SKiM®

IGBT Modules

Mounting Instructions

Version 1.3 / July 2011

1 Preparation, Surface Specifications

To obtain the maximum thermal conductivity the underside of the module must be free from grease and particles. Further, the contact springs have to be clean and should never come into contact with hands to ensure a reliable electrical contact over the long-term.

The heat sink must fulfil the following specifications:

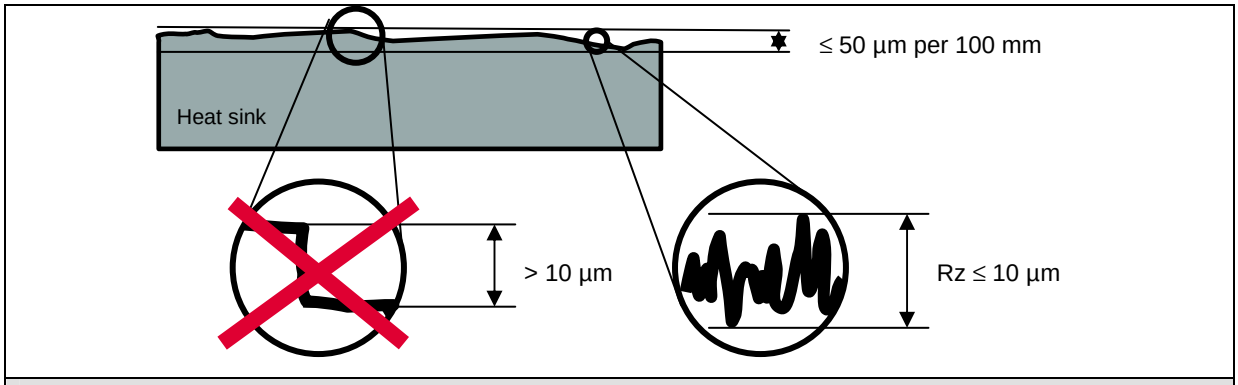

Fig. 1-1 Heat sink surface specifications

- Uneveness of heat sink mounting area must be ≤ 50µm per 100 mm (DIN EN ISO 1101)
- Roughness “Rz” ≤ 10 µm (DIN EN ISO 4287)
- No steps > 10 µm (DIN EN ISO 4287)

Surface of heat sink should be free of grease, e.g. by cleaning the heat sink in a fat-dissolving solvent. A good indication is given by the DIN 53364, surface tension ≥ 32 mN / m. Tap holes must free of turnings. The supplier of the heat sinks should chose adequate packaging to avoid contamination and mechanical damage during transport.

2 Assembly

Before setting up the electrical connection (including any electrical incoming test), the module must first be mounted onto the heat sink as described as follows. The mounting of the pressure part (cf. section 2.2) establishes the electrical connection for the main terminals. The mounting of the printed circuit board as described in 2.6 provides to a safe connection of the auxiliary springs.

2.1 Application of Thermal Paste

As a standard, the SKiM 63-93 modules come with pre-applied silicone paste (P12 WACKER CHEMIE). A 21 +- 6µm thick paste layer is applied by a screen printing process, which was optimized for the SKiM 63-93 modules.

2.2 Mounting the Pressure Part to the Heat Sink

Recommended

- gloves (e.g. Nylon with PU fingertips)
- bouffant caps

Before mounting, the heat sink surface must be cleaned. Well proven is the usage of a tissue (WYPALLx70 Kimberly-Clark) and Isopranol.

The SKiM is mounted to the heat sink in two steps. The first step is to mount the pressure part. In this step both the electrical and the thermal connections are established. This means that if the pressure part is not mounted to a heat sink, the SKiM module will not work properly.

Before mounting, remove the ESD-cover. **Caution: after removal of the ESD-cover, the SKiM module must not be turned up-side down until the PCB board is mounted (see section 2.6).** Otherwise the auxiliary contact springs may drop out of the spring domes.

The SKiM has to be placed on to the appropriate heat sink area from above. During the entire mounting process, the module must not be moved on the heat sink, not even for minor adjustments. SEMIKRON therefore recommends introducing a guidance tool for the assembly process.

After the module has been positioned on the heat sink, the screws have to be pre-tightened. Then the mounting torque M_s has to be applied. Pre-tightening and final tightening has to be done in the order given in Fig. 2-2. During the assembly process the thermal paste will spread evenly, meaning that reliable and homogeneous thermal contact is achieved.

SEMIKRON recommends the following screw (according to DIN EN ISO 898-1)

- M4 - 8.8
- Strength of screw: “8.8”
  = Tensile strength - Rm = 800 N / mm²
  = Yield point - Re = 640 N / mm²
- To comply with the creepage and clearance distances for 1200 V, the height of the screw head must not exceed 4 mm.
- No washers are needed.

Assembly steps

- Pre-tightening torque ≤ 1.5 Nm
- The mounting torque has to be between min. 2.5 Nm and max. 4.0 Nm
  (SEMIKRON recommends the following settings for the automated screw driver: 3.0 Nm – 3.5 Nm)
- The screws for the pressure part have to be assembled in the order described in Fig. 2-2.

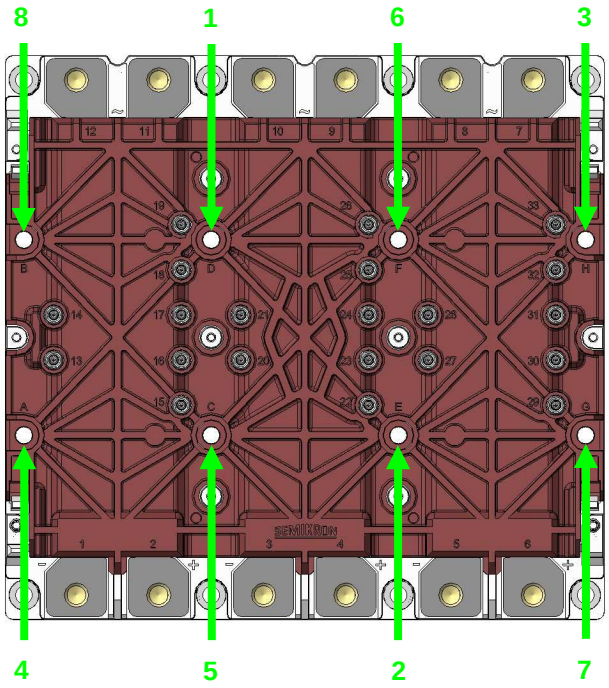

Fig. 2-1 Assembly order for screws for the pressure part of SKiM (assembly to heat sink)

Case to Heat Sink Assembly

The second mounting step is to fix the outer module case on the heat sink. This is recommended especially for high shock and vibration environments.

Since the module itself is already mounted (see previous section), this process step is simpler: No guidance tool is necessary nor is pre-tightening. The mounting torque M_s, as well as the recommendations for the screw type (diameter, strength, head type) are the same as for section 2.2. Only the length might be adapted as desired.

The screws for the pressure part have to be assembled in the order described in Fig. 2-3.

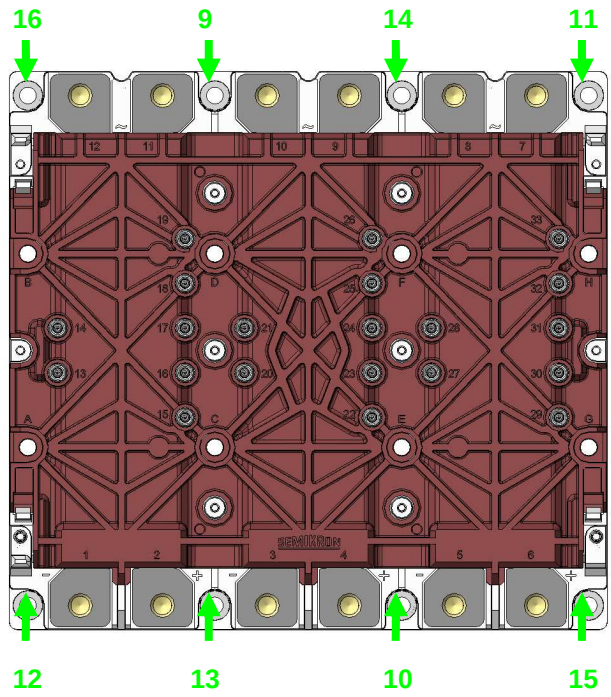

Fig. 2-2 Assembly order for screws for the SKiM case (assembly to heat sink)

2.3 Mounting to the Main Terminals

SKiM is a power electronic module and not a part of the mechanical construction. The maximum forces which must not be exceeded are given in Fig. 2-3. It is necessary to arrange additional mechanical supports.

For the DC link connection it is better to apply a slight pressure force in –Z direction than pull forces in +Z direction. Nevertheless, the SKiM module is still not meant to support the DC link, which is why additional mechanical components have to be used. Mechanical support also has to be provided for the AC connection (e.g. motor cables) in order to protect the module from mechanical forces and unnecessary vibration stress.

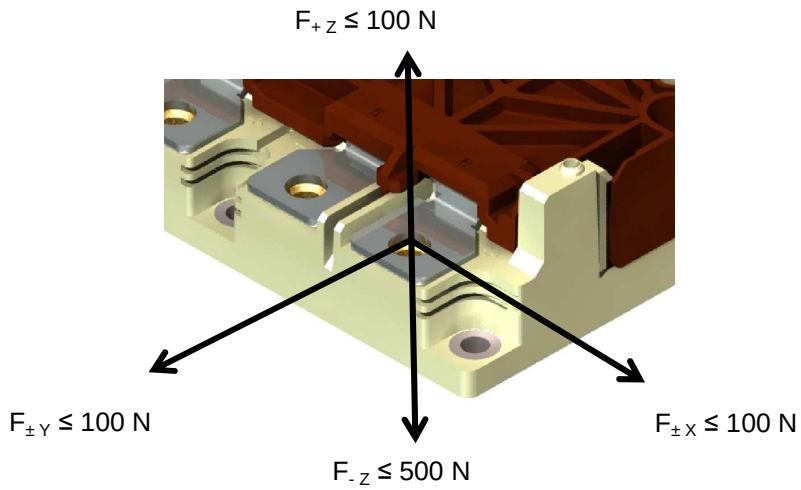

Fig. 2-3 Maximum forces at the main terminals

SEMIKRON recommends the following screw (according to DIN EN ISO 898-1)

- M6 - 8.8
- Strength of screw: “8.8”
  = Tensile strength - R_m = 800 N / mm²
  = Yield point - R_e = 640 N / mm²
- The depth of the screw in the module has to be between min. 6.0 mm and max. 8.5 mm.
- The mounting torque has to be between min. 6.0 Nm and max. 8.0 Nm

2.4 Paralleling of AC Terminals

Inside the SKiM module the two AC terminals are paralleled as shown in Fig. 2-4. This means it is not necessary to connect both terminals. With just one screw the terminal can conduct the maximum terminal current $I_{t(RMS)}$ as given in the data sheets.

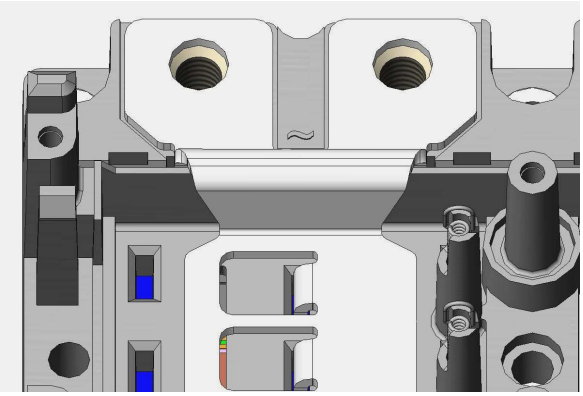

Fig. 2-4 Detail: AC terminal of SKiM

2.5 Mounting the Printed Circuit Board

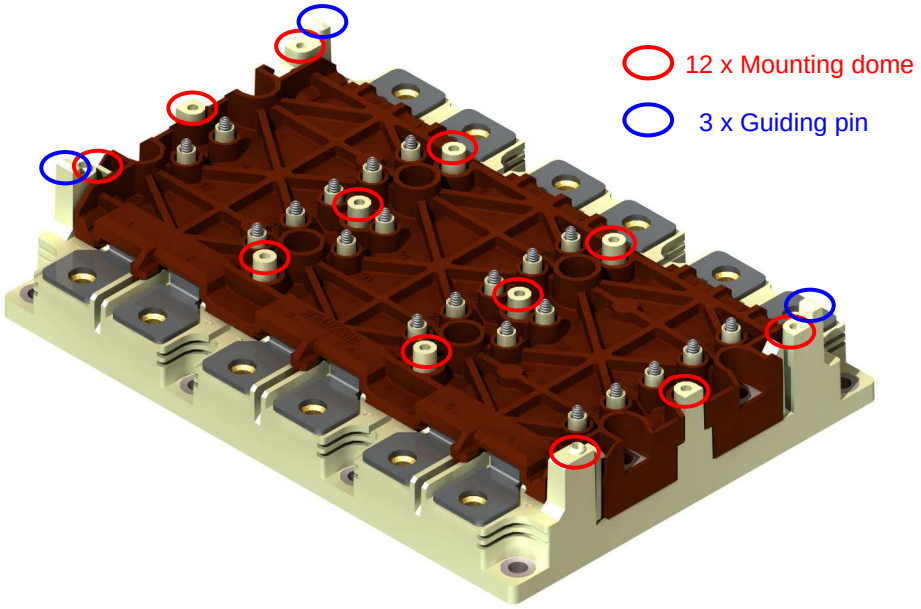

Fig. 2-5 SKiM mounting domes and guiding pins

SEMIKRON recommends the following screws

- Self-tapping screws as e.g.
  - EJOT DELTA PT WN 5451 25x10
  - Screw head “TORX T8”
  - Surface specification “A2F”
  - http://www.ejot.de/
- The screw length has to be 10.0 mm.
- A mounting torque M = 0.5 Nm is recommended. A minimum torque of M_{min} = 0.45 Nm and a maximum torque M_{max} = 0.6 Nm can be tolerated.
- With M = 0.5 Nm re-mounting is possible up to 3 times.

2.6 Automated Screw Driver

The use of torque wrenches with an automatic release is strongly recommended. These should be calibrated regularly.

As to power screw drivers, an electric power screw driver is recommended. With pneumatic systems, the behaviour of the clutch can lead to a shock and torque overshoot which would damage the SKiM module.

The screwing speed has to be limited to a maximum speed of 300 r.p.m. (revolutions per minute).

2.7 Removing the SKiM from the Heat Sink

The thermal paste provides good adhesion between the module and the heat sink. Since the DBC substrates with the chips are not glued to the case, these would stick to the heat sink when the module was removed as soon as the screws are loosened.

There are two proper ways of removing the module:

- Wait 24 hours after the screws have been loosened and then slide the module carefully from the heat sink.
- Heat the heat sink to 60 °C after the screws have been loosened and then slide the module carefully from the heat sink.

3 ESD Protection

SKiM IGBT modules are sensitive to electrostatic discharge, because discharge of this kind can damage or destroy the sensitive MOS structure of the gate. For shipping, all SKiM modules are packed in conductive plastic trays that provide ESD protection.
When handling and assembling the modules it is recommended that a conductive grounded wristlet be worn and a conductive grounded workplace be used. All staff should be suitably trained for correct ESD handling.

4 Disclaimer

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