

Handling Instruction

for **MiniSKiiP®**



This handling instruction is valid for all types of **MiniSKiiP®** modules.


					Handling Instruction	
					V23990-K-M118-* -31	Page 1 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

Table of contents:

1. PCB Specification for the MiniSKiiP® contact system 3

2. Assembly Instructions 3

 2.1 Preparation, surface specification 3

 2.1.1 Heat sink 3

 2.1.2 Mounting surface 4

 2.1.3 Spring contact specification 6

 2.2 Assembly 6

 2.2.1 Application of thermal paste 6

 2.2.2 Pre-applied thermal paste 7

 2.2.3 Mounting the MiniSKiiP® 9

 2.2.4 Mounting material 10

3 Storage Conditions 10

4 ESD protection 10

5 Disclaimer 10

Table of figures:

Fig. 2.1 Heat sink surface specification 3

Fig. 2.2 DCB with fingerprints or discoloration 4

Fig. 2.3 Bottom Surface of DBC after rework 4

Fig. 2.4 Scratches on the MiniSKiiP® bottom surface 5

Fig. 2.5 Etching hole (hole reaching down to substrate level) in the MiniSKiiP® bottom surface 5

Fig. 2.6 Etching hole (hole not reaching down to substrate level) in the MiniSKiiP® bottom surface 5

Fig 2.7 Variance of the DBC position 6


Fig 2.8: Spring overlay 6

Fig. 2.9: Module with pre-applied thermal paste (normal pattern) 7

Fig. 2.10: Variable honeycomb pattern 7

Fig. 2.11- 2.16: Defects in the thermal paste structure 8

Fig.2.17: Skin effect on thermal paste 8

					Handling Instruction	
					V23990-K-M118-* -31	Page 2 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

1. PCB Specification for the MiniSKiiP® contact system

The material combination between the MiniSKiiP® spring surface and the corresponding contact pad surface of the PCB has an influence to the contact resistance for different currents. Tin Lead alloy (SnPb) is an approved interface for application with MiniSKiiP® modules. A sufficient plating thickness has to be ensured according to PCB manufacturing process. In order to apply with RoHS rules the use of the following PCB finish materials can be recommended:

- Nickel Gold flash (NiAu)
- Hot Air Leveling Tin (HAL Sn)
- Chemical Tin (Chem.l Sn)

Not recommended for use are boards with OSP (organic solderability preservatives) passivation. OSP is not suitable to guarantee a long term corrosion free contact. The OSP passivation is disappearing nearly 100% after a solder process or after 6 month storage.

2. Assembly Instructions

2.1 Preparation, surface specification

To obtain the maximum thermal conductivity of the module, heat sink and module must fulfill the following specifications.

2.1.1 Heat sink

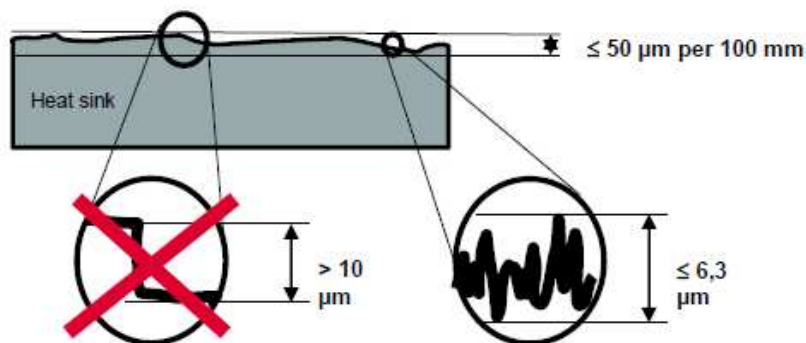



Fig. 2.1 Heat sink surface specification

- Heat sink must be free from grease and particles
- Unevenness of heat sink mounting area must be $\leq 50 \mu\text{m}$ per 100 mm (DIN EN ISO 1101)
- $RZ \leq 6.3 \mu\text{m}$ (DIN EN ISO 4287)
- No steps $> 10 \mu\text{m}$ (DIN EN ISO 4287)

					Handling Instruction	
					V23990-K-M118-* -31	Page 3 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

2.1.2 Mounting surface

The mounting surface of MiniSKiiP® module must be free from grease and all kind of particles. MiniSKiiP® is using DBC without finishing or with gold flash finish (NiAu). Fingerprints or discolorations (Fig. 2.2) on the bottom side of the DBC do not affect the thermal behavior and can not be rated as a failure criteria.

Due to rework or a second cleaning process, there might be imperfections of the NiAu flash on the bottom side of the DBC. An imperfection on the NiAu flash does not affect the thermal behavior (Fig 2.3). The NiAu flash is only required on the top side of the DBC serving the function of spring landing pads. The bottom side is only gold flashed due to the flash process. A single side flash would be much more costly to realize.

Due to the manufacturing process, the bottom side of the MiniSKiiP® may exhibit scratches, holes or similar marks. The following figures are defining surface characteristics, which do not affect the thermal behavior. Distortions with higher values as specified can be rated as failure.

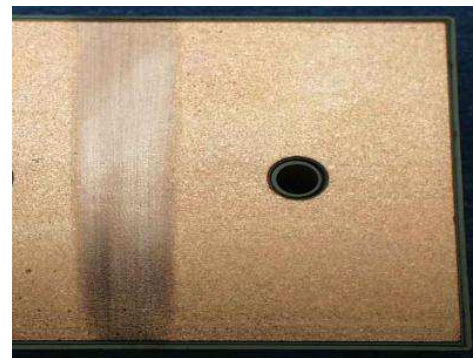
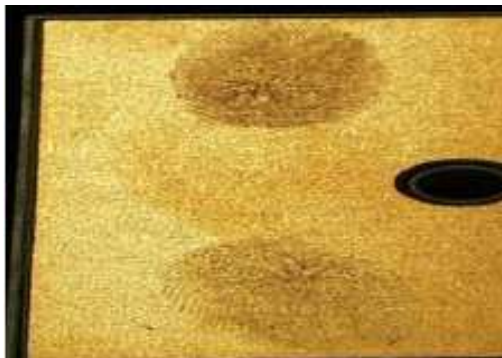



Fig. 2.2 DCB with fingerprints or discoloration



Fig. 2.3 Bottom Surface of DCB after rework

					Handling Instruction	
					V23990-K-M118-* -31	Page 4 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

The MiniSKiiP® bottom surface must in any case comply with the following specification (Fig 2.4 to Fig. 2.6)

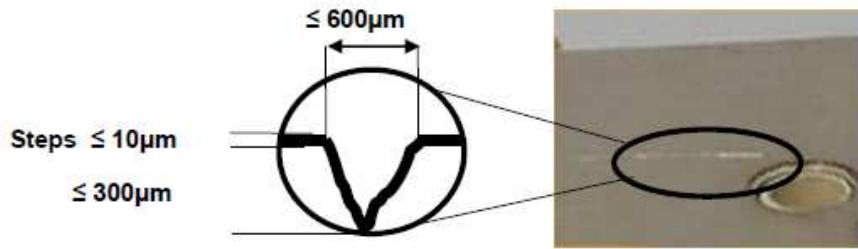


Fig. 2.4 Scratches on the MiniSKiiP® bottom surface

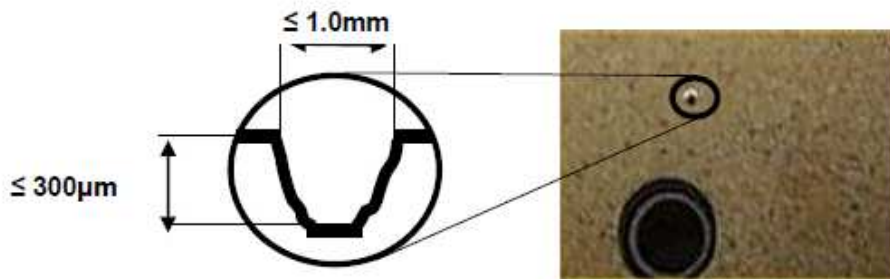


Fig. 2.5 Etching hole (hole reaching down to substrate level) in the MiniSKiiP® bottom surface

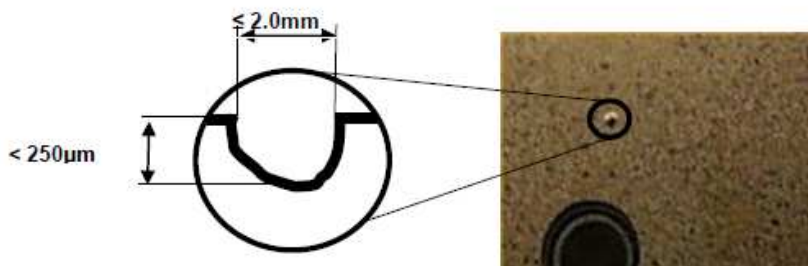
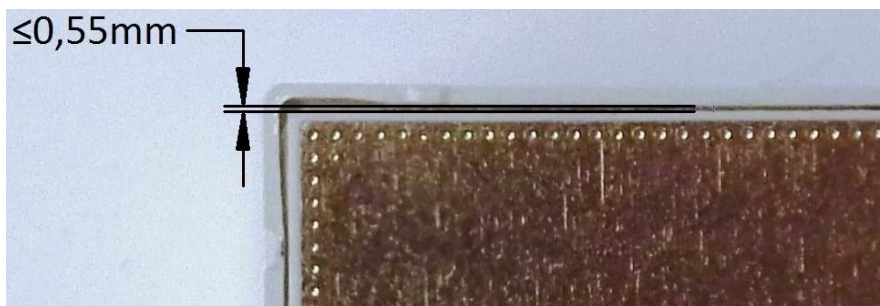


Fig. 2.6 Etching hole (hole not reaching down to substrate level) in the MiniSKiiP® bottom surface

Etched dimples on the edge of the DBC reducing stress between the copper layer and the ceramic substrate. Usually dimples have a diameter of approximately $\varnothing \approx 0.6$ mm and a depth of approximately 0.3 mm. Since dimples are never below any IGBT- or Diode chip, there is no influence on the thermal resistance. Due to the manufacturing process, the position of substrate in the plastic housing may vary. The maximum tolerable gap between housing and substrate is 0.55 mm (Fig 2.7).



					Handling Instruction	
					V23990-K-M118-* -31	Page 5 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

Fig 2.7 Variance of the DBC position

2.1.3 Spring contact specification

- To ensure a proper contact after mounting the dimension for the spring standing out of the housing is min.: 1,1 mm (Fig. 2.8) measured from the top surface to the head of the spring. (Typ. value: 1,35mm)
- The base material of the spring is a high-performance copper alloy and no spring fatigue expected over the complete MiniSKiiP® lifetime.
- For proper functionality the spring contacts must not be contaminated by oil, sweat or other substances.
- Do not touch the spring surface with bare fingers! For this reason Vincotech recommends to wear gloves during the handling of the MiniSKiiP® modules. Do not use any contact spray or other chemicals on the springs!

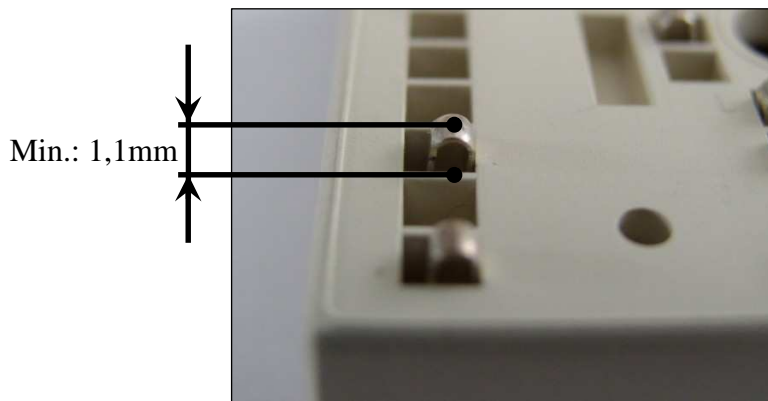



Fig 2.8: Spring overlay

2.2 Assembly

2.2.1 Application of thermal paste

A thin layer of thermal paste should be applied on the heat sink surface or module bottom surface. VINCOTECH recommends screen printing for applying the thermal paste. The screen printing process offers reproducibility and accuracy of the thickness of the paste. Applying paste by a hard rubber roller might be applicable but usually has to be handled with extra care for acceptable results. A thickness check should be done though to verify the thermal paste thickness. The following values are recommended for „Silicone Paste P 12” from WACKER CHEMIE:

MiniSKiiP® 0:	30 µm – 50 µm
MiniSKiiP® 1:	30 µm – 50 µm
MiniSKiiP® 2:	55 µm – 75 µm
MiniSKiiP® 3:	55 µm – 75 µm

					Handling Instruction	
					V23990-K-M118-* -31	Page 6 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

2.2.2 Pre-applied thermal paste

VINCOTECH offers the MiniSKiiP® module with pre-applied thermal paste to simplify the module assembly process. The thermal paste is applied to the modules by VINCOTECH prior to delivery to the customer, thus eliminating this critical process step from the customer's manufacturing process. In this way, assembly is more efficient, reproducible and controllable. (The thermal paste layer is applied to the module in an automated, monitored screen-printing process in an optimum thickness.)

There is two different pattern type used at VINCOTECH:

- normal honeycomb pattern (Fig. 2.9)
- variable honeycomb pattern (Fig. 2.10)



Fig. 2.9: Module with pre-applied thermal paste (normal pattern)

The following types of MiniSKiiP® modules requires a special hexagon screen printing form (Fig. 2.10). (If the screen printig process at the customer is required, than for an accurate CAD file (.dxf) of this screen type please contact your sales manager.)

- V23990-K42x
- V23990-K43x

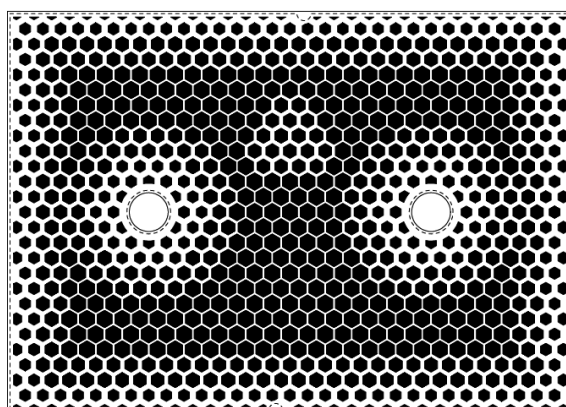



Fig. 2.10: Variable honeycomb pattern

					Handling Instruction	
					V23990-K-M118-* -31	Page 7 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

Due to the automated screen-printing process, the following slight deviations may occur but have no influence on the mounting process or the thermal properties.

- slight variations in print positioning
- slight defects in the thermal paste structure (Fig. 2.11-2.15)
- slight sub-surface migration (Fig. 2.16)

The maximum permissible deviation in size from the honeycomb structure is 5%.



Fig. 2.11



Fig. 2.12



Fig. 2.13



Fig. 2.14



Fig. 2.15

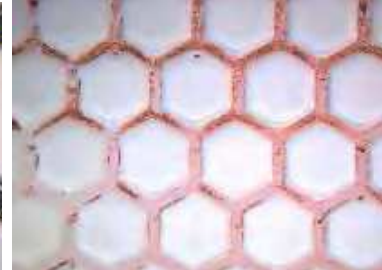


Fig. 2.16

If the modules are stored or transported (see also „Storage conditions” at page 10) at high temperatures (<math><60^{\circ}\text{C}</math>) and high humidity (>85%), a thin skin may form on the surface of the thermal paste layer (Fig. 2.17). This variation has no influence on the thermal properties of the module or the functional behavior of the thermal grease.




Fig.2.17: Skin effect on thermal paste

Always observe the thermal paste manufacturer’s specifications as set down in the safety data sheet. The latest versions can be found on the following sites:

Wacker P12:

<<http://www.drawin.de/dasat/index.php?cid=100153&conid=0&sid=dasat>>


					Handling Instruction	
					V23990-K-M118-* -31	Page 8 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

2.2.3 Mounting the MiniSKiiP®

- Place the MiniSKiiP® on the appropriate heat sink area and tighten the screw with the nominal torque: $2.0 \text{ Nm} < M < 2.5 \text{ Nm}$.
- In case of a MiniSKiiP® 3 type with two screws, first tighten both screws with max. 1 Nm and then continue with nominal torque ($2.0 \text{ Nm} < M < 2.5 \text{ Nm}$).
- The use of an electric power screwdriver is recommended over a pneumatic tool. The specified screw parameters are better adjustable and especially the final torque will be reached more smoothly. With pneumatic systems, a shock and a higher torque overshoot by reaching the final (preset) torque due to the behavior of the clutch can be seen.
- A limitation of the mounting screw velocity is recommended to allow the thermal paste to flow and distribute equally, especially if a more dense paste is used. If tightened with higher velocity the ceramic may develop cracks due to the inability of the paste to flow as fast as necessary and therefore causing an uneven surface. The values below are valid for Wacker P12 thermal paste and use of an electric drilling tool.
- The maximum screw velocity for tightening should not exceed 250 rpm. A soft level out (no torque overshoot) will reduce the stress even further and is preferable.
- Due to relaxation of the housing and flow of thermal paste, the loosening torque will be reduced. A value of 1 Nm is still sufficient to ensure a proper thermal contact. The design of the housing, the elastic bending of the metal plate in the pressure lid and the adhesion of the thermal paste still ensure electrical contact and sufficient thermal coupling from module to heat sink.

Important: Do not re-tighten the screw to nominal mounting torque value again! A retightening of the screws will put DBC, housing and springs under stress.

- For rework or test purposes pressure lid and PCB can be disassembled from the MiniSKiiP® module and can be remounted or replaced. If the module was placed on the wrong position of the heat sink, it could be removed and placed correctly, as long as the module has not been screwed to the heat sink. It is possible to remove it with necessary diligence, as the thermal paste causes high adhesion. After the removal, all thermal paste has to be removed carefully from the module as well as from the heat sink. Alcohol can be used for cleaning.
- If the MiniSKiiP® was assembled for some time, the pressure system has already relaxed. Even though the MiniSKiiP® can be re-assembled, the pressure distribution on the power hybrid might have changed compared to a new module, which can lead to different thermal resistance values compared to those given in the data sheet.

					Handling Instruction	
					V23990-K-M118-* -31	Page 9 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		

2.2.4 Mounting material

Recommendation for mounting screw:
M4 according to DIN 7991 - 8.8, or similar screw with TORX-head.

Strength of screw: "8.8"

Tensile strength $R_m = 800 \text{ N / mm}^2$

Yield point $R_e = 640 \text{ N / mm}^2$

The minimum depth of the screw in the heat sink is 6.0 mm.

3 Storage Conditions

- **Unassembled** 20 000 h /60 °C 95% RH

Modules with pre-applied phase change material:

13 000 h / -25°C<T<60°C 10%<RH< 95%.

- **Assembled** 20 000 h /60 °C 95% RH

After extreme humidity the reverse current limits may be exceeded but do not degrade the performance of the MiniSKiiP®.

4 ESD protection


Modules are sensitive to electrostatic discharge, because such a discharge can damage or destroy the sensitive chips. All modules are ESD protected in the shipment box by conductive plastic trays. During the handling and assembly of the modules it is recommended to wear a conductive grounded wristlet and ensure conductive grounded working place.

5 Disclaimer

The information within this document does not substitute customer's own tests, because the circumstances of the application cannot be controlled by Vincotech.

The content of this document is according to today's standards and knowledge and written up with necessary care.

MiniSKiiP® is a trademark of SEMIKRON Elektronik GmbH & Co. KG

					Handling Instruction	
					V23990-K-M118-* -31	Page 10 / 10
03	modified housing; doc. update	09.12.2011.	Nabilek J.	Óri A.		
Ver	Alteration	Date	Des. / Mod.	Appr.		