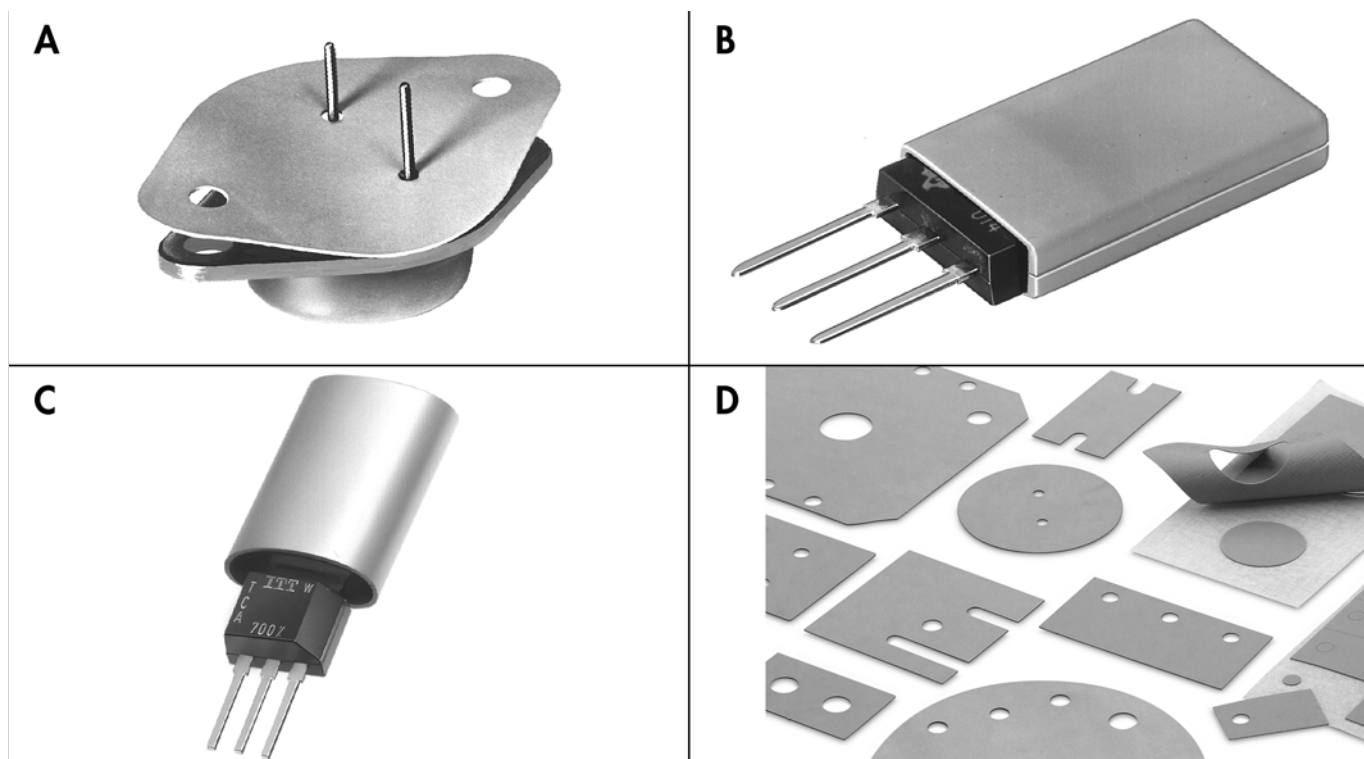


Thermally conductive foil made of siliconelastomer

Silicon-rubber insulating material for semiconductors



A: washer; **B:** insulating cap; **C:** insulating tube; **D:** cutting

Our thermal conduction wafers effect following advantages:

- good surface contact, as material is flexible
- reduced production costs as a matter of mounting without thermal conducting paste (clean and fast)
- spring-back of the elastic material protects the transistor against damage
- free of any toxic substances

customer specific versions:

- cutting and blanks of our thermal conductive foil according to drawing
- as plate or reel-ware
- other foils, plastics, papers, etc. upon request

Technical data

	foil WS ...	cap WSI ...	foil WG ...	foil WK ...	foil WB ...
material thickness	0.3 mm	0.9 mm	0.2 mm	0.2 mm	0.15 mm
material hardness	75 Shore A	75 Shore A	87 Shore A	87 Shore A	90 Shore A
breakdown voltage	10 kV	15 kV	6,5 kV	6,5 kV	3 kV
thermal resistance	0.4 K/W	0.96 K/W	0.42 K/W	0.45 K/W	0.34 K/W
insulation resistance	$2.9 \cdot 10^{15} \Omega \text{ cm}$	$2.9 \cdot 10^{15} \Omega \text{ cm}$	$5.7 \cdot 10^{15} \Omega \text{ cm}$	$5.7 \cdot 10^{15} \Omega \text{ cm}$	$1.6 \cdot 10^{15} \Omega \text{ cm}$
thermal conductivity	1.22	1.22	1.13	0.92	1.43
extensibility	100 %	100 %	2 %	2 %	4 %
temperature range	-60 °C ... +180 °C	-60 °C ... +180 °C	-60 °C ... +180 °C	-60 °C ... +180 °C	-60 °C ... +180 °C
flammability	UL 94 V-0	UL 94 V-0	UL 94 V-0	UL 94 V-0	UL 94 V-0

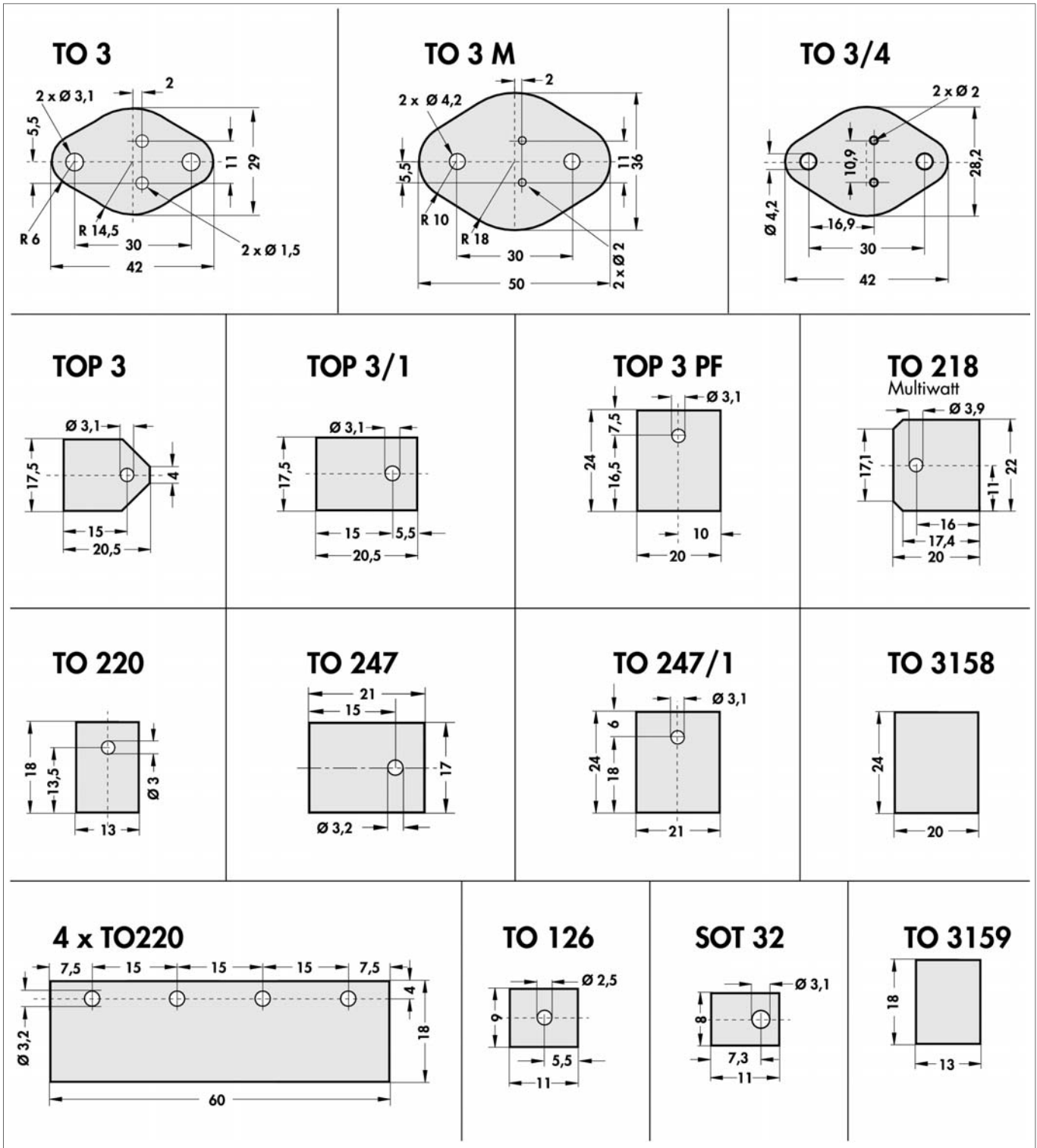
The thermal details refer to an area of 1 inch² (6.45 cm²).

Heatsinks for TO 5 and TO 18
Profiles for PCB components
Heatsinks for PCB
Profiles for lock-in fixing spring

→ C ? - ?
→ A ?
→ A ?
→ A ? - ?

Profiles for PCB mounting
Processor overview
Pin heatsinks for IC
Heatsinks for BGA

→ A ? - ?
→ B 2 - 7
→ B ? - ?
→ B ? - ?

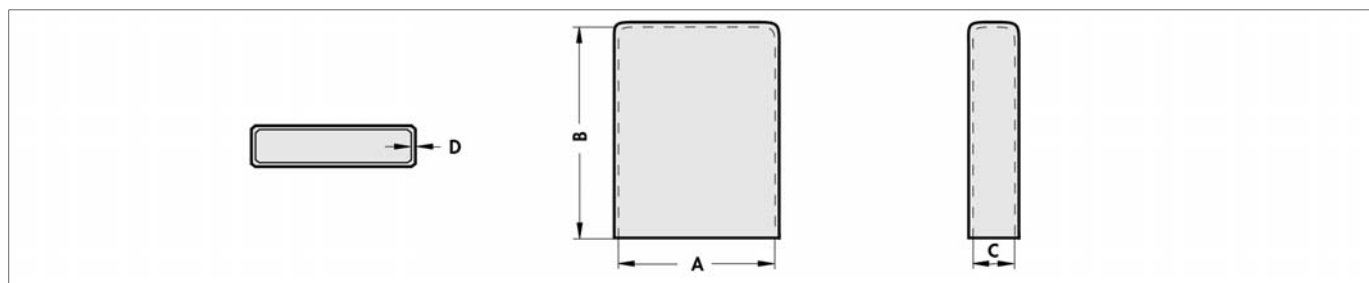


other cuttings on request

Thermally conductive foil made of siliconelastomer

foil type	foil WS	foil WG	foil WK	foil WB
material	silicone foil, standard	silicone foil, GF reinforced	silicone foil, GF reinforced, one-sided self-adhesive	silicone foil, GF reinforced
Washer				
TO-3	WS 3	WG 3	WK 3	WB 3
TO-3 M	WS 3 M		WK 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		WK TOP 3	
TOP 3/1	WS TOP 3/1		WK TOP 3/1	
TO 218		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			
TO-247 Ø 14.5 mm	WSM-247			
Tape material (width)				
24 mm			WKT 24	
30 mm	WST 30			WBT 30
36 mm	WST 36			
85 mm	WST 85			
300 mm		WGT 300	WKT 300	WBT 300

Insulating cap



art. no.	type	dim. [mm]			
		A	B	C	D
WSI 220 210	TO 220	11	21.0	5.0	0.9
WSI 220 225	TO 220	11	22.5	5.0	0.3
WSI TOP 3 235	TOP 3	18	23.5	5.0	0.9
WSI TOP 3 280	TOP 3	16	28.0	5.0	0.3
WSI TO 3 PL	TO 3 PL / TO 247	22	34.0	5.5	0.9

Heatsinks for TO 5 and TO 18
 Profiles for PCB components
 Heatsinks for PCB
 Profiles for lock-in fixing spring

→ C ? - ?
 → A ?
 → A ?
 → A ? - ?

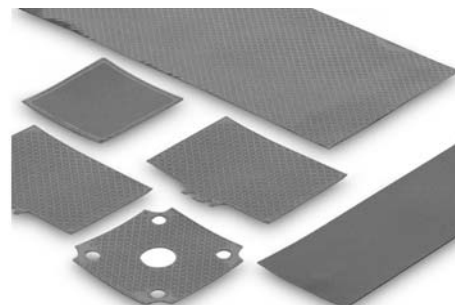
Profiles for PCB mounting
 processor overview
 Pin heatsinks for IC
 Heatsinks for BGA

→ A ? - ?
 → B 2 - 7
 → B ? - ?
 → B ? - ?

A

Thermally conductive foil both sides adhesive

- good thermal characteristics
- double-sided adhesive layers
- replaces mechanical fastenings
- cuttings and cut-outs upon request



art. no.	width [mm]	version	art. no.	width [mm]	version
WLFT 404 R25	25	running metre	WLFT 414 R100	100	running metre
WLFT 404 R50	50	running metre	WLFT 414 R200	200	running metre
WLFT 404 R100	100	running metre	WLFT 405 R25	25	running metre
WLFT 404 R200	200	running metre	WLFT 405 R50	50	running metre
WLFT 414 R25	25	running metre	WLFT 405 R100	100	running metre
WLFT 414 R50	50	running metre	WLFT 405 R200	200	running metre

art. no.	dimensions [mm]	version	art. no.	dimensions [mm]	version
WLFT 404 100x100	100 x 100	plate	WLFT 414 200x200	200 x 200	plate
WLFT 404 100x200	100 x 200	plate	WLFT 405 100x100	100 x 100	plate
WLFT 404 200x200	200 x 200	plate	WLFT 405 100x200	100 x 200	plate
WLFT 414 100x100	100 x 100	plate	WLFT 405 200x200	200 x 200	plate
WLFT 414 100x200	100 x 200	plate			

Technical data

	WLFT 404	WLFT 414	WLFT 405
description	isolations, double-sided adhesive	isolations, double-sided adhesive; RoHS Konform ohne DeBDE	non isolations, double-sided adhesive
complete thickness	0.127 (± 0.03) mm	0.127 (± 0.03) mm	0.15 (± 0.03) mm
truss material	polyimide 0.025 mm	polyimide 0.025 mm	aluminium foil 0.05 mm
glue layer	acrylate (pressure sensitive) double-sided	acrylate (pressure sensitive) double-sided	acrylate (pressure sensitive) double-sided
specific thermal resistance	3.7 °C cm ² /W	3.7 °C cm ² /W	3.4 °C cm ² /W
thermal conductivity	0.37 W/mK	0.37 W/mK	0.5 W/mK
holding force (overlapping)	0.86 MPa	0.69 MPa	0.93 MPa
holding force (shear rate)	Al 25 °C 0.897 [MPa]/ Al 150 °C 0.345 [MPa]/ Cu 25 °C 0.828 [MPa]/ Cu 150 °C 0.31 [MPa]/ Al₂O₃ 25 °C 1.17 [MPa]/ Al₂O₃ 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]/ Al₂O₃ 25 °C 1.0 [MPa]/ Al₂O₃ 150 °C 0.41 [MPa]
temperature range	-40 °C ... +150 °C	-40 °C ... +150 °C	-40 °C ... +150 °C
breakdown voltage	5 kV (AC)	5 kV (AC)	–
flammability	UL 94 V-0	UL 94 V-0	UL 94 V-0

E 5
Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Heatsinks for transistors

→ A ?
→ A ? - ?
→ A ? - ?
→ C ? - ?

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

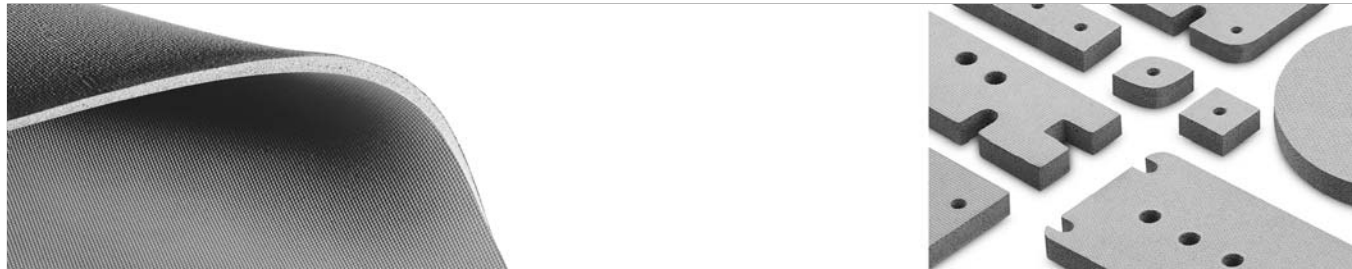
→ C ? - ?
→ E ? - ?
→ E ? - ?
→ E 7

N

Heat conductive foam and gel foils

Heat conductive silicon foam foil

- 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 16	1.60 ±0.4
WSF 32	3.20 ±0.8
WSF 635	6.35 ±1.2
WSFS 635	6.35 ±1.2

WSF ... not adhesive; **WSFS 635** one side adhesive; **WSFS 635** double sided adhesive and **WSF ...** adhesive upon request according to NASA gas emission requirements
available as plates 914 x 914 mm, cuttings on customer's requirements

Thermal resistance at 3.2 mm material thickness:

compression %	contact	10	25	50
contact pressure PSI	ü 1	5	12	34
R _{th} K/W (1 in ² x 3.2 mm)	6	4.5	2.5	1
heat conductivity W/mK	0.3	0.4	0.45	0.65

thermal conductivity	0.108 W/mK (substrate)
hardness range	13 Shore A
compression, 25%	9...18 PSI
temperature range	-61 °C ... +204 °C
extensibility	150 %
tensile strength	120 PSI
breakdown voltage	2.5 kV/mm
tightness	1.118 g/cm ³
flammability	UL 94 : V-1 at thickness ≥ 3.2 mm

Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Heatsinks for transistors

→ A ?
→ A ? - ?
→ A ? - ?
→ C ? - ?

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

→ C ? - ?
→ E ? - ?
→ E ? - ?
→ E 7

Heat conductive foam and gel foils

Gel thermal conducting foil

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



art. no.	material thickness [mm]	R _{th} [°C in ² /W]	UL 94
GEL 05	0.5 ±0.1	0.57	V-0
GEL 10	1.0 ±0.2	1.02	V-0
GEL 15	1.5 ±0.2	1.45	V-0
GEL 20	2.0 ±0.3	1.71	V-0
GEL 25	2.5 ±0.3	2.11	V-0
GEL 30	3.0 ±0.3	2.34	V-0
GEL 35	3.5 ±0.3	2.59	V-0
GEL 40	4.0 ±0.4	2.79	V-0
GEL 45	4.5 ±0.4	3.03	V-0
GEL 50	5.0 ±0.5	3.30	V-0
GEL G05	0.5 ±0.1	0.67	V-1
GEL G1	1.0 ±0.2	1.11	V-1
GEL G15	1.5 ±0.2	1.66	V-1
GEL G2	2.0 ±0.3	1.92	V-1
GEL G25	2.5 ±0.3	2.40	V-1
GEL G3	3.0 ±0.3	2.68	V-0
GEL G35	3.5 ±0.3	2.75	V-0
GEL G4	4.0 ±0.4	2.92	V-0
GEL G45	4.5 ±0.4	3.19	V-0
GEL G5	5.0 ±0.5	3.37	V-0

version:

art. no. **GEL ...** standard

art. no. **GEL G ...** GF reinforced, adherent layer on one side

delivery form:

plates, usable plain 300 X 200 mm, covered with protection film on booth sides, cuttings on customer's requirements

Technical data

	GEL	GEL G
thermal conductivity	1.5	1.5
volume resistance	> 1x10 ⁶ MΩ/m	> 1x10 ⁶ MΩ/m
hardness range	< 49 Shore 00	< 49 Shore 00
temperature range	-60 °C ... + 200 °C	-60 °C ... + 200 °C
extensibility	100 %	60 %
dielectric constant	5.8 [50 Hz] / 5.6 [1 KHz] / 5.5 [1 MHz]	5.8 [50 Hz] / 5.6 [1 KHz] / 5.5 [1 MHz]
breakdown voltage	14 kV/mm (AC)	8 kV/mm (AC)
tightness	2.6 g/cm ³	2.6 g/cm ³
dielectric loss factor	0.048 [50 Hz] / 0.015 [1 KHz] / 0.003 [1 MHz]	0.048 [50 Hz] / 0.015 [1 KHz] / 0.003 [1 MHz]

E 7

Thermal conductive glue
Thermal conductive paste
Thermal conduct. foil WLFT 404/405
SMD-heatsinks

→ E 15
 → E 13
 → E 5
 → B ? - ?

Heatsinks for PGA
Profiles for PCB mounting
Mounting for TO 3 angle
Profiles for lock-in fixing spring

→ B ? - ?
 → A ? - ?
 → A ?
 → A ? - ?

Kapton insulator washers

- very low thermal resistance
- optimised heat conductivity
- best mechanical characteristics
- 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 cleaning 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

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

material	polyimide; polyimide-carrier foil with silicone-free phase changing thermal conductive layer completely coated on both sides
material thickness	0,077
thermal conductivity	0.45 W/mK (substrate)
insulation resistance	10 ¹⁴ Ω
thermal resistance	0.15 K/W (at 1 inch ² ; = 6.45 cm ² ; = TO 3 (KAP 3))
temperature range	-40 °C ... +150 °C
phase change temperature	52 °C
extensibility	30 %
breakdown voltage	7.8 kV
flammability	UL 94 V-0

The thermal details refer to an area of 1 inch² (6.45 cm²).

Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Heatsinks for transistors

→ A ?
→ A ? - ?
→ A ? - ?
→ C ? - ?

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

→ C ? - ?
→ E ? - ?
→ E ? - ?
→ E 7

A

Aluminium oxide wafers

B

C

D

E

F

G

H

I

K

L

M

N

art. no. AOS 3 G ± 3 mm □ 0.1	art. no. AOS 3 ± 2.9 mm □ 0.123	art. no. AOS 3 P ± 1.5 mm □ 0.061	art. no. AOS 3 P SL ± 1.5 mm □ 0.15	art. no. AOS 3 P 2 ± 1 mm □ 0.15
art. no. AOS 66 ± 2.5 mm □ 0.10	art. no. AOS 218 247 ± 3 mm □ 0.15	art. no. AOS 218 247 1 ± 1.5 mm □ 0.02	art. no. AOS 220 ± 1.5 mm □ 0.054	art. no. AOS 220 4 ± 1.5 mm □ 0.054
art. no. AOS 220 3 ± 1.6 mm □ 0.11	art. no. AOS 247 ± 1 mm □ 0.02	art. no. AOS 220 SL ± 4.5 mm □ 0.054	art. no. AOS 127 ± 3 mm □ 0.076	art. no. AOS 93 ± 2.3 mm □ 0.03
art. no. AOS 32 ± 1.5 mm □ 0.033	art. no. AOS 18 ± 1.5 mm □ 0.023	art. no. AOS 5 ± 1.5 mm □ 0.032		

± = thickness; □ = flatness

other thicknesses and versions on request

material	Al ₂ O ₃ - ceramics
thermal resistance	0,3K/W
specific electrical resistance	> 10 ¹⁴ Ω/cm
thermal conductivity	25 W/mK
dielectric constant	9
linear expansion coefficient	~8·10 ⁻⁶ /K
snap through stability	10 KV/mm

E 9

Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Heatsinks for transistors

→ A ?
→ A ? - ?
→ A ? - ?
→ C ? - ?

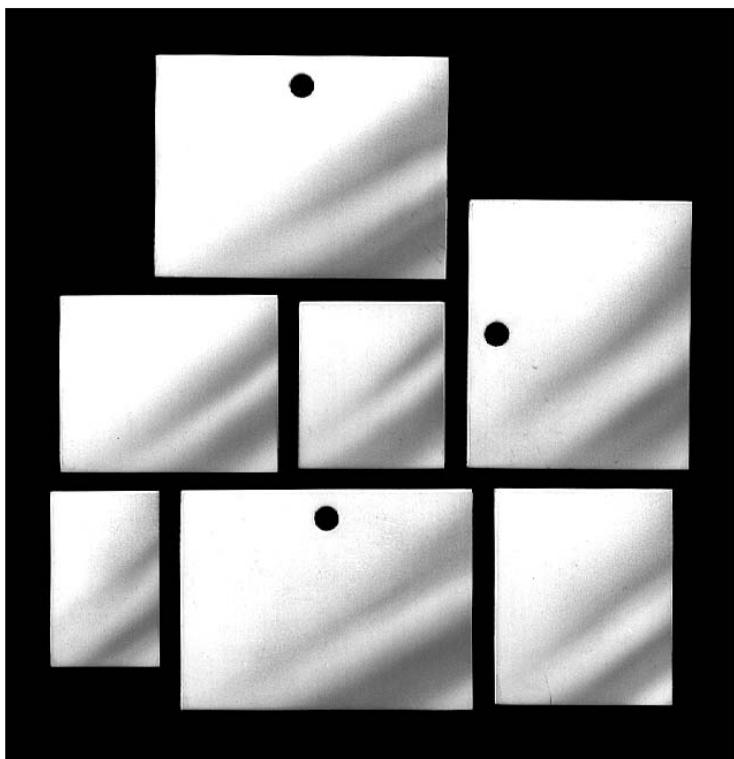
Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

→ C ? - ?
→ E ? - ?
→ E ? - ?
→ E 7

Aluminium oxide wafers

Aluminium oxide wafers according to customer's instructions

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



material thickness [mm]	outer dimensions [mm]
2.540	114 x 114
2.000	114 x 114
1.500	114 x 114
1.270	114 x 114
1.000	114 x 114/ 160 x 113/ 165 x 115
0.800	114 x 114/ 160 x 113/ 165 x 115
0.635	106,5 x 106,5/ 114 x 114/ 160 x 113/ 165 x 115
0.500	106,5 x 106,5/ 114 x 114
0.400	106,5 x 106,5/ 114 x 114
0.300	106,5 x 106,5/ 114 x 114
0.250	106,5 x 106,5/ 114 x 114

Heatsinks for transistors → C ? - ?
Finger-shaped heatsinks → C ? - ?
Insulating clamping parts → E ?
Mounting material for semiconduct. → E ? - ?

Kapton insulator washers → E 8
GEL thermal conductive foil → E 7
Insulator sleeves → E ?
Heatsinks for PCB → A ?

A

Mica wafers

B

C

D

E

F

G

H

I

K

L

M

N

art. no. GS 3 TO-3	art. no. GS 4 D TO 93	art. no. GS 5 D TO 93	art. no. GS 66 P TO 66	art. no. GS 3 P TOP 3
art. no. GS 32 P SOT 32	art. no. GS 218 TO 218	art. no. GS 220 P TO 220	art. no. GS 220 4 TO 220	art. no. GS 3 P SL TOP 3
art. no. GS 220 C TO 220				

material	muskovit
material thickness	0.05 mm
insulation resistance	$3 \times 10^{17} \Omega/\text{cm}$
thermal resistance (AOS 3)	0.4 K/W
snap through stability	5 kV

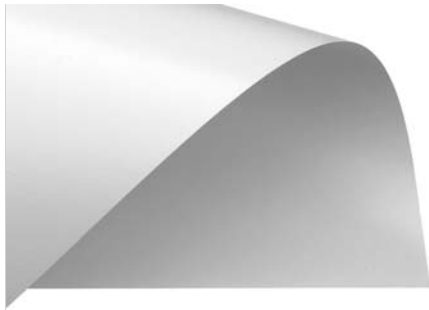
E 11
Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Heatsinks for transistors

 → A ?
 → A ? - ?
 → A ? - ?
 → C ? - ?

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

 → C ? - ?
 → E ? - ?
 → E ? - ?
 → E 7

Free standing film



- self-supporting differential phase changing thermal interface material, contains no substrate (Free Standing Film)
- materials with phase change temperature at 52 °C;
- best thermal conductivity, exceeding phase change temperature point, material flows into all gaps between components and heatsink
- thixotropic, does not migrate from the interface area
- no lowering of thermal conductivity though thermal cycling
- application with very low contact pressure, due to non elastomeric material, particularly suitable for clamp mounting of components
- electrically non-conductive, but not an insulator
- self adhering characteristics, also suitable for large areas
- no toxic ingredients
- custom required shapes on request

art. no.	container	dimensions [mm]
FSF 52 P	plate, protection foil on both sides	330 x 343 x 0.127 ±0.025

All with protection foil on both sides.

phase change temperature	52 °C
colour	white
tightness	2 g/cm ³
thermal conductivity	0.9
thermal resistance (1 in², TO 3) at contact pressure of	0.03 K/W 0.031 N/mm ²
temperature range	max. +200 °C
adhesive holding force	0.35 N/mm ²
flammability	UL 94 V-0
dielectric constant	3.8_3.4

Silicone wafers → E 2
Finger-shaped heatsinks → C ?
Distance sleeves for PCB 's in HP grid → E ?
Distance sleeves → E ?

GEL thermal conductive foil → E 7
Spacers → E ?
Profiles for PCB components → A ?

E 12

A

B

C

D

E

F

G

H

I

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M

N

Thermal transfer compound and thermal interface film

Silicon thermal transfer compound

Thermal transfer compound used to reduce the thermal transmission resistance between semiconductor and heatsink.



art. no.	container	delivery quantity [g]
WLP 004	box	4
WLP 035	box	35
WLP 500	box	500
WLP 300 S	cartridge	300
WLP 500 S	cartridge	500

Silicone-free thermal transfer compound

Thermal transfer compound used to reduce the thermal transmission resistance between semiconductor and heatsink.



art. no.	container	delivery quantity [ml]
WLPF 05	syringe	2
WLPF 10	syringe	5
WLPF 20	syringe	10
WLPF 50	syringe	20

Technical data

	WLP	WLPF
composition	silicone oil, inorganic filling material	Silicone free synthetic liquid. Metal oxide filling.
consistence	pastey	pastey
colour	white	white-grey
tightness	1.1 g/cm ³	ca. 2 g/cm ³
thermal conductivity	0.61	>0.7
specific electrical resistance	> 10 ¹² Ω/cm	> 10 ¹² Ω/cm
flashpoint	none (DIN 53213)	of the basic oil >280 °C (ISO 2592)
drop point	>260 °C	-
thermal resistance	no bleeding at (4 h / 200°C)	<1 % (96 h / 200 °C)
temperature range	-70 °C ... +250 °C	-40 °C ... +150 °C
acid number	< 0.01 mg KOH/g	-
solubility in water	insoluble	insoluble

E 13

Mica wafers
Kapton insulator washers
Mounting pads
Mounting parts for heatsinks

→ E 11
→ E 8
→ E ?
→ E ? - ?

Silicone wafers
Thermal conductive foil
Thermal. conductive silicone foam foil
Insulator caps

→ E 2 - 4
→ E 5
→ E 6
→ E ?

Graphit thermal transfer compound



art. no.	container	delivery quantity [ml]
WLPG 02	syringe	2
WLPG 05	syringe	5
WLPG 10	syringe	10
WLPG 20	syringe	20

Technical data

	WLPG
composition	graphite filler, silicone free, organic filling material, biodegradable matrix based on oil
consistance	pastey
colour	black
tightness	> 1.25 g/cm ³
thermal conductivity	10.5 W/mK
specific electrical resistance	10 ⁵ Ω/cm (typical)
breakdown voltage	not applicable, because conducting
flashpoint	for oil DIN 51755, 321 °C
temperature range	-40 °C ... +320 °C
solubility in water	soluble

A

Thermally conductive material

- thermally conductive, electrically non-conductive adhesive
- two part epoxy resin adhesive, metaloxide filled
- fully replaces mechanical fastenings
- excellent function and application characteristics

WLK 5

WLK 10


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

WLK 30

WLK 120


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

to be stored at a cool and dark place

thermal conductivity	0.836 W/mK
specific thermal resistance	120 °C cm/W
pass resistance	10 ¹⁶ Ω/cm
temperature range	-56 °C ... +149 °C
hardening time	190 °C approx. 20 min/ 38 °C approx. 6 h/ 20 °C approx. 16 - 24 h
glue layer	epoxide
mixture proportion	10:1

N

E 15

Mica wafers
Kapton insulator washers
Mounting pads
Mounting parts for heatsinks

→ E 11
→ E 8
→ E ?
→ E ? - ?

Silicone wafers → E 2 - 4
Thermal conductive foil → E 5
Thermal. conductive silicone foam foil → E 6
Insulator caps → E ?

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