innotec	CoB1204 / CoB1205 / CoB1208 Mini ZENIGATA / GW6DMB / GW6DGB / GW6DMC / GW6DGC / GW6DMD / GW6DGD / GW6DME / GW6DGE / GW6TGB / Tiger ZENIGATA / GW6TGC LEMWM24780 / LEMWM24790 / LEMWM24980 / LEMWM24990 / LEMWM24B80 / LEMWM24B90

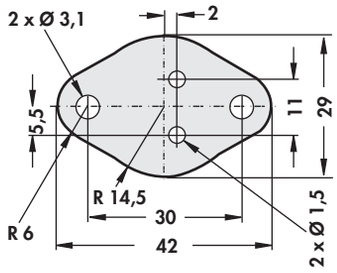
Thermal conductive foils for LED

dimension [mm]	blanks	manufacturer	LED package
23.85 x 23.85		Cree	CXA25XX / CXB25XX
24 x 24		Osram	Soleriq S19
27.35 x 27.35		Cree	CXA30XX / CXB30XX
28 x 28		Lumileds Luxeon Citizen Seoul Semiconductor LG Innotec	CoB 1211 CLU046 / CLU048 / CLU731 SAW822 / SAW922 LEMWM28D80 / LEMWM28D90 / LEMWM28E80 / LEMWM28E90
34.85 x 34.85		Cree	CXA35XX / CXB35XX / CXA2Studio
38 x 38		Citizen Seoul Semiconductor Nichia	CLU056 / CLU058 / CLU550 SAW833 / SAW933 NFEWH

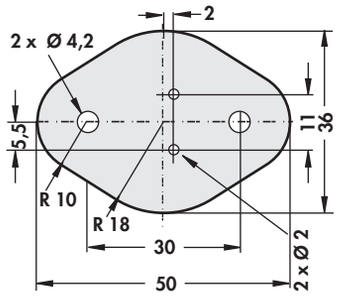
Silicone rubber insulating material for semiconductors

– other cuttings on request

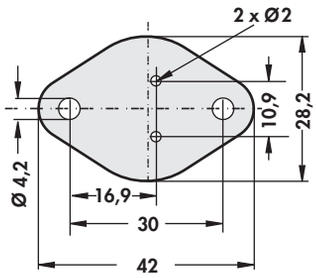
TO 3



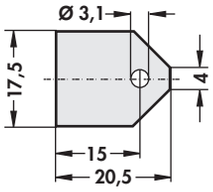
TO 3 M



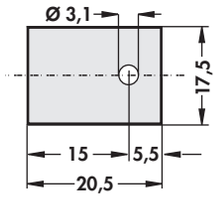
TO 3/4



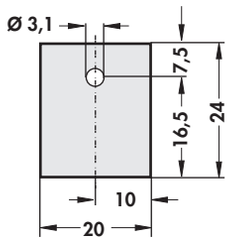
TOP 3



TOP 3/1

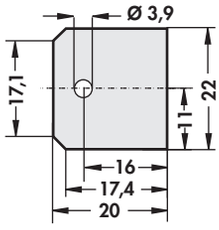


TOP 3 PF

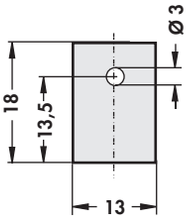


TO 218

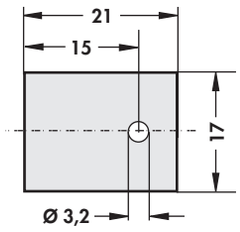
Multiwatt



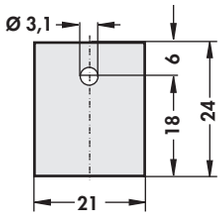
TO 220



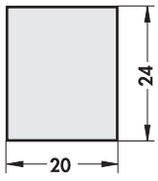
TO 247



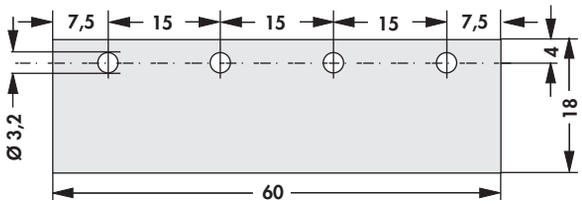
TO 247/1



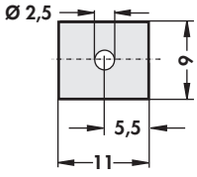
TO 3158



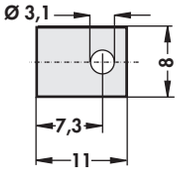
4 x TO220



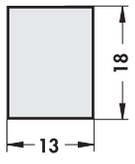
TO 126



SOT 32



TO 3159



Silicone rubber insulating material for semiconductors

foil type	foil WS	foil WG	foil WK	foil WB
material	silicone foil, standard	silicone foil, GF reinforced	silicone foil, GF reinforced, one side self-adhesive	silicone foil, GF reinforced
washer				
TO-3	**WS 3**	**WG 3**	**WK 3**	**WB 3**
TO-3 M	**WS 3 M**			
TO-3/4	**WS 3/4**		**WK 3/4**	
TO-3 PF	**WS 3 P**	**WG 3 P**	**WK 3 P**	**WB 3 P**
3158	**WS 3158**		**WK 3158**	**WB 3158**
TOP 3	**WS TOP 3**			
TOP 3/1	**WS TOP 3/1**		**WK TOP 3/1**	
TO 218 (Multiwatt)		**WG 218**		
TO 247	**WS 247**		**WK 247**	
TO 220	**WS 220**	**WG 220**	**WK 220**	**WB 220**
4 X TO 220	**WS 4 220**			
3159	**WS 3159**		**WK 3159**	**WB 3159**
TO 126			**WK 126**	
SOT 32			**WK 32**	
TO 247/1	**WS 247/1**			
insulating tube				
TO-220 Ø 11 mm, length 25 mm	**WSC-220**			
TO-3 PF Ø 13.5 mm, length 25 mm	**WSC-3 P**			
TO-247 Ø 14.5 mm, length 30 mm	**WSC-247**			
insulating tube as meterpiece				
TO-220 Ø 11 mm	**WSM-220**			
TO-3 PF Ø 13.5 mm	**WSM-3 P**			
tape material (width)				
24 mm			**WKT 24**	
30 mm	**WST 30**		**WKT 30**	**WBT 30**
36 mm	**WST 36**	**WGT 36**	**WKT 36**	**WBT 36**
85 mm	**WST 85**		**WKT 85**	
300 mm		**WGT 300**	**WKT 300**	**WBT 300**

	Foil WS	Foil WG	Foil WK	Foil WB
colour	green			brown
material	silicone foil, standard	silicone foil, GF reinforced	silicone foil, GF reinforced, one side self-adhesive	silicone foil, GF reinforced
material thickness	0.3 mm $^{+0.1/\ -0}$	0.2 mm $^{+0.02/\ -0.04}$		0.15 mm $^{+0.02/\ -0.04}$
thermal resistance	0.4 K/W	0.42 K/W	0.45 K/W	0.34 K/W
hardness	75 Shore A	87 Shore A		90 Shore A
thermal conductivity	1.22 W/m·K	1.13 W/m·K	0.92 W/m·K	1.43 W/m·K
temperature range	-60°C... +180°C			
insulation resistance	$2.9 \cdot 10^{15}$ Ω·cm	$5.7 \cdot 10^{15}$ Ω·cm		$1.6 \cdot 10^{15}$ Ω·cm
elongation	100 %	2 %		4 %
dielectric strength	10 kV	6.5 kV		3 kV
class of inflammability	UL 94 V-0			

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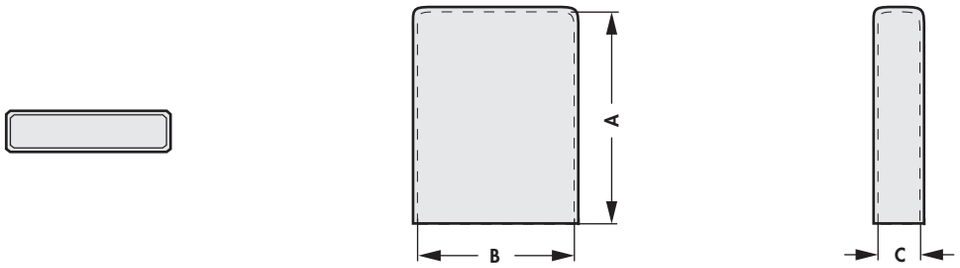
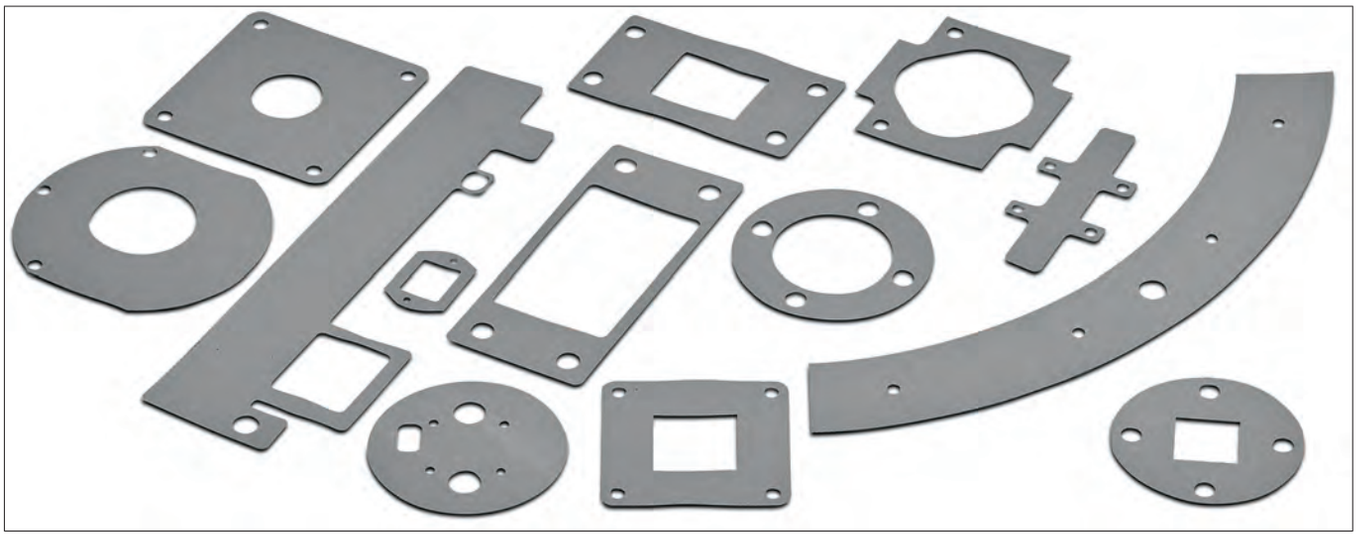
Insulating caps



art. no.	type	dim. [mm]		
		A	B	C
WSI 220 225	TO 220	22.5	11	5.0
WSI TOP 3 280	TO 3 PL/TO 247	28.0	16	
WSI 220 210	TO 220	21.0	11	
WSI TOP 3 235	TOP 3	23.5	18	
WSI TO 3 PL	TO 3 PL/TO 247	34.0	22	5.5

	Foil WSI 0.3 mm	**Foil WSI 0.9 mm**
colour	green	
material thickness	0.3 mm $^{+0.1/-0}$	0.9 mm $^{+0.15/-0.1}$
thermal resistance	0.4 K/W	0.96 K/W
hardness	75 Shore A	
thermal conductivity	1.22 W/m·K	
temperature range	-60°C... +180°C	
insulation resistance	$2.9 \cdot 10^{15}$ Ω·cm	
elongation	100 %	
dielectric strength	10 kV	15 kV
class of inflammability	UL 94 V-0	

Thermally conductive foil made of siliconelastomer



– silicone foil with glass fibre reinforcement
– free from toxic substances
– very good thermal and mechanical properties
– one-sided or double-sided adhesive layer upon request
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFS 09 18	0.178	**WFS 09 23**	0.229

	WFS 09 18	**WFS 09 23**
version	silicone foil with glass fibre reinforcement	
colour	grey	
hardness	85 Shore A	
thermal conductivity	0.9 W/m·K	
temperature range	-60°C... +180°C	
elongation	54 %	
volume resistance	10^{11} Ω·m	
dielectric constant	5.5 [1 kHz]	
tear strength	3,000 psi	
tensile strength	5 kN/m	
dielectric strength	3.5 kV	4.5 kV
class of inflammability	UL 94 V-0	
type of delivery	rolled goods, roll width 300mm/ cuttings on customer's requirement	

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFS 09 18 [K/W]	6.62	5.93	5.14	4.38	3.61
thermal resistance WFS 09 23 [K/W]	8.51	7.62	6.61	5.63	4.64
thermal impedance WFS 09 18 [K-cm²/W]	11.37	8.87	7.06	5.12	3.37
thermal impedance WFS 09 23 [K-cm²/W]	14.62	11.43	9.06	6.56	4.31

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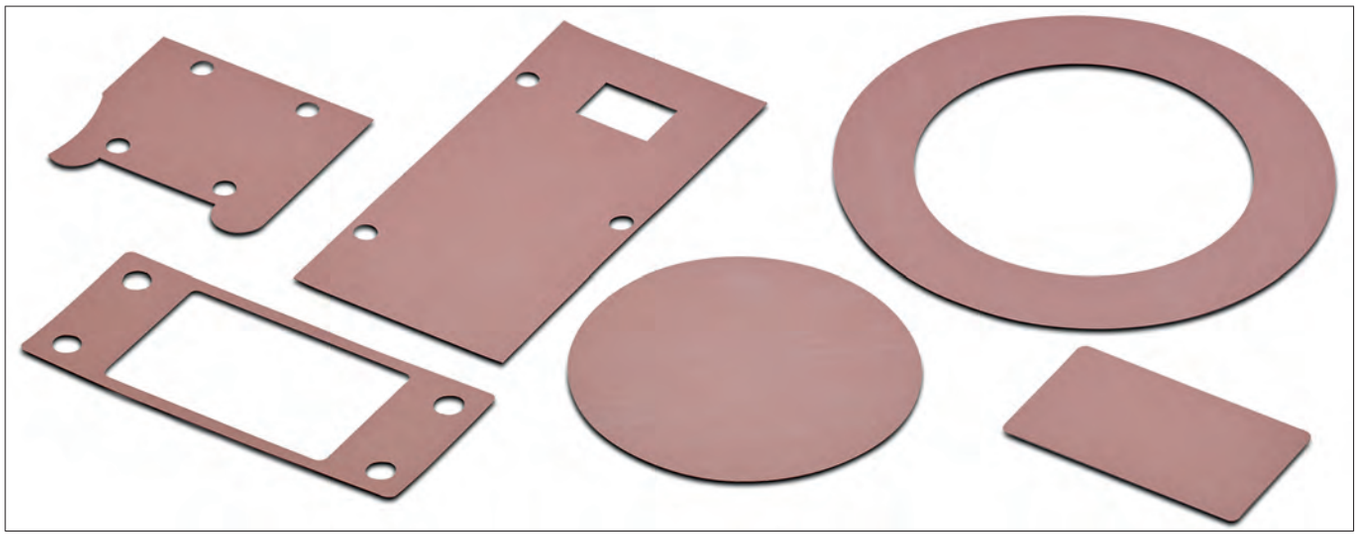
Thermally conductive foil made of siliconelastomer



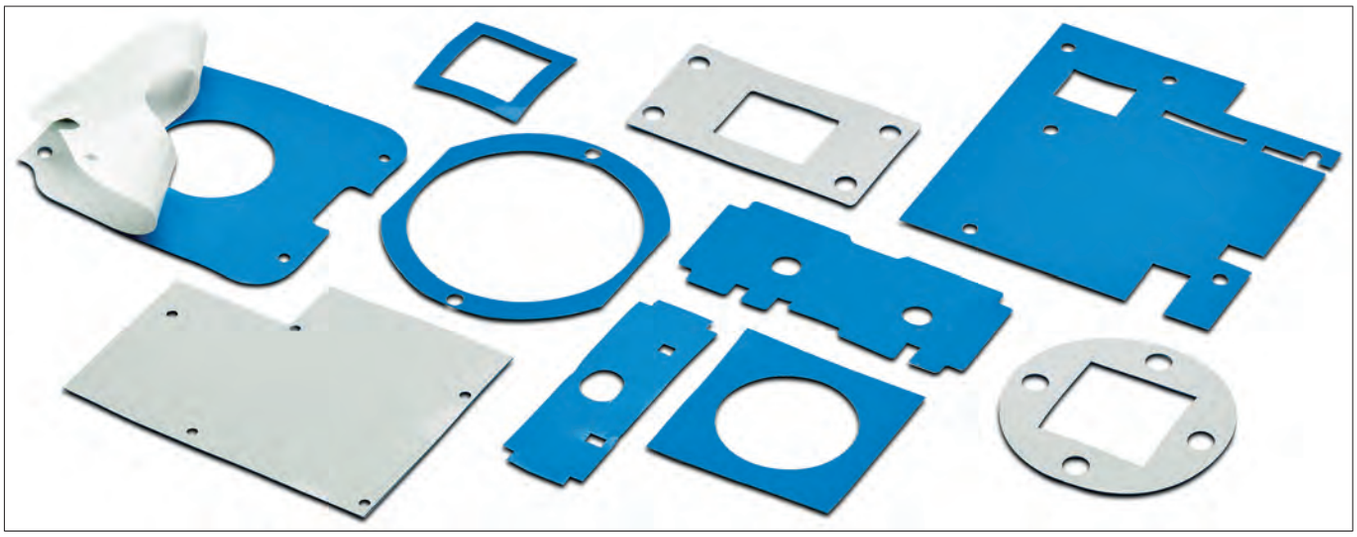
– very good suitable for low tightening torques or spring applications
– good electrical insulating properties
– optimal contacting between device and heatsink
– one-sided adhesive layer upon request
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]
WFS 16	0.229

	WFS 16
version	silicone foil with glass fibre reinforcement
colour	pink
hardness	92 Shore A
thermal conductivity	1.6 W/m·K
temperature range	-60°C... +180°C
elongation	20 %
volume resistance	10^{10} Ω·m
dielectric constant	6 [1 kHz]
tear strength	1,300 psi
dielectric strength	5.5 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 300mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	10	25	50	100	200
thermal resistance WFS 16 [K/W]	3.96	3.41	2.90	2.53	2.32
thermal impedance WFS 16 [K-cm²/W]	5.93	4.68	3.81	2.93	2.56

Thermally conductive foil made of siliconelastomer



– silicone material with glass fibre reinforcement
– optimal contacting between device and heatsink
– simplified mounting by means of double-sided adhesive layer
– automatic assembling possible
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]
WFS 18	0.203

	WFS 18
version	silicone foil with glass fibre reinforcement
colour	blue
hardness	75 Shore A
thermal conductivity	1.8 W/m·K
temperature range	-60°C... +180°C
elongation	22 %
volume resistance	10^{11} Ω·m
dielectric constant	6.1 [1 kHz]
tear strength	238 psi
tensile strength	0,34 kN/m
dielectric strength	3 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 250mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFS 18 [K/W]	1.54	1.52	1.51	1.49	1.46
thermal impedance WFS 18 [K-cm²/W]	2.31	1.75	1.43	1.31	1.25

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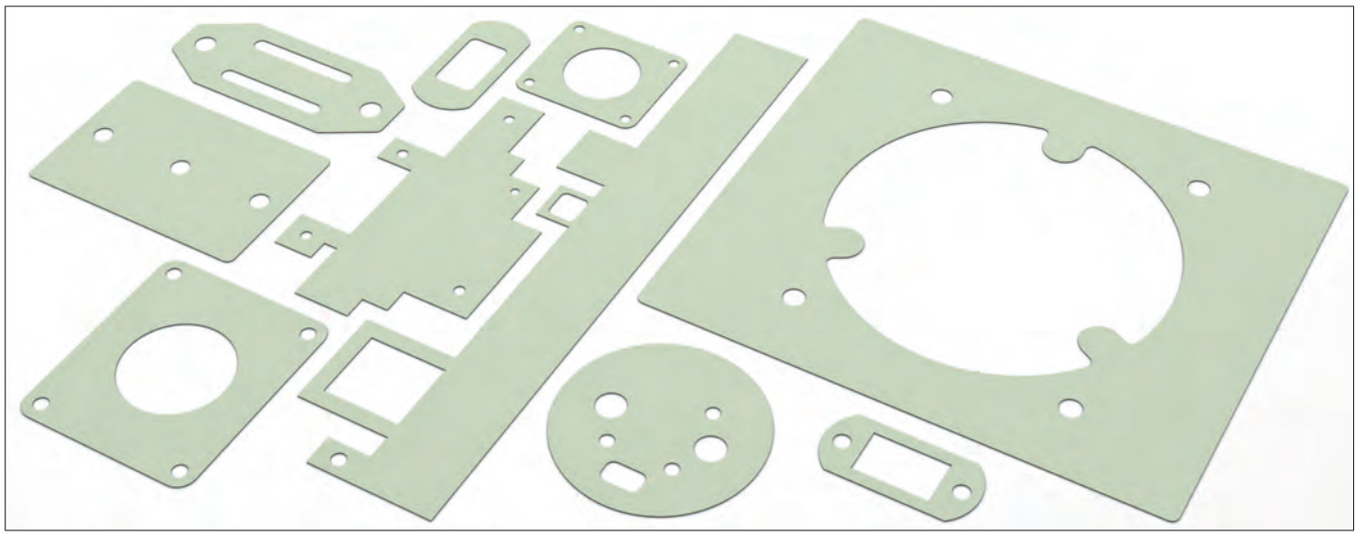
Thermally conductive foil made of siliconelastomer



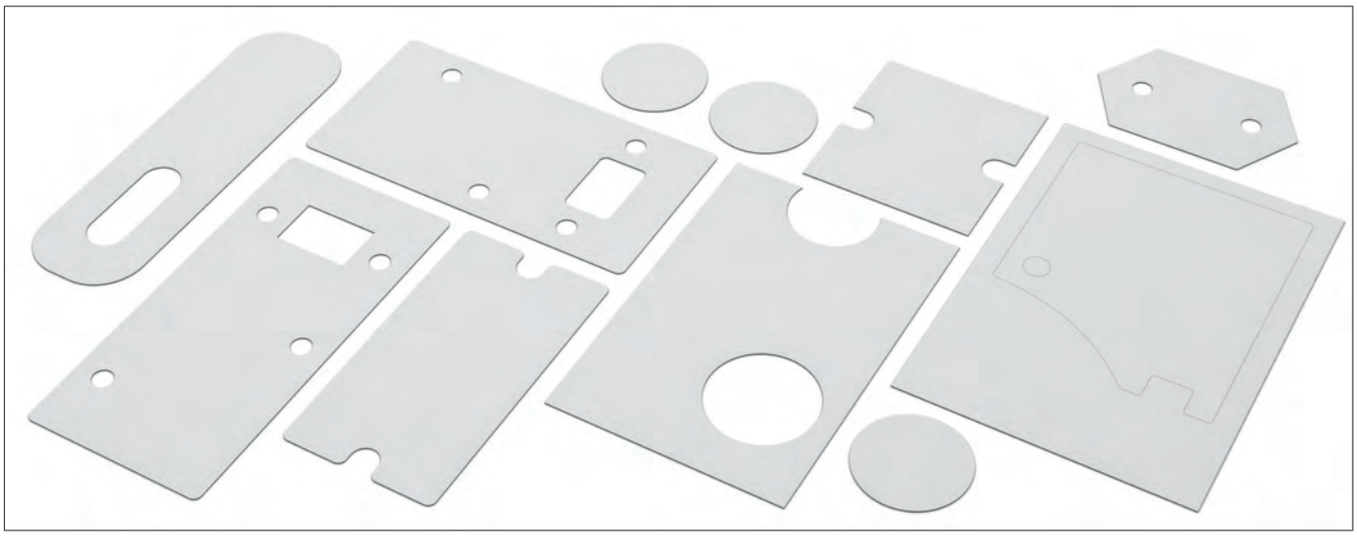
– silicone foil with a high operating temperature range
– high mechanical stability
– easy handling and application
– cuts, punch-outs and contours according to customer-specific drawing specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFK 18	0.225	**WFK 18 GK**	0.250
WFK 18 G		**WFK 18 K**	

	WFK 18	**WFK 18 G**	**WFK 18 GK**	**WFK 18 K**
version	silicone foil without glass fibre reinforcement, one-sided protection foil	silicone foil with glass fibre reinforcement, one-sided protection foil	silicone foil with glass fibre reinforcement and one-sided adhesive layer, one-sided protection foil	silicone foil without glass fibre reinforcement and one-sided adhesive layer, one-sided protection foil
colour	lime-green			
density	2.29 g/cm³			
hardness	65 - 75 Shore A			
thermal conductivity	1.8 W/m·K			
thermal resistance	0.32 K/W	0.5 K/W	0.55 K/W	0.39 K/W
temperature range	-60°C ... +250°C			
elongation	75 %			
volume resistance	$2.5 \cdot 10^{11}$ Ω·m			
dielectric constant	2.9 [1 kHz]			
tensile strength	2 N/mm²	7,5 N/mm²		2 N/mm²
dielectric strength	8 kV			
class of inflammability	UL 94 V-0			
type of delivery	plates, usable area 300x250mm/ other dimensions upon request			

Thermal resistances vs. contact pressure				
pressure [psi]	**7.25**	**29**	**58**	**87**
thermal resistance WFK 18 [K/W]	0.50	0.42	0.37	0.33
thermal impedance WFK 18 [K-cm²/W]	1.75	1.38	1.25	1.18

Thermally conductive foil made of siliconelastomer



– silicone foil with very good thermal properties
– good electrical insulation resistance
– easy handling and application
– cuts and contours according to customer specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFK 25	0.225	**WFK 25 GK**	0.250
WFK 25 G		**WFK 25 K**	

	WFK 25	**WFK 25 G**	**WFK 25 GK**	**WFK 25 K**
version	silicone foil without glass fibre reinforcement, one-sided protection foil	silicone foil with glass fibre reinforcement, one-sided protection foil	silicone foil with glass fibre reinforcement and one-sided adhesive layer, one-sided protection foil	silicone foil without glass fibre reinforcement and one-sided adhesive layer, one-sided protection foil
colour	white			
density	2.33 g/cm³			
hardness	70 - 80 Shore A			
thermal conductivity	2.5 W/m·K			
thermal resistance	0,22 K/W	0,25 K/W	0,3 K/W	0,265 K/W
temperature range	-60°C ... +250°C			
elongation	31 %			
volume resistance	2.5·10¹¹ Ω·m			
dielectric constant	3 [1 kHz]			
tensile strength	1,5 N/mm²	7,5 N/mm²		1,5 N/mm²
dielectric strength	1.5 kV			
class of inflammability	UL 94 V-0			
type of delivery	plates, usable area 300x250mm/ other dimensions upon request		plates, usable area 300x235mm/ other dimensions upon request	

Thermal resistances vs. contact pressure				
pressure [psi]	**7.25**	**29**	**58**	**87**
thermal resistance WFK 25 [K/W]	0.38	0.33	0.30	0.27
thermal impedance WFK 25 [K-cm²/W]	1.13	1.00	0.92	0.83

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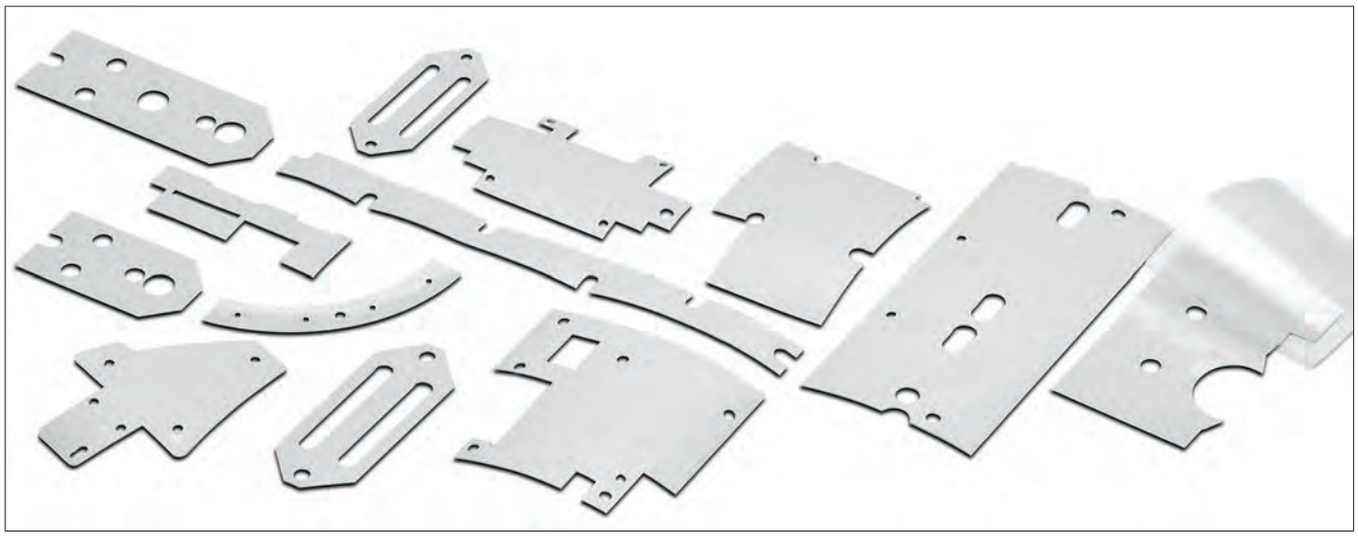
Thermally conductive foil made of siliconelastomer



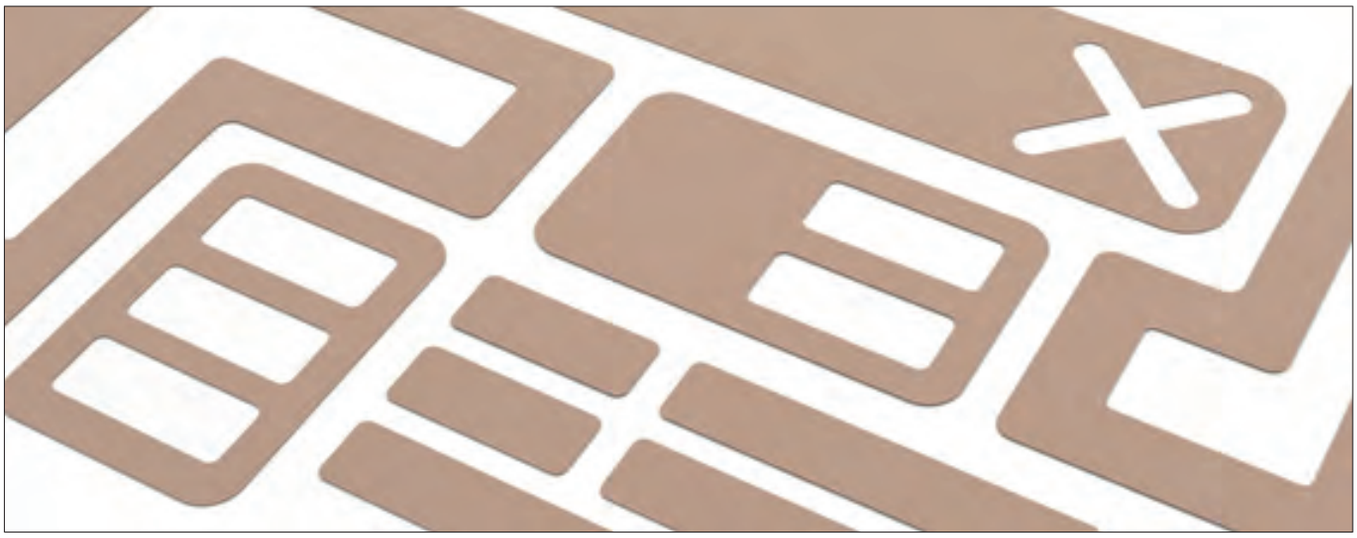
– silicone-foil with very good thermal properties
– excellent insulating properties
– simple and stable handling by means of glass fibre carrier material
– one-sided adhesive layer upon request
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFSA 30 38	0.381	**WFSA 30 50**	0.508

	WFSA 30
version	silicone foil with glass fibre reinforcement
colour	white
hardness	90 Shore A
thermal conductivity	3 W/m·K
temperature range	-60°C ... +200°C
volume resistance	10^{11} Ω·m
dielectric constant	7 [1 kHz]
heat capacity	1 J/g·K
dielectric strength	4 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 250mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFSA 30 38 [K/W]	2.05	1.94	1.86	1.79	1.72
thermal impedance WFSA 30 38 [K-cm²/W]	3.31	2.50	2.00	1.75	1.62

Thermally conductive foil made of siliconelastomer



– silicone material with glass fibre reinforcement
– very good thermal conductivity, electrical insulating
– excellent mechanical and physical properties
– cuttings and different punchings on customer's requirement

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFF 33 02	0.2	**WFF 33 02 K**	0.2
WFF 33 03	0.3	**WFF 33 03 K**	0.3

	WFF 33 02	**WFF 33 03**	**WFF 33 02 K**	**WFF 33 03 K**
version	silicone foil with glass fibre reinforcement		silicone foil with glass fibre reinforcement, double-sided adhesive layer	
colour	light brown			
hardness	80 IRHD	94 IRHD	80 IRHD	94 IRHD
thermal conductivity	3.3 W/m·K			
temperature range	-40°C... +150°C			
elongation	3 %			
volume resistance	$1.6 \cdot 10^{12}$ W·m	$1.8 \cdot 10^{12}$ W·m	$1.6 \cdot 10^{12}$ W·m	$1.8 \cdot 10^{12}$ W·m
dielectric constant	2.9 [50Hz] / 2.8 [1kHz] / 2.8 [1MHz]	3.6 [50Hz] / 3.6 [1kHz] / 3.6 [1MHz]	2.9 [50Hz] / 2.8 [1kHz] / 2.8 [1MHz]	3.6 [50Hz] / 3.6 [1kHz] / 3.6 [1MHz]
heat capacity	1 J/g·K			
tear strength	782 psi	810 psi	782 psi	810 psi
dielectric strength	6 kV	9 kV	6 kV	9 kV
class of inflammability	UL 94 V-0			
type of delivery	rolled goods, different roll widths on request/ cuttings on customer's requirement			

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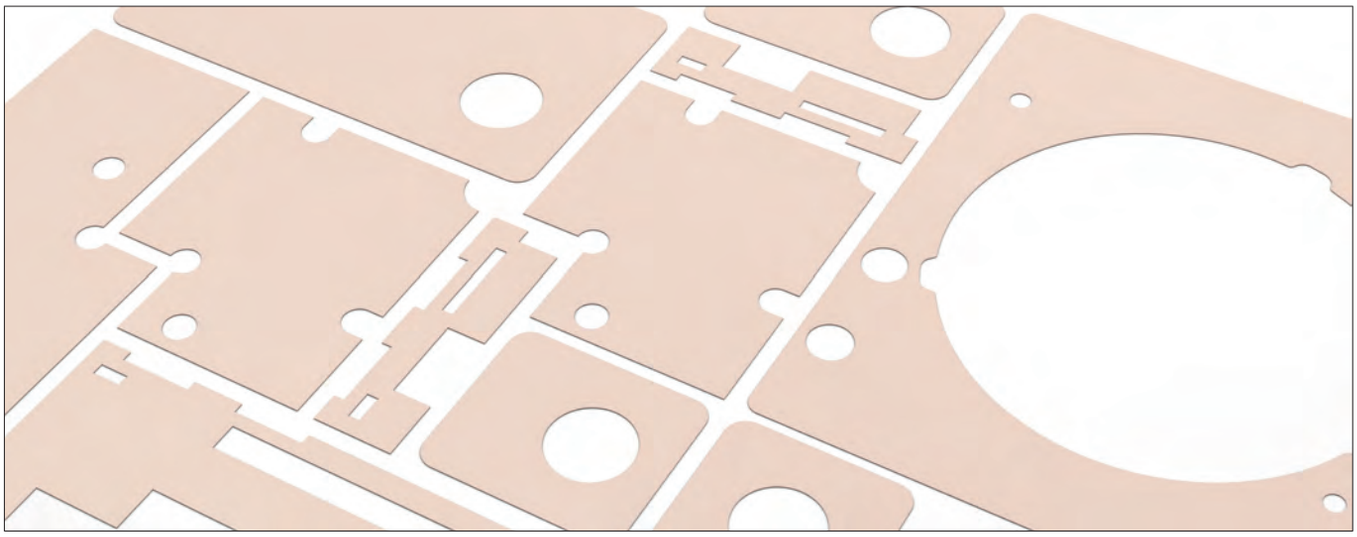
Thermally conductive foil made of siliconelastomer

– silicone foil with very good thermal conduction properties
– high dimensional stability due to glass fibre layer
– good electrical properties
– excellent processing properties
– contour and drawing parts according to customer specifications

art. no.	material thickness [mm]
WFS 34 020	0.20
WFS 34 030	0.30
WFS 34 045	0.45

	WFS 34
version	silicone foil with glass fibre reinforcement
colour	dark gray
density	2.84 g/cm^3
hardness	90 Shore A
thermal conductivity	3.4 W/m·K
temperature range	-40°C ... +180°C
volume resistance	3·10^{13} Ω·cm
dielectric strength	7 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 300mm/ other dimensions upon request

Thermally conductive foil made of siliconelastomer



– silicone foil with very good thermal conductivity
– high insulation and dielectric strength
– very large operating temperature range
– one-sided adhesive coating as an mounting aid
– customer-specific cuts and punch-outs according to drawing

art. no.	material thickness [mm]
WFK 35 012	0.125
WFK 35 022	0.225
WFK 35 G	
WFK 35 GK	0.250
WFK 35 K	

	WFK 35	**WFK 35 G**	**WFK 35 GK**	**WFK 35 K**
version	silicone foil without glass fibre reinforcement, one-sided protection foil	silicone foil with glass fibre reinforcement, one-sided protection foil	silicone foil with glass fibre reinforcement and one-sided adhesive layer, one-sided protection foil	silicone foil without glass fibre reinforcement and one-sided adhesive layer, one-sided protection foil
colour	pink			
density	1.97 g/cm³			
hardness	70 - 80 Shore A			
thermal conductivity	3.5 W/m·K			
thermal resistance	0.16 K/W	0.22 K/W	0.27 K/W	0.26 K/W
temperature range	-60°C ... +250°C			
elongation	25 %			
volume resistance	1.3·10¹⁴ Ω·m			
dielectric constant	2.3 [1 kHz]			
tensile strength	1,3 N/mm²	10 N/mm²		1,3 N/mm²
dielectric strength	1.5 kV			
class of inflammability	UL 94 V-0			
type of delivery	plates, usable area 300x250mm/ other dimensions upon request		plates, usable area 300x235mm/ other dimensions upon request	

Thermal resistances vs. contact pressure				
pressure [psi]	**7.25**	**29**	**58**	**87**
thermal resistance WFK 35 [K/W]	0.25	0.21	0.17	0.15
thermal impedance WFK 35 [K-cm²/W]	0.94	0.81	0.75	0.56

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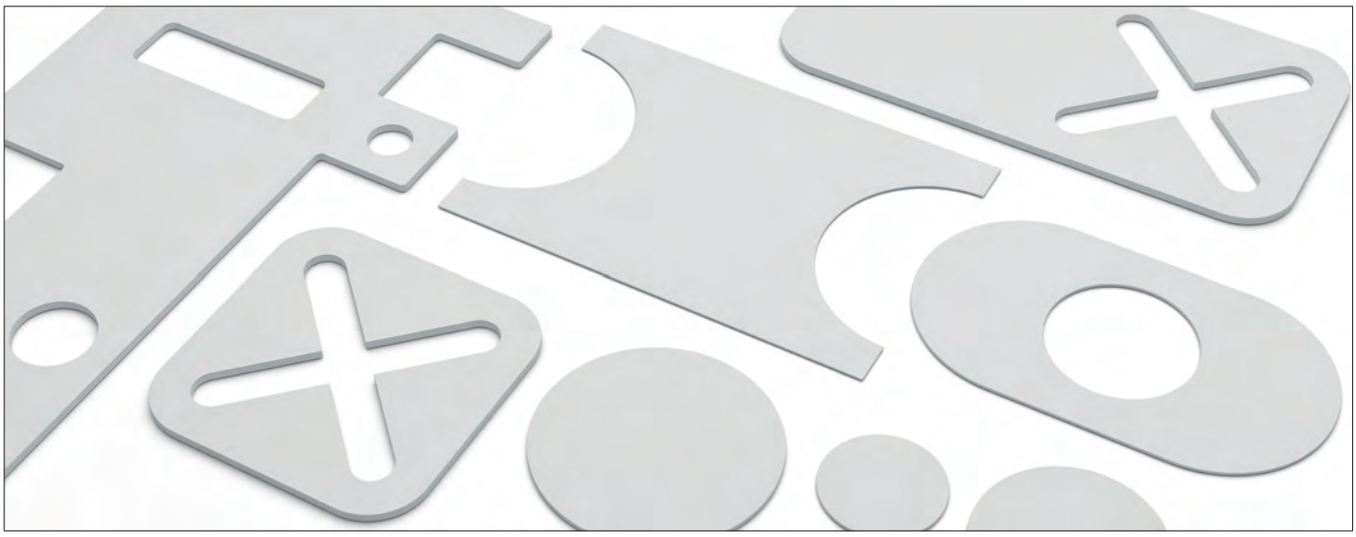
Thermally conductive foil made of siliconelastomer



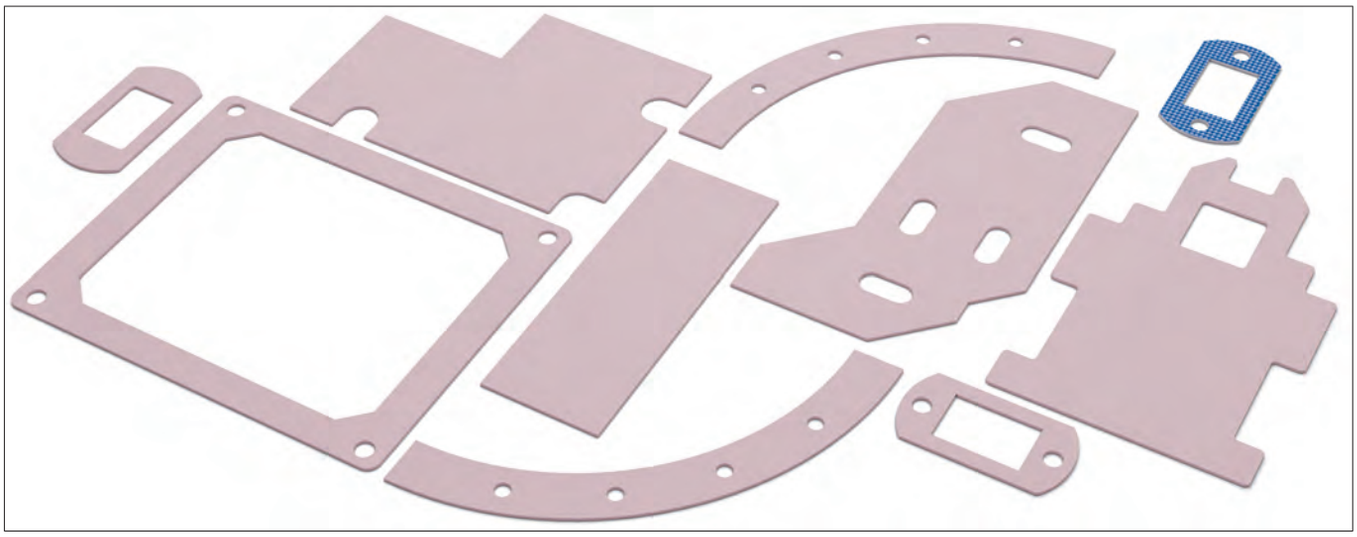
– silicone foil with ceramic filling and high thermal conductivity
– optimal connection of electronic components
– high mechanical stability and easy handling
– extreme aging- and chemical resistance
– special cuts or geometries according to customer specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFC 50 02	0.20	**WFC 50 04**	0.45
WFC 50 03	0.30	**WFC 50 08**	0.80

	WFC 50 02	WFC 50 03	WFC 50 04	WFC 50 08
version	silicone foil with ceramic filling and glass fibre reinforced design			
colour	white			
thermal conductivity	5 W/m·K			
temperature range	-50°C ... +200°C			
volume resistance	$1.7 \cdot 10^{13}$ Ω·m	$7.9 \cdot 10^{13}$ Ω·m	$9.2 \cdot 10^{13}$ Ω·m	$8.9 \cdot 10^{13}$ Ω·m
dielectric constant	3.3 [1 MHz]			
dielectric strength	3 kV	6 kV	9 kV	>10 kV
class of inflammability	UL 94 V-0			
type of delivery	plates, usable area 440x510mm/ other dimensions upon request			

Thermal resistances vs. contact pressure		
pressure [psi]	**29**	**145**
thermische impedance WFC 50 02 [K-cm²/W]	1.87	0.71
thermische impedance WFC 50 03 [K-cm²/W]	2.06	0.96
thermische impedance WFC 50 04 [K-cm²/W]	2.26	1.10
thermische impedance WFC 50 08 [K-cm²/W]	3.35	1.74

Thermally conductive foil made of siliconelastomer



– silicone foil with excellent thermal conductivity
– very good electrical properties
– adhesive coating for easy assembly handling
– particularly suitable for high-performance applications
– cuts and contours according to customer's drawing specifications

art. no.	material thickness [mm]
WFK 65	0.250
WFK 65 K	0.275

	WFK 65	WFK 65 K
version	silicone foil without glass fibre reinforcement, one-sided protection foil	silicone foil with adhesive layer, one-sided protection foil
colour	red	
density	1.23 g/cm³	
hardness	60 - 70 Shore A	
thermal conductivity	6,5 W/m·K	
thermal resistance	0,09 K/W	
temperature range	-40°C... +200°C	
elongation	2 %	
volume resistance	$2 \cdot 10^{14}$ Ω·m	
dielectric constant	2.4 [1 kHz]	
tensile strength	13 N/mm²	
dielectric strength	1 kV	
class of inflammability	UL 94 V-0	
type of delivery	plates, usable area 300x250mm/ other dimensions upon request	plates, usable area 300x235mm/ other dimensions upon request

Thermal resistances vs. contact pressure				
pressure [psi]	7.25	29	58	87
thermal resistance WFK 65 [K/W]	0.18	0.12	0.10	0.08
thermal impedance WFK 65 [K-cm²/W]	0.68	0.50	0.39	0.31

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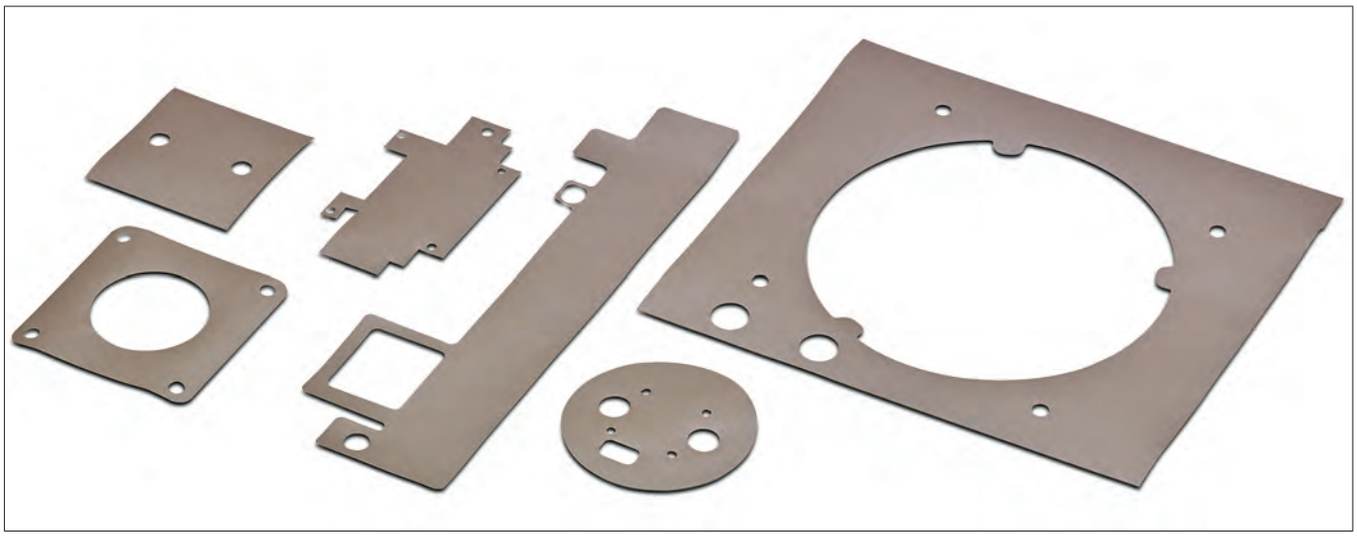
Thermally conductive foil made of siliconelastomer

– silicone foil with excellent thermal conductivity
– very good insulation properties
– high material strength due to glass fibre reinforcement
– simple handling and application
– customised cuts and geometries according to drawing

art. no.	material thickness [mm]
WFS 80 020	0.20
WFS 80 030	0.30
WFS 80 045	0.45

	WFS 80
version	silicone foil with glass fibre reinforcement
colour	light gray
density	1.6 g/cm³
hardness	85 Shore A
thermal conductivity	8 W/m·K
temperature range	-40°C ... +180°C
volume resistance	$2.9 \cdot 10^{14}$ Ω·cm
tear strength	1,885 psi
tensile strength	45 kN/m
dielectric strength	7 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 420x500mm/ other dimensions upon request

Silicone-free thermal conductive foils



– thermal conductive foil based on polyester
– particularly suitable for silicone-free applications
– very good insulating properties
– one-sided adhesive layer upon request
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]
WFPK 09	0.152

	WFPK 09
version	kapton carrier foil with ceramic filled polyester resin double-sided fully coated
colour	brown
hardness	90 Shore A
thermal conductivity	0.9 W/m·K
temperature range	-20°C... +150°C
elongation	40 %
volume resistance	10^{12} Ω·m
dielectric constant	5 [1 kHz]
tear strength	5,000 psi
tensile strength	5 kN/m
dielectric strength	6 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 292mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFPK 09 [K/W]	5.64	5.04	4.34	3.69	3.12
thermal impedance WFPK 09 [K-cm²/W]	9.68	7.56	5.93	4.37	2.87

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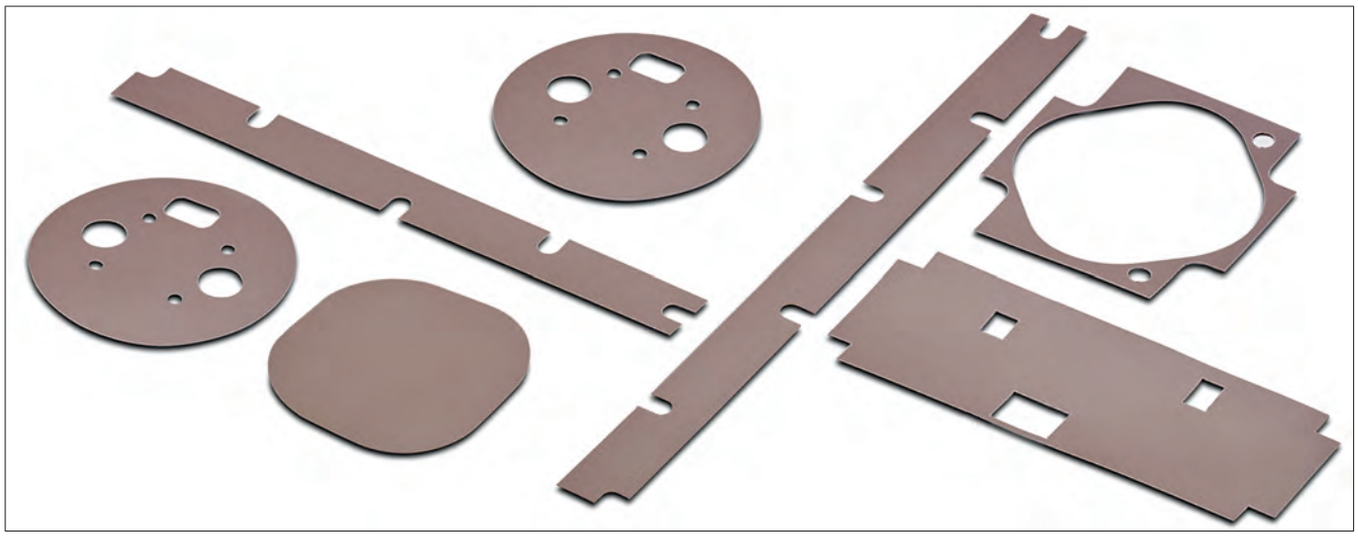
Silicone-free thermal conductive foils



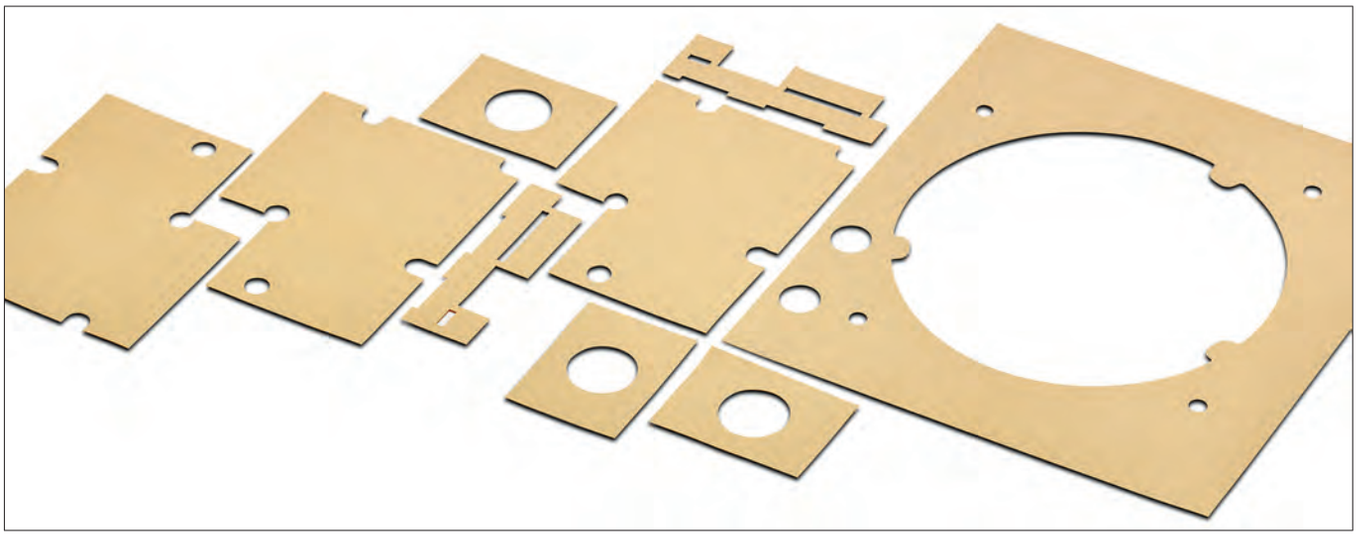
– thermal conductive foil based on polyester
– particularly suitable for silicone-free applications
– very good thermal and mechanical properties
– simplified mounting by means of adhesive layers upon request
– cuts and contours made of sheet or roll material as per your specifications

art. no.	material thickness [mm]
WFP 09	0.229

	WFP 09
version	glass fibre-carrier foil with ceramic filled polyester resin double-sided fully coated
colour	brown
hardness	90 Shore A
thermal conductivity	0.9 W/m·K
temperature range	-20°C... +150°C
elongation	10 %
volume resistance	10^{11} Ω·m
dielectric constant	5.5 [1 kHz]
tear strength	7,000 psi
tensile strength	18 kN/m
dielectric strength	2.5 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 300mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFP 09 [K/W]	5.85	5.61	5.13	4.59	4.12
thermal impedance WFP 09 [K-cm²/W]	10.12	8.43	7.06	5.37	3.81

Silicone-free thermal conductive foils



– thermal conductive foil for silicone-free applications
– thermal conductive foil based on polyester
– very good insulating properties
– one-sided adhesive layer upon request
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]
WFPK 13	0.152

	WFPK 13
version	kapton carrier foil with ceramic filled polyester resin double-sided fully coated
colour	yellow
hardness	90 Shore A
thermal conductivity	1.3 W/m·K
temperature range	-20°C... +150°C
elongation	40 %
volume resistance	10^{12} Ω·m
dielectric constant	3.7 [1 kHz]
tear strength	5,000 psi
tensile strength	5 kN/m
dielectric strength	6 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 292mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFPK 13 [K/W]	3.76	3.35	2.75	2.30	2.03
thermal impedance WFPK 13 [K-cm²/W]	6.50	5.00	3.75	2.68	1.88

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Silicone-free thermal conductive foils

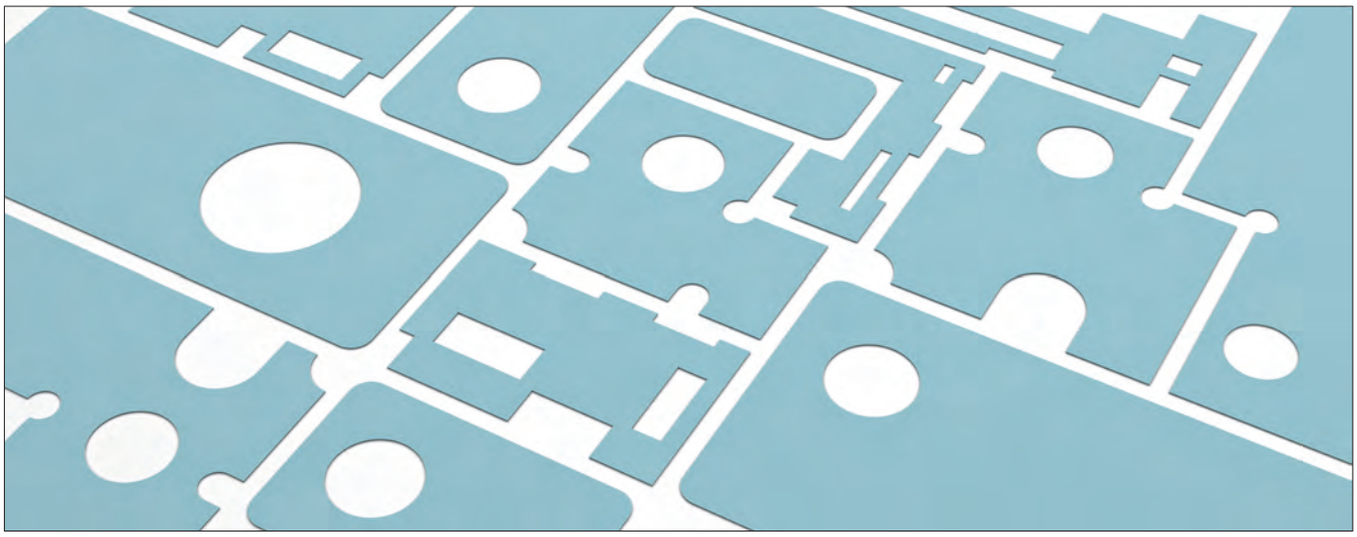
– polyurethane-based thermal conductive foil
– very good mechanical properties
– excellent insulation properties
– adhesive coating for easy handling
– cut to size and contours according to customised drawing specifications

art. no.	material thickness [mm]
WFKF 18 015	0.150
WFKF 18 017 K	0.175
WFKF 18 032 K	0.325

	WFKF 18 015	**WFKF 18 ... K**
version	ceramic-filled heat-conducting foil based on polyurethane, one-sided protective film	ceramic-filled heat-conducting foil based on polyurethane including adhesive coating, one-sided protective film
colour	blue	
density	2.26 g/cm^3	
hardness	80 - 90 Shore A	
thermal conductivity	1.8 W/m·K	
thermal resistance	0.2 K/W	
temperature range	-40°C... +125°C	
elongation	130 %	
volume resistance	1.4·10^{14} W·m	
dielectric constant	3.2 [1 kHz]	
tensile strength	3 N/mm^2	
dielectric strength	4 kV	
class of inflammability	UL 94 V-0	
type of delivery	plates, usable area 500x470mm/ other dimensions upon request	plates, usable area 500x460mm/ other dimensions upon request

Thermal resistances vs. contact pressure				
pressure [psi]	**7.25**	**29**	**58**	**87**
thermal resistance WFKF 18 [K/W]	0.19	0.15	0.12	0.11
thermal impedance WFKF 18 [K-cm^2/W]	1.23	0.94	0.74	0.70

Silicone-free thermal conductive foils



– thermal conductive foil for silicone-free applications
– epoxy-based thermal conductive foil
– excellent insulation properties
– cuts and contours according to customised drawing specifications

art. no.	material thickness [mm]
WFKF 30 02	0.2

	WFKF 30 02
version	silicone-free, ceramic-filled heat conducting foil
colour	light blue
density	1.44 g/cm³
hardness	70 - 85 Shore A
thermal conductivity	3 W/m·K
thermal resistance	0.165 K/W
temperature range	-40°C... +150°C
elongation	>50 %
volume resistance	4.1·10⁹ Ω·m
dielectric constant	2 [1 kHz]
tensile strength	1 N/mm²
dielectric strength	6 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 500x500mm/ other dimensions upon request

Thermal resistances vs. contact pressure				
pressure [psi]	7.25	29	58	87
thermal resistance WFKF 30 02 [K/W]	0.25	0.18	0.16	0.16
thermal impedance WFKF 30 02 [K-cm²/W]	0.49	0.35	0.32	0.31

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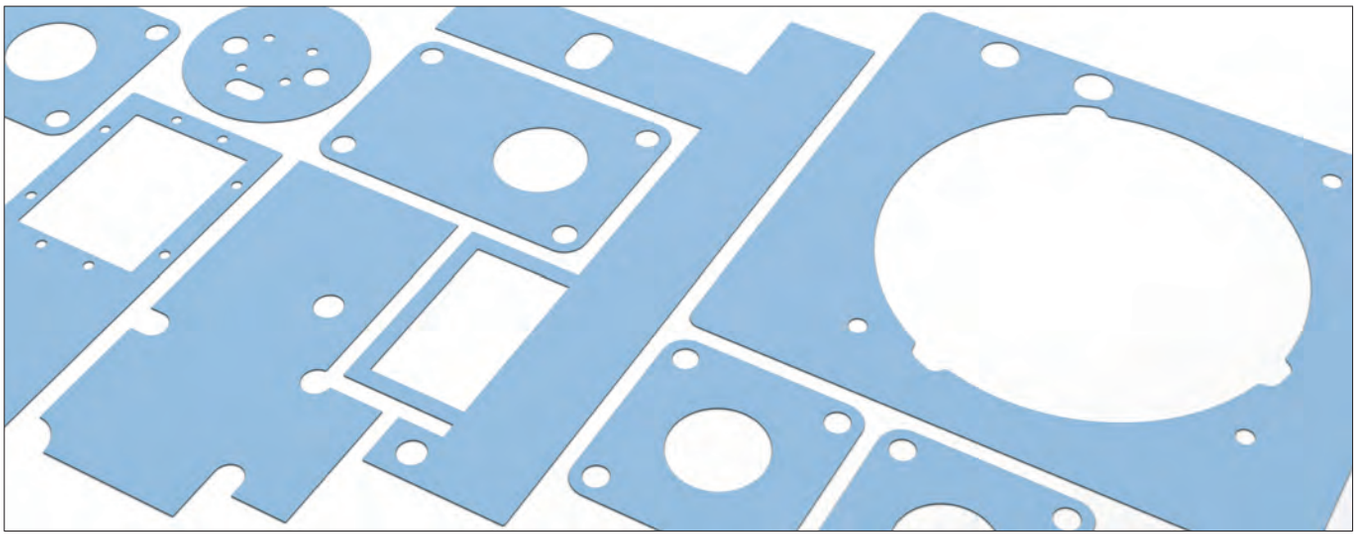
Silicone-free thermal conductive foils



– heat conductive foil based on polyurethane
– very good mechanical properties
– high thermal conductivity for smallest heat transfer resistances
– adhesive coating for easy handling
– cuts and contours according to customer's drawing specifications

art. no.	material thickness [mm]
WFK 60 01	0.100
WFK 60 02	0.200
WFK 60 03	0.300
WFK 60 K	0.225

	WFK 60	**WFK 60 K**
version	ceramic-filled heat-conducting foil based on polyurethane	ceramic-filled heat-conducting foil based on polyurethane including adhesive coating, one-sided protective film
colour	light blue	
density	1.46 g/cm^3	
hardness	70 - 85 Shore A	
thermal conductivity	6 W/m·K	
thermal resistance	0.82 K/W	
temperature range	-40°C... +125°C	
elongation	150 %	
volume resistance	2·10^{11} Ω·m	
dielectric constant	3.1 [1 kHz]	
tensile strength	2 N/mm^2	
dielectric strength	4 kV	
class of inflammability	UL 94 V-0	
type of delivery	plates, usable area 300x235mm/ other dimensions upon request	plates, usable area 300x230mm/ other dimensions upon request

Thermal resistances vs. contact pressure				
pressure [psi]	**7.25**	**29**	**58**	**87**
thermal resistance WFK 60 [K/W]	0.24	0.16	0.12	0.09
thermal impedance WFK 60 [K-cm^2/W]	0.88	0.56	0.38	0.31

Thermal conductive foil made of aluminium

– double-sided coated aluminium foil
– good replacement for thermal pastes
– electroconductive with wide temperature range
– low heat-transmission resistance between device and heatsink
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]
WFQ 25	0.152

	WFQ 25
version	aluminium foil with double-sided coating
colour	black
hardness	93 Shore A
thermal conductivity	2.5 W/m·K
temperature range	-60°C... +180°C
volume resistance	10^2 Ω·m
dielectric strength	electrically conductive
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 300mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance WFQ 25 [K/W]	2.44	1.73	1.23	1.05	0.92
thermal impedance WFQ 25 [K-cm²/W]	3.25	1.88	1.38	0.94	0.75

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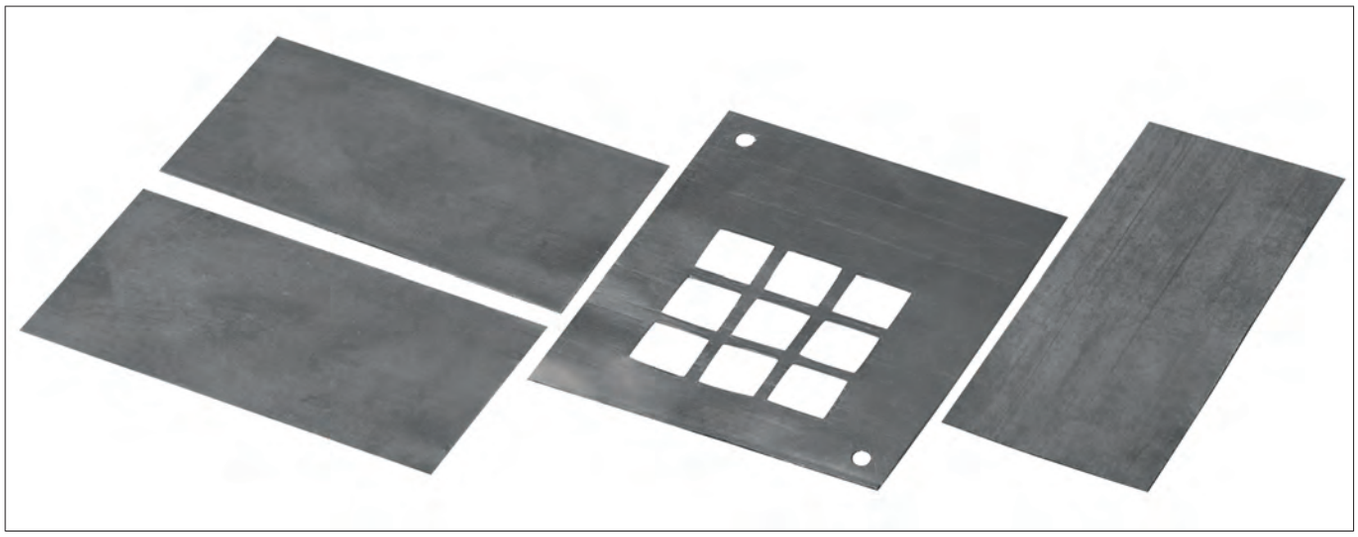
High thermoconducting graphite foils

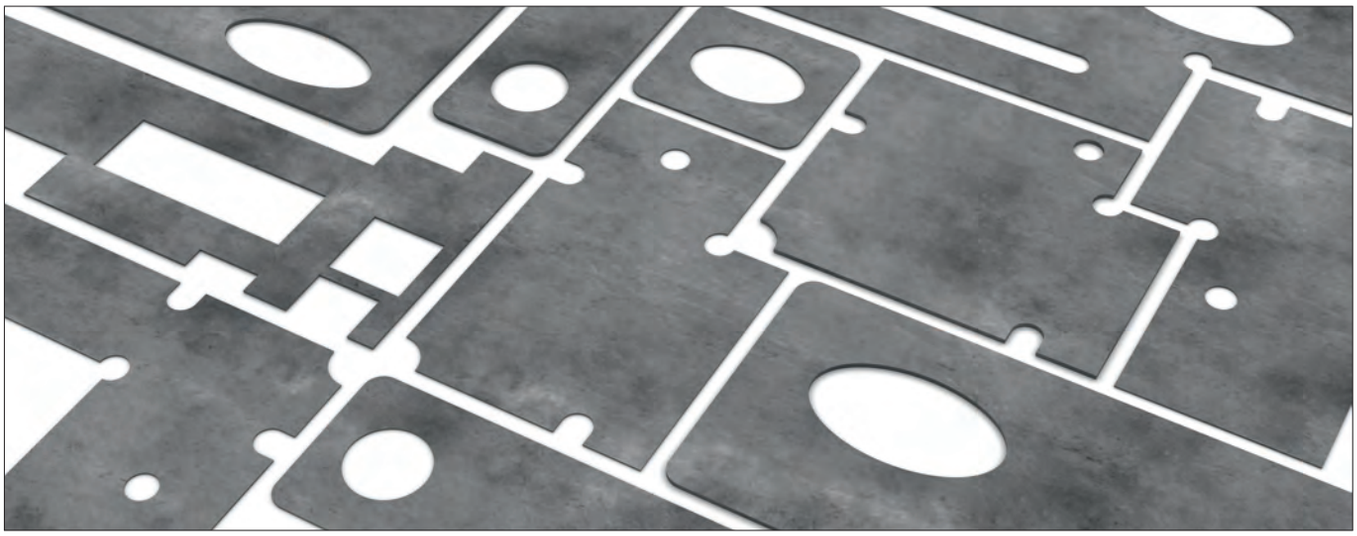


– high-compressed anisotropic natural graphite
– very good thermal characteristics
– optimal for heat spreading
– high operating temperature range
– tape width (B) available in different dimensions and lengths
– different material thicknesses and coatings upon request
– customer specified cuttings and stampings acc. to drawing

art. no.	B [mm]	art. no.	B [mm]
WLFG S 900 R 25	25	**WLFG S 900 K R 25**	25
WLFG S 900 R 50	50	**WLFG S 900 K R 50**	50
WLFG S 900 R 100	100	**WLFG S 900 K R 100**	100

	WLFG S 900	**WLFG S 900 K**
version	graphite foil, electrically conductive	
material thickness	0.15 mm	0.175 mm
version	without adhesive coating	adherent layer on one side
colour	dark gray	
density	<1.6 g/cm³	
hardness	30 Shore D	
thermal conductivity z (x/y)	7.5 (<450) W/m·K	
thermal resistance	0,08 K/W	
specific thermal resistance	34°C mm²/W	
temperature range	-40°C... +500°C	
tear strength	10 N/mm²	
elongation at break	5 %	
class of inflammability	UL 94 V-0	
type of delivery	sold by the meter	

High thermoconducting graphite foils



– highly thermally conductive graphite foil
– with and without adhesive coating
– very good temperature resistance
– ideally suited as a heat spreader
– customer-specific cuts and molded parts

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WLFG 9813 R310	0.13	**WLFG 9813 K R310**	0.13
WLFG 9825 R310	0.25	**WLFG 9825 K R310**	0.25
WLFG 9850 R310	0.50	**WLFG 9850 K R310**	0.50

	WLFG 98 ...	**WLFG 98 ... K**
version	graphite foil, electrically conductive	
version	without adhesive coating	adherent layer on one side
colour	grey	
hardness	85 Shore A	
thermal conductivity z (x/y)	8 (140) W/m·K	
temperature range	-240°C ... +350°C	
volume resistance	$11 \cdot 10^{-4}$ Ω·cm	
dielectric constant	<0,001 [1 MHz]	
class of inflammability	UL 94 V-0	
type of delivery	rolled goods, roll width 310mm/ other dimensions upon request/ sheet material auf Anfrage	

Thermal resistances vs. contact pressure / surface TO 220			
pressure [psi]	**10**	**29**	**145**
thermal impedance WLFG 9813 (K) R310 [K-cm²/W]	0.77	0.58	0.39
thermal impedance WLFG 9825 (K) R310 [K-cm²/W]	1.55	1.00	0.64
thermal impedance WLFG 9850 (K) R310 [K-cm²/W]	2.60	1.48	1.00

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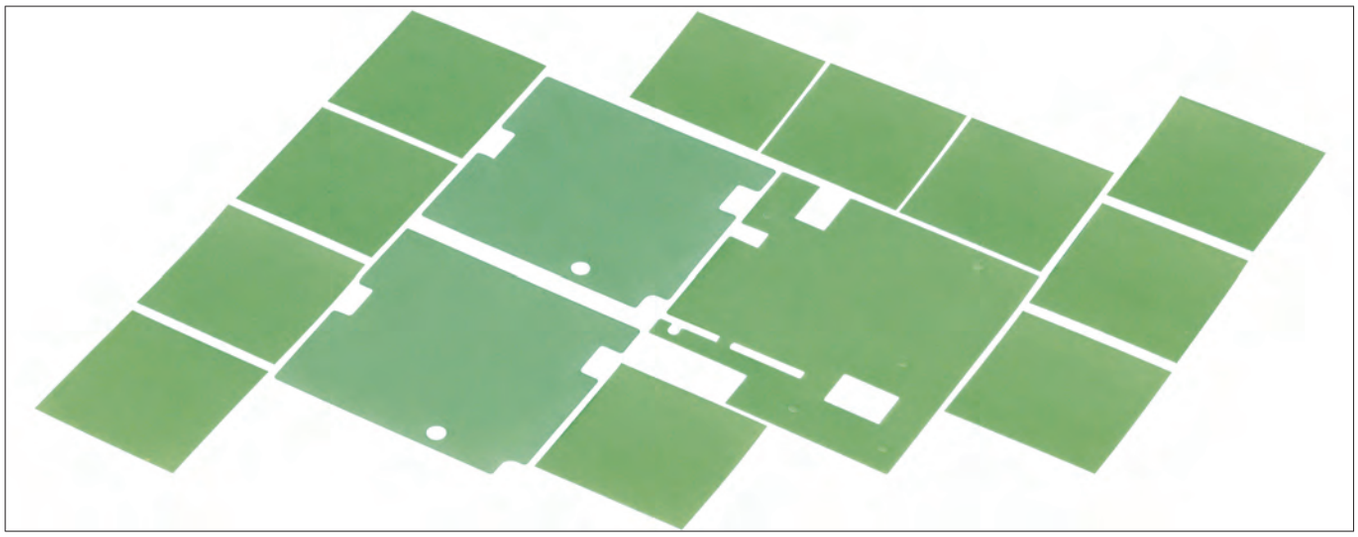
Thermal conductive foil one-sided adhesive

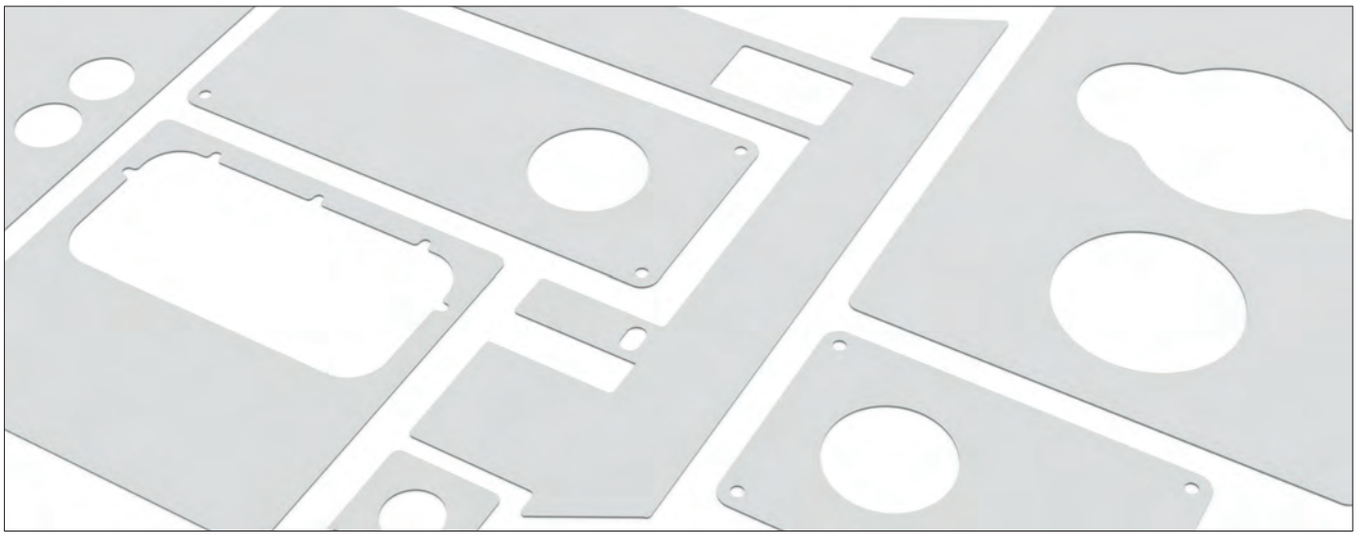


– one-side adhesive thermal conductive foil
– glass fibre reinforced design
– very good thermal conductivity
– simple handling and mounting
– cuts and contours according to customer's drawing specifications

art. no.	material thickness [mm]
WLFT 30 015	0.15
WLFT 30 023	0.23

	WLFT 30 015	WLFT 30 023
version	silicone foil with glass fibre reinforcement	
colour	green	
hardness	80 Shore A	
thermal conductivity	3 W/m·K	
temperature range	-60°C ... +200°C	
elongation	5 %	
volume resistance	$>10^9$ Ω·cm	
dielectric constant	6 [1 kHz]	
tear strength	1 N/mm²	
dielectric strength	4 kV	6 kV
class of inflammability	UL 94 V-0	
type of delivery	plates, usable area 300x200mm/ other dimensions upon request	

Thermal conductive foil one-sided adhesive



– one-sided adhesive thermal conductive foil
– additional fiberglass reinforcement
– high long-term and mechanical stability
– easy handling and mounting
– cuts and contours according to customer-specific drawing specifications

art. no.	material thickness [mm]
WLFT 40 023	0.23

	WLFT 40 023
version	silicone foil with glass fibre reinforcement
colour	white
hardness	90 Shore A
thermal conductivity	4 W/m·K
temperature range	-60°C ... +200°C
elongation	5 %
volume resistance	$10 \cdot 10^{11}$ Ω·cm
dielectric constant	4.2 [1 MHz]
tear strength	4.9 N/mm²
dielectric strength	6 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 300mm/ cuttings on customer's requirement

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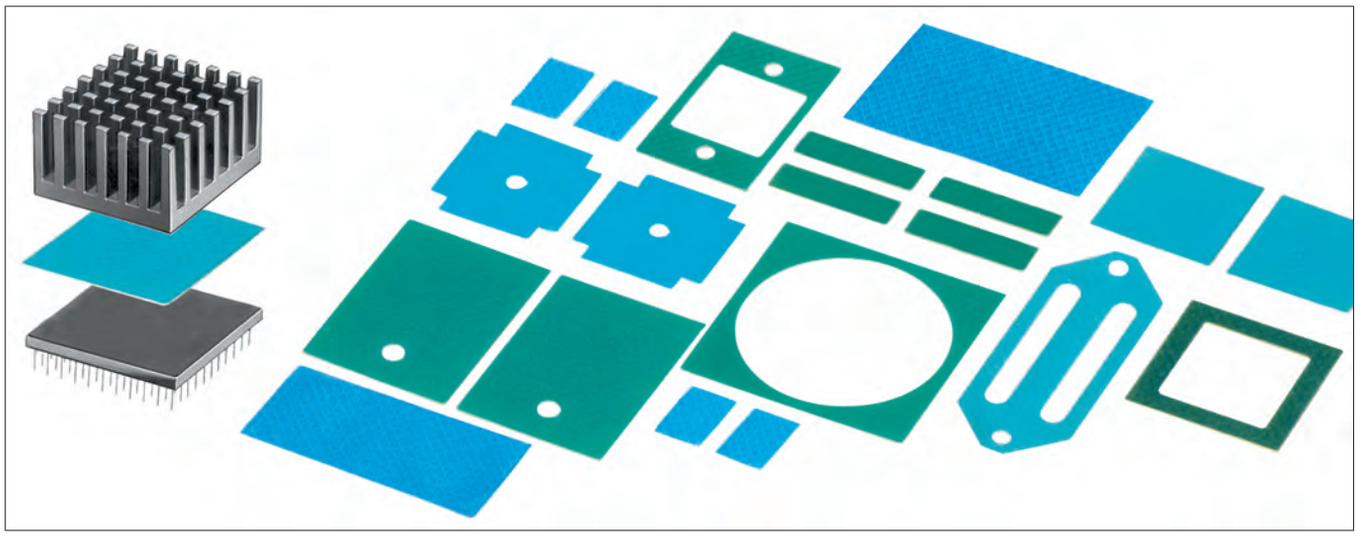
Thermally conductive foil both sides adhesive



– double-side adhesive thermal conductive foil with good thermal properties
– coated carrier film with pressure-sensitive acrylate adhesive
– curing of the adhesive layer can be influenced by temperature and time
– serves as a substitute for mechanical connections
– excellent adhesive properties on aluminium and ceramics
– simple and secure attachment of e.g. heatsinks to electronic devices
– designs as electrically conductive or electrically insulating thermal conductive foil
– supplied in sheet and tape form, other forms on request
– tape width (B) available in different dimensions and lengths
– 24h sample delivery service for individual production according to customer drawing
– customised cuts and contours according to drawing specifications

art. no.	B [mm]	type of delivery
WLFT 404 R25	25	sold by the meter
WLFT 404 R50	50	
WLFT 404 R100	100	
WLFT 404 R200	200	
WLFT 414 R25	25	
WLFT 414 R50	50	
WLFT 414 R100	100	
WLFT 414 R200	200	
WLFT 405 R25	25	
WLFT 405 R50	50	
WLFT 405 R100	100	
WLFT 405 R200	200	
WLFT 412 R25	25	
WLFT 412 R50	50	
WLFT 412 R100	100	
WLFT 412 R200	200	

Thermally conductive foil both sides adhesive

art. no.	dimensions [mm]	type of delivery
WLFT 404 100x100	100x100	plate
WLFT 404 100x200	100x200	
WLFT 404 200x200	200x200	
WLFT 414 100x100	100x100	
WLFT 414 100x200	100x200	
WLFT 414 200x200	200x200	
WLFT 405 100x100	100x100	
WLFT 405 100x200	100x200	
WLFT 405 200x200	200x200	
WLFT 412 100x100	100x100	
WLFT 412 100x200	100x200	
WLFT 412 200x200	200x200	

	WLFT 404	**WLFT 414**	**WLFT 405**	**WLFT 412**
version	insulating, double sided adhesive		non insulating, double-sided adhesive	
material thickness	0.127 mm ± 0.03		0.15 mm ± 0.03	0.23 mm ± 0.025
material filling	polyimide (Kapton MT) 0.025mm		aluminium foil 0.05mm	Aluminiumgeflecht
glue layer	acrylate (pressure sensitive) double-sided			
colour	blue			grey
thermal conductivity	0.4 W/m·K		0.5 W/m·K	1.4 W/m·K
thermal impedance (@ 300 psi)	3.7 °C cm²/W		3.4 °C cm²/W	2 °C cm²/W
holding force (overlapping)	0.86 MPa	0.69 MPa	0.93 MPa	
temperature range	-30°C... +125°C			
holding force (shear force)	**Al** 25°C 0.897 [MPa]/ **Al** 150°C 0.345 [MPa]/ **Cu** 25°C 0.828 [MPa]/ **Cu** 150°C 0.31 [MPa]/ **Al**$_2$O$_3$ 25°C 1.17 [MPa]/ **Al**$_2$O$_3$ 150°C 0.34 [MPa]	**Al** 25°C 1.04 [MPa]/ **Al** 150°C 0.104 [MPa]	**Al** 25°C 0.86 [MPa]/ **Al** 150°C 0.38 [MPa]/ **Cu** 25°C 1.1 [MPa]/ **Cu** 150°C 0.48 [MPa]/ **Al**$_2$O$_3$ 25°C 1.0 [MPa]/ **Al**$_2$O$_3$ 150°C 0.41 [MPa]	
dielectric strength	5 kV (AC)			
class of inflammability	UL 94 V-0			

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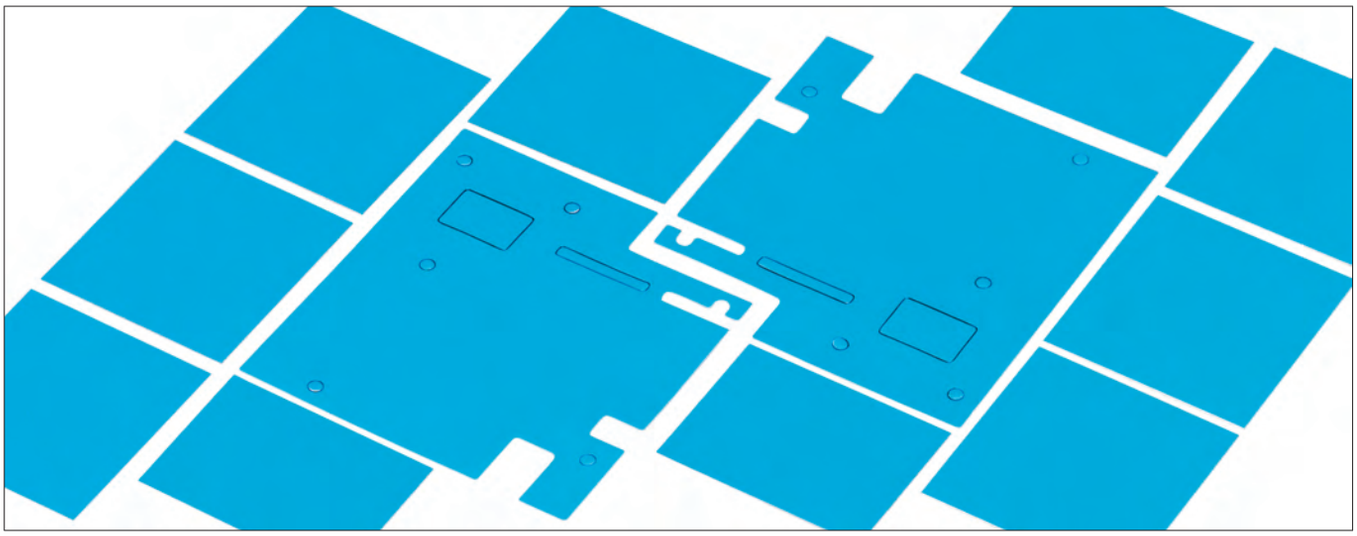
Thermally conductive foil both sides adhesive

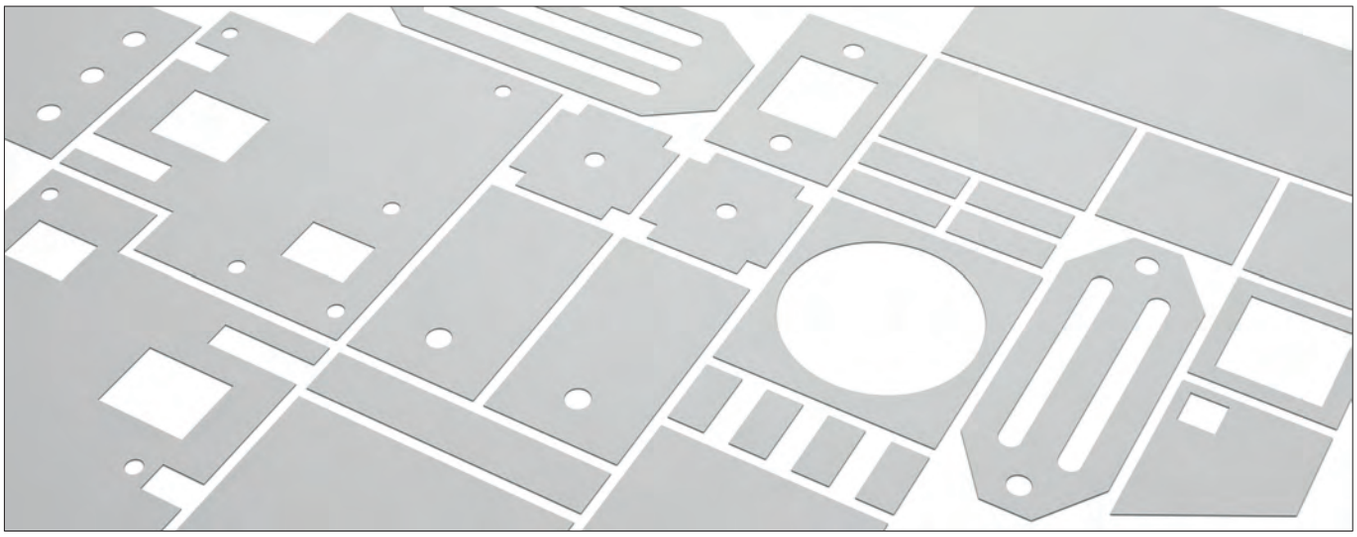


– double sided adhesive layer
– optimal adhesion of different substrates
– very good thermal conductivity, electrical insulating
– easy handling due to double sided protection foil
– optimized surface moistening and excellent impact strength
– cutouts and different punchings according to customer drawing

art. no.	type of delivery
WLFT 8805	plates, usable area 300x200mm/ other dimensions upon request
WLFT 8810	
WLFT 8815	
WLFT 8820	

	WLFT 8805	**WLFT 8810**	**WLFT 8815**	**WLFT 8820**
version	double sided adhesive, filled acrylic polymer			
material thickness	0.13 mm	0.25 mm	0.38 mm	0.5 mm
filling material	ceramic			
protection cover	silicone treated polyester, 37.5 - 50 µm			
colour	blue			
thermal conductivity	0.6 W/m·K			
specific thermal resistance	3.2°C cm²/W	5.8°C cm²/W	7.7°C cm²/W	9.7°C cm²/W
temperature range	permanent up to 100°C			
peel strength at RT 70°C and 72 h	5.8 N/cm	8.3 N/cm	9.8 N/cm	11.9 N/cm
volume resistance	$5.2 \cdot 10^{11}$ Ω/cm	$3.9 \cdot 10^{11}$ Ω/cm	$3.8 \cdot 10^{11}$ Ω/cm	
dielectric strength	26 kV/mm			
class of inflammability	UL 746 C			

Thermally conductive foil both sides adhesive



– double-sided adhesive thermal conductive foil
– excellent adhesive properties on different materials
– filling material with ceramic particles
– very good thermal conductivity and technical performance
– cuts and contours according to customer's drawing specifications

art. no.	type of delivery
WLFT 8926 02	plates, usable area 300x200mm/ other dimensions upon request
WLFT 8926 025	
WLFT 8926 05	

	WLFT 8926 02	**WLFT 8926 025**	**WLFT 8926 05**
version	double sided adhesive, filled acrylic polymer		
material thickness	0.2 mm	0.25 mm	0.5 mm
filling material	ceramic		
protection cover	silicone treated polyester		
colour	yellowish white		
thermal conductivity	1.5 W/m·K		
specific thermal resistance	8.49 °C cm²/W	8.74°C cm²/W	9.7°C cm²/W
temperature range	permanent up to 80°C		
peel strength at RT 70°C and 72 h	15 N/cm		
dielectric strength	15 kV/mm		
class of inflammability	UL 94 V-0		

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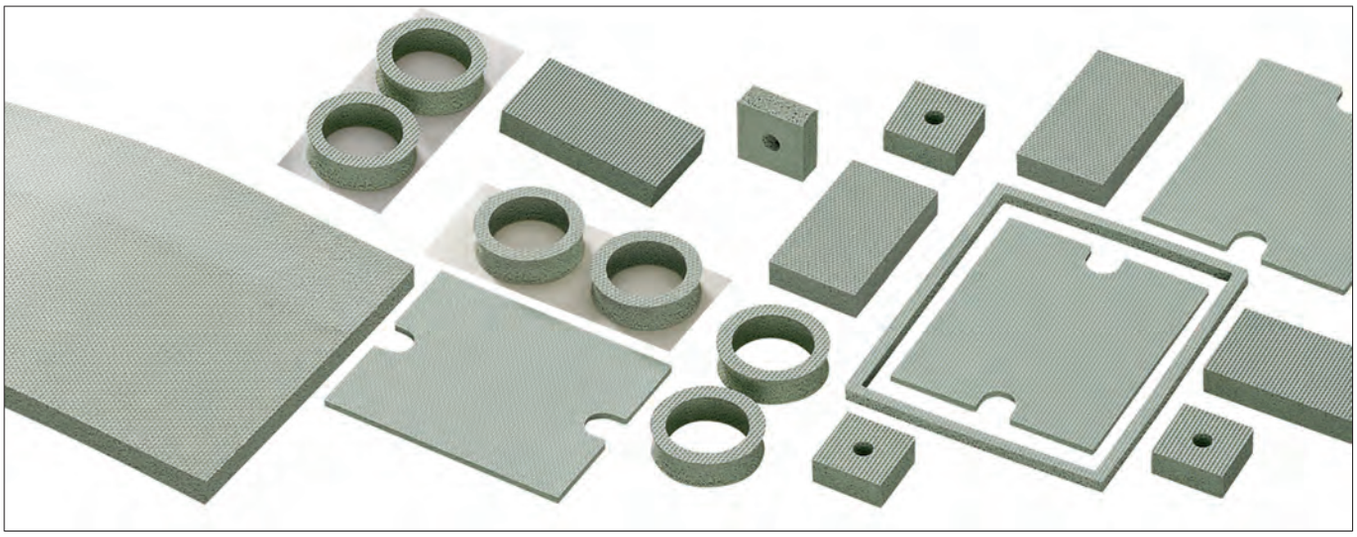
Thermally conductive silicon foam foils



– elastomer foam with closed cell structure
– good heat conductor e.g. between components, heatsinks and casing parts
– electrical insulating
– can be compressed even with a low contact pressure
– absorbs shocks and vibrations

art. no.	material thickness [mm]
WSF 08	0.80 ±0.4
WSF 16	1.60 ±0.4
WSF 24	2.40 ±0.8
WSF 32	3.20 ±0.8
WSF 48	4.80 ±0.8
WSF 635	6.35 ±1.2
WSFS 635	

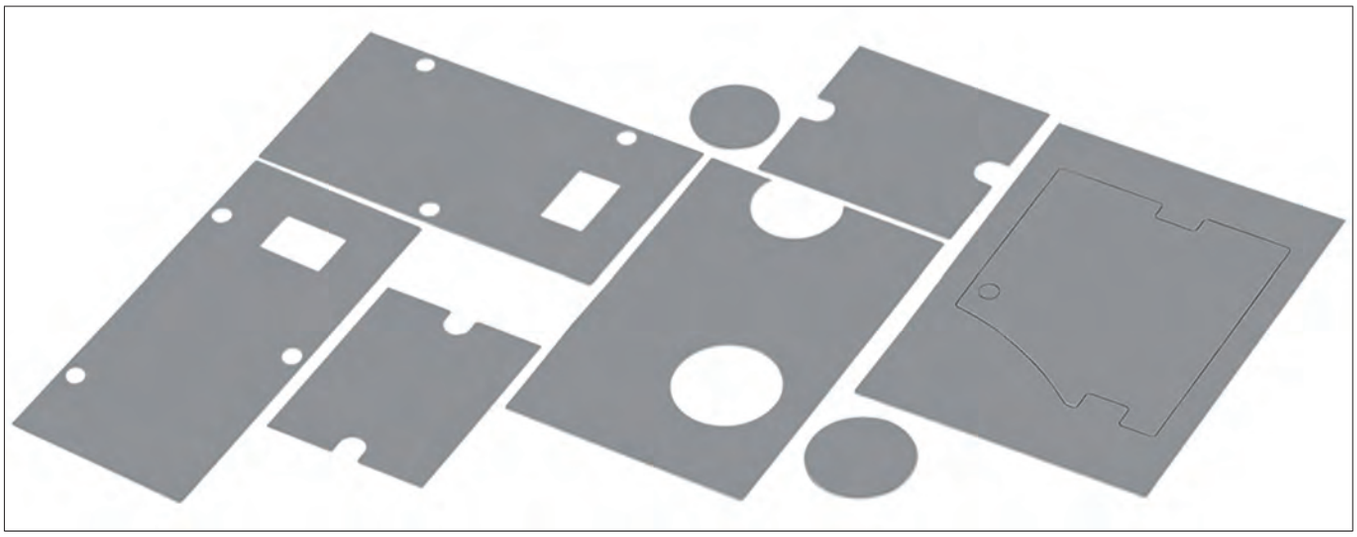
Thermal resistance at 3.2 mm material thickness:

compression [%]	contact	10	25	50
contact pressure [psi]	>1	5	12	34
R_{th} [K/W] (1 in² x 3.2 mm)	6	4.5	2.5	1
heat conductivity [W/mK]	0.3	0.4	0.45	0.65

– **WSFS 635** double sided adhesive and **WSF** self-adhesive upon request
– according to NASA gas emission requirements

	WSF	**WSFS 635**
version	non adhesive	one-sided self-adhesive
colour	green	
density	1.105 g/cm³	
hardness	13 Shore A	
temperature range	-62°C ... +205°C	
thermal conductivity	0.108 W/m·K (substrate)	
compression, 25%	18 psi	
elongation	150 %	
tear strength	120 psi	
dielectric strength	4 kV/mm	
class of inflammability	UL 94 V-1 (at thickness ≥3.2mm)	
type of delivery	plates, usable area 914x914mm/ other dimensions upon request	

Silicone free thermal adhesive foils



– silicone free gap-filler with good thermal characteristics
– smooth, compressible and elastic
– cut outs, punchings and modifications according to customer specification
– other material thicknesses upon request

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]	art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL F 15 10	1.0 ±0.2	1.02	6.60	**GEL F 15 G 10**	1.0 ±0.2	1.16	7.50
GEL F 15 15	1.5 ±0.2	1.39	9.00	**GEL F 15 G 15**	1.5 ±0.2	1.66	10.75
GEL F 15 20	2.0 ±0.3	1.75	11.30	**GEL F 15 G 20**	2.0 ±0.3	2.17	14.00

	GEL F 15	**GEL F 15 G**
version	standard	polyamide film mash reinforced
colour	light gray	
density	2.1 g/cm³	
hardness	53 Shore 00	
thermal conductivity	1.5 W/m·K	
temperature range	-40°C... +105°C	
elongation	150 %	
volume resistance	$1 \cdot 10^9$ MΩ/m	
dielectric constant	9.12 [50 Hz] / 8.55 [1 kHz] / 5.83 [1 MHz]	
dielectric loss factor	0,152 [50 Hz] / 0,135 [1 kHz] / 0,034 [1 MHz]	
dielectric strength	11 kV/mm	
class of inflammability	accordant UL 94 V-0	
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request	

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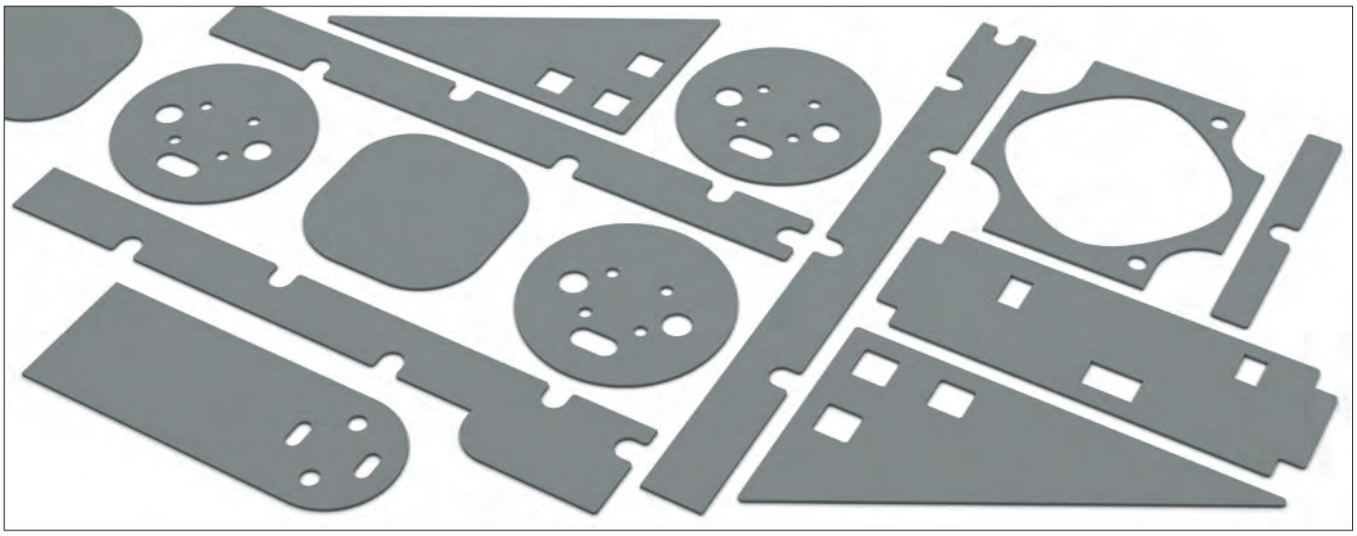
Silicone free thermal adhesive foils



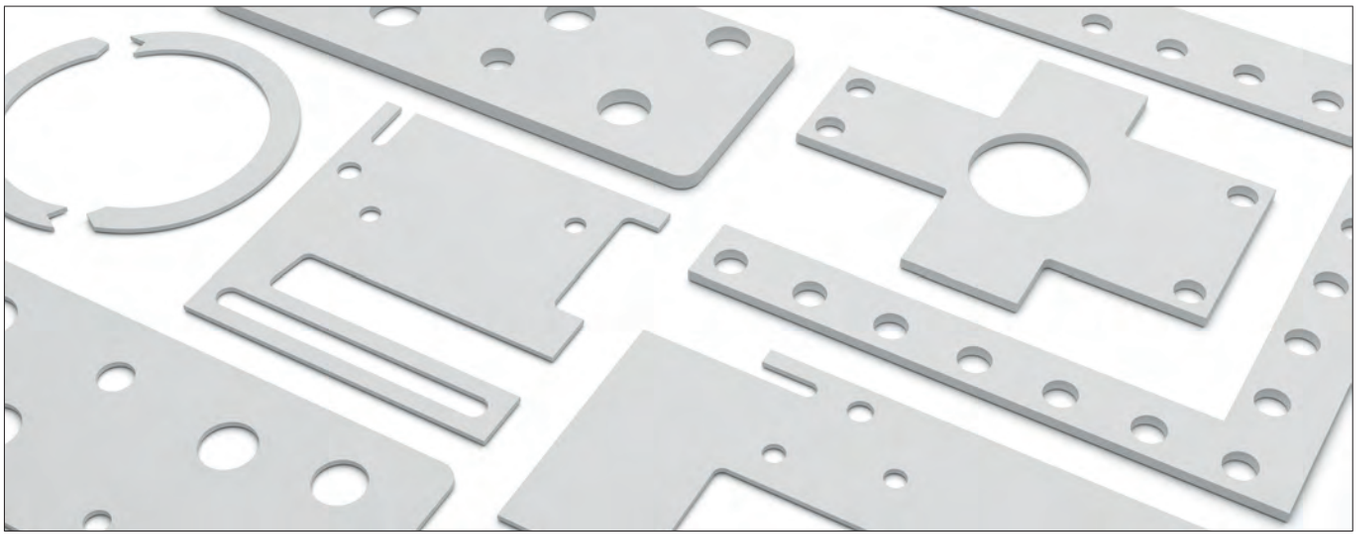
– silicone-free thermal conductive foil
– particularly suitable for silicone-free applications
– very good thermal and mechanical properties
– high electrical insulation
– cuts and contours made of sheet or roller material according to your specifications

art. no.	material thickness [mm]
WFKF 20 05	0.5
WFKF 20 10	1.0

	WFKF 20
version	silicone-free foil without glass fibre reinforcement
colour	grey
density	1.5 g/cm³
hardness	55 - 65 Shore 00
thermal conductivity	2 W/m·K
thermal resistance	0.6 K/W
temperature range	-40°C ... +130°C
volume resistance	$5.3 \cdot 10^9$ Ω·m
dielectric constant	5.6 [1 KHz]
elastic modulus	244 g/cm²
tensile strength	18 kN/m
dielectric strength	7 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 450x250mm/ other dimensions upon request

Thermal resistances vs. contact pressure				
pressure [psi]	0	14.50	29	43.51
thermal resistance WFKF 20 05 [K/W]	0.60	0.56	0.53	0.50
thermal resistance WFKF 20 10 [K/W]	1.31	1.20	0.98	0.89

Silicone free thermal adhesive foils



– soft and adaptable acrylic-based thermal conductive foil
– very good compensation of unevennesses and differences in components
– natural adhesive properties and high dielectric strength
– cuts and contours with cutouts according to customer drawings

art. no.	material thickness [mm]
GEL F 30 05	0.5
GEL F 30 10	1.0
GEL F 30 15	1.5

	GEL F 30 ...
version	silicone-free thermal conductive foils
colour	white-grey
density	2.1 g/cm^3
hardness	70 Shore 00
thermal conductivity	3 W/m·K
temperature range	-40°C ... +110°C
volume resistance	6·10^9 Ω·m
dielectric constant	5.4 [1 GHz]
dielectric strength	12 kV/mm
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 240x300mm/ other dimensions upon request

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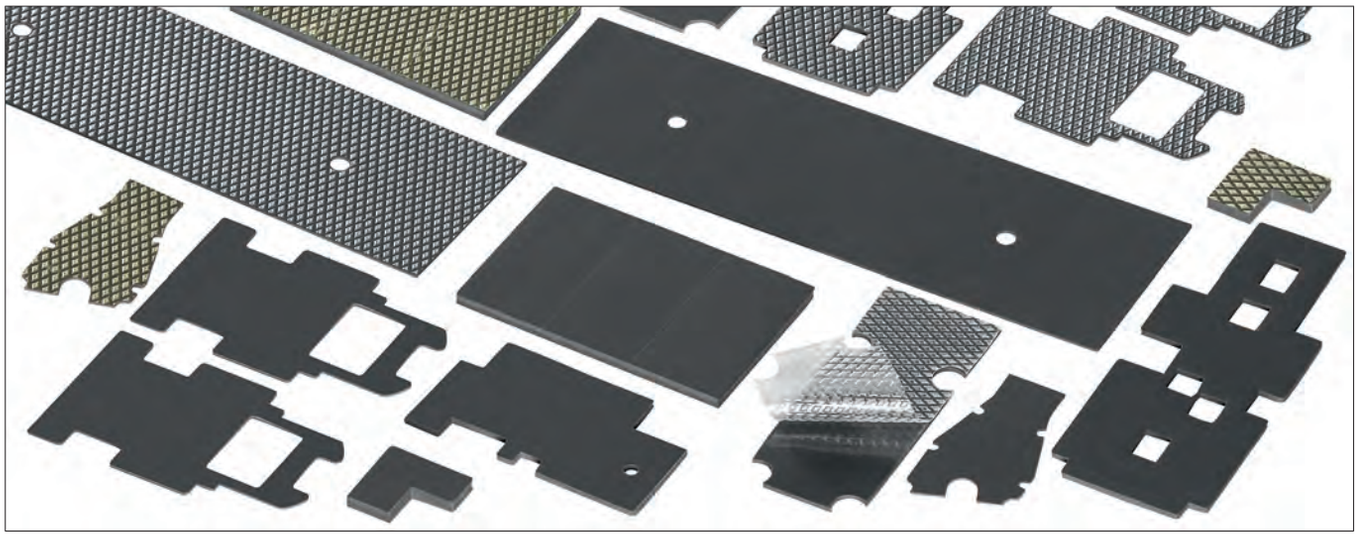
Gel thermal conducting foils

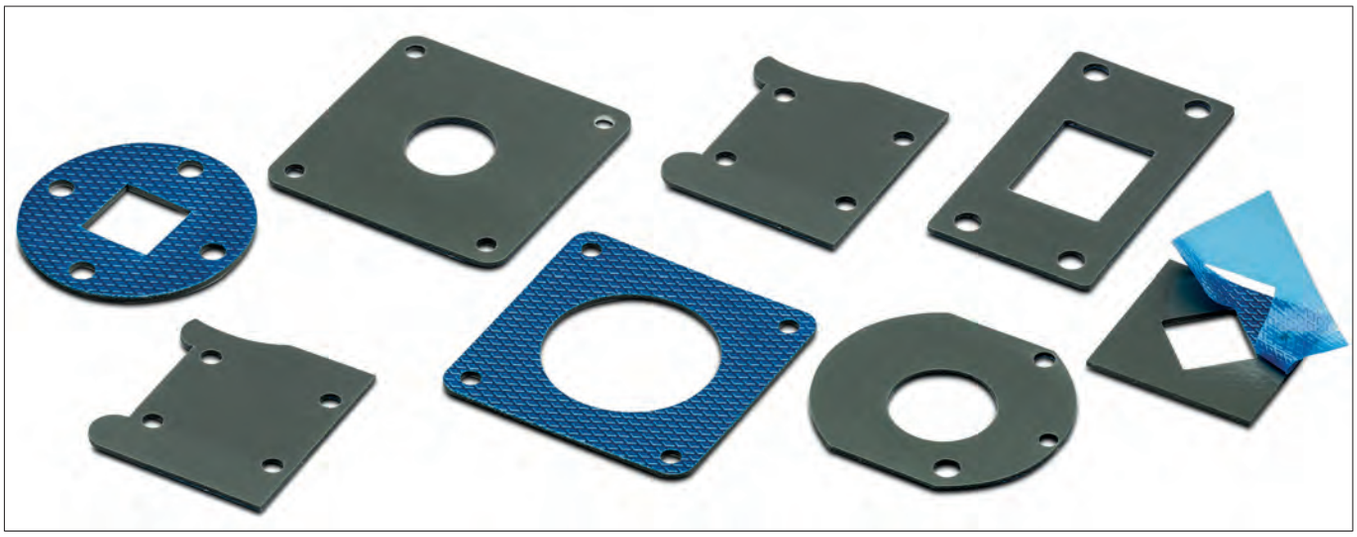


– highly heat-conductive silocon foil
– smooth, elastic and compressible
– equals uneven surfaces very well (Gap-Filler)

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]	art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 05	0.5 ±0.1	0.69	4.45	**GEL G 05**	0.5 ±0.1	0.63	4.04
GEL 10	1.0 ±0.2	1.03	6.64	**GEL G 1**	1.0 ±0.2	1.17	7.56
GEL 15	1.5 ±0.2	1.39	8.96	**GEL G 15**	1.5 ±0.2	1.59	10.27
GEL 20	2.0 ±0.3	1.52	9.78	**GEL G 2**	2.0 ±0.3	2.07	13.33
GEL 25	2.5 ±0.3	2.10	13.58	**GEL G 25**	2.5 ±0.3	2.61	16.81
GEL 30	3.0 ±0.3	2.35	15.15	**GEL G 3**	3.0 ±0.3	2.89	18.66
GEL 35	3.5 ±0.3	2.56	16.51	**GEL G 35**	3.5 ±0.3	3.35	21.63
GEL 40	4.0 ±0.4	3.25	20.95	**GEL G 4**	4.0 ±0.4	3.56	22.96
GEL 45	4.5 ±0.4	3.38	21.82	**GEL G 45**	4.5 ±0.4	3.89	25.10
GEL 50	5.0 ±0.5	3.52	22.70	**GEL G 5**	5.0 ±0.5	4.22	27.23

	GEL	**GEL G 05 - 25**	**GEL G 3 - 5**
version	standard	polyamide film mash reinforced, adherent layer on one side	
colour	dark gray		
density	2.6 g/cm³		
hardness	49 Shore 00		
thermal conductivity	1.5 W/m·K		
temperature range	-60°C ... +200°C		
elongation	100 %	60 %	
volume resistance	1·10⁶ MΩ/m		
dielectric constant	5.8 [50 Hz]/ 5.6 [1 KHz]/ 5.5 [1 MHz]		
dielectric loss factor	0.048 [50 Hz]/ 0.015 [1 KHz]/ 0.003 [1 MHz]		
dielectric strength	14 kV/mm (AC)	8 kV/mm (AC)	
class of inflammability	UL 94 V-0	UL 94 V-1	UL 94 V-0
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request		

Gel thermal conducting foils



– very soft thermal conductive foil
– without any reinforcing layer
– optimal balance of bigger unevennesses
– thermal conductive foil both-sided adherent
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFG 15 05	0.508	**WFG 15 25**	2.540
WFG 15 10	1.016	**WFG 15 30**	3.175
WFG 15 15	1.524	**WFG 15 40**	4.064
WFG 15 20	2.032	**WFG 15 50**	5.080

	WFG 15
version	silicone film without reinforcement
colour	black
hardness	40 Shore 00
thermal conductivity	1.5 W/m·K
temperature range	-60°C ... +200°C
volume resistance	10^{11} Ω·m
dielectric constant	5.5 [1 kHz]
heat capacity	1 J/g·K
dielectric strength	6 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 406x203mm/ other dimensions upon request

Thermal resistances vs. material thickness								
material thicknesses [mm]	**0.508**	**1.016**	**1.524**	**2.032**	**2.540**	**3.175**	**4.064**	**5.08**
thermal impedance WFG 15 [K-cm²/W]	3	7.5	10	13.13	16.25	21.25	26.25	33.125

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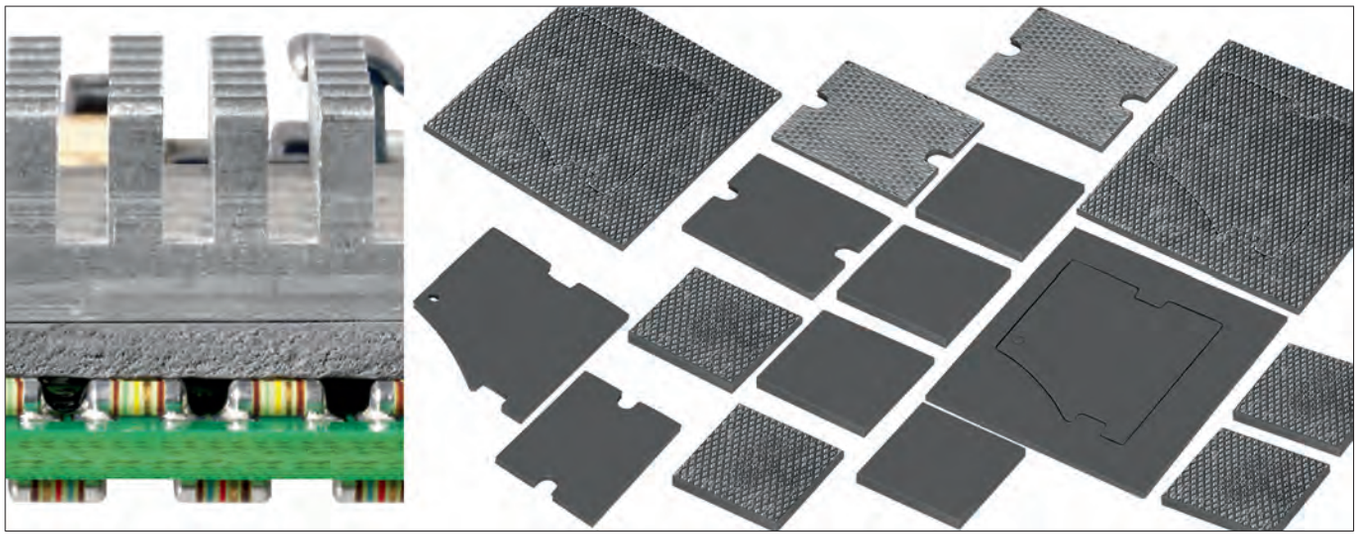
Gel thermal conducting foils

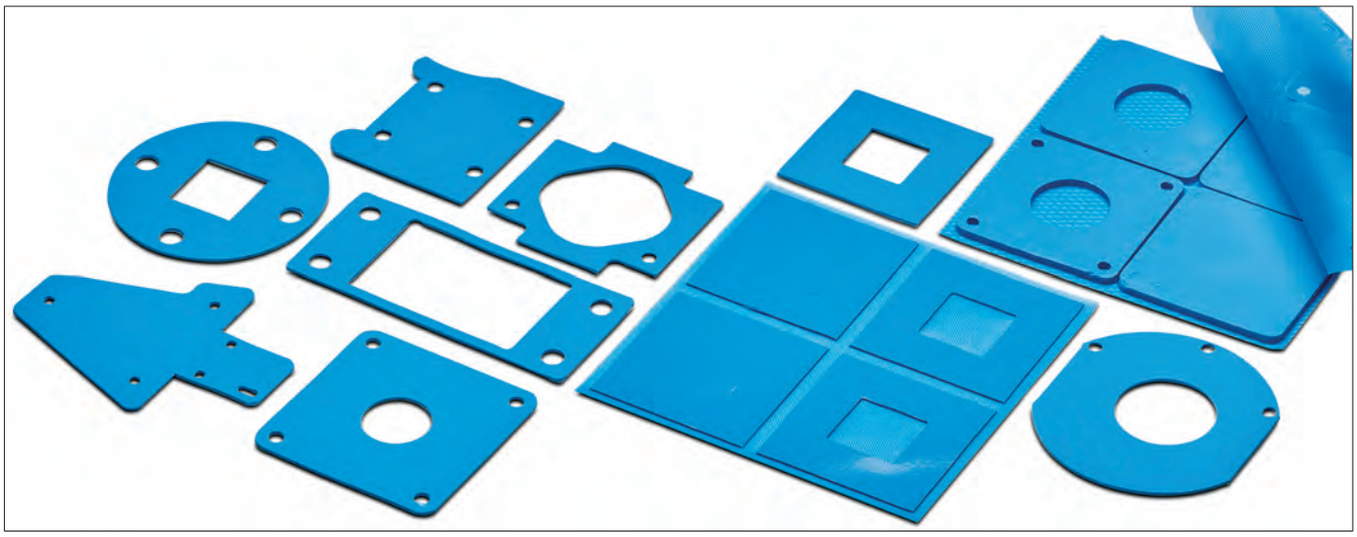


– GEL thermal conductive foils with very good thermical characteristics
– for balancing non-planarities and differences in components (gap-filler)
– soft, elastic and compressible
– customer specific cuts and punchings according to drawing

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]	art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 28 05	0.5 ±0.15	0.23	1.48	**GEL 28 G 05**	0.5 ±0.15	0.29	1.85
GEL 28 10	1.0 ±0.20	0.44	2.76	**GEL 28 G 10**	1.0 ±0.20	0.47	2.99
GEL 28 15	1.5 ±0.20	0.61	3.82	**GEL 28 G 15**	1.5 ±0.20	0.72	4.53
GEL 28 20	2.0 ±0.30	0.80	5.00	**GEL 28 G 20**	2.0 ±0.30	0.97	6.07
GEL 28 25	2.5 ±0.30	0.90	5.65	**GEL 28 G 25**	2.5 ±0.30	1.15	7.23
GEL 28 30	3.0 ±0.30	1.10	6.90	**GEL 28 G 30**	3.0 ±0.30	1.23	7.69
GEL 28 35	3.5 ±0.30	1.27	7.97	**GEL 28 G 35**	3.5 ±0.30	1.35	8.46
GEL 28 40	4.0 ±0.30	1.39	8.69	**GEL 28 G 40**	4.0 ±0.30	1.67	10.47
GEL 28 50	5.0 ±0.30	1.67	10.47	**GEL 28 G 50**	5.0 ±0.30	1.92	12.02

	GEL 28	**GEL 28 G**
version	standard	polyamide film mash reinforced
colour	grey	
density	2.7 g/cm³	
hardness	50 Shore 00	55 Shore 00
thermal conductivity	2.5 W/m·K	
temperature range	-60°C ... +200°C	
elongation	64 %	32 %
volume resistance	3.6·10⁴ MΩ/m	
dielectric constant	8.98 [50 Hz] / 8.63 [1 kHz] / 8.05 [1 MHz]	
dielectric loss factor	0.0826 [50 Hz]/0.0300 [1 kHz]/0.0052 [1 MHz]	
dielectric strength	15 kV/mm	
class of inflammability	UL 94 V-0	
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request	

Gel thermal conducting foils



– good compressible gap filling material
– high thermal conductivity
– very good shearing and tensile strength
– double-sided natural adhesive layer
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFGH 30 05	0.508	**WFGH 30 20**	2.032
WFGH 30 10	1.016	**WFGH 30 25**	2.540
WFGH 30 15	1.524	**WFGH 30 30**	3.175

	WFGH 30
version	silicone foil with glass fibre reinforcement
colour	blue
hardness	15 Shore 00
thermal conductivity	3 W/m·K
temperature range	-60°C ... +200°C
volume resistance	10^{10} Ω·m
dielectric constant	6.5 [1 kHz]
heat capacity	1 J/g·K
dielectric strength	5 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 406x203mm/ other dimensions upon request

Thermal resistances vs. material thickness						
material thicknesses [mm]	**0.508**	**1.016**	**1.524**	**2.032**	**2.540**	**3.175**
thermal impedance WFGH 30 [K-cm²/W]	1.88	3.75	5	6.88	8.13	10.93

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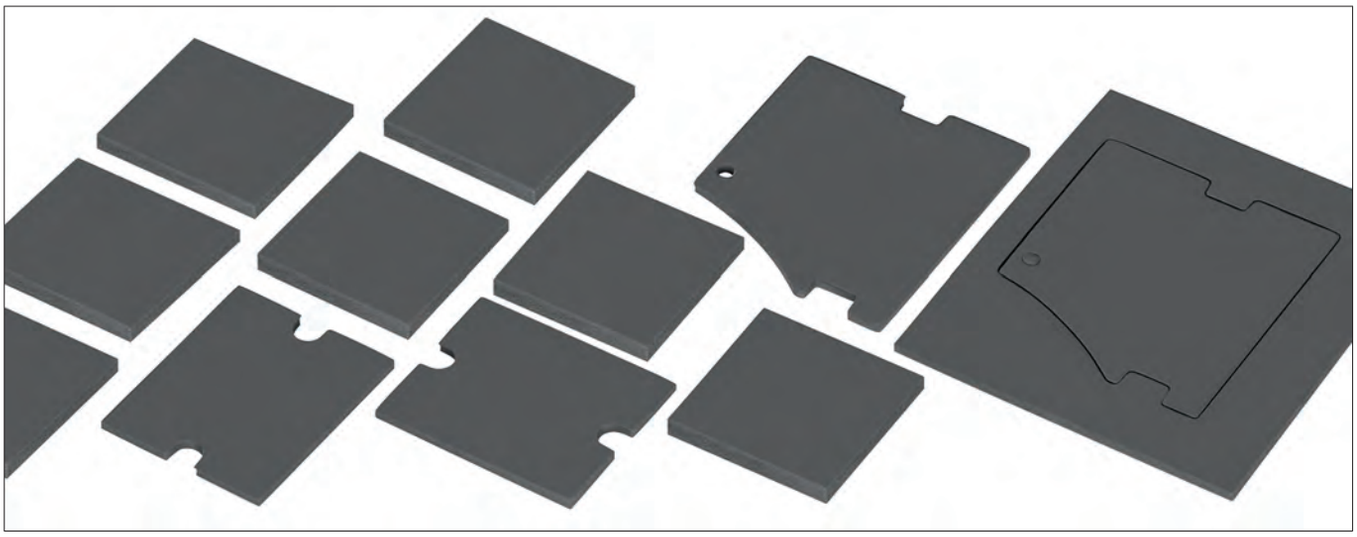
Gel thermal conducting foils

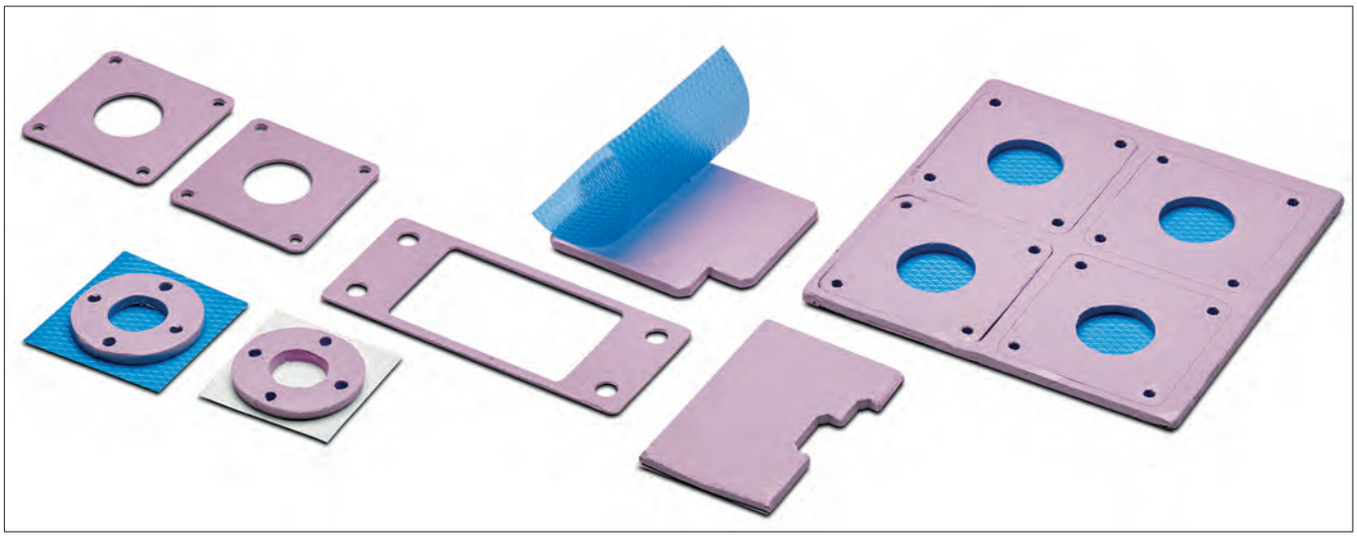


– gap filler with exceptionally good thermal conductivity and low outgassing
– especially smooth, compressible and elastic
– cut outs, punchings and modifications according to customer specification
– other material thicknesses upon request

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]	art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 45 05	0.5 ±0.15	0.28	1.75	**GEL 45 G 05**	0.5 ±0.15	0.22	1.37
GEL 45 10	1.0 ±0.20	0.37	2.31	**GEL 45 G 10**	1.0 ±0.20	0.35	2.18
GEL 45 15	1.5 ±0.20	0.46	2.87	**GEL 45 G 15**	1.5 ±0.20	0.45	2.81
GEL 45 20	2.0 ±0.30	0.56	3.50	**GEL 45 G 20**	2.0 ±0.30	0.55	3.43
GEL 45 25	2.5 ±0.30	0.68	4.25	**GEL 45 G 25**	2.5 ±0.30	0.62	3.87
GEL 45 30	3.0 ±0.30	0.79	4.93	**GEL 45 G 30**	3.0 ±0.30	0.73	4.56
GEL 45 35	3.5 ±0.35	0.87	5.43	**GEL 45 G 35**	3.5 ±0.35	0.83	5.18
GEL 45 40	4.0 ±0.40	0.95	5.93	**GEL 45 G 40**	4.0 ±0.40	0.93	5.81
GEL 45 45	4.5 ±0.45	1.04	6.50	**GEL 45 G 45**	4.5 ±0.45	1.00	6.25
GEL 45 50	5.0 ±0.50	1.14	7.12	**GEL 45 G 50**	5.0 ±0.50	1.07	6.68

	GEL 45	**GEL 45 G**
version	standard	polyamide film mash reinforced
colour	grey	
density	3.2 g/cm³	
hardness	45 Shore 00	
thermal conductivity	4.5 W/m·K	
temperature range	-60°C ... +200°C	
elongation	50 %	
volume resistance	$1.4 \cdot 10^5$ Ω/cm	
dielectric constant	8.98 [50 Hz] / 8.63 [1 kHz] / 8.05 [1 MHz]	
dielectric loss factor	0,0249 [50 Hz] / 0,0219 [1 kHz] / 0,00675 [1 MHz]	
dielectric strength	11 kV/mm	
class of inflammability	UL 94 V-0	
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request	

Gel thermal conducting foils



– very good compressibility
– particularly suitable for low contact pressure
– double-sided natural adhesive layer
– wide temperature range
– cuts and contours according to customer specific drawing specifications

art. no.	material thickness [mm]	art. no.	material thickness [mm]
WFGH 50 05	0.508	**WFGH 50 20**	2.032
WFGH 50 10	1.016	**WFGH 50 25**	2.540
WFGH 50 15	1.524	**WFGH 50 30**	3.175

	WFGH 50
version	silicone foil with glass fibre reinforcement
colour	violet
hardness	35 Shore 00
thermal conductivity	5 W/m·K
temperature range	-60°C ... +200°C
volume resistance	10^{10} Ω·m
dielectric constant	8 [1 kHz]
heat capacity	1 J/g·K
dielectric strength	5 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 406x203mm/ other dimensions upon request

Thermal resistances vs. material thickness						
material thicknesses [mm]	**0.508**	**1.016**	**1.524**	**2.032**	**2.540**	**3.175**
thermal impedance WFGH 50 [K-cm²/W]	1.25	2.5	3.75	5.18	6.25	8.13

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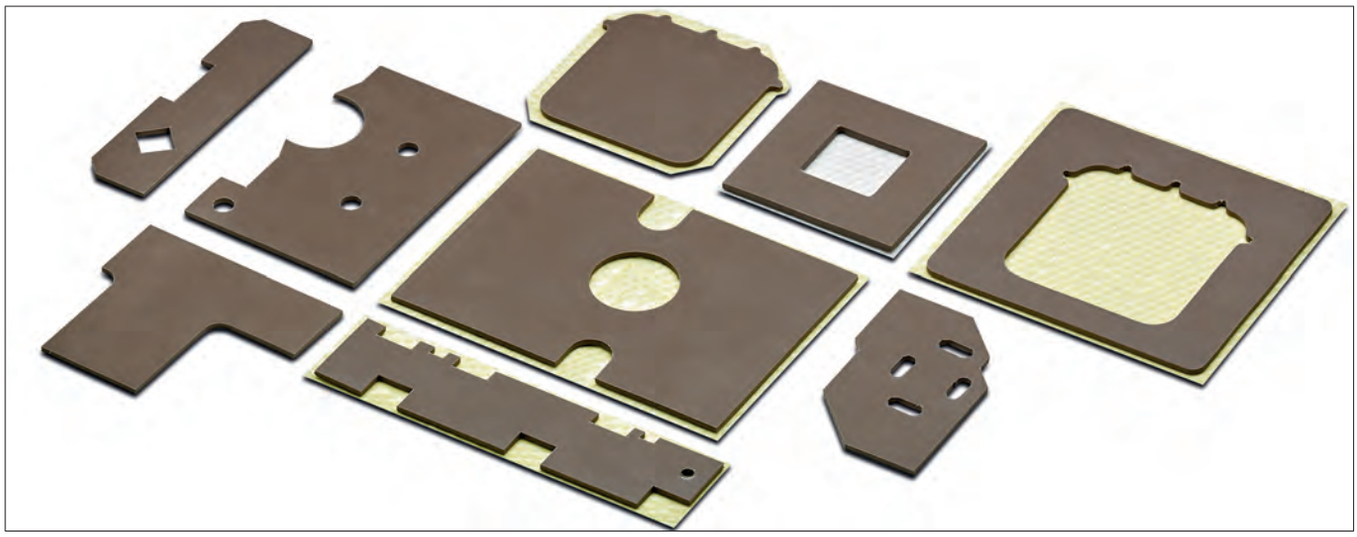
Gel thermal conducting foils

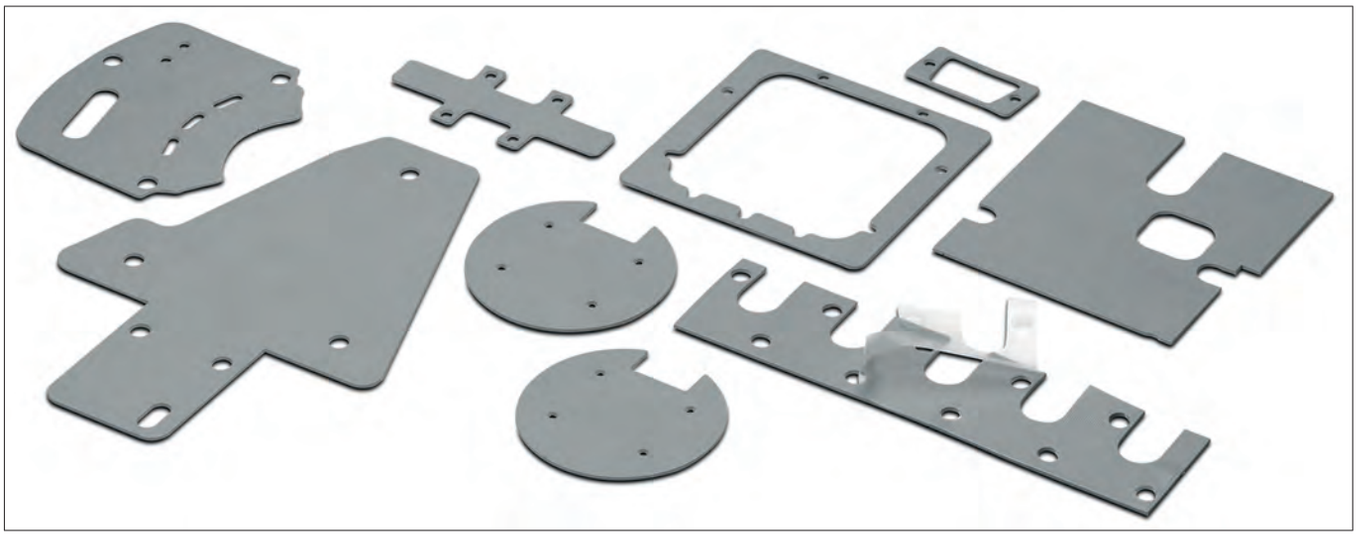


– GEL silicone foils with especially high thermal conductivity
– balances non-planarities and differences in components (Gap filler)
– soft, elastic and compressible
– cuts, punchings and special designs according to customer specifications

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]	art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 60 05	0.5 ±0.1	0.20	1.30	**GEL 60 G 05**	0.5 ±0.1	0.21	1.37
GEL 60 10	1.0 ±0.2	0.33	2.11	**GEL 60 G 10**	1.0 ±0.2	0.31	1.99
GEL 60 15	1.5 ±0.2	0.53	3.45	**GEL 60 G 15**	1.5 ±0.2	0.48	3.08
GEL 60 20	2.0 ±0.3	0.61	3.91	**GEL 60 G 20**	2.0 ±0.3	0.62	4.00
GEL 60 25	2.5 ±0.3	0.72	4.67	**GEL 60 G 25**	2.5 ±0.3	0.77	4.96

	GEL 60	**GEL 60 G**
version	standard	polyamide film mash reinforced
colour	dark reddish grey	
density	3.2 g/cm³	
hardness	52 Shore 00	
thermal conductivity	6 W/m·K	
temperature range	-60°C ... +200°C	
elongation	80 %	
volume resistance	1·10⁶ MΩ/m	
dielectric constant	6.4 [50 Hz]/6.4 [1 kHz]/6.4 [1 MHz]	
dielectric loss factor	0.035 [50 Hz]/0.005 [1 kHz]/0.001 [1 MHz]	
dielectric strength	13 kV/mm	
class of inflammability	UL 94 V-0	
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request	

Gel thermal conducting foils



– high heat conducting silicone foil as a gap-filler
– very good compression with high dielectric strength
– optimal for balancing big unevennesses or production tolerances
– customer specific cuts according to drawing
– other material compositions and thicknesses upon request

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]	art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 80 10	1.0 ±0.15	0.17	1.10	**GEL 80 G 05**	0.5 ±0.10	0.12	0.77
GEL 80 15	1.5 ±0.20	0.26	1.68	**GEL 80 G 10**	1.0 ±0.15	0.19	1.22
GEL 80 20	2.0 ±0.30	0.36	2.32	**GEL 80 G 15**	1.5 ±0.20	0.28	1.81
GEL 80 25	2.5 ±0.30	0.45	2.91	**GEL 80 G 20**	2.0 ±0.30	0.38	2.45
GEL 80 30	3.0 ±0.30	0.57	3.68	**GEL 80 G 25**	2.5 ±0.30	0.47	3.01
GEL 80 G 03	0.3 ±0.06	0.09	0.58	**GEL 80 G 30**	3.0 ±0.30	0.59	3.49

	GEL 80	**GEL 80 G**
version	standard	polyamide film mash reinforced
colour	light gray	
density	3.39 g/cm³	
hardness	75 Shore 00	
thermal conductivity	13 W/m·K	
temperature range	-40°C... +150°C	
elongation	50 %	
volume resistance	$1 \cdot 10^{13}$ Ω·cm	
dielectric constant	9.54 [50 Hz] / 8.82 [1 kHz] / 7.92 [1 MHz]	
dielectric loss factor	0,063 [50 Hz] / 0,044 [1 kHz] / 0,014 [1 MHz]	
dielectric strength	15 kV/mm	
class of inflammability	UL 94 V-0	
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request	

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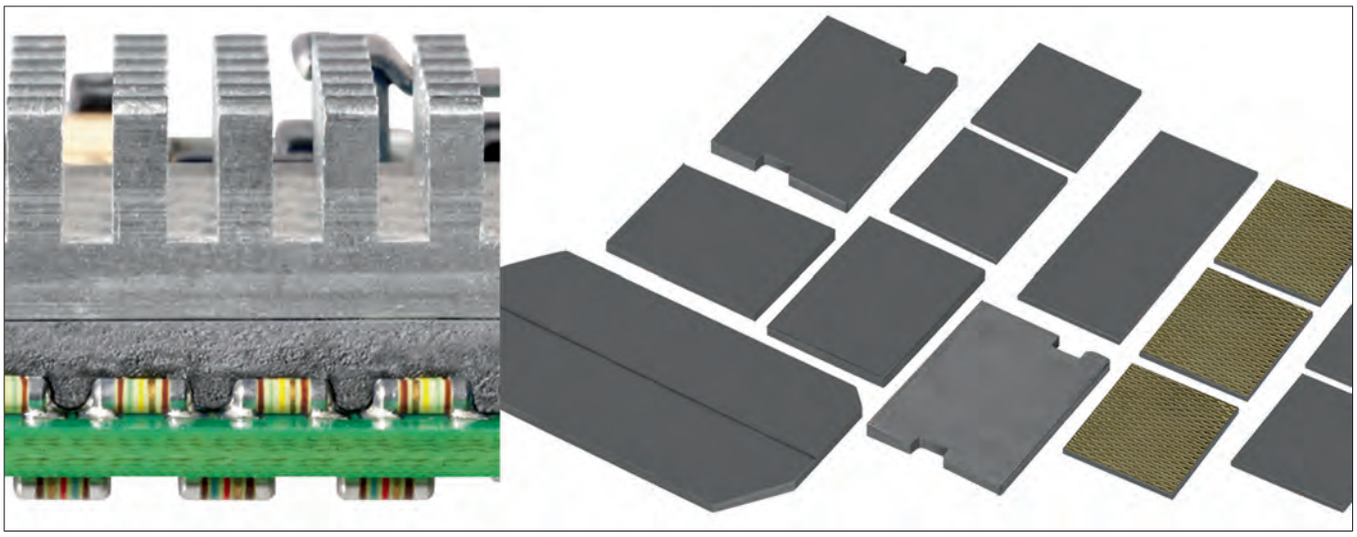
Gel thermal conductive foils for extreme compression

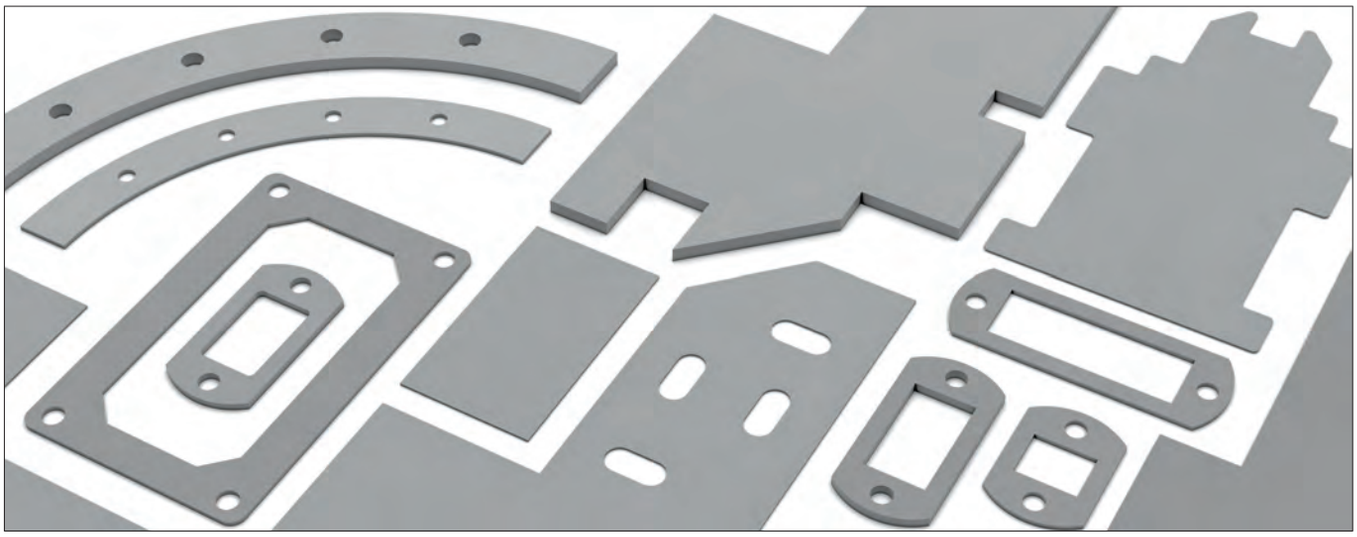


– specially soft design
– levels smallest air gaps and unevennesses
– cuts and contours with cutouts according to customer's specifactions

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 28 S 10	1.0 ±0.15	0.42	2.7
GEL 28 S 15	1.5 ±0.20	0.60	3.9
GEL 28 S 20	2.0 ±0.30	0.76	4.9
GEL 28 S 25	2.5 ±0.30	0.90	5.8
GEL 28 S 30	3.0 ±0.30	1.02	6.6
GEL 28 S 35	3.5 ±0.35	1.15	7.4
GEL 28 S 40	4.0 ±0.40	1.27	8.2
GEL 28 S 45	4.5 ±0.45	1.45	9.4
GEL 28 S 50	5.0 ±0.50	1.64	10.6

	GEL 28 S
version	standard
colour	grey
density	2.6 g/cm³
hardness	9 ASKER C
thermal conductivity	2.5 W/m·K
temperature range	-40°C... +150°C
volume resistance	$1 \cdot 10^{11}$ Ω·m
dielectric constant	7.21 [50 Hz] / 6.73 [1 kHz] / 6.25 [1 MHz]
dielectric loss factor	0.059 [50 Hz] / 0.031 [1 kHz] / 0.007 [1 MHz]
dielectric strength	18 kV/mm
class of inflammability	UL 94 V-0
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request

Gel thermal conductive foils for extreme compression



– very soft silicone-based thermal conductive material
– double side adhesive surface
– good chemical and ageing resistance
– other material thicknesses on request
– cuts and contours according to customised drawing specifications

art. no.	material thickness [mm]
GEL 30 S 05	0.5
GEL 30 S 10	1.0
GEL 30 S 15	1.5
GEL 30 S 20	2.0
GEL 30 S 25	2.5
GEL 30 S 30	3.0
GEL 30 S 35	3.5
GEL 30 S 40	4.0

	GEL 30 S
version	silicone foil, protective film on both sides
colour	grey
hardness	7 Shore A
thermal conductivity	3 W/m·K
temperature range	-60°C ... +200°C
elongation	450 %
tear strength	0.7 N/mm²
dielectric strength	1 kV/mm
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 305x305mm/ other dimensions upon request

Thermal resistances vs. contact pressure					
pressure [psi]	**10**	**20**	**30**	**40**	**50**
thermal impedance GEL 30 S 30 [K-cm²/W]	16.7	15.9	26.3	13.5	12.7

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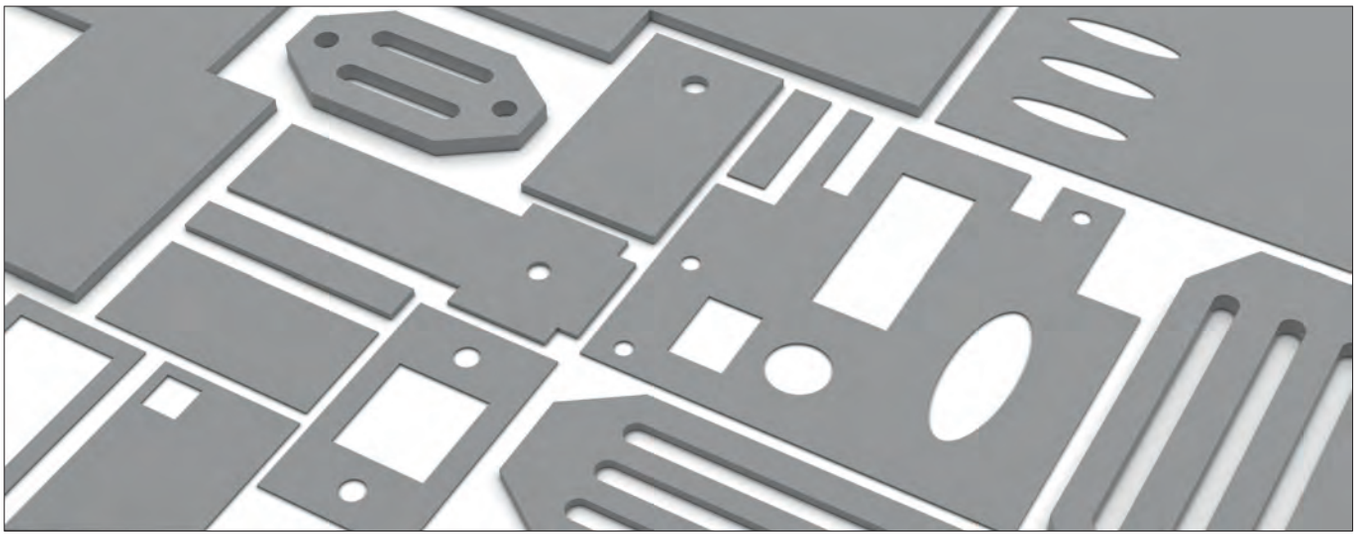
Gel thermal conductive foils for extreme compression



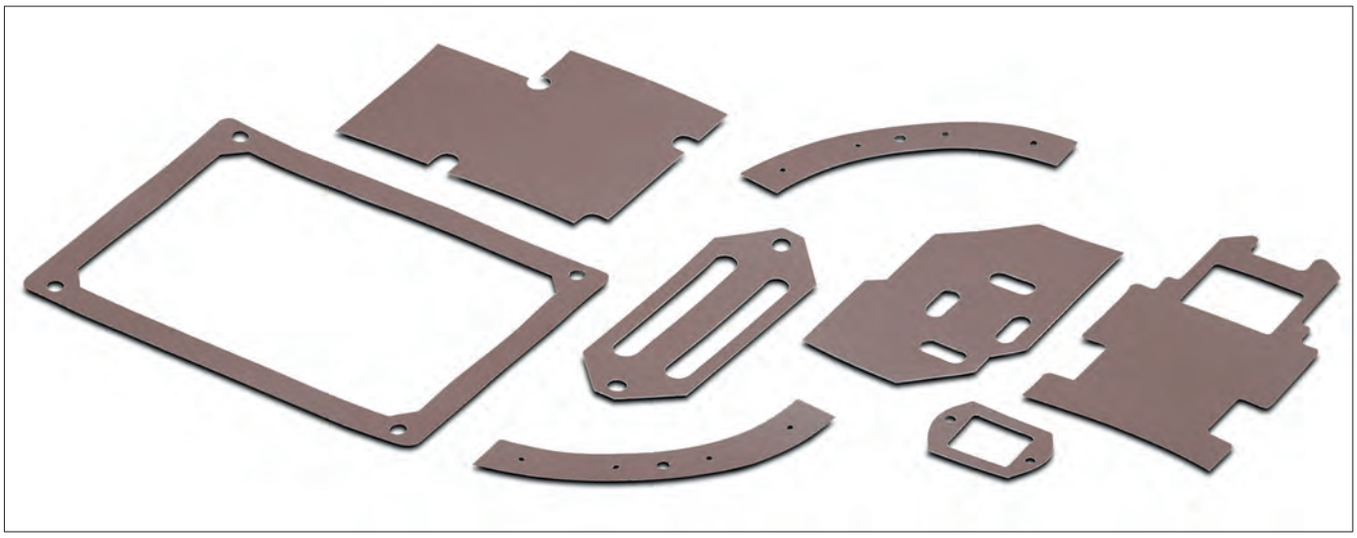
– very soft silicone foil with good compressibility
– mounting facilitation due to adherent surfaces
– very good compensation of larger unevennesses
– low contact pressure to reduce thermal transfer resistances
– shaped parts and material cuts according to your specifications

art. no.	material thickness [mm]
GEL 50 S 05	0.5
GEL 50 S 10	1.0
GEL 50 S 15	1.5
GEL 50 S 20	2.0
GEL 50 S 25	2.5
GEL 50 S 30	3.0
GEL 50 S 35	3.5
GEL 50 S 40	4.0

	GEL 50 S
version	silicone foil, protective film on both sides
colour	grey
hardness	20 Shore A
thermal conductivity	5 W/m·K
temperature range	-60°C ... +200°C
elongation	250 %
tear strength	0.34 N/mm²
dielectric strength	2 kV/mm
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 305x305mm/ other dimensions upon request

Thermal resistances vs. contact pressure					
pressure [psi]	**10**	**20**	**30**	**40**	**50**
thermal impedance GEL 50 S 20 [K-cm²/W]	8.2	8	7.6	7.3	7

Gel thermal conductive foils for extreme compression



– very soft and compressible thermal conductive foil
– simple compensation of bigger differences in components
– double-sided adhesive surfaces with protective foil
– excellent dielectric strength
– drawing parts acc. to customer's specification upon request

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 60 S 15	1.5 +0.5/ -0.0	0.45	2.9
GEL 60 S 20	2.0 +0.7/ -0.0	0.52	3.3
GEL 60 S 25	2.5 +0.7/ -0.0	0.67	4.3

	GEL 60 S
version	standard with double-sided adhesive surface
colour	dark gray
density	3.2 g/cm³
thermal conductivity	6 W/m·K
temperature range	-40°C... +150°C
elongation	95 %
volume resistance	$1 \cdot 10^{14}$ Ω·cm
dielectric constant	7.37 [50 Hz] / 7.31 [1 kHz] / 7.34 [1 MHz]
dielectric loss factor	0,0101 [50 Hz] / 0,0022 [1 kHz] / 0,0007 [1 MHz]
dielectric strength	13 kV/mm
class of inflammability	UL 94 V-0
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request

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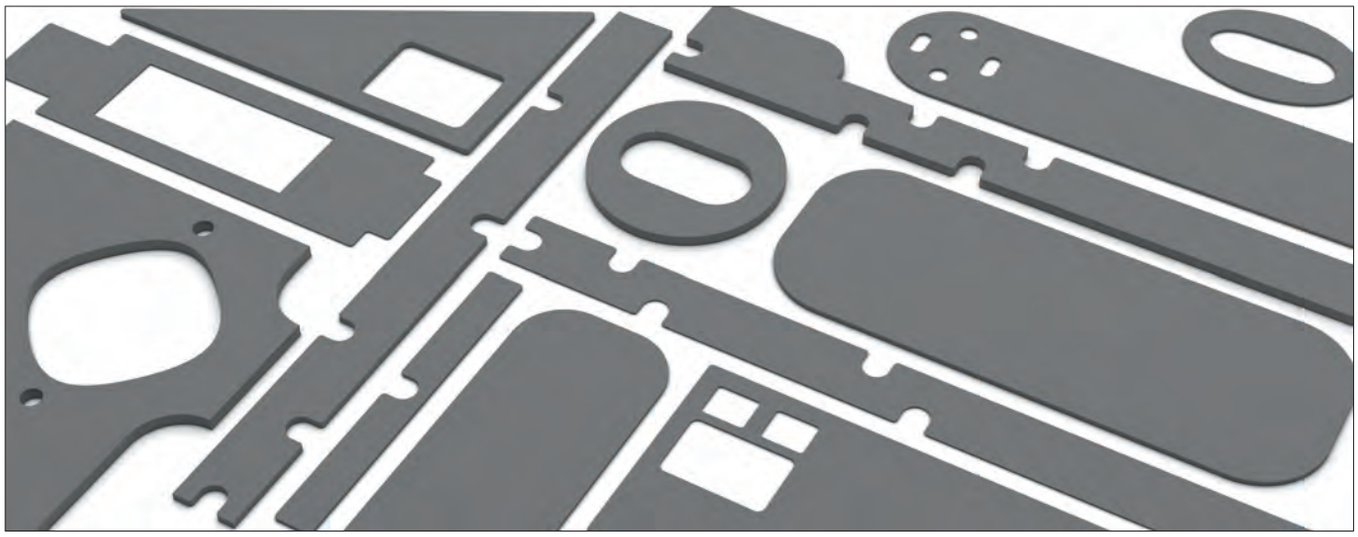
Gel thermal conductive foils for extreme compression



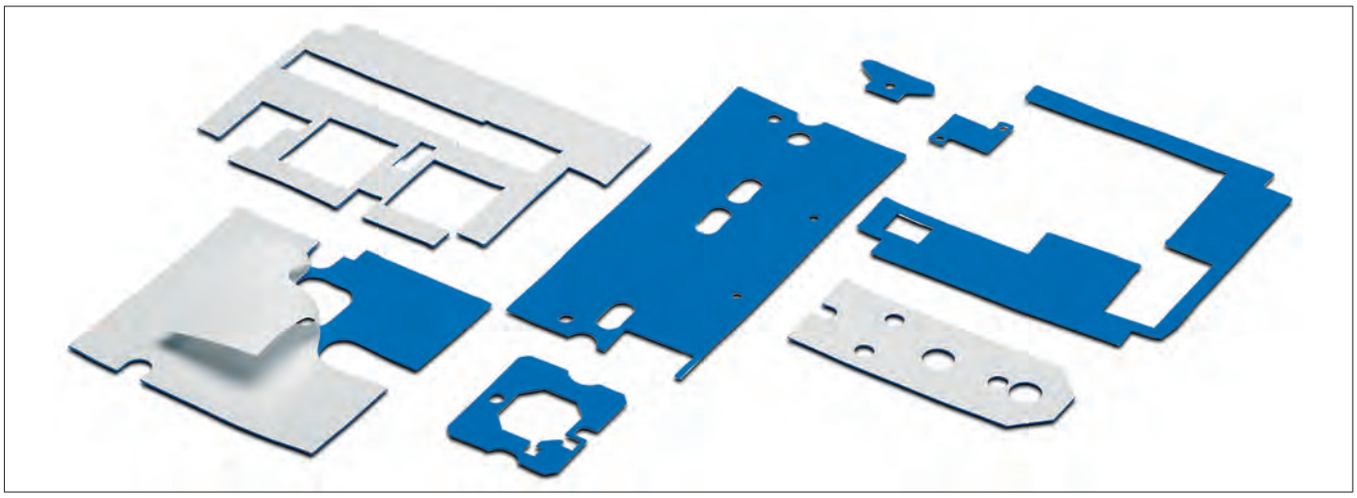
– very adaptable gel thermal conductive foil
– high thermal conductivity and application temperature range
– very good compression with light contact pressure
– other sheet dimensions and material thicknesses on request
– individual moulded parts according to customer drawing

art. no.	material thickness [mm]
GEL 70 S 05	0.5
GEL 70 S 10	1.0
GEL 70 S 15	1.5
GEL 70 S 20	2.0
GEL 70 S 25	2.5
GEL 70 S 30	3.0
GEL 70 S 35	3.5
GEL 70 S 40	4.0

	GEL 70 S
version	silicone foil, protective film on both sides
colour	dark gray
hardness	10 Shore A
thermal conductivity	7 W/m·K
temperature range	-60°C ... +200°C
elongation	40 %
tear strength	0.34 N/mm²
dielectric strength	6 kV/mm
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 305x305mm/ other dimensions upon request

Thermal resistances vs. contact pressure					
pressure [psi]	**10**	**20**	**30**	**40**	**50**
thermal impedance GEL 70 S 20 [K-cm²/W]	5.3	5	4.6	4.2	3.9

Gel thermal conductive foils for extreme compression



– extremely strong compressible gap-filler thermal conductive foil
– very high efficiency in connection with very high thermal conductivity
– little force for material compression
– perfectly suitable for balancing smallest unevennesses
– cuts and contours according to customer drawing

art. no.	material thickness [mm]	R_{th} (100 kPa) [°C in²/W]	R_{th} (100 kPa) [°C cm²/W]
GEL 130 S 05	0.5 ±0.10	0.08	0.5
GEL 130 S 10	1.0 ±0.15	0.17	1.0
GEL 130 S 15	1.5 ±0.25	0.22	1.4
GEL 130 S 20	2.0 ±0.35	0.28	1.8

	GEL 130 S
version	standard with double-sided adhesive surface
colour	blue
density	3.3 g/cm³
thermal conductivity	13 W/m·K
temperature range	-40°C... +150°C
elongation	95 %
volume resistance	$1 \cdot 10^{13}$ Ω·cm
dielectric constant	9.28 [50 Hz] / 8.58 [1 kHz] / 7.761 [1 MHz]
dielectric loss factor	0,0483 [50 Hz] / 0,0389[1 kHz] / 0,0147 [1 MHz]
dielectric strength	12 kV/mm
class of inflammability	UL 94 V-0
type of delivery	on both sides covered with protective foil/ plates, usable area 300x200mm/ other dimensions upon request

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Fluid GEL thermal conductive material

– two-part fluid gap filling material
– high dimensional stability after mounting
– automatic dispensation
– optimum balance of roughness and unevennesses
– to be stored at 25 °C room temperature, vertical standing with opening pointing downwards
– other delivery forms and container seizes upon request
– more package sizes and container types upon request
– store cool and dry

art. no.	basin	contents of delivery
GEL S 18	cartridge	1x 50 ml cartridge / 3x mixer GEL M 18

	GEL S 18
version	two-part fluid gap filling material
colour	yellow/ white (A/B)
density	2.7 g/cm³
hardness	50 Shore 00
thermal conductivity	1.8 W/m·K
mixture proportion	1:1
viscosity	25 Pa·s
temperature range	-60°C ... +200°C
volume resistance	10^{10} Ω·m
dielectric constant	6.4 [1 kHz]
heat capacity	1 J/g·K
dielectric strength	400 V
durability	6 months @ 25°C
working life at room temperature	60 min @ 25°C
hardening time	300 min @ 25°C / 10 min @ 100°C
class of inflammability	UL 94 V-0
type of delivery	cartridge with additional mixers

Accessories

art. no.	contents of delivery
GEL M 18	10x mixer für 50 ml cartridge (packing unit 10 pieces)
WLK P	1x applicator gun for 50 ml cartridge

Fluid GEL thermal interface material

– two-component liquid gap filler material
– ceramic highly filled silicone elastomers and gels
– high heat dissipation and good insulation properties with low viscosity
– automatic dispensing option
– storage at 25 °C room temperature, vertically upright with the opening facing down
– other delivery forms and container sizes on request
– store in a cool, dry place

art. no.	basin	contents of delivery
GEL S 20	cartridge	1x 50 ml cartridge / 3x mixer GEL M 50
GEL S 30		
GEL S 40		

	GEL S 20	GEL S 30	GEL S 40
version	two-part fluid gap filling material		
colour	yellow	green	lila
density	2.3 g/cm³	2.94 g/cm³	3.05 g/cm³
hardness	45 - 60 Shore 00	65 - 85 Shore 00	
thermal conductivity	1.8 W/m·K	3 W/m·K	4.3 W/m·K
mixture proportion	1:1		
viscosity	45-70 Pa·s	50-80 Pa·s	55-85 Pa·s
temperature range	-40°C... +200°C		
heat capacity	1 J/g·K		
dielectric strength	20 kV/mm	12 kV/mm	10 kV/mm
durability	6 months @ 25°C		
working life at room temperature	20 min @ 25 °C		
hardening time	60 min @ 25 °C		
class of inflammability	UL 94 V-0		
type of delivery	cartridge with additional mixers		

Accessories

art. no.	contents of delivery
GEL M 50	10x mixer für 50 ml cartridge (packing unit 10 pieces)
WLK P	1x applicator gun for 50 ml cartridge

Fluid GEL thermal interface material

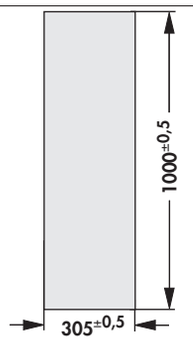
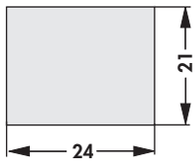
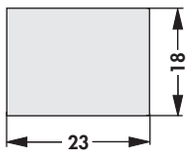
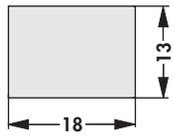
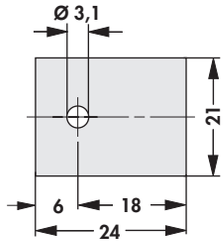
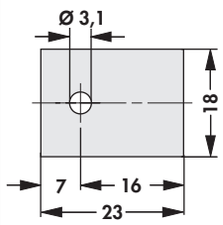
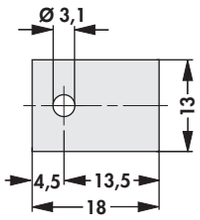
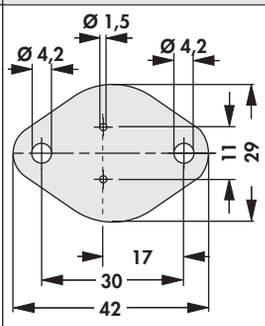
– fully curing one-component system
– very good thermal conductivity
– thicker and thinner layer thicknesses possible
– no bleeding, small compression force necessary
– automatic dispensable
– more package sizes and container types upon request
– store cool and dry

art. no.	basin	contents of delivery
GEL S 35 10	syringe	1x 10 ml Spritze
GEL S 35	cartridge	1x 30 ml cartridge

	GEL S 35
version	one-part fluid gap filling material
colour	pink
density	3.2 g/cm^3
thermal conductivity	3.5 W/m·K
temperature range	-55°C … +200°C
volume resistance	10^{12} Ω·m
dielectric constant	7 [100 kHz]
heat capacity	1 J/g·K
dielectric strength	8 kV/mm
durability	18 months
class of inflammability	UL 94 V-0
type of delivery	Spritze/ cartridge

Kapton insulator washers

– very low thermal resistance
– optimised heat conductivity
– best mechanical charactaristics
– polyimide-carrier foil with silicone-free phase changing thermal conductive layer completely coated on both sides
– clean processing, no abrasion of the coating
– stacked foils do not stick together
– good resistance against cleening agents
– no cold flow
– low pressure force necessary, thus particularly applicable for spring-fixing of semiconductors
– cuttings and special versions according to customer's requirements
– the thermal details refer to an area of 1 inch² (6.45 cm²)

				
art. no.	**art. no.**	**art. no.**	**art. no.**	**art. no.**
KAP 1 P suitable for pre-cut parts (plate)	**KAP 247 O** TO 248/ TO 218/ TO 247	**KAP 218 O** TO 218	**KAP 220 O** TO 220	**KAP 218** TO 248/ TO 218/ TO 247
				
art. no.	**art. no.**	**art. no.**		
KAP 220 G TO 220	**KAP 220 K** TO 220	**KAP 3 K** TO 3		

	KAP 1 P	KAP
material	polyimide-carrier foil with silicone-free phase changing thermal conductive layer completely coated on both sides	
phase change temperature	52 °C	
thermal resistance	0.15 K/W [at 1 inch²; = 6.45 cm²; = TO 3 (KAP 3)]	
temperature range	-40°C... +150°C	
thermal conductivity	0.45 W/m·K (substrate)	
insulation resistance	10^{14} Ω	
material thickness	0.077mm (substrate 0.05mm)	
elongation	30 %	
dielectric strength	7.8 kV	
class of inflammability	UL 94 V-0	
type of delivery	plate	cut

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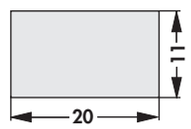
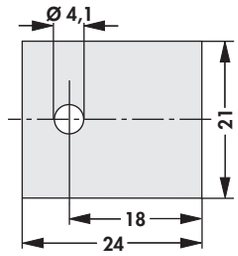
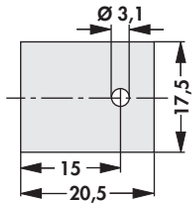
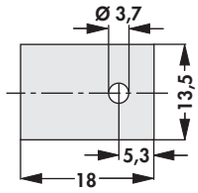
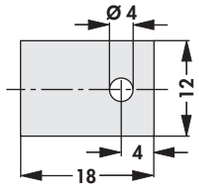
Mica wafers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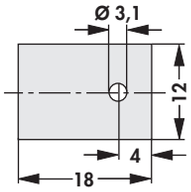
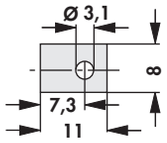
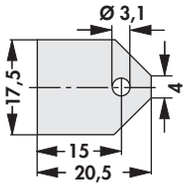
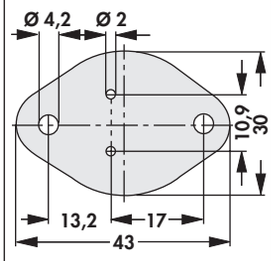
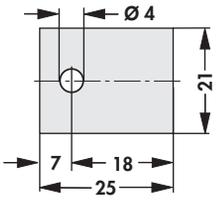
GS 220 C TO 220	**GS 218** TO 218	**GS 3 P SL** TOP 3	**GS 66 P** TO 66	**GS 220 4** TO 220
				
art. no.	**art. no.**	**art. no.**	**art. no.**	
GS 220 P TO 220	**GS 32 P** SOT 32	**GS 3 P** TOP 3	**GS 3** TO 3	

	GS
material	muskovit
material thickness	0.05 mm
thermal resistance (GS 3)	0.4 K/W
dielectric strength	5 kV
insulation resistance	$3 \cdot 10^{17}$ Ω·cm

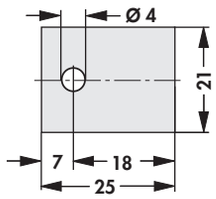
Aluminium oxide wafers

– other thicknesses and versions on request
‡ = thickness; ▱ = flatness

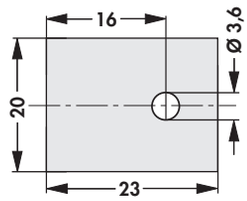
art. no.
AOS 247
‡ 1 mm ▱ 0.02 mm



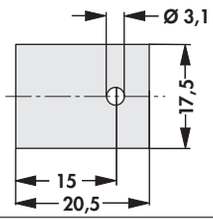
art. no.
AOS 218 247
‡ 3 mm ▱ 0.02 mm



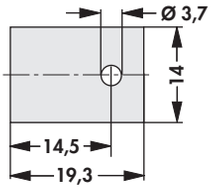
art. no.
AOS 218 247 1
‡ 1.5 mm ▱ 0.02 mm



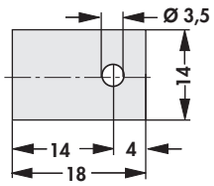
art. no.
AOS 3 P 2
‡ 1 mm ▱ 0.02 mm



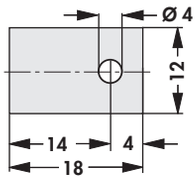
art. no.
AOS 3 P SL
‡ 1.5 mm ▱ 0.02 mm



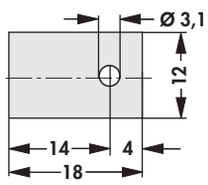
art. no.
AOS 220 3
‡ 1.6 mm ▱ 0.02 mm



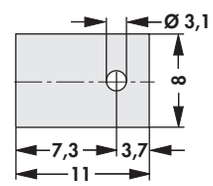
art. no.
AOS 220 SL
‡ 4.5 mm ▱ 0.02 mm



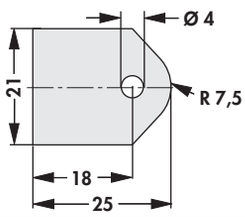
art. no.
AOS 220 4
‡ 1.5 mm ▱ 0.02 mm



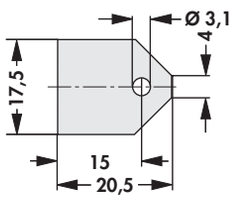
art. no.
AOS 220
‡ 1.5 mm ▱ 0.02 mm



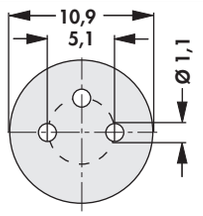
art. no.
AOS 32
‡ 1.5 mm ▱ 0.02 mm



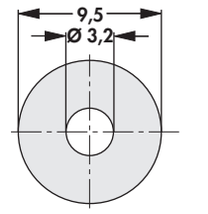
art. no.
AOS 127
‡ 3 mm ▱ 0.02 mm



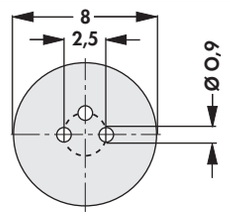
art. no.
AOS 3 P
‡ 1.5 mm ▱ 0.02 mm



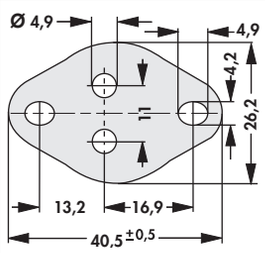
art. no.
AOS 5
‡ 1.5 mm ▱ 0.02 mm



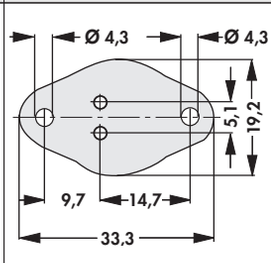
art. no.
AOS 93
‡ 2.3 mm ▱ 0.02 mm



art. no.
AOS 18
‡ 1.5 mm ▱ 0.02 mm



art. no.
AOS 3
‡ 3 mm ▱ 0.02 mm



art. no.
AOS 66
‡ 2.5 mm ▱ 0.02 mm

	AOS
material	AL_2O_3 - ceramics
specific electrical resistance	$>10^{14}$ Ω/cm
thermal conductivity	25 W/m·K
dielectric constant	9
linear expansion coefficient	~8·10-6/K
thermal resistance	0.3 K/W [at 1 inch²; = 6.45 cm²; = TO 3 (AOS 3 G)]
dielectric strength	10 kV/mm

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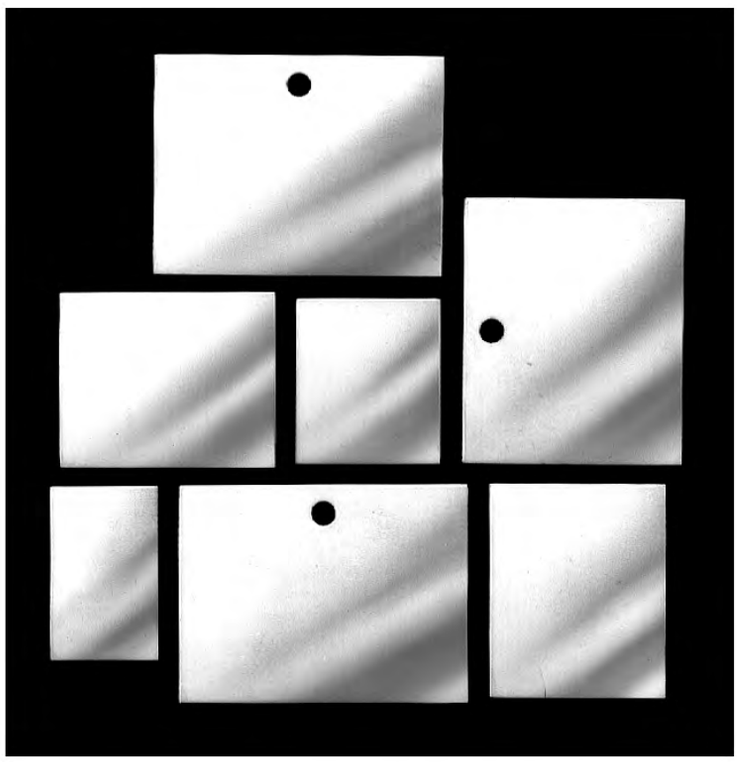
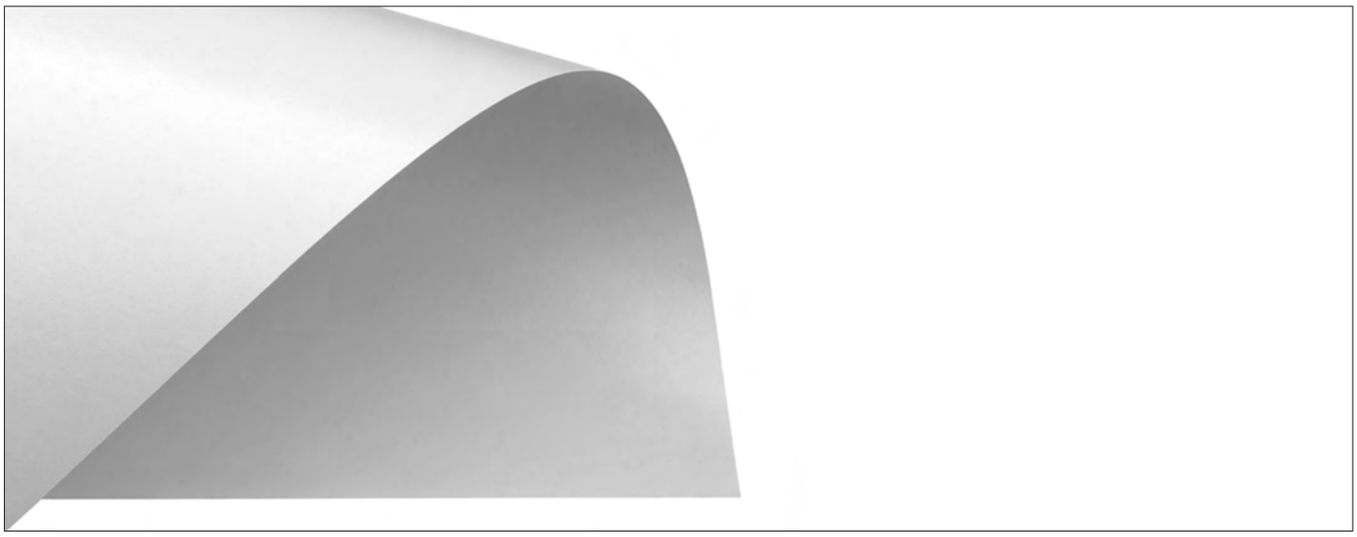
Aluminium oxide wafers according to customer's instructions

– laser-cut versions with outer dimensions and cutouts according to customer's requirements
– other plate dimensions upon request



material thickness [mm]	outer dimensions [mm]
0.250	106,6x106,6
0.300	
0.400	114.3x114.3
0.500	106,6x106,6/ 160x113
0.635	106,6x106,6/ 160x113/ 180x113
0.800	114.3x114.3/ 160x113/ 165x114
1.000	114.3x114.3/ 160x113/ 165x114/ 180x130
1.270	114.3x114.3
1.500	114.3x114.3/ 290x100
2.000	114.3x114.3
2.540	

Phase Change thermal interface material



– strapless (free standing film) changing condition thermal conductive material as a foil
– material with phase changing temperature at 48 °C or 52 °C
– best thermal conductivity, above the phase change temperature the material flows in all gaps of the impinged device and heatsink
– thixotropic, therefore no migration of the material away from the moistened surface
– no influence on the thermal conductivity due to thermal cycles
– only low contact pressure necessary, as it is no elastomer and therefore ideally suitable for clamp mounting of the devices
– not electrically conductive, but no insulator
– self-adhesive properties, also suitable for large surfaces
– no toxic ingredients
– customised cuts upon request
– with double-sided protective film

art. no.	material thickness [mm]
FSF 30 P	0.120 ±0.025
FSF 52 P	0.127 ±0.025
FSF 20 P	0.200 ±0.025

	FSF 30 P	FSF 52 P	FSF 20 P
colour	grey	white	
density	2.4 g/cm³	2 g/cm³	2.9 g/cm³
phase change temperature	50 °C	52 °C	48 °C
thermal conductivity	3 W/m·K	0.9 W/m·K	2 W/m·K
thermal resistance (1 in², TO 3) at contact pressure of	0.1 K/W 0.031 N/mm²	0.03 K/W 0.031 N/mm²	0.08 K/W 0.031 N/mm²
temperature range	≤+150°C	≤+200°C	≤+150°C
adhesive holding force	0.6 N/mm²	0.35 N/mm²	0.6 N/mm²
dielectric constant	5.2 [1 kHz] / 4.8 [1 MHz]	3.8 [1 kHz] 3.4 [1 MHz]	4.8 [1 kHz] / 4.4 [1 MHz]
class of inflammability	UL 94 V-0		
type of delivery	plates, usable area 400x300mm/ other dimensions upon request	plates, usable area 343x330mm/ other dimensions upon request	plates, usable area 400x300mm/ other dimensions upon request

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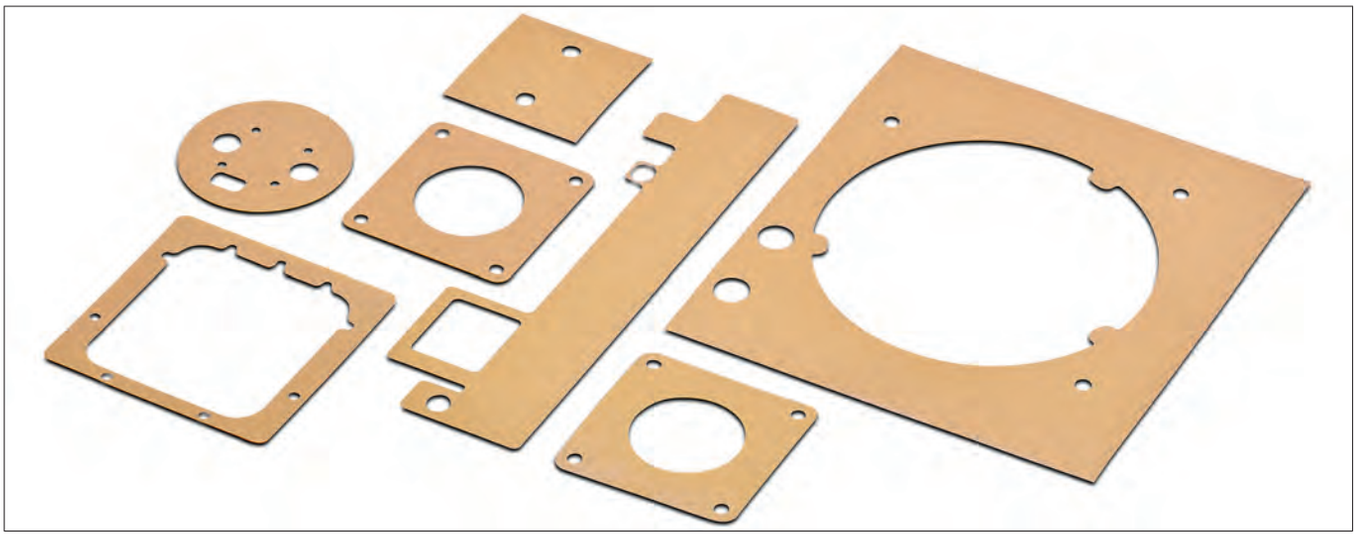
Phase Change thermal interface material



– phase change material on a polyimide basis
– very good thermal properties
– one-sided adhesive layer eases the mounting
– particularly suitable for the application of spring clips
– cuts and contours upon customised drawing specifications

art. no.	material thickness [mm]
FSF 15 P 011	0.114
FSF 15 P 012	0.127
FSF 15 P 014	0.140

	FSF 15 P
version	electrically insulating phase change material with polyimide reinforcement and one-sided adhesive layer
colour	gold
phase change temperature	52 °C
thermal conductivity	1.5 W/m·K
temperature range	-40°C... +150°C
elongation	40 %
volume resistance	10^{12} Ω·m
dielectric constant	4.5 [1 kHz]
tear strength	7,000 psi
dielectric strength	5 kV
class of inflammability	UL 94 V-0
type of delivery	rolled goods, roll width 266mm/ cuttings on customer's requirement

Thermal resistances vs. contact pressure / surface TO 220					
pressure [psi]	**10**	**25**	**50**	**100**	**200**
thermal resistance FSF 15 P 011 [K/W]	1.20	1.15	1.11	1.06	1.00
thermal resistance FSF 15 P 012 [K/W]	1.47	1.41	1.37	1.33	1.29
thermal resistance FSF 15 P 014 [K/W]	1.59	1.48	1.43	1.38	1.35
thermal impedance FSF 15 P 011 [K-cm²/W]	1.31	1.25	1.19	1.13	1.06
thermal impedance FSF 15 P 012 [K-cm²/W]	1.44	1.38	1.31	1.25	1.19
thermal impedance FSF 15 P 014 [K-cm²/W]	1.75	1.69	1.63	1.56	1.50

Phase Change thermal interface material

– phase change material on a polyimide basis
– very good thermal properties
– easy handling and high dielectric strength
– particularly suitable for the application of spring clips
– cuts and contours upon customised drawing specifications

art. no.	material thickness [mm]
FSF 16 P 010	0.102
FSF 16 P 011	0.114
FSF 16 P 012	0.127

	FSF 16 P
version	electrically insulating phase change material with polyimide reinforcement
colour	green
phase change temperature	55 °C
thermal conductivity	1.6 W/m·K
temperature range	-40°C... +150°C
elongation	40 %
volume resistance	10^{12} Ω·m
dielectric constant	4.5 [1 kHz]
tear strength	7,000 psi
dielectric strength	5 kV
class of inflammability	UL 94 V-0
type of delivery	plates, usable area 300x275mm/ other dimensions upon request

Thermal resistances vs. contact pressure					
pressure [psi]	10	25	50	100	200
thermal resistance FSF 16 P 010 [K/W]	0.95	0.94	0.92	0.91	0.90
thermal resistance FSF 16 P 011 [K/W]	1.19	1.17	1.16	1.14	1.12
thermal resistance FSF 16 P 012 [K/W]	1.38	1.37	1.35	1.33	1.32
thermal impedance FSF 16 P 010 [K-cm²/W]	0.81	0.81	0.75	0.75	0.75
thermal impedance FSF 16 P 011 [K-cm²/W]	1.06	1.00	1.00	1.00	0.93
thermal impedance FSF 16 P 012 [K-cm²/W]	1.18	1.18	1.18	1.12	1.12

Thermal conductive paste

Silicon thermal transfer compound

– thermal conductive paste used to reduce the thermal transmission resistance between semiconductor and heatsink

art. no.	basin	delivery quantity [g]
WLP 004	box	4
WLP 035		35
WLP 500		500
WLP 300 S	cartridge (310 ml)	300
WLP 500 S		500

Silicone-free thermal transfer compound

– thermal conductive paste used to reduce the thermal transmission resistance between semiconductor and heatsink

art. no.	basin	delivery quantity [ml]	delivery quantity [g]
WLPF 05	syringe	2	—
WLPF 10		5	
WLPF 20		10	
WLPF 50		20	
WLPF 300 S	cartridge (310 ml)	—	300

	WLP	**WLPF**
composition	silicone oil, inorganic filling material	silicone free synthetic liquid. Metal oxide filling.
specific electrical resistance	$>10^{12}$ Ω/cm	
flashpoint	none (DIN 53213)	
drop point	>260°C	
thermal resistance	no bleeding at (4 h/200°C)	
acid number	< 0.01 mg KOH/g	
consistance	pastey	
colour	white	white-grey
density	1.1 g/cm³	
thermal conductivity	0.61 W/m·K	0.5 W/m·K
temperature range	-40°C ... +250°C	-40°C... +150°C
solubility in water	insoluble	
oil separation (thickener)		≤ 2% (40°C / 168h)
flow pressure at 20°C (thickener)		≤ 200 mbar
kinetic viscosity (base oil)		ca. 90 mm²/s (40°C) ca. 13 mm²/s (100°C)

Thermal conductive paste

Ceramic filled, silicone-free thermal conductive paste with high thermal conductivity

– suitable especially for silicone-sensitive applications
– no drying out, hardening or melting of the thermal conductive paste
– high long-term stability
– further package sizes, container types such as cans, cartridge, etc. upon request

art. no.	basin	delivery quantity [ml]
WLPK 3	syringe	3
WLPK 5		5
WLPK 10		10

	WLPK
composition	silicone-free, synthetic fluid ceramic filled
consistance	pastey
colour	silver
density	1.4 g/cm³
thermal conductivity	10 W/m·K
temperature range	-60°C ... +150°C
dielectric strength	not applicable, because conducting
solubility in water	insoluble

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Thermally conductive adhesive

– thermally conductive, electrically non-conductive adhesive
– two part epoxy resin adhesive, metaloxide filled
– fully replaces mechanical fastenings
– excellent function and application characteristics
– **to be stored at a cool and dark place**

art. no.	composition	art. no.	composition
WLK 5	5 g resin/0.5 g hardener	**WLK 10**	10 g resin/1 g hardener

art. no.	composition	art. no.	composition
WLK 30	30 g resin/3 g hardener	**WLK 120**	120 g resin/12 g hardener

	WLK
thermal conductivity	0.836 W/m·K
specific thermal resistance	1.2 m·K/W
temperature range	-56°C... +149°C
hardening time	20°C approx. 16-24h / 25°C approx. 8 h / 120°C approx. 20 min
volume resistance	10^{16} Ω/cm
glue layer	Epoxid
mixture proportion	10:1

Thermally conductive adhesive

– solvent-free and thermal conductive two part adhesive
– epoxy based filled with aluminium oxide
– composition of hardener and resin (1:1) with statical mixing tube
– lockability of the container via Luer-Lock System
– good usage and working properties
– more package sizes and container types upon request
– store cool and dry

art. no.	basin	contents of delivery
WLK DK 4	syringe	1x 4 ml syringe / 3x mixer WLK M4
WLK DK 10		1x 10 ml syringe / 3x mixer WLK M4
WLK DK 50	cartridge	1x 50 ml cartridge / 3x mixer WLK M 50

	WLK DK
thermal conductivity	1 W/m·K
specific thermal resistance	118°C cm/W
temperature range	-50°C... +145°C
working life at room temperature	approx. 30 min
hardening time	60°C approx. 4 h/25°C approx. 16 h
volume resistance	$8 \cdot 10^{11}$ Ω/cm
glue layer	Epoxid
mixture proportion	1:1

Accessories

art. no.	contents of delivery
WLK M 4	10x mixer für 4 & 10 ml syringe (packing unit 10 pieces)
WLK M 50	10x mixer für 50 ml cartridge (packing unit 10 pieces)
WLK P	1x applicator gun for 50 ml cartridge

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Thermally conductive adhesive

– space networking thermal conductive glue made on silicone basis
– very good thermal conductivity
– mixing in ration 1:1 with static mixing tube
– hardening will be proceeded at room temperature
– wide range of temperatures
– store cool, dark and dry

art. no.	basin	contents of delivery
WLK SK 50	cartridge	1x 50 ml cartridge / 3x mixer WLK SK M

	WLK SK 50
version	2-component silicone thermal adhesive
colour	violet
density	2.8 g/cm^3
hardness	65 Shore A
thermal conductivity	2 W/m·K
temperature range	-60°C... +180°C
working life at room temperature	approx. 30 min
hardening time	25°C approx. 8 h / 50°C approx. 4 h / 85°C approx. 1 h
volume resistance	10^{11} Ω·m
dielectric constant	6.9 [1 KHz]
heat capacity	1 J/g·K
dielectric strength	10.8 kV/mm
Scherfestigkeit bei RT	1.4 MPa
class of inflammability	UL 94 V-0

Accessories

art. no.	contents of delivery
WLK SK M	10x mixer für 50 ml cartridge (packing unit 10 pieces)
WLK P	1x applicator gun for 50 ml cartridge

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Terms and conditions of business

1. General provisio

1.1. The present General Terms and Conditions (GTC) apply to all of our business relationships with out customers ("Purchaser"). The GTC only apply if the Purchaser is an entrepreneur (§ 14 of the German Civil Code), a legal entity of public law or a special fund under public law.
The GTC particularly apply for contracts about the sale and/or the delivery of transportable objects ("Goods"), regardless of whether we manufacture the Goods ourselves or buy them in from suppliers (§§ 433, 651 of the G man Civil Code). Unless otherwise agreed, the GTC apply, in the version valid at the time of the Purchaser's order or in the version last transmitted to them, as a framework agreement for similar future contracts, without us having to refer to them each time.

1.2. Our GTC apply exclusively. Deviating, contradicting or additional General Terms and Conditions of the Purchaser are only part of the contract if we have expressly authorised their validity. This approval requirement applies in any case, also if we make deliveries to the Purchaser without reserve, in full knowledge of their Terms and Conditions. Individual, isolated agreements with the Purchaser (including ancillary agreements, additions and changes) always take priority over these GTC. The content of this type of agreement, subject to counterevidence, is to be determined according to a written contract or our written confirmation.

1.3. Legally relevant declarations and announcements of the Purchaser with regards to the contract (for example deadline agreements, defect notifications, withdrawal or reduction) are to be submitted in writing, i.e. in written or text form (for example letter, e-mail, fax). Legal form provisions and other certificates, especially in case of doubts about the legitimation of the declaring party, remain unaffected.

1.4. References to the validity of legal provisions are only for clarification purposes. The legal provisions therefore apply even if there is no reference, unless they have been modified directly in these GTC or expressly excluded.

2. Quotations and orde

Our quotations shall be subject to change without notice and are non-binding. This applies also to information contained in price lists, leaflets etc. Delivery dates stated in our quotations or given to the purchaser by any other means are approximate, and we shall endeavour to keep to them. Delays in delivery shall give no right to claims, unless we have explicitly confirmed such delivery dates and an adequate period of grace granted to us has expired. Orders shall only be binding on us when they have been explicitly confirmed in writing, regard- less of the form in which they have been placed with us. Statements made in catalogues are simply descriptions of goods and under no circumstances do they constitute warranted qualities. Furthermore, the characteristics of our samples cannot be regarded as warranted characteristics.

3. Pric

Prices shall be valid only when confirmed by us in writing. They are exclusive of VAT at the current rate and incidentals such as postage and packing, freight, insurance etc., as of storage. If deli- very is made more than 4 months after the date of order, we shall be entitled to invoice the price valid at the date of despatch, even though different prices were initially confirmed. The price valid at the date of despatch shall also apply if the order was confirmed without prices being stated. When an order on call is placed, partial deliveries shall be invoiced at the price valid at the date of despatch. Any request by the purchaser for subsequent modifications shall entitle us to amend prices.

4. Conditions of payme

The invoiced sum is to be paid net within 30 days of date of invoice and delivery. If the purchaser is in default with any payment, we are entitled to claim interest for such default at the normal rate of interest charged for current accounts. If we are able to prove that we have incurred greater losses as a result of the delay, we shall be entitled to claim compensation for such damages. We are however entitled at any time, in the context of an ongoing business relationship, to execute a delivery in full or in part only against an advance deposit. We shall declare a corresponding reserve at the latest at the confirmation of the contract.

5. Set- f, right to retention

Only claims which have been recognised by us or have become legally binding may be offset against our invoices. Any right to a retention to be exercised by the purchaser in connection with our claims is explicitly excluded. In case of defects in the delivery, the rights of the Purchaser remain unaffected, particularly with regards to point 10.3 of these GTC.

6. Deliv y

The delivery is performed from the storage, wherever the place of fulfilment for the delivery and any subsequent fulfilment may be. Upon request by the Purchaser, the Goods will be sent to a different place of their choice (shipped purchase). Delivery of our goods is explicitly made on behalf of and at the risk of the purchaser. The risk shall pass over to the purchaser when the ordered goods leave our premises. The same applies if goods are collected in our premises from the point in time at which we notify the purchaser that they are ready for collection. Unless we have received instructions to the contrary from the purchaser, we shall decide at our discretion on the most economical delivery method without assuming any liability for the chosen means of delivery.

7. Specially manufactured goo

Components made according to a sample or a drawing or by special request must be taken over and paid for, unless they have a defect we are answerable for and which makes the components completely unfit for the purchaser's purposes. If their fitness for the purchaser's purposes is only reduced, the purchaser may request a reduction of payment but the contract shall not be cancelled.

8. Quantiti

We are entitled to supply quantities which are above or below the ordered quantities by up to 10%. Such deviations are usual in this trade and the deliveries are deemed as being in compliance with the contract. If delivery quantities fall below the ordered quantities there shall be no right to subsequent delivery of the missing quantity.

9. Res vation of proprietary rights

9.1. All goods supplied shall remain our property until all current and future claims resulting from the Purchase contract and the business relationship with the purchaser (secured claims) have been paid in full. The purchaser is entitled to dispose of the purchased goods in the ordinary course of business transactions. Reservation of proprietary rights also applies to products resulting from processing, mixing up or combining our goods, in which case we are considered as manufacturers. In the case where our goods are processed, mixed up or combined with goods of third parties, and the proprietary rights of such third parties remain in force, we are entitled to co-ownership according to the proportion of the amount invoiced for such processed goods. In such cases such rights to co-ownership shall be safeguarded by the purchaser.

9.2. The purchaser shall transfer to us, as a security, his claims against third parties resulting from the resale of our goods in full or in the proportion of our coownership (see subparagraph 9.1). He is entitled to collect the amount of such claims on our behalf until revoked or until cessation of his payments made to us. The purchaser is not entitled to assign these claims to third parties.

9.3. The purchaser is not entitled to mortgage or transfer the goods which are subject to reservation by way of security.

9.4. The purchaser shall advise us immediately at any seizure of our goods or of any infringement of our rights by third parties.

9.5. In case of a default in payment or a deterioration in the financial situation, we are entitled to request immediate handing over of the goods which are subject to reservation. Any time limited claims shall immediately become due.

9.6. If the value of the securities exceeds our claims by more than 20%, securities to a corresponding amount will be released by us on request at our discretion.

10. arranty

10.1. We expressly point out that all information and data is given to the best of our knowledge and belief. The user is solely responsible for the proper use of our products and he should check their suitability for the intended application.
Fischer Elektronik do not assume any warranty, whether expressed or implied, for the suitability, function or merchantibility of their products in specific or general applications, and they cannot be held liable for accidental or consequential damage due to non-observance of the above. .

10.2. Claims for defects can only be considered if the purchaser has complied with their obligation to check goods and submit a complaint as per Sections 377, 381 of the German Commercial Code [HGB]. If goods have a defect attributable to us, we are obliged to effect a cure, excluding the purchaser's right to withdraw from the contract or to reduce the purchase price (reduction), unless we are entitled to refuse to effect a cure by virtue of legal regulations. The purchaser shall grant us an adequate period of grace for effecting a cure. A cure may at our discretion be an elimination of the defect (rectification) or the supply of new products. We are entitled to determine the cure owed according to the payment of the purchase price due by the Purchaser. The Purchaser, however, is entitled to retain a part of the purchase price that is proportionate to the defect. The expenses incurred for the verification and cure, particularly transport, road, work and materials costs (not: expansion and installation costs) are borne by us, if there is indeed a defect. Otherwise, we can require that the Purchaser bear the costs arising from the unjustified defect rectification request (particularly examination and transport costs), unless the Purchaser could not have been aware that the defect rectification was unnecessary.

10.3. If goods have a defect attributable to us, we are obliged to provide subsequent fulfilment, excluding the purchaser's right to withdraw from the contract or to reduce the purchase price (abatement), unless we are entitled to refuse subsequent fulfilment by virtue of legal provisions. The purchaser shall grant us an adequate period of grace for subsequent fulfilment. Subsequent fulfilment may at our discretion be an elimination of the defect (rectification) or the supply of new products.

10.4. If rectification of the defect has failed, the purchaser shall be entitled to request a reduction in the purchase price (abatement) or to withdraw from the contract. Rectification shall be deemed to have failed after the second vain attempt, unless further attempts are reasonable in view of the object of the contract and can be reasonably imposed on the purchaser.

10.5. The purchaser's right to put forward further claims for damages shall remain unaffected by this.

10.6. If it becomes apparent (by the opening of an application for an insolvency procedure for example) after the conclusion of the contract that our claims to the purchase price are endangered due to lacking payment capacities of the Purchaser, we will then be entitled to refuse the delivery and – after a possible period of notice – to withdraw from the contract in accordance with the legal provisions (§ 321 of the German Civil Code). For contracts about the manufacturing of specific items (making to specification), we can declare the withdrawal immediately; the legal regulations about the dispensability of giving a period of notice remain unaffected.

11. Withdra

When delivery in accordance with the contract is not possible for reasons beyond our control, we are entitled to withdraw from the contract. Such withdrawal shall not en title the purchaser to assert any right against us.

12. Export clause

We are not obliged to reimburse damages arising from delays in delivery or it being completely impossible to deliver as a result of statutory or official export restrictions, unless we act with intent or gross negligence suffered by the Customer or other persons. The Customer's duty to pay the agreed remuneration shall not be affected by disruptions in our performance as a result of export restrictions. We shall be entitled to withdraw from the contract if, after the contract is signed, our performance is disrupted as a result of export restrictions.

13. Place of formance and jurisdiction, applicable law

13.1. The place of performance and the placeof venue for deliveries and payments andfor any litigation arising between us andthe purchaser shall be the headquarters of our company.

13.2. The relationship between the contractual parties shall be regulated solely in accordance with the law in force in the Federal Republic of Germany. The regulations of international uniform law, particularly the UN CISG, shall not apply.

Status as at: 29.07.2019

The latest T&Cs shall apply at all times.
They may be downloaded at www.fischerelektronik.de

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