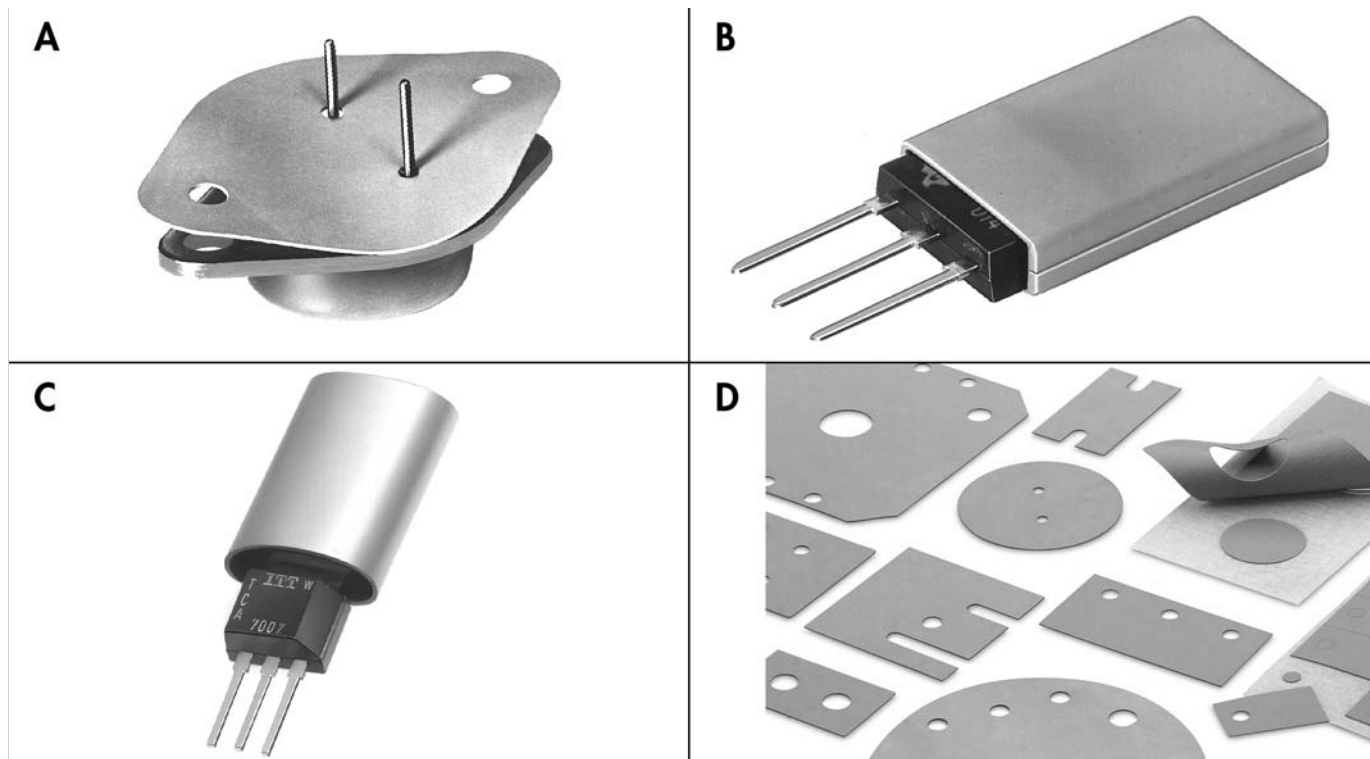


Thermally conductive foil made of siliconelastomer

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 15 – 16
→ A 92
→ A 90
→ A 86 – 89

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

→ A 90 – 111
→ B 2 – 7
→ B 20 – 27
→ B 16 – 19

A

Thermally conductive foil made of siliconelastomer
Silicone rubber insulating material for semiconductors

B

C

D

E

F

G

H

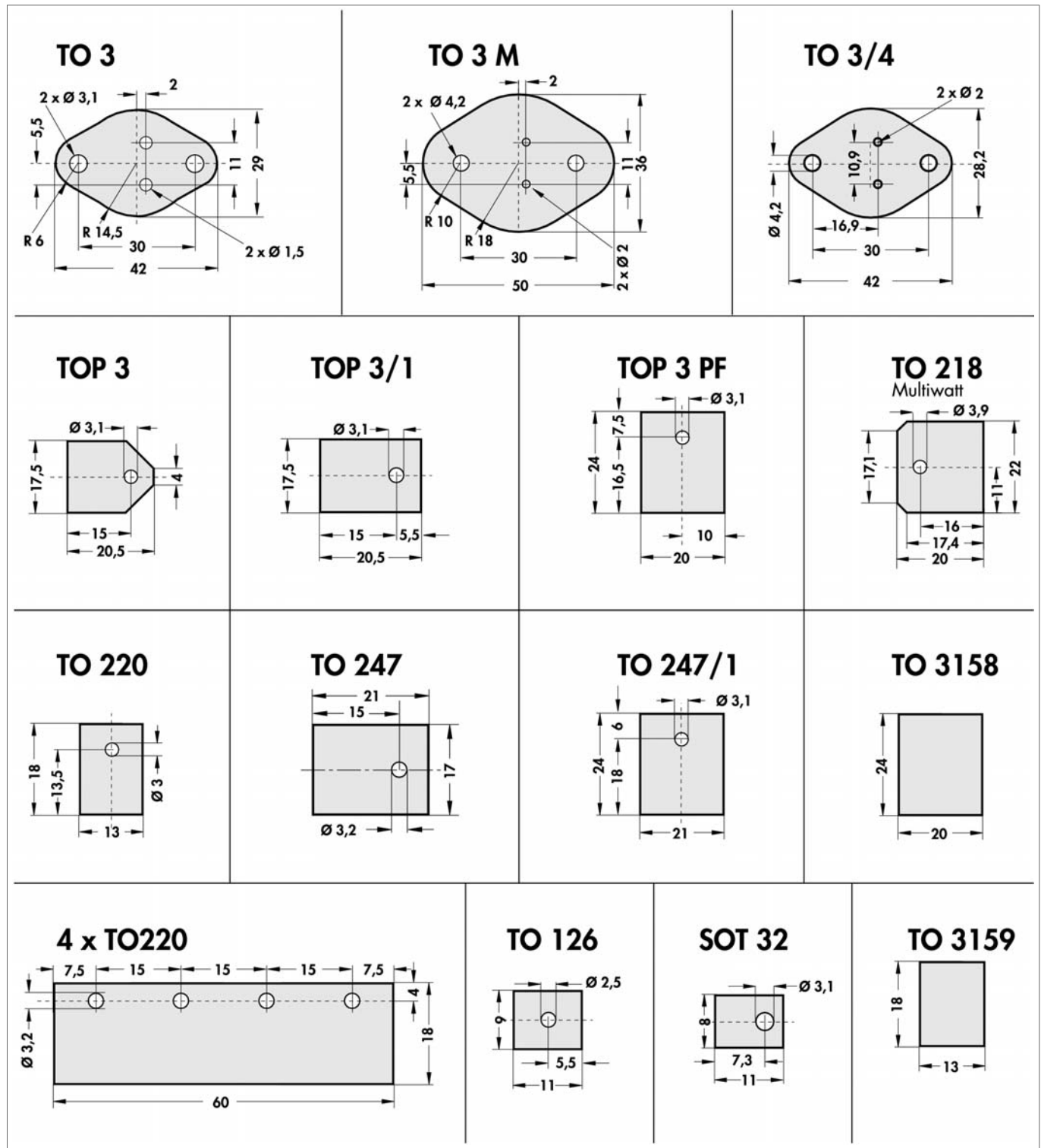
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other cuttings on request

E 3

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

 → C 15 – 16
 → A 92
 → A 90
 → A 86 – 89

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

 → A 90 – 111
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 → B 20 – 27
 → B 16 – 19

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 15 - 16
 → A 92
 → A 90
 → A 86 - 89

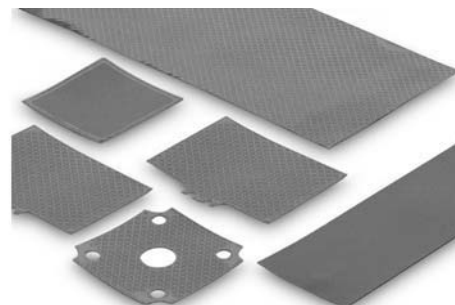
Profiles for PCB mounting
 processor overview
 Pin heatsinks for IC
 Heatsinks for BGA

→ A 90 - 111
 → B 2 - 7
 → B 20 - 27
 → B 16 - 19

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 92**
→ **A 90 – 92**
→ **A 90 – 111**
→ **C 4 – 9**
Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

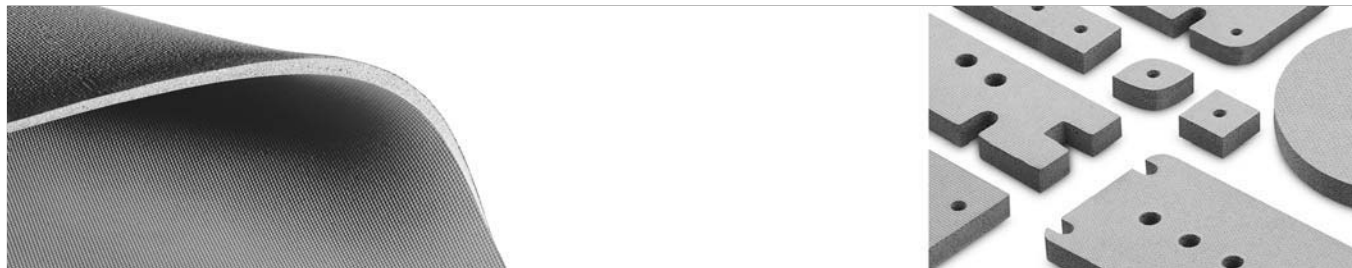
→ **C 2 – 3**
→ **E 24 – 31**
→ **E 32 – 33**
→ **E 7**

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 92
→ A 90 - 92
→ A 90 - 111
→ C 4 - 9

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

→ C 2 - 3
→ E 24 - 31
→ E 32 - 33
→ 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 38 – 40

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

→ B 10 – 15
 → A 90 – 111
 → A 123
 → A 86 – 89

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 92
→ A 90 - 92
→ A 90 - 111
→ C 4 - 9

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

→ C 2 - 3
→ E 24 - 31
→ E 32 - 33
→ 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 92
→ A 90 - 92
→ A 90 - 111
→ C 4 - 9

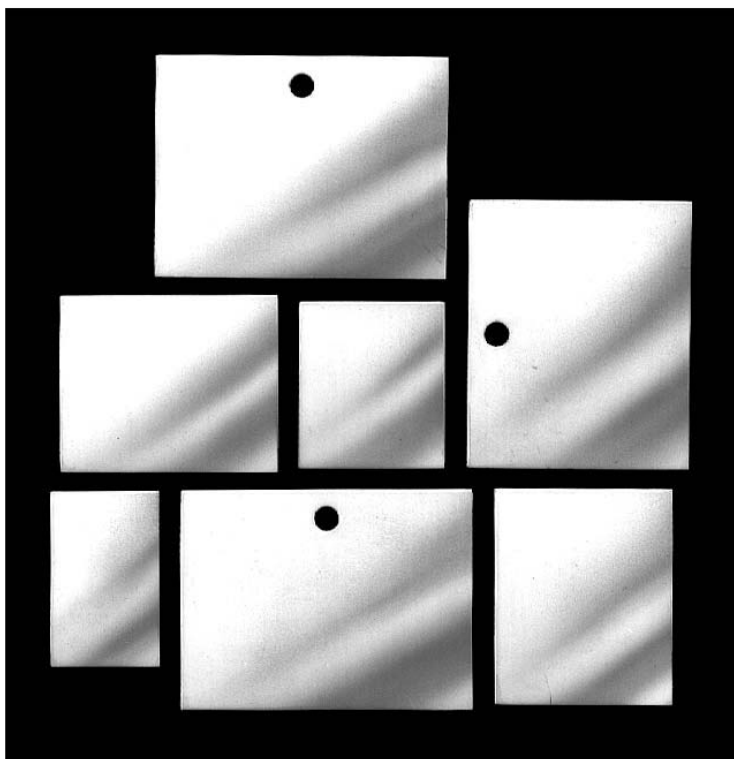
Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

→ C 2 - 3
→ E 24 - 31
→ E 32 - 33
→ 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 4 – 9
Finger-shaped heatsinks → C 2 – 3
Insulating clamping parts → E 38
Mounting material for semiconduct. → E 37 – 41

Kapton insulator washers → E 8
GEL thermal conductive foil → E 7
Insulator sleeves → E 44
Heatsinks for PCB → A 90

E 10

A

B

C

D

E

F

G

H

I

K

L

M

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A

Mica wafers

B

C

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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				

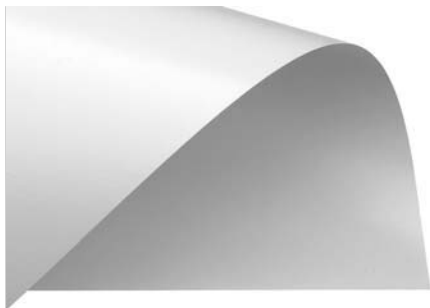
material	muskovit
material thickness	0.05 mm
insulation resistance	$3 \times 10^{17} \Omega/\text{cm}$
thermal resistance (AOS 3)	0.4 K/W
snap through stability	5 kV

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

 → A 92
 → A 90 - 92
 → A 90 - 111
 → C 4 - 9

Finger-shaped heatsinks
Distance sleeves
Spacers
GEL thermal conductive foil

 → C 2 - 3
 → E 24 - 31
 → E 32 - 33
 → 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 2
Distance sleeves for PCB's in HP grid → E 31
Distance sleeves → E 24

GEL thermal conductive foil → E 7
Spacers → E 32
Profiles for PCB components → A 92

E 12

A

B

C

D

E

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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 39
→ E 42 - 43

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

→ E 2 - 4
→ E 5
→ E 6
→ E 43

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

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E 15

Mica wafers
Kapton insulator washers
Mounting pads
Mounting parts for heatsinks

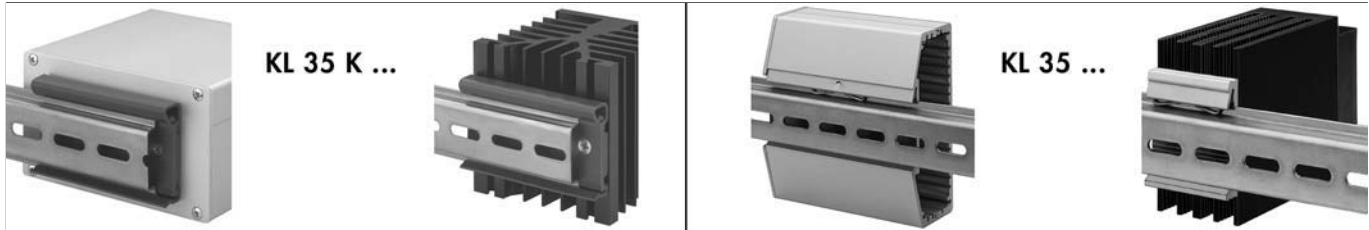
→ E 11
→ E 8
→ E 39
→ E 42 - 43

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

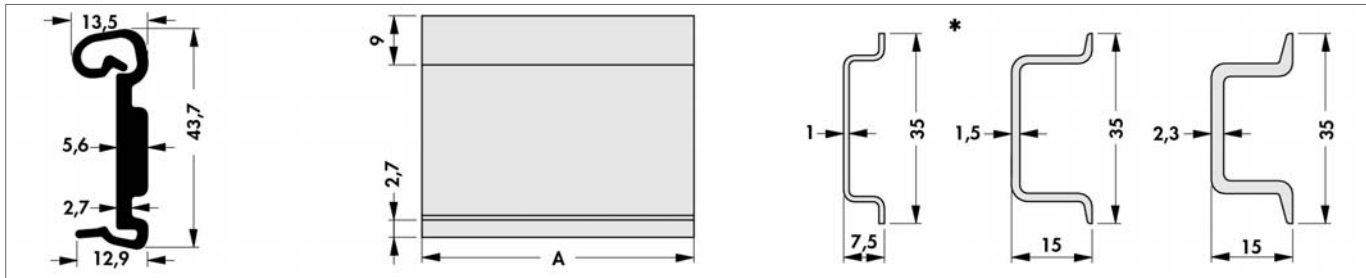
→ E 2 - 4
→ E 5
→ E 6
→ E 43

Fastening for mounting rail

universal, solid plastic clip fastening for all 35 mm mounting rails; **suitable for rail material thicknesses from 1 to 2.3 mm according to DIN EN 50 022**; registered design DE 200 07 435.0; **fast and easy mounting of heatsinks, casings etc. due to direct snap up on the mounting rail**



safe hold due to a stable extruded plastic profile with integrated spring back; **electroconductive material or surface on request**; special lengths and treatments on customer's request

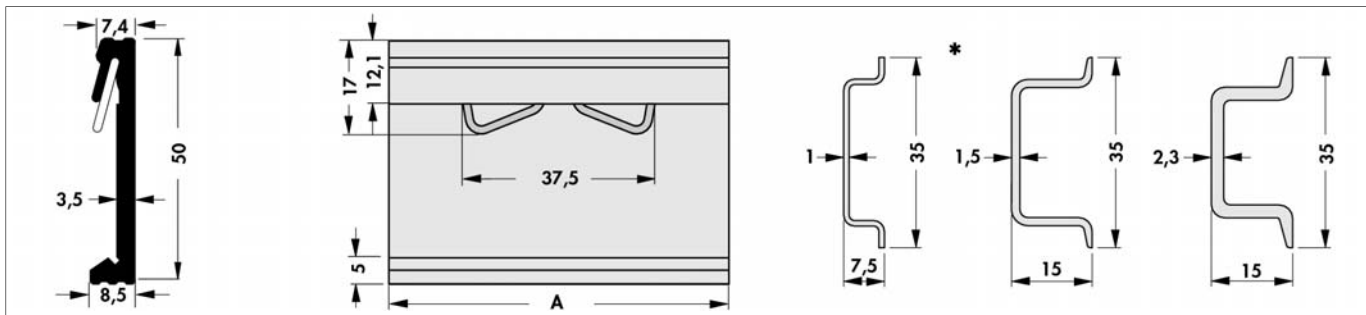


art. no.	dim. [mm] length on stock	art. no.	dim. [mm] length on stock
KL 35 K 40	40	KL 35 K 75	75
KL 35 K 50	50	KL 35 K 100	100

* = examples of mounting rail versions suitable for KL 35 K

material	rigid PVC
heat distortion	-30 °C ... +80 °C
colour	anthracite grey
flammability	UL 94 V-0

safe hold due to a stable extruded profile with integrated stainless steel spring; **special lengths (≥ 40 mm)**, treatments and surfaces on request



art. no.	dim. [mm] length on stock	art. no.	dim. [mm] length on stock
KL 35 50	50	KL 35 100	100
KL 35 75	75		

* = examples of mounting rail versions suitable for KL 35

surface clear anodised

material	aluminium
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Distance sleeves for PCB's in HP grid → E 31
 Extractors for guide rails → E 22
 Insulating clamping parts → E 38
 Miniature distance sleeves → E 26


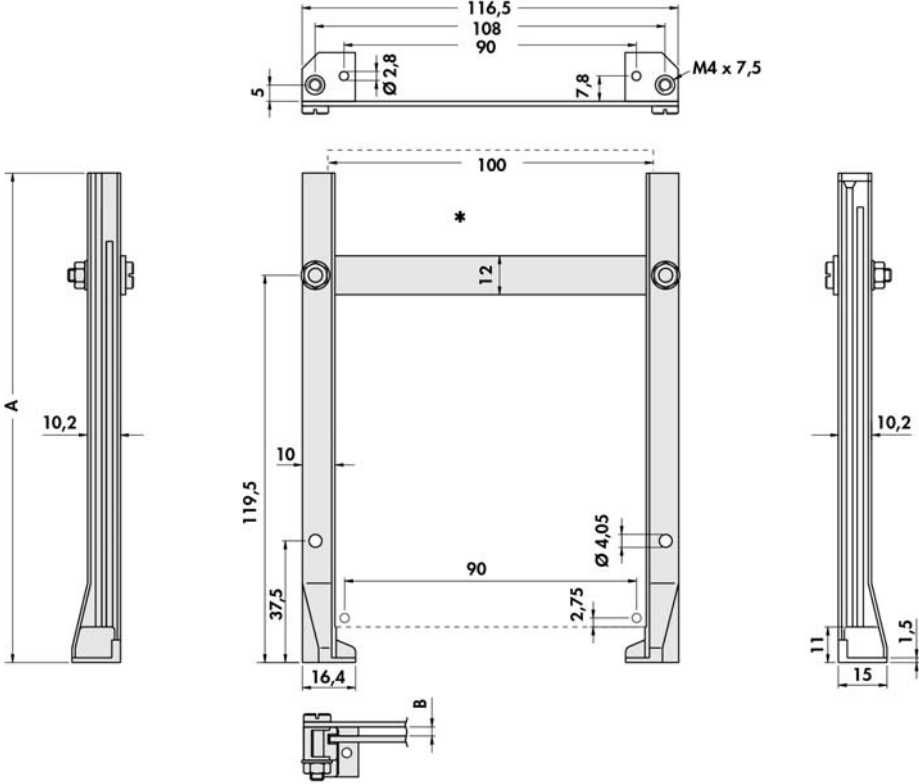
Mounting pads for transistors → E 40
 Mounting parts for heatsinks → E 42 - 43
 Heatsink profile-overview → A 13 - 16
 Vibration dampers → E 34

A

Guide rails

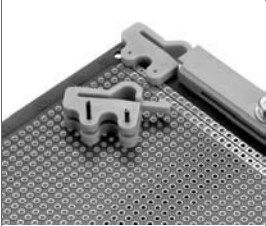
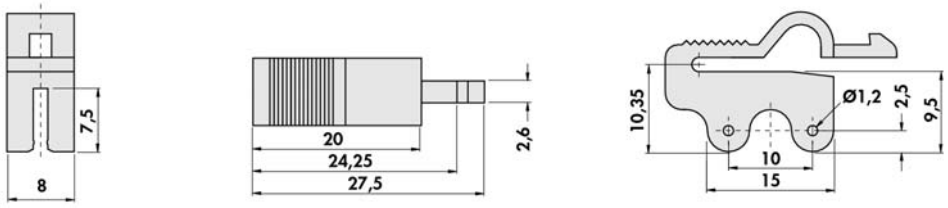
Srew-on type

- for eurocards
- connectors according to DIN 41612 or VG 95324 mountable
- high stability through inner reinforcements
- stable foot mounting trough inserted brass- thread inserts
- groove depth: 2.2 mm, groove width 1.9 mm
- suitable for PCB thicknesses from 0.5 to 1.85 mm

			
	art. no. FS 151 P	dim. [mm] A 151	

* = printed circuit board

– only for FS 151 P

			
	art. no. CLIP 151		
material	polycarbonate, GF reinforced		
temperature range	-40 °C ... +125 °C		
flammability	UL 94 V-0		

E 17


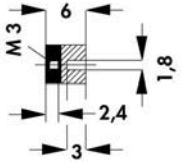
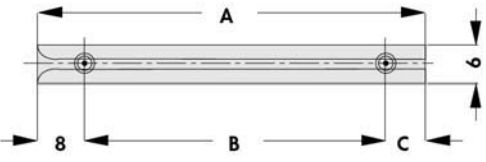
Distance sleeves for PCB's in HP grid → E 31
 Snap-in guide rails → E 21 – 22
 Extractors for guide rails → E 22
 Insulating clamping parts → E 38

Solder pins → E 36
 Mounting pads for transistors → E 40
 Vibration dampers → E 34
 Heatsinks for PCB → A 90 – 92


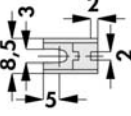
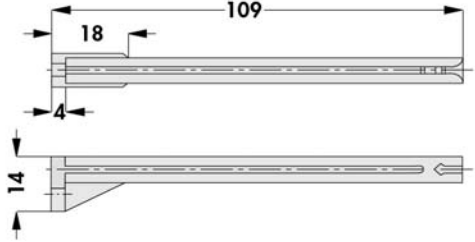

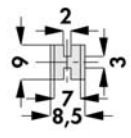
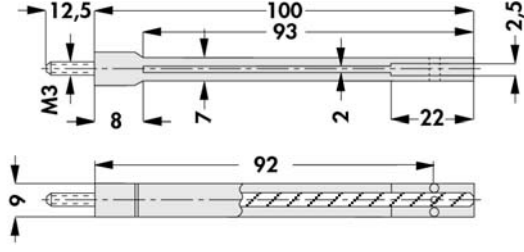

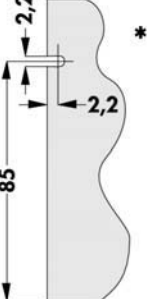
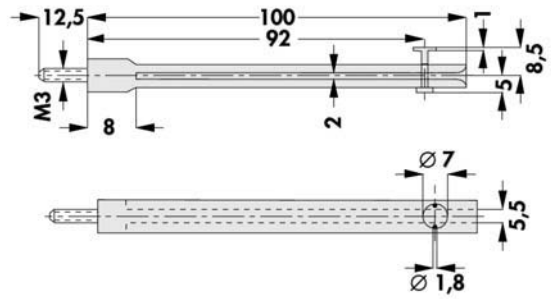
N

Guide rails

Srew-on type

			
art. no.	dim. [mm]		
	A	B	C
FS 6 065	65	50	7
FS 6 070	70	50	12
FS 6 080	80	67	5
FS 6 090	90	67	15
FS 6 100	100	84	8
FS 6 110	110	84	18
FS 6 120	120	84	28
FS 6 130	130	84	38

material	polycarbonate, GF reinforced
temperature range	-20 °C ... +130 °C
thread nut	brass nickel-plated
flammability	UL 94 V-0

art. no.			
FS 109			
art. no.			
FS 100			
art. no.			
MSVL 100			

* = position of snap-in slot

material	polyamide, GF reinforced
temperature range	-40 °C ... +205 °C
flammability	UL 94 V-0

Distance sleeves for PCB's in HP grid → E 31
 Snap-in guide rails → E 21 - 22
 Extractors for guide rails → E 22
 Insulating clamping parts → E 38

Solder pins → E 36
 Mounting pads for transistors → E 40
 Vibration dampers → E 34
 Heatsinks for PCB → A 90 - 92

A

Guide rails

B


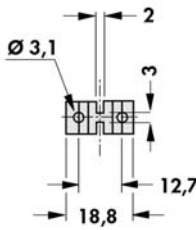
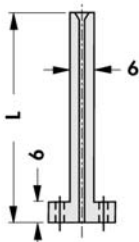
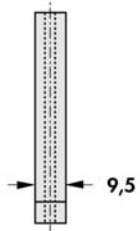
Lockable mounting rails

- lockable by pushing the plastic pin or the metal button
- no conductive connection to the PCB
- the PCB requires a snap-in slot in accordance to the drawing
- other position with locking device on request

C

D


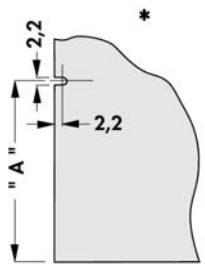
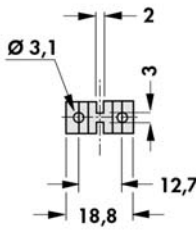
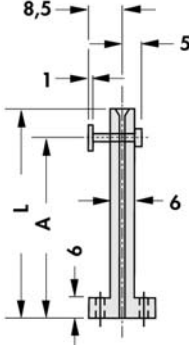
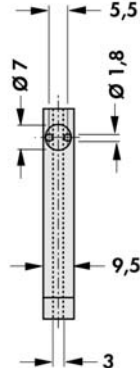
E

						
	art. no.	version	dim. [mm]			
	FS 85 50	without locking device	L			
	FS 85 60	without locking device	50			
	FS 85 70	without locking device	60			
FS 85 85	without locking device	70				
FS 85	without locking device	85				

F

G

H

								
	art. no.	version	dim. [mm]					
	MSVL 50	with locking device	L	A				
	MSVL 60	with locking device	50	42				
	MSVL 70	with locking device	60	52				
MSVL 85	with locking device	70	62					
		85	76					

* = position of snap-in slot

I

K

material	polyamide, GF reinforced
temperature range	-40 °C ... +205 °C
flammability	UL 94 V-0

L

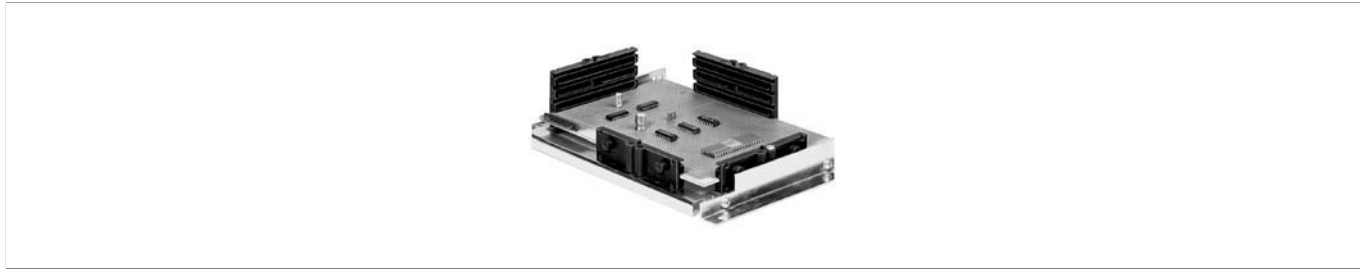
M

N

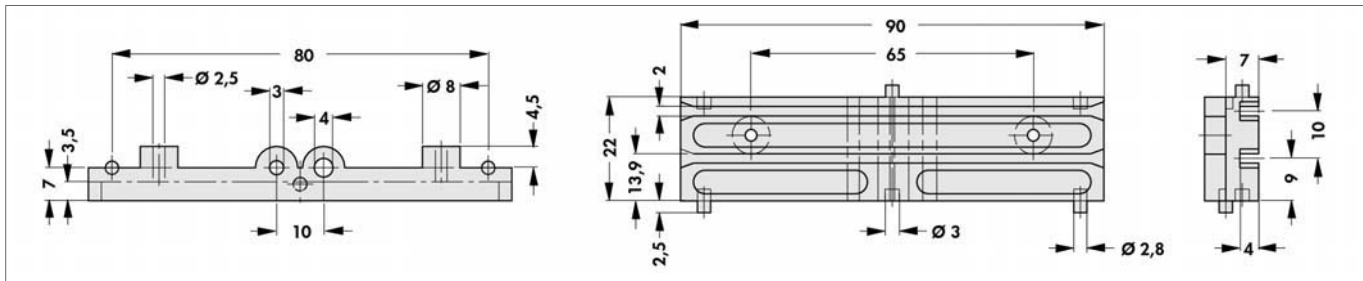
E 19

Distance sleeves for PCB's in HP grid → E 31
 Snap-in guide rails → E 21 – 22
 Extractors for guide rails → E 22
 Insulating clamping parts → E 38

Solder pins → E 36
 Mounting pads for transistors → E 40
 Vibration dampers → E 34
 Heatsinks for PCB → A 90 – 92



The guide bars have got mounting holes for vertical and horizontal assembly of printed circuits. They can also be stacked together horizontally or vertically using pins and treatments.



art. no.
MSHV 90

material	polyamide, GF reinforced
flammability	UL 94 V-0

Distance sleeves for PCB's in HP grid → E 31
 Snap-in guide rails → E 21 - 22
 Extractors for guide rails → E 22
 Insulating clamping parts → E 38

Solder pins → E 36
 Mounting pads for transistors → E 40
 Vibration dampers → E 34
 Heatsinks for PCB → A 90 - 92

E 20

A

B

C

D

E

F

G

H

I

K

L

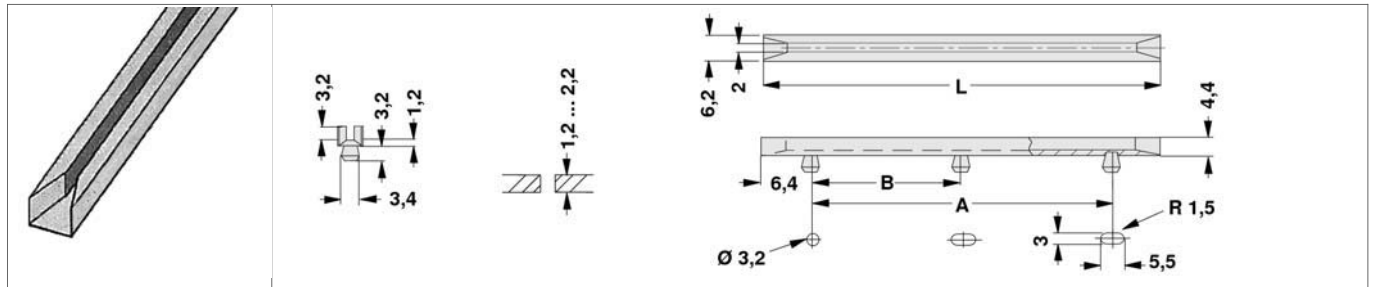
M

N

Guide rails

Snap-in

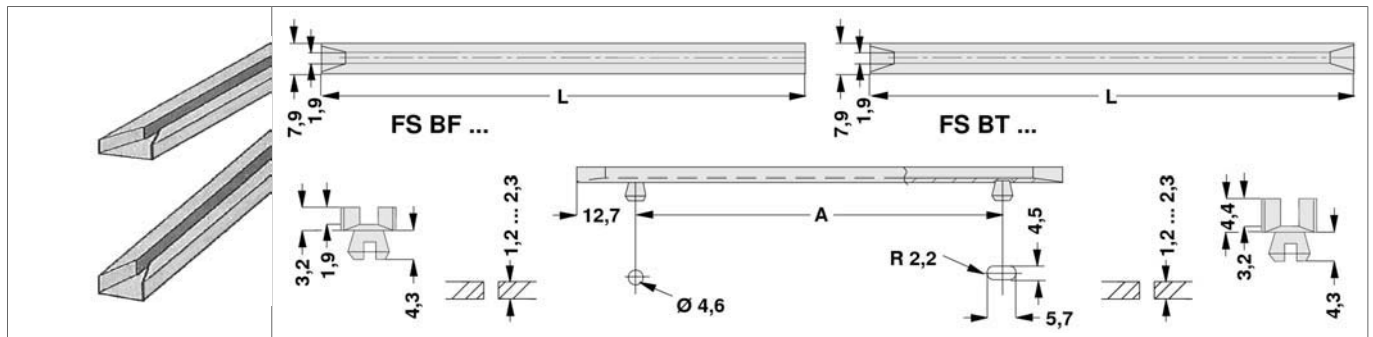
narrow version



art. no.	dim. [mm]		art. no.	dim. [mm]		
	L	A		L	A	B
FS S 06 2	63.5	50.8	FS S 15 2	152.4	139.7	–
FS S 07 2	76.2	63.5	FS S 16 2	165.1	152.4	–
FS S 08 2	88.9	76.2	FS S 19 3	190.5	177.8	88.9
FS S 10 2	101.6	88.9	FS S 20 2	203.2	190.5	–
FS S 11 2	114.3	101.6	FS S 20 3	203.2	190.5	95.2
FS S 12 2	127.0	114.3	FS S 21 2	215.9	203.2	–
FS S 13 2	139.7	127.0	FS S 21 3	215.9	203.2	101.6

material	nylon, natural coloured
temperature range	-40 °C ... +120 °C
flammability	UL 94 V-2

wide version



art. no.	version	dim. [mm]		art. no.	version	dim. [mm]	
		L	A			L	A
FS BF 06	shallow groove	63.5	38.1	FS BT 06	deep groove	63.5	38.1
FS BF 07	shallow groove	76.2	50.8	FS BT 07	deep groove	76.2	50.8
FS BF 08	shallow groove	88.9	63.5	FS BT 08	deep groove	88.9	63.5
FS BF 10	shallow groove	101.6	76.2	FS BT 10	deep groove	101.6	76.2
FS BF 11	shallow groove	114.3	88.9	FS BT 11	deep groove	114.3	88.9
FS BF 12	shallow groove	127.0	101.6	FS BT 12	deep groove	127.0	101.6
FS BF 13	shallow groove	139.7	114.3	FS BT 13	deep groove	139.7	114.3
FS BF 15	shallow groove	152.4	127.0	FS BT 15	deep groove	152.4	127.0
FS BF 16	shallow groove	165.1	139.7	FS BT 16	deep groove	165.1	139.7
FS BF 17	shallow groove	177.8	152.4	FS BT 17	deep groove	177.8	152.4
FS BF 19	shallow groove	190.5	165.1	FS BT 19	deep groove	190.5	165.1
FS BF 20	shallow groove	203.2	177.8	FS BT 20	deep groove	203.2	177.8

material	nylon, natural coloured
temperature range	-40 °C ... +120 °C
flammability	UL 94 V-2

E 21

Ejectors
Spacers
Insulating clamping parts
Clamp fixing for DIN-rail

→ **E 23**
 → **E 32 – 33**
 → **E 38**
 → **E 16**

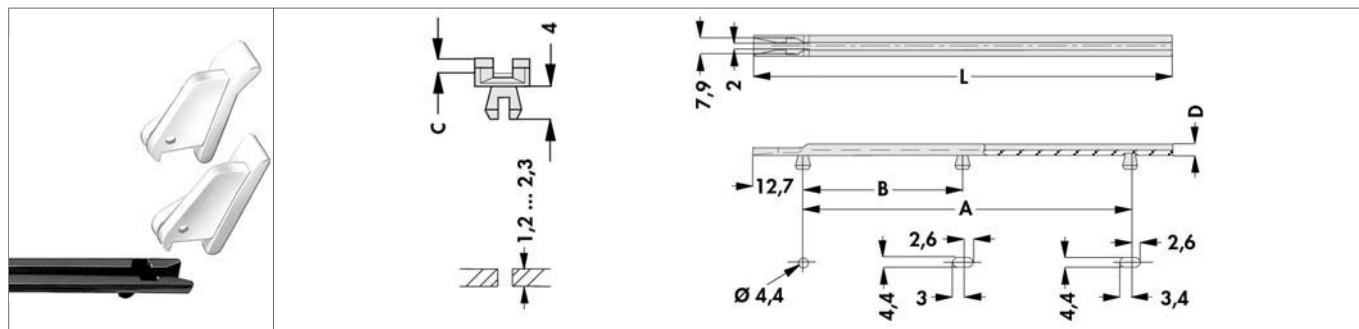
Solder pins
Profiles for PCB mounting
Heatsinks for PCB
Profiles for PCB components

→ **E 36**
 → **A 90 – 111**
 → **A 90**
 → **A 92**

Guide rails

Ejectors

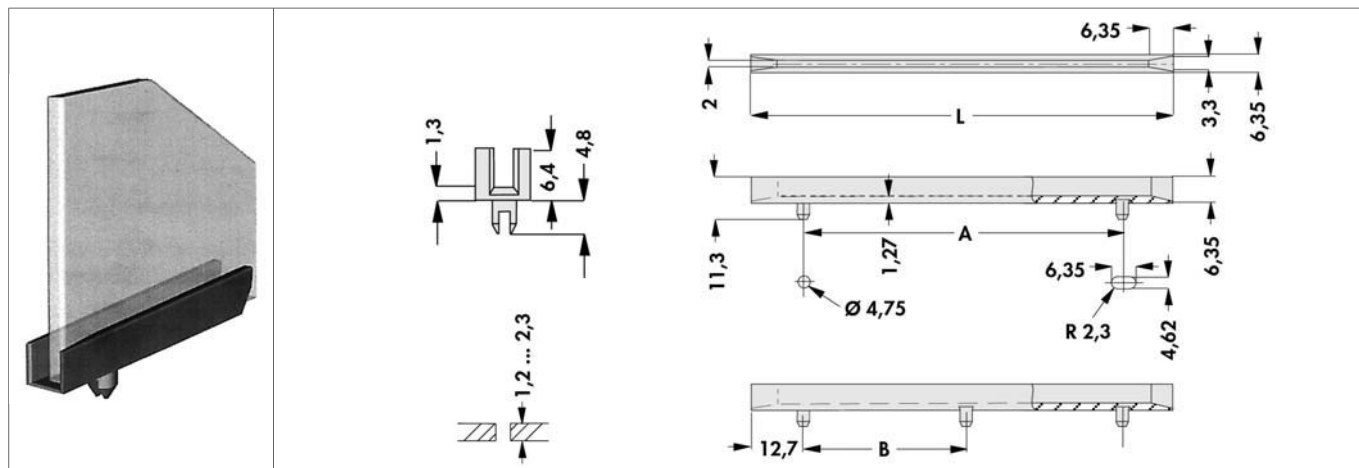
- low profile
- suitable for ejectors **art. no. AHG V 14** und **AHG V 17**



art. no.	dim. [mm]				art. no.	dim. [mm]				
	L	A	C	D		L	A	B	C	D
FS LP 05	50.8	25.8	2	3.2	FS LP 17	177.8	153.2	–	2.0	3.2
FS LP 07	76.2	38.5	2	3.2	FS LP 22	228.6	191.3	95.7	2.0	3.6
FS LP 08	88.9	38.5	2	3.2	FS LP 27	279.4	229.4	114.7	2.0	3.6
FS LP 10	101.6	76.6	2	3.2	FS LP 29	292.1	267.9	134.0	2.4	4.0
FS LP 11	114.3	76.6	2	3.2	FS LP 30	304.8	267.9	134.0	2.4	4.0
FS LP 12	127.0	76.6	2	3.2	FS LP 31	317.5	267.9	134.0	2.4	4.0
FS LP 13	139.7	76.6	2	3.2	FS LP 33	330.2	306.0	153.0	2.4	4.0
FS LP 15	152.4	127.4	2	3.2	FS LP 34	342.9	306.0	153.0	2.4	4.0
FS LP 16	165.1	127.4	2	3.2	FS LP 35	355.6	306.0	153.0	2.4	4.0

material	polyamide, GF reinforced
temperature range	-40 °C ... +120 °C
flammability	UL 94 V-0

- deep guideway
- bevelled entrance zone



art. no.	dim. [mm]		
	L	A	B
FS U 06	63.5	38.1	–
FS U 11	114.3	88.9	–
FS U 15	152.4	127.0	–
FS U 20	203.2	177.8	88.9

material	polyamide, GF reinforced
temperature range	-40 °C ... +120 °C
flammability	UL 94 V-0

Ejectors
Spacers
Insulating clamping parts
Clamp fixing for DIN-rail

- E 23
- E 32 – 33
- E 38
- E 16

Solder pins
Profiles for PCB mounting
Heatsinks for PCB
Profiles for PCB components

- E 36
- A 90 – 111
- A 90
- A 92

E 22

A

B

C

D

E

F

G

H

I

K

L

M

N

Guide rails

Ejectors

<p>art. no.</p>	
<p>AHG V 14</p>	<p>* = mounting dimensions; locking in FS LP</p>
<p>art. no.</p>	
<p>AHG V 17</p>	<p>* = mounting dimensions; locking in FS LP</p>
<p>art. no.</p>	
<p>AHG K 27</p>	
<p>art. no.</p>	
<p>AHG K 28</p>	
<p>art. no.</p>	<p>dim. [mm]</p>
<p>AHG L 7</p>	<p>A</p>
<p>AHG L 8</p>	<p>7.4</p>
	<p>8.9</p>

contents of delivery: all ejectors with matching spring pin

material	nylon
temperature range	-40 °C ... +120 °C
flammability	UL 94 V-2

E 23

Screw mounted guide rails
 Snap-in guide rails
 Guide rails for PCBs
 Insulating clamping parts

→ E 17 – 20
 → E 21 – 22
 → E 17 – 22
 → E 38

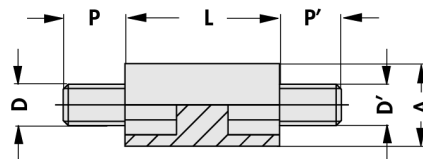
Miniature distance sleeves
 Thermal conductive material
 Insulator sleeves
 Distance sleeves for PCB's in HP grid

→ E 26
 → E 2 – 15
 → E 44
 → E 31

Insulating spacers with internal and external thread



- insulated assembly of stacked PCBs
- insulated assembly of stacked heatsinks with varying capacities
- insulated assembly of chassis plates in cases
- insulated supports in the wiring
- mechanically very stable, as threads are made of brass
- other lengths on request



art. no.	dim. [mm]			
	A	D/D'	P/P'	L
ISAB 25 A ...	6.5	M2.5/M2.5	6.0	10/ 15/ 20/ 25
ISAB 3 A ...	8.0	M3/M3	6.0	10/ 20
ISAB 4 A ...	8.0	M4/M4	6.0	15/ 20/ 25
ISAB 5 A ...	9.5	M5/M5	10.0	20/ 25/ 30/ 35/ 40
ISAB 6 A ...	12.7	M6/M6	12.7	25

**... Please indicate length "L"
other lengths on request**

dimensions = nominal size: deviation ± 0.5 mm

dielectric strength	approx. 40 kV/mm
creeping current resistance	3c, level KA
thread inserts	brass
temperature range	-30 °C ... +85 °C (short term +200 °C)
surface treatment	raw
plastic body	polyamide 66
colour	natural (opaque)

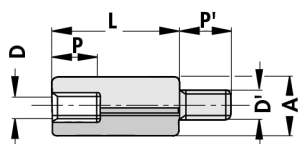
Distance sleeves for PCB's in HP grid → E 31
 Spacers → E 32 - 33
 Guide rails for PCBs → E 17 - 22
 Clamp fixing for DIN-rail → E 16 - 16

Mounting parts for heatsinks → E 42 - 43
 Thermal conductive material → E 2 - 15
 Profiles for PCB mounting → A 90 - 111
 Profiles for PCB components → A 92

A

Distance sleeves and spacers

B

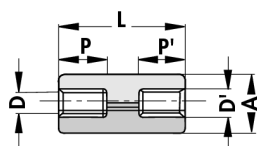


C

art. no.	dim. [mm]			
	A	D/D'	P/P'	L
ISAB 25 B ...	6.5	M2.5/M2.5	6.0	10/ 13/ 15/ 18/ 20/ 25/ 30
ISAB 3 B ...	8.0	M3/M3	6.0	10/ 13/ 15/ 18/ 20/ 25/ 30/ 35/ 40
ISAB 4 B ...	8.0	M4/M4	6.0	15/ 20/ 25/ 30/ 35/ 40
ISAB 5 B ...	9.5	M5/M5	10.0	20/ 25/ 30/ 35/ 40
ISAB 6 B ...	12.7	M6/M6	12.7	25/ 30/ 35/ 40/ 45/ 50

D

E



F

art. no.	dim. [mm]			
	A	D/D'	P/P'	L
ISAB 25 C ...	6.5	M2.5/M2.5	6.0	10/ 13/ 15/ 18/ 20/ 25/ 30
ISAB 3 C ...	8.0	M3/M3	6.0	10/ 13/ 15/ 18/ 20/ 25
ISAB 4 C ...	8.0	M4/M4	6.0	15/ 20/ 25/ 30/ 35/ 40
ISAB 5 C ...	9.5	M5/M5	10.0	20
ISAB 6 C ...	12.7	M6/M6	12.0	25
ISAB 6 C ...	12.7	M6/M6	12.7	30/ 35/ 40/ 45/ 50

G

H

... Please indicate length "L"

other lengths on request

dimensions = nominal size: deviation ± 0.5 mm; at ISAB 3 C ... L=10 => P/P'=3.5

I

dielectric strength	approx. 40 KV/mm
creeping current resistance	3c, level KA
thread inserts	brass
temperature range	-30 °C ... +85 °C (short term +200 °C)
surface treatment	raw
plastic body	polyamide 66
colour	natural (opaque)

K

L

M

N

E 25

Screw mounted guide rails
 Snap-in guide rails
 Guide rails for PCBs
 Insulating clamping parts

→ E 17 – 20
 → E 21 – 22
 → E 17 – 22
 → E 38

Miniature distance sleeves → E 26
 Thermal conductive material → E 2 – 15
 Insulator sleeves → E 44
 Distance sleeves for PCB's in HP grid → E 31

Distance sleeves and spacers

Miniature spacers with threads



- allows compact, insulated constructions
- reduced volume in case of stack assembly
- insulated mounting of heatsinks, PCB, housing parts etc.
- very good mechanical stability due to brass inserts

art. no.	dim. [mm]		
	S	G	L
ISAM 2 A ...	6	M 2.5	4/ 5/ 6/ 7/ 8/ 9/ 10/ 11/ 12
ISAM 3 A ...	7	M 3	4/ 5/ 6/ 7/ 8/ 9/ 10/ 11/ 12
art. no.	dim. [mm]		
	S	G	L
ISAM 2 B ...	6	M 2.5	7/ 8/ 9/ 10/ 11/ 12
ISAM 3 B ...	7	M 3	7/ 8/ 9/ 10/ 11/ 12
art. no.	dim. [mm]		
	S	G	L
ISAM 2 C ...	6	M 2.5	9/ 10/ 11/ 12
ISAM 3 C ...	7	M 3	9/ 10/ 11/ 12

... Please indicate length "L"

dimensions = nominal size: $L \pm 0.5$ mm

dielectric strength	30 KV/mm
creeping current resistance	3c, level KA
thread inserts	brass
temperature range	-30 °C ... +85 °C (short term +200 °C)
surface treatment	raw
plastic body	polyamide 66
colour	natural (opaque)

Distance sleeves for PCB's in HP grid → E 31

Spacers → E 32 - 33

Snap rivet → E 37

Mounting parts for heatsinks → E 42 - 43

Vibration dampers → E 34

Insulating distance sleeves → E 24 - 26

Insulating clamping parts → E 38

Mounting material for semiconduct. → E 37 - 41

E 26

A

B

C

D

E

F

G

H

I

K

L

M

N

A

Distance sleeves and spacers

B

C

D

E

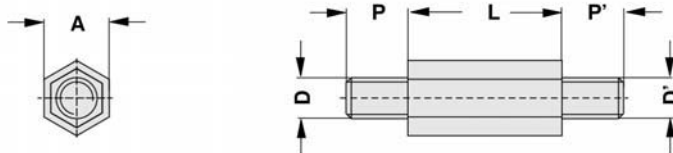
Insulating spacers with internal and external thread


- insulated assembly of stacked PCBs
- insulated assembly of stacked heatsinks with varying capacities
- insulated assembly of chassis plates in cases
- insulated supports in the wiring
- mechanically very stable, as threads are made of brass
- other lengths on request

F

G

H



art. no.	dim. [mm]				
	A	P	D/D'	P'	L
ISAS 25 A ...	6.35	6	M2.5/M2.5	6.0	15/ 20/ 25/ 30/ 35/ 40
ISAS 30 A ...	6.35	6	M3/M3	6.0	15/ 20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 40 A ...	8.00	6	M4/M4	6.0	15/ 20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 50 A ...	9.50	10	M5/M5	10.0	20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 60 A ...	12.70	12.7	M6/M6	12.7	25/ 30/ 35/ 40/ 45/ 50/ 60

... Please indicate length "L"

other lengths on request

dimensions = nominal size: deviation ± 0.5 mm

dielectric strength	approx. 40 KV/mm
creeping current resistance	3c, level KA
thread inserts	brass
temperature range	-30 °C ... +85 °C (short term +200 °C)
surface treatment	raw
plastic body	polyamide 66
colour	natural (opaque)

L

M

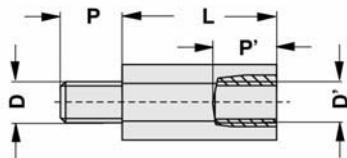
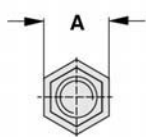
N

E 27

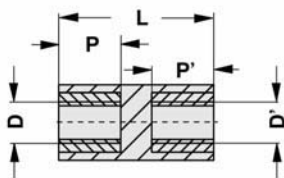
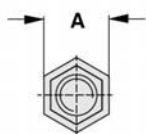
Distance sleeves for PCB's in HP grid → E 31
 Spacers → E 32 – 33
 Snap rivet → E 37
 Mounting parts for heatsinks → E 42 – 43

Vibration dampers → E 34
 Insulating distance sleeves → E 24 – 26
 Insulating clamping parts → E 38
 Mounting material for semiconduct. → E 37 – 41

Distance sleeves and spacers



art. no.	dim. [mm]				
	A	P	D/D'	P'	L
ISAS 25 B ...	6.35	6	M2.5/M2.5	6.0	15/ 20/ 25/ 30/ 35/ 40
ISAS 30 B ...	6.35	6	M3/M3	6.0	15/ 20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 40 B ...	8.00	6	M4/M4	6.0	15/ 20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 50 B ...	9.50	10	M5/M5	10.0	20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 60 B ...	12.70	12.7	-	12.7	25/ 30/ 35/ 40/ 45/ 50/ 60



art. no.	dim. [mm]				
	A	P	D/D'	P'	L
ISAS 25 C ...	6.35	6	M2.5/M2.5	6.0	15/ 20/ 25/ 30/ 35/ 40
ISAS 30 C ...	6.35	6	M3/M3	6.0	15/ 20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 40 C ...	8.00	6	M4/M4	6.0	15/ 20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 50 C ...	9.50	10	M5/M5	10.0	20/ 25/ 30/ 35/ 40/ 45/ 50
ISAS 60 C ...	12.70	12.7	M6/M6	12.7	25/ 30/ 35/ 40/ 45/ 50/ 60

**... Please indicate length "L"
other lengths on request**

dimensions = nominal size: deviation ± 0.5 mm; at ISAS 3 C ... L=10 \Rightarrow P/P'=3.5

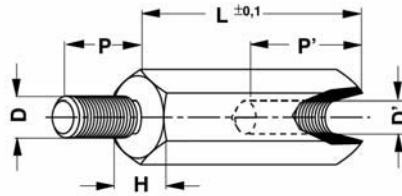
dielectric strength	approx. 40 kV/mm
creeping current resistance	3c, level KA
thread inserts	brass
temperature range	-30 °C ... +85 °C (short term +200 °C)
surface treatment	raw
plastic body	polyamide 66
colour	natural (opaque)

Distance sleeves for PCB's in HP grid \rightarrow E 31
 Spacers \rightarrow E 32 - 33
 Snap rivet \rightarrow E 37
 Mounting parts for heatsinks \rightarrow E 42 - 43

Vibration dampers \rightarrow E 34
 Insulating distance sleeves \rightarrow E 24 - 26
 Insulating clamping parts \rightarrow E 38
 Mounting material for semiconduct. \rightarrow E 37 - 41

Distance sleeves and spacers

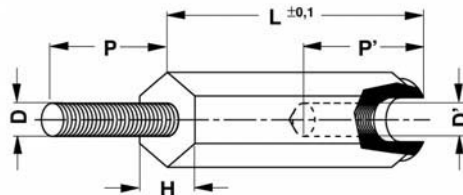
spacers with internal and external thread



art. no.	dim. [mm]				
	P'	P	D/D'	H	L
GBM 2550 ...	2.5	6	M 2.5	5	5
GBM 2550 ...	5.0	6	M 2.5	5	10
GBM 2550 ...	8.0	6	M 2.5	5	15/ 20
GBM 2550 ...	10.0	8	M 2.5	5	25/ 30/ 35
GBM 3050 ...	2.5	8	M 3	5	5
GBM 3050 ...	5.0	8	M 3	5	10/ 12/ 14
GBM 3050 ...	10.0	8	M 3	5	15/ 18/ 20
GBM 3050 ...	10.0	10	M 3	5	25/ 30/ 35/ 40/ 45/ 50
GBM 4070 ...	2.5	8	M 4	7	5
GBM 4070 ...	5.0	8	M 4	7	10
GBM 4070 ...	8.0	8	M 4	7	15
GBM 4070 ...	10.0	8	M 4	7	20
GBM 4070 ...	10.0	10	M 4	7	25/ 30/ 35/ 40/ 45/ 50
GBM 5080 ...	5.0	8	M 5	8	10
GBM 5080 ...	6.0	8	M 5	8	15/ 20
GBM 5080 ...	10.0	10	M 5	8	25/ 30/ 35/ 40/ 45/ 50

... Please indicate length "L"
other lengths and threads on request

material	brass
surface treatment	6 µm nickel-plated, solderable



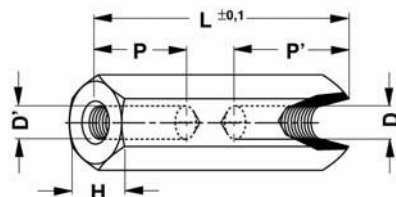
art. no.	dim. [mm]				
	P'	P	D/D'	H	L
GBP 3060 ...	7	8	M 3	6	10
GBP 3060 ...	8	8	M 3	6	12
GBP 3060 ...	10	8	M 3	6	15/ 18/ 20/ 25/ 30
GBP 4080 ...	7	8	M 4	8	10
GBP 4080 ...	9	8	M 4	8	12
GBP 4080 ...	10	8	M 4	8	15/ 18/ 20/ 25/ 30/ 35/ 40/ 45/ 50

... Please indicate length "L"
other lengths and threads on request

material	polyamide, GF reinforced
temperature range	-30 °C ... +110 °C
colour	black

Distance sleeves and spacers

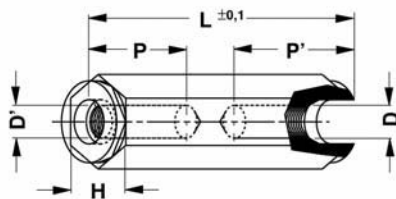
distance sleeves with internal thread



art. no.	dim. [mm]				
	P'	P	D/D'	H	L
ABM 2550 ...	–	=L	M 2.5	5	5/ 8/ 10/ 12/ 15
ABM 2550 ...	8	8	M 2.5	5	18
ABM 2550 ...	10	10	M 2.5	5	20/ 25/ 30/ 35/ 40/ 45/ 50
ABM 3050 ...	–	=L	M 3	5	5/ 8/ 9/ 10/ 12/ 13/ 15
ABM 3050 ...	8	8	M 3	5	16/ 18/ 19
ABM 3050 ...	10	10	M 3	5	20/ 25/ 29/ 30/ 35/ 40/ 45/ 50
ABM 4070 ...	–	=L	M 4	7	5/ 8/ 10/ 12/ 15
ABM 4070 ...	9	9	M 4	7	18
ABM 4070 ...	10	10	M 4	7	20/ 25/ 30/ 35/ 40/ 45/ 50

... Please indicate length "L"
other lengths and threads on request

material	brass
surface treatment	6 µm nickel-plated, solderable



art. no.	dim. [mm]				
	P'	P	D/D'	H	L
ABP 2550 ...	–	=L	M 2.5	5	10
ABP 2550 ...	6	6	M 2.5	5	15/ 20/ 25/ 30
ABP 3060 ...	–	=L	M 3	6	10/ 12/ 15
ABP 3060 ...	8	8	M 3	6	20
ABP 3060 ...	10	10	M 3	6	25/ 30
ABP 4080 ...	–	=L	M 4	8	10/ 15/ 20
ABP 4080 ...	10	10	M 4	8	20

... Please indicate length "L"
other lengths and threads on request

material	polyamide, GF reinforced
temperature range	-30 °C ... +110 °C
colour	black

Distance sleeves for PCB's in HP grid → E 31
Spacers → E 32 – 33
Snap rivet → E 37
Mounting parts for heatsinks → E 42 – 43

Vibration dampers → E 34
Insulating distance sleeves → E 24 – 26
Insulating clamping parts → E 38
Mounting material for semiconduct. → E 37 – 41

E 30

A

B

C

D

E

F

G

H

I

K

L

M

N

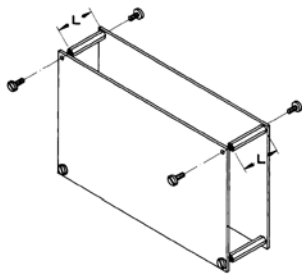
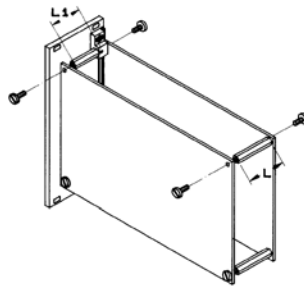
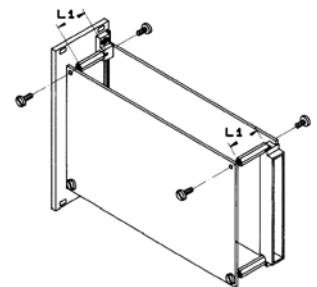
A

Distance sleeves and spacers

B

Distance sleeves for PCB in HP grid

These internally threaded distance sleeves mount PCBs to the correct pitch for insertion into subracks


ABM TE

ABM TE...DIN
ABM TE

ABM TE...DIN

C

D

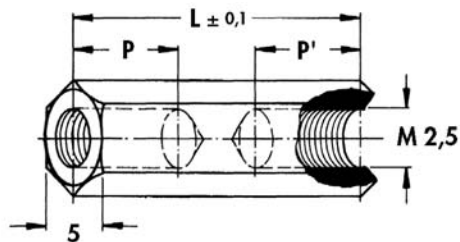
E

ABM TE: spacer between two PC boards

ABM TE ... DIN: spacer between two PC boards, one of them equipped with DIN-connector resp. A front panel/PCB Interconnection device VS 1.

F

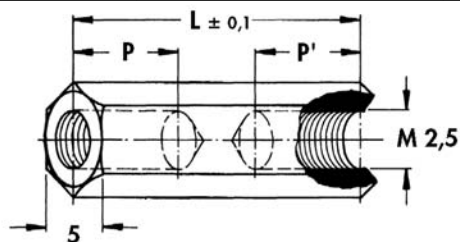
G



art. no.	suitable for TE	dim. [mm]	
		P	L
ABM TE 04	4	8	18.72
ABM TE 06	6	8	28.88
ABM TE 08	8	8	39.04

H

I



art. no.	suitable for TE	dim. [mm]	
		P	L
ABM TE 04 DIN	4	=L	12.72
ABM TE 06 DIN	6	8	22.88
ABM TE 08 DIN	8	8	33.04

K

L

spacers with internal and external thread to HP grid on request

material	brass
surface treatment	8 µm nickel-plated, solderable

M

N

E 31

Solder pins
Plugs
Miniature distance sleeves
Mounting parts for heatsinks

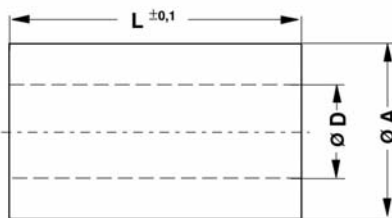
→ E 36
→ E 36
→ E 26
→ E 42 - 43

Heatsink profile-overview
Heatsinks for PCB
Special profiles
Clamp fixing for DIN-rail

→ A 13 - 16
→ A 90
→ A 136
→ E 16

Distance sleeves and spacers

Spacers

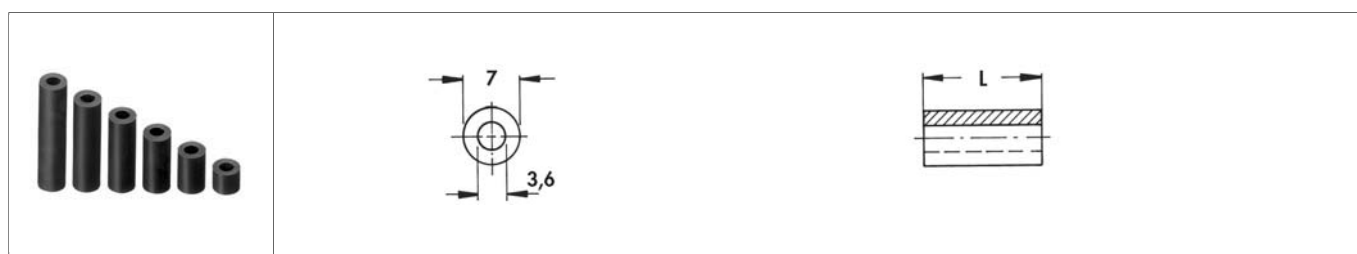


art. no.	dim. [mm]		
	A	D	L
AHM 3260...	6	3.2	1/ 2/ 3/ 4/ 5/ 6/ 7/ 8/ 9/ 10/ 12/ 15/ 18/ 25/ 30
AHM 4380...	8	4.3	1/ 2/ 3/ 4/ 5/ 6/ 7/ 8/ 9/ 10/ 12/ 15/ 18/ 25/ 30

... Please indicate length "L"

dimensions = nominal size: $L \pm 0.1$ mm

material	brass
surface treatment	8 μ m nickel-plated, solderable



art. no.	length [mm]	art. no.	length [mm]
DR 071 V0	1	DR 713 V0	13
DR 072 V0	2	DR 714 V0	14
DR 073 V0	3	DR 715 V0	15
DR 074 V0	4	DR 720 V0	20
DR 075 V0	5	DR 725 V0	25
DR 076 V0	6	DR 730 V0	30
DR 077 V0	7	DR 735 V0	35
DR 078 V0	8	DR 740 V0	40
DR 079 V0	9	DR 745 V0	45
DR 710 V0	10	DR 750 V0	50
DR 711 V0	11	DR 755 V0	55
DR 712 V0	12	DR 760 V0	60

special lengths on request

material	polyamide
heat distortion	180 °C
temperature range	+180 °C
colour	black
flammability	UL 94 V-0

Solder pins
Plugs
Miniature distance sleeves
Mounting parts for heatsinks

→ E 36
→ E 36
→ E 26
→ E 42 - 43

Heatsink profile-overview
Heatsinks for PCB
Special profiles
Clamp fixing for DIN-rail

→ A 13 - 16
→ A 90
→ A 136
→ E 16

E 32

A

B

C

D

E

F

G

H

I

K


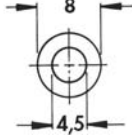
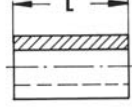

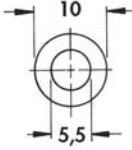
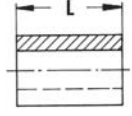
L

M

N

Distance sleeves and spacers

Spacers

					
art. no.	length [mm]	art. no.	length [mm]	art. no.	length [mm]
DR 081 V0	1	DR 813 V0	13		
DR 082 V0	2	DR 814 V0	14		
DR 083 V0	3	DR 815 V0	15		
DR 084 V0	4	DR 820 V0	20		
DR 085 V0	5	DR 825 V0	25		
DR 086 V0	6	DR 830 V0	30		
DR 087 V0	7	DR 835 V0	35		
DR 088 V0	8	DR 840 V0	40		
DR 089 V0	9	DR 845 V0	45		
DR 810 V0	10	DR 850 V0	50		
DR 811 V0	11	DR 855 V0	55		
DR 812 V0	12	DR 860 V0	60		
					
art. no.	length [mm]	art. no.	length [mm]	art. no.	length [mm]
DR 105 V0	5	DR 135 V0	35		
DR 110 V0	10	DR 140 V0	40		
DR 115 V0	15	DR 145 V0	45		
DR 120 V0	20	DR 150 V0	50		
DR 125 V0	25	DR 155 V0	55		
DR 130 V0	30	DR 160 V0	60		

special lengths on request

material	polyamide
heat distortion	180 °C
temperature range	+180 °C
colour	black
flammability	UL 94 V-0

E 33

Solder pins
Plugs
Miniature distance sleeves
Mounting parts for heatsinks

→ E 36
→ E 36
→ E 26
→ E 42 - 43

Heatsink profile-overview
Heatsinks for PCB
Special profiles
Clamp fixing for DIN-rail

→ A 13 - 16
→ A 90
→ A 136
→ E 16

Vibration dampers and solder terminals

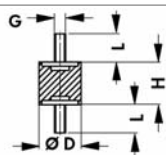
Vibration dampers, rubber metal buffers

Construational elements to vibration damping and insulation

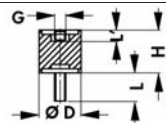
Universal applicable round metal, anti vibration buffers for solving vibration problems.



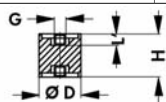
- reduction of dynamic component stress
- vibration insulation for disc drives and motors
- impact reducing on sensitive instruments
- reduction of the noise level
- prevention of vibration resonance phenomena (amplified effect)
- compensation of mechanical inbalances



art. no.	dim. [mm]			
	H	G	Ø D	L
SMP 410 A ...	10	M 4	10	10
SMP 415 A ...	15/ 20	M 4	15	10
SMP 515 A ...	15/ 20	M 5	15	12



art. no.	dim. [mm]				
	G	H	L'	Ø D	L
SMP 410 B ...	M 4	10	4	10	10
SMP 415 B ...	M 4	15/ 20	4	15	10
SMP 515 B ...	M 5	15/ 20	5	15	12



art. no.	dim. [mm]			
	G	H	L'	Ø D
SMP 410 C ...	M 4	15/ 20	4	10
SMP 415 C ...	M 4	15/ 20	4	15
SMP 515 C ...	M 5	20	5	15

... please indicate height "H"

other lengths and hardness range on request

material	rubber-metal connection
rubber	natural rubber (NR according to ISO)
hardness range	approx. 50 Shore A
extensibility and tebsile strength	very good
colour	black
metall parts	steel tin-plated
temperature range	-40 °C ... +80 °C (short term +90 °C)

Distance sleeves for PCB's in HP grid → E 31
 Spacers → E 32 - 33
 Guide rails for PCBs → E 17 - 22
 Clamp fixing for DIN-rail → E 16

Mounting parts for heatsinks → E 42 - 43
 Thermal conductive material → E 2 - 15
 Profiles for PCB mounting → A 90 - 111
 Profiles for PCB components → A 92

E 34

A

B

C

D

E

F

G

H

I


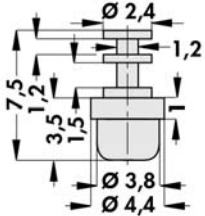

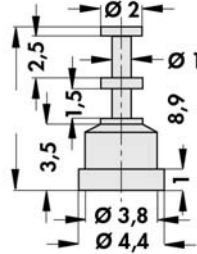

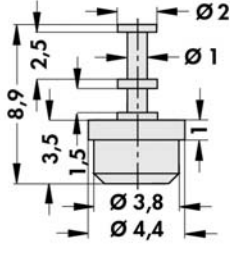

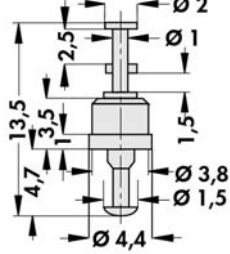

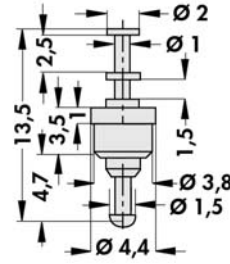
K

L

M

N

Vibration dampers and solder terminals
Solder terminals

art. no. LSD 07520		
art. no. LSD 08910		
art. no. LSD 08920		
art. no. LSD 13510		
art. no. LSD 13520		

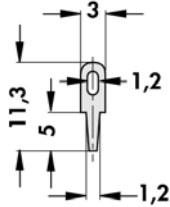
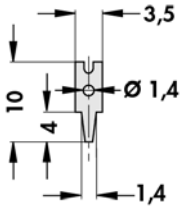
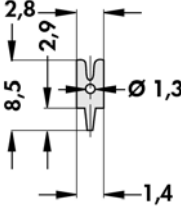
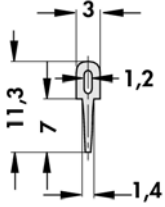
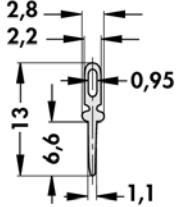
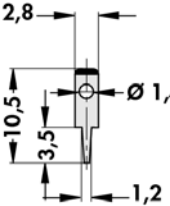
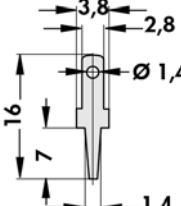
material	insulating body: PTFE (teflon)
contact pin	brass, 2 µm Ni, 4 µm Ag
temperature range	-200 °C ... +260 °C

E 35

Distance sleeves for PCB's in HP grid → E 31
 Spacers → E 32 – 33
 Guide rails for PCBs → E 17 – 22
 Clamp fixing for DIN-rail → E 16

Mounting parts for heatsinks → E 42 – 43
 Thermal conductive material → E 2 – 15
 Profiles for PCB mounting → A 90 – 111
 Profiles for PCB components → A 92

Solder pins


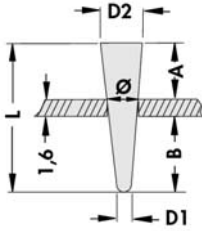
				
art. no. LS 101 ±0.6 mm	art. no. LS 102 ±0.6 mm	art. no. LS 103 ±0.6 mm	art. no. LS 104 ±0.6 mm	art. no. LS 105 ±0.5 mm
				
art. no. LS 106 ±0.8 mm	art. no. LS 107 ±0.5 mm			

± = thickness

material	brass, 6 μm Sn
-----------------	----------------

Plugs

- made from re-usable, heat- and flux-resistant material
- prevent solder from flushing unused holes in PCBs

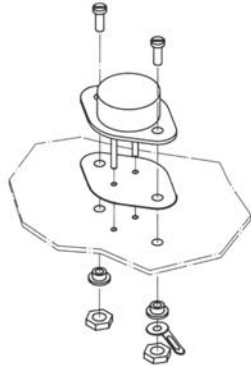
						
art. no.	dim. [mm]					
	D1	D2	A	max. diameter of the bushing	B	L
LOS 04	1.0	4.1	7.9	2.5	5.6	15.1
LOS 05	2.3	5.3	7.9	3.8	5.6	15.1
LOS 06	3.6	6.6	7.9	5.1	5.6	15.1

Solder terminals → E 35
 Distance sleeves for PCB's in HP grid → E 31
 Spacers → E 32 – 33
 Insulating clamping parts → E 38

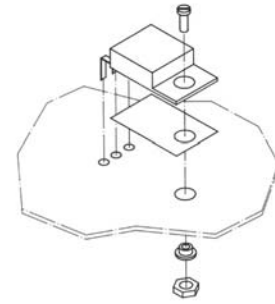
Miniature distance sleeves → E 26
 Mounting material for semiconduct. → E 37 – 41
 Mounting parts for heatsinks → E 42 – 43
 Extruded heatsinks → A 22 – 85

Mounting kits for insulation of power transistors

**MST 3
MSTS 3**



**MST 220
MSTS 220**



art. no.	for transistor	version	contents of delivery
MST 3	TO 3	with mica wafer GS 3	1 mica wafer, 2 insulator sleeves, 1 tin-plated solder lug, 2 cheese head screws, nickel-plated, 2 screw nuts M 3 nickel-plated
MSTS 3	TO 3	with silicone wafer WS 3	1 silicone wafer, 2 insulator sleeves, 1 tin-plated solder lug, 2 cheese head screws, nickel-plated, 2 screw nuts M 3 nickel-plated
MST 220	TO 220	with mica wafer GS 220	1 mica wafer, 1 tin-plated solder lug, 1 cheese head screw, nickel-plated, 1 screw nut M 3 nickel-plated
MSTS 220	TO 220	with silicone wafer WS 220	1 silicone wafer, 1 insulator sleeve, 1 tin-plated solder lug, 1 cheese head screw, nickel-plated, 1 screw nut M 3 nickel-plated

Snap rivet for quick fastening of TO 220

- detachable plastic snap rivet for quick fastening of transistors onto heatsinks and cooling plates (e.g. FK 212-CB, FK 216-CB, FK 222-220, FK 232, FK 233, FK 235-L 1)
- suitable for material thickness: 1.0 – 1.5 mm
- suitable for hole diameter: 3.5 – 4.0 mm

art. no.	for transistor		
EPN 1	TO 220		

* = bottom view. Pin not inserted

material	polysulphone, GF reinforced
temperature range	-70 °C ... +180 ° (5 sec. +260 °C)
flammability	UL 94 V-0

E 37

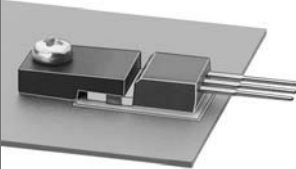
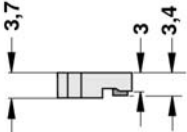
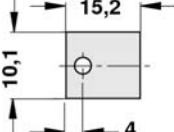
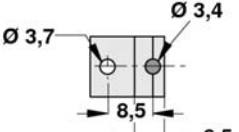
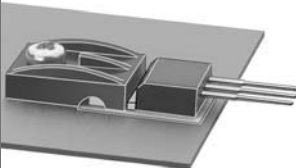
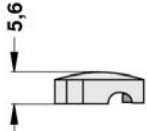
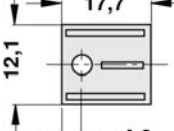
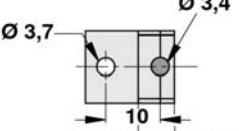
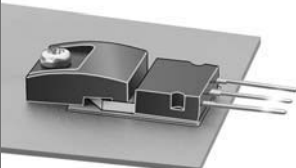
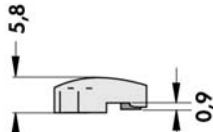
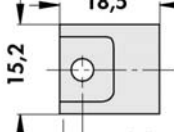
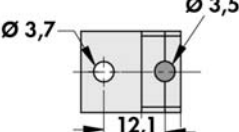
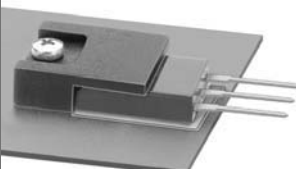
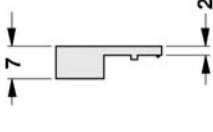
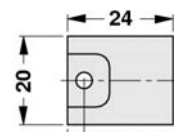
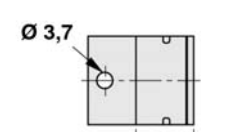
Distance sleeves for PCB's in HP grid → E 31
 Spacers → E 32 – 33
 Guide rails for PCBs → E 17 – 22
 Clamp fixing for DIN-rail → E 16

Mounting parts for heatsinks → E 42 – 43
 Thermal conductive material → E 2 – 15
 Profiles for PCB mounting → A 90 – 111
 Profiles for PCB components → A 92

Insulating clamping parts for power transistors

Plastic insulating clamping parts for mounting transistors in cases TO 220, TO 218 and TO 247 for enhanced dielectric strengths

- electrically insulating assembly of the transistor by means of a plastic clamping part
- pin with a reaching into the hole of the transistor plate
- fastening of clamping part onto the mounting plate by screws, no electroinsulating connection to the transistor
- dielectric strength only determined by the insulating washer between transistor and mounting surface
- no insulating bush necessary, thus no dielectric breakdown

art. no. ISP 220				
art. no. ISP 220 V				
art. no. ISP 218				
art. no. ISP 247				

material	polyamide, GF reinforced
heat distortion	205(1,8 MPa) 135(8 MPa)
dielectric strength	>27 KV/mm
dielectric constant	8 [100 Hz] 4,5 [1 MHz]
dielectric loss factor	1300 [100 Hz] 450 [1 MHz]
specific volume resistance	>10 ¹³ Ω/cm
colour	black
flammability	UL 94 V-0

Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Thermal conductive material

→ A 92
→ A 90
→ A 90 – 111
→ E 2 – 15

Insulating distance sleeves
Vibration dampers
Aluminium oxide wafers
Snap rivet

→ E 24 – 26
→ E 34
→ E 9 – 10
→ E 37

E 38

A

B

C

D

E

F

G

H

I

K

L

M

N

Mounts

art. no. MS 53 3 TO 5	art. no. MS 53 7 TO 5	art. no. MS 53 25 TO 5	art. no. MS 54 25 TO 5	art. no. MS 58 5 TO 5-8 p.
art. no. MS 58 7 TO 5-8 p.	art. no. MS 56 15 TO 5-6 p.	art. no. MS 58 15 TO 5-8 p.	art. no. MS 510 15 TO 5-10 p.	art. no. MS 3518 25 TO 5/ TO 18
art. no. MS 3518 35 TO 5/ TO 18	art. no. MS 34 518 TO 5 / TO 18	art. no. MS 183 25 TO 18	art. no. MS 184 25 TO 18	art. no. MS 183 35 TO 18
art. no. MS 184 35 TO 18	art. no. MS 183 7 TO 18	art. no. MS 184 7 TO 18	art. no. MS 84 4 TO 8	art. no. MS 923 25 TO 92
art. no. MS 4016 max. 16 contacts	art. no. US 58 4 TO 5	art. no. US 512 4 TO 5		

* = **mounting pads**: the US-pads convert the TO 5 pin circle to a pitch of .1".

material	polyamide 6, GF reinforced
temperature range	-40 °C ... +205 °C
flammability	UL 94 V-0 (at thickness ≥ 3 mm), UL 94 V-1

E 39

Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Thermal conductive material

→ A 92
→ A 90
→ A 90 - 111
→ E 2 - 15

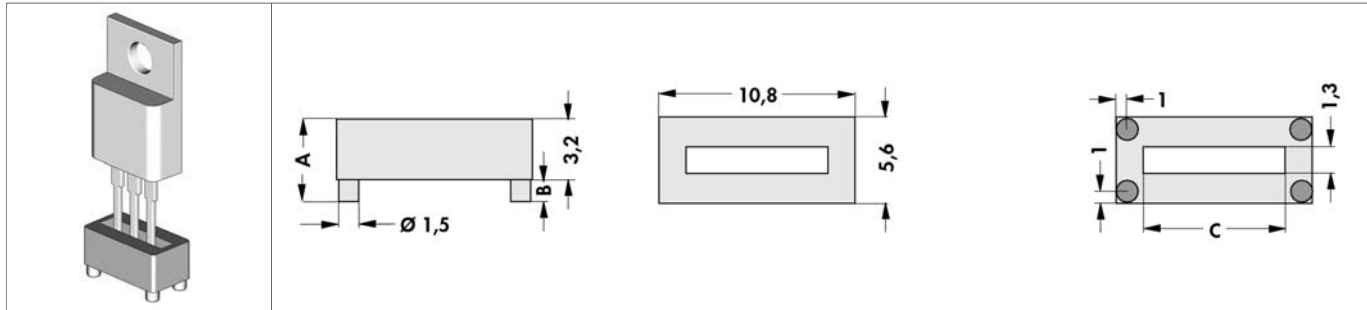
Insulating distance sleeves
Vibration dampers
Aluminium oxide wafers
Snap rivet

→ E 24 - 26
→ E 34
→ E 9 - 10
→ E 37

Mounts

Mounts for power transistors

for TO 220, TO 219, TO 202 and similar; **for vertical and horizontal mounting**; also suitable as mounting bracket for angled connections

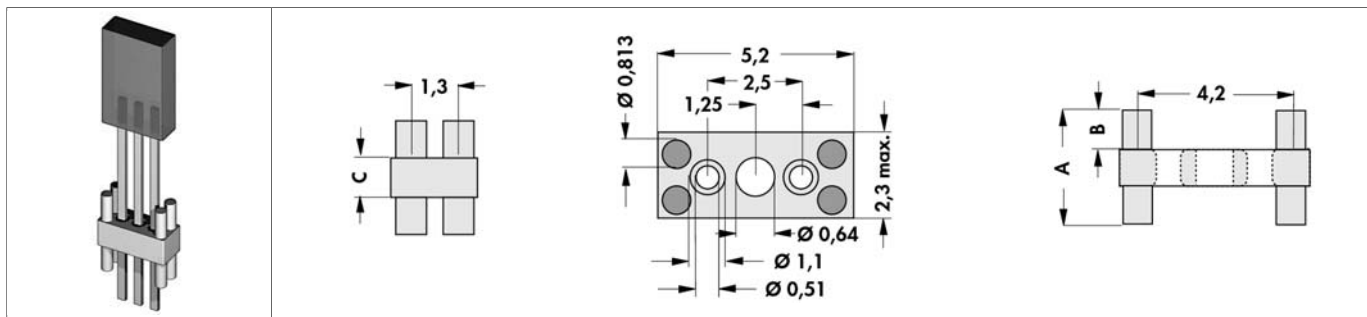


art. no.	colour	dim. [mm]		
		A	B	C
MLW 32	white	3.2	–	7.1
MLW 38	white	3.8	0.64	7.1
MLW 44	white	4.4	1.30	7.1
MLW 51	white	5.1	1.90	7.1
MLB 32	black	3.2	–	6.5
MLB 38	black	3.8	0.64	6.5
MLB 44	black	4.4	1.30	6.5
MLB 51	black	5.1	1.90	6.5

material	polyamide 6 (nylon)
temperature range	-40 ... +120
flammability	UL 94 V-2

Mounts for rectangular LEDs

for LED 2x4 mm oder 2x5 mm; **symmetric version for easy assembly**; self-adhesive



art. no.	dim. [mm]		
	A	B	C
MRL 20	2.0	0.5	1.0
MRL 30	3.0	1.0	1.0
MRL 41	4.1	1.5	1.0
MRL 51	5.1	2.0	1.0
MRL 61	6.1	1.1	3.8
MRL 71	7.1	1.7	3.8
MRL 81	8.1	2.2	3.8
MRL 89	8.9	2.5	3.8

material	polyamide 6 (nylon), white
temperature range	-40 ... +120
flammability	UL 94 V-2

Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Thermal conductive material

→ A 92
→ A 90
→ A 90 – 111
→ E 2 – 15

Insulating distance sleeves
Vibration dampers
Aluminium oxide wafers
Snap rivet

→ E 24 – 26
→ E 34
→ E 9 – 10
→ E 37

E 40

A

B

C

D

E

F

G

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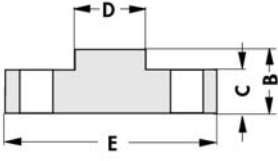
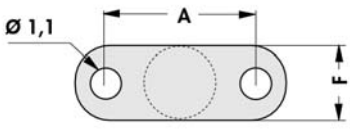
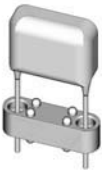
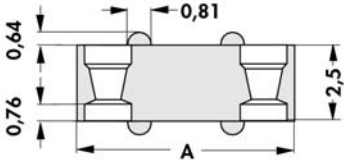
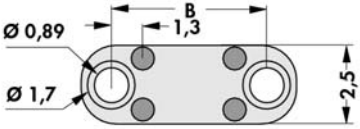

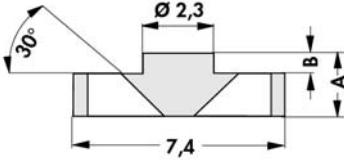
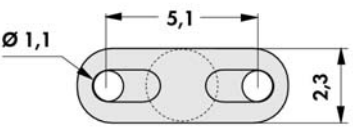
M

N

Mounts

Mounts for discrete components

suitable for various components e.g. resistors, capacitors etc.

						
art. no.	dim. [mm]					
	A	B	C	D	E	F
MD A 04	2.5	1.1	0.55	1.3	4.6	2.3
MD A 06	3.8	1.1	0.55	2.3	6.9	3.2
MD A 07	5.1	1.1	0.55	2.3	7.4	2.3
MD A 08	6.4	1.1	0.66	2.3	8.6	2.3
MD A 09	7.6	1.1	0.66	3.6	9.9	2.3
MD A 12	10.2	1.1	0.76	4.8	12.4	2.3
						
art. no.	dim. [mm]					
	A			B		
MD B 07	7.6			5.1		
MD B 08	8.9			6.4		
MD B 10	10.2			7.6		
MD B 11	11.4			8.9		
MD B 12	12.7			10.2		
MD B 15	15.2			12.7		
						
art. no.	dim. [mm]					
	A			B		
MD C 13	1.3			-		
MD C 18	1.8			0.56		
MD C 22	2.2			0.89		
material	polyamide 6 (nylon)					
temperature range	-30 ... +110					
flammability	UL 94 V-2					

E 41


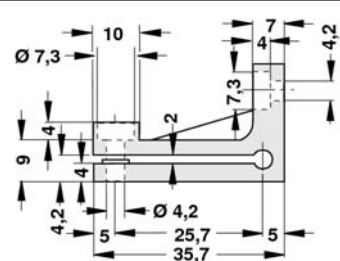
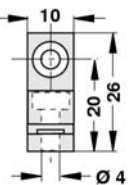

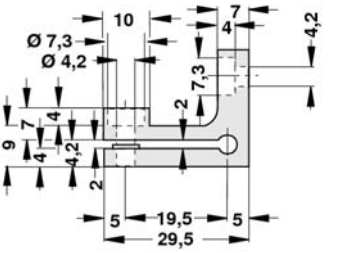
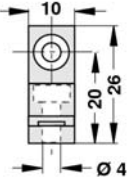

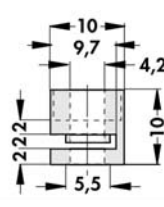
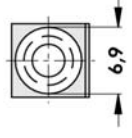

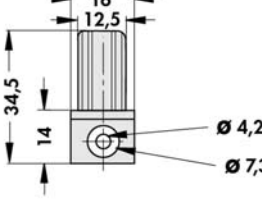
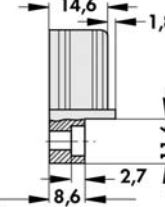

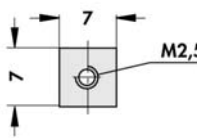
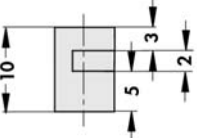
Profiles for PCB components
Heatsinks for PCB
Profiles for PCB mounting
Thermal conductive material

→ A 92
→ A 90
→ A 90 - 111
→ E 2 - 15

Insulating distance sleeves
Vibration dampers
Aluminium oxide wafers
Snap rivet

→ E 24 - 26
→ E 34
→ E 9 - 10
→ E 37

Mounting parts for heatsinks

art. no. IS 1			
for SK 01, 02, 03, 11, 14, 21, 30, 34, 36, 39, 46, 69; heatsink length: 50 mm			
art. no. IS 2			
for SK 01, 02, 03, 11, 14, 21, 30, 34, 36, 39, 46, 69; heatsink length: 37,5 75 100 mm			
art. no. IS 3			
for SK 01, 02, 03, 11, 14, 21, 30, 34, 36, 39, 46, 69			
art. no. IS 4			
for SK 06			
art. no. IS 5			
for SK 20			

material	polyamide 6, GF reinforced
flammability	UL 94 V-0

Heatsink profile-overview
 Profiles for PCB mounting
 Heatsinks for PCB
 Insulating distance sleeves

→ A 13 - 16
 → A 90 - 111
 → A 90
 → E 24 - 26

Insulating clamping parts → E 38
 Mounting pads for transistors → E 40
 Mounting pads for single components → E 41
 Mounting material for semiconduct. → E 37 - 41

E 42

A

B

C

D

E

F

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A

Mounting parts for heatsinks

B

C

D

E

F

G

H

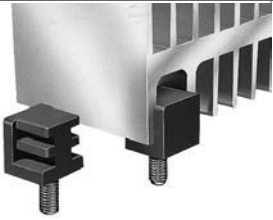
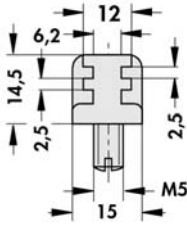
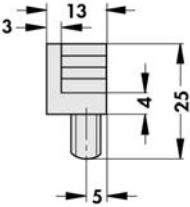

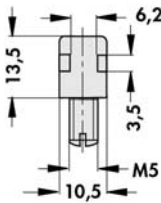
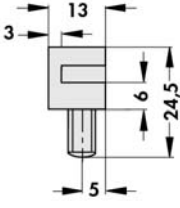
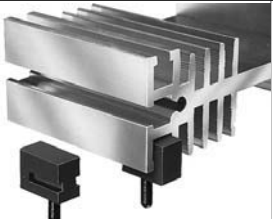
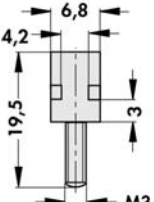
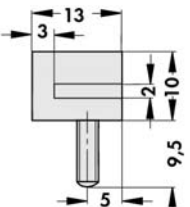
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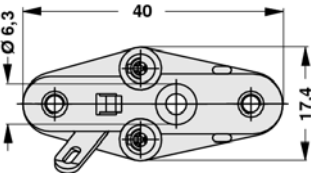
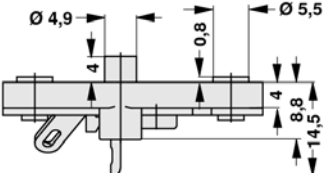
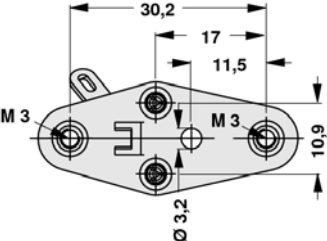
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art. no.			
IS 6	for SK 67		
art. no.			
IS 7	for SK 70		
art. no.			
IS 8	for SK 20		
material	polyamide 6, GF reinforced		
flammability	UL 94 V-0		

Sockets for power transistors TO 3


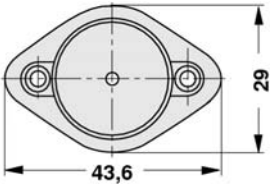
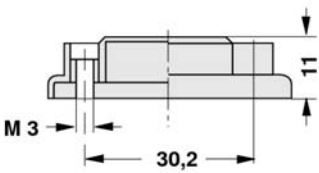

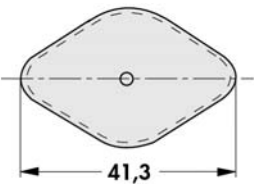
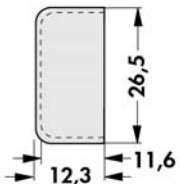
			
art. no.	dim. [mm] number of contacts		
TF 3 2	3		
insulator	PCT, glassfibre filled		
contact	beryllium copper; 4 ... 6 μm Sn		
current rating	15 A max.		
contact resistance	<10 mΩ		
temperature range	-65 °C ... +290 °C		
insulation resistance	>10 ¹⁰ Ω/cm		
capacity	1 pF		
test voltage	1650 V		

E 43
Heatsink profile-overview
Profiles for PCB mounting
Heatsinks for PCB
Insulating distance sleeves
→ A 13 - 16
→ A 90 - 111
→ A 90
→ E 24 - 26
Insulating clamping parts
Mounting pads for transistors
Mounting pads for single components
Mounting material for semiconduct.
→ E 38
→ E 40
→ E 41
→ E 37 - 41

Insulating caps and insulator sleeves

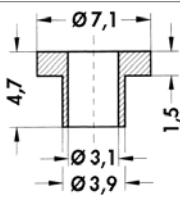
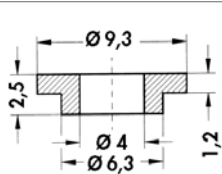
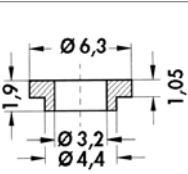
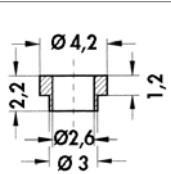
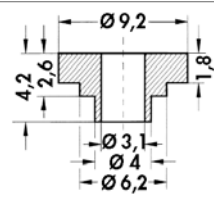
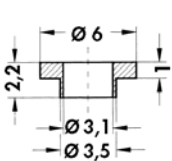
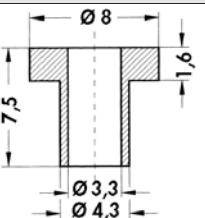
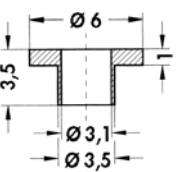
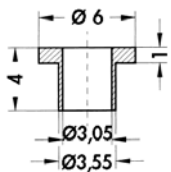
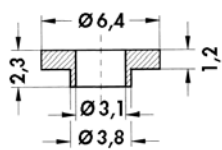
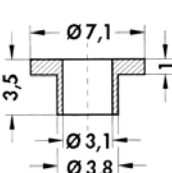
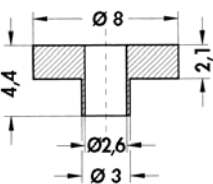
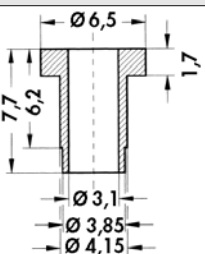
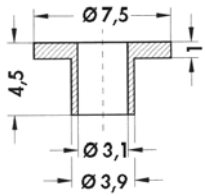
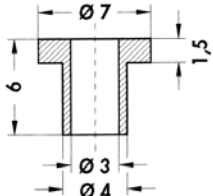
Insulating caps

different transistor flange levels will be compensated by the impressed sleeves

art. no.			
IK 341 3			
art. no.			
IK 3			

material	polyamide, GF reinforced (caps)
pressed-in sleeves	brass, nickel-plated
flammability	UL 94 V-0

Insulator sleeves

				
art. no. IB 1 / IBT 1	art. no. IB 2 / IBT 2	art. no. IB 3 / IBT 3	art. no. IB 4 / IBT 4	art. no. IB 5 / IBT 5
				
art. no. IB 6 / IBT 6	art. no. IB 7 / IBT 7	art. no. IB 8 / IBT 8	art. no. IB 9 / IBT 9	art. no. IB 10 / IBT 10
				
art. no. IB 11 / IBT 11	art. no. IB 12 / IBT 12	art. no. IB 13 / IBT 13	art. no. IB 14 / IBT 14	art. no. IB 15 / IBT 15

	IB 1 - IB 7	IB 8 - IB 15	IBT 1 - IBT 15
material	polyamide 4.6, GF reinforced	thermoplastic resin	PTFE (teflon)
form stability	-40 °C ... +163 °C	-10 °C ... +200 °C	-260 °C ... +250 °C
dielectric strength	>30 KV/mm	>38 KV/mm	>40 KV/mm
flammability	UL 94 V-0	accordant UL 94 V-0	UL 94 V-0

Mica wafers
Thermal conductive material
Mounting for TO 3 angle
Kapton insulator washers

→ E 11
→ E 2 - 4
→ A 123
→ E 8

Aluminium oxide wafers
Thermal conductive paste
Thermal conductive glue
Distance sleeves

→ E 9 - 10
→ E 13
→ E 15
→ E 24 - 25

E 44

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