

SEMiX[®]

IGBT Modules & Bridge Rectifier Family

Technical Explanations

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Content

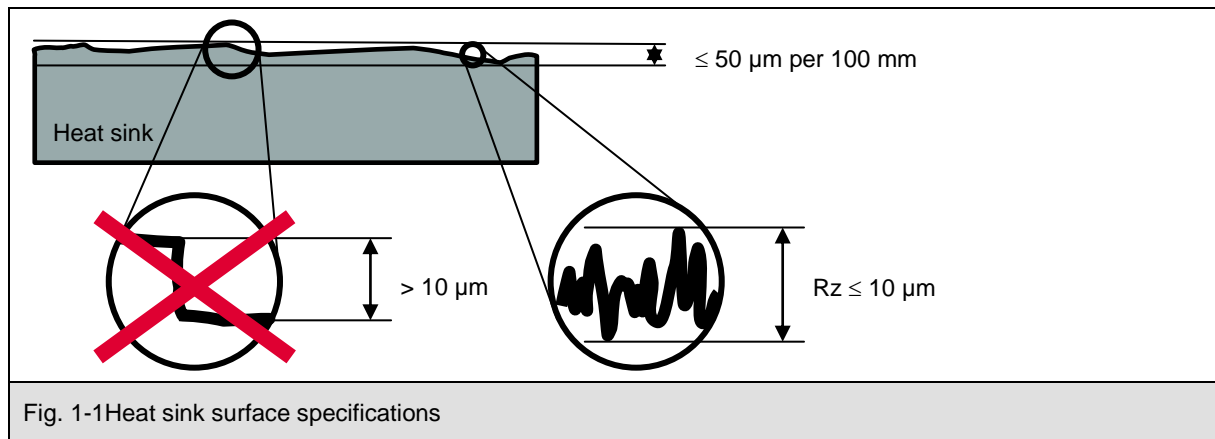
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1 Mounting Instructions

1.1 Preparation, Surface Specifications

To obtain maximum thermal conductivity the underside of the module must be free from grease and particles. Furthermore, to ensure long-term reliable electrical contacts the contact springs have to be kept clean at all times and should never be touched by hand.

The heat sink must fulfil the following specifications:



- ◆ The heat sink must be free from grease and particles
- ◆ Unevenness of heat sink mounting area must be ≤ 50 µm per 100 mm (DIN EN ISO 1101)
- ◆ Roughness "Rz" ≤ 10 µm (DIN EN ISO 4287)
- ◆ No steps > 10 µm (DIN EN ISO 4287)

1.2 Assembly

1.2.1 Applying Thermal Paste

A thin layer of thermal paste has to be applied onto the heat sink surface or the underside of the module. A layer thickness of 50 µm – 100 µm is recommended for silicone paste P12 from WACKER CHEMIE or silicone-free paste HTC from ELECTROLUBE.

The thickness of the layer can be determined using a measurement gauge as shown in Fig. 1-2.

SEMIKRON recommends screen printing to apply thermal paste. In certain cases a hard rubber roll might be suitable for the application of thermal paste.

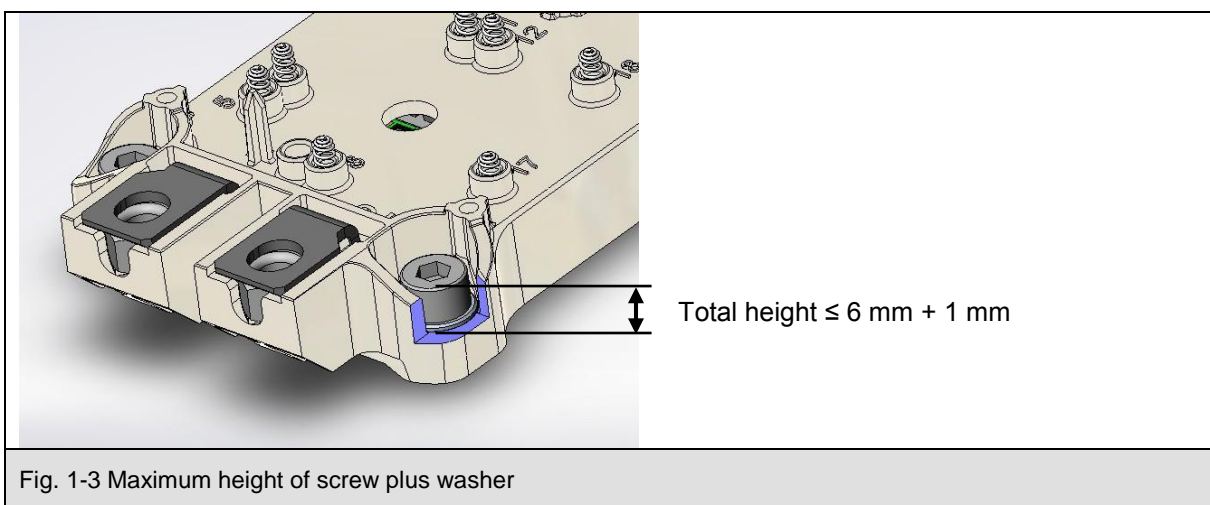


1.2.2 Mounting a SEMiX module to the Heat Sink

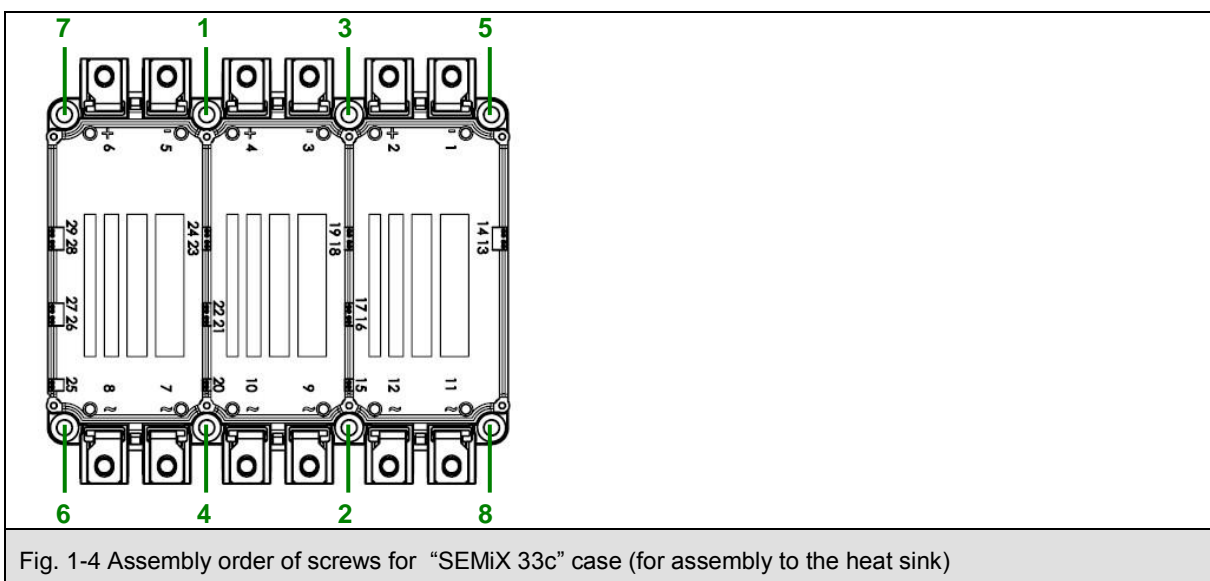
The SEMiX has to be placed on the appropriate heat sink area. Then the screws have to be pre-tightened with max. 1.0 Nm. Finally, the mounting torque M_s (as given in the data sheets) has to be applied. During the assembly process the thermal paste shall spread evenly, ensuring that good and homogeneous thermal contact is achieved.

SEMIKRON recommends using the following type of screw:

- ◆ M5 - 8.8
- ◆ Strength of screw: 8.8
 - = Tensile strength - $R_m = 800 \text{ N / mm}^2$
 - = Yield point - $R_e = 640 \text{ N / mm}^2$
- ◆ The mounting torque M_s has to be between min. 3.0 Nm and max. 5.0 Nm, respectively $4.0 \text{ Nm} \pm 25\%$ (unless otherwise specified in the data sheet)
- ◆ To comply with the creepage and clearance distances, the height of the screw and washer must not exceed $6 \text{ mm} + 1 \text{ mm}$. Refer also to Fig. 1-3.



For modules with four screws the screws must be assembled in diagonal (crosswise) order. For six-pack modules in the “SEMiX 33c” case the screws have to be assembled in the order described in Fig. 1-4.



1.2.3 Mounting to the Main Terminals of SEMiX

Since SEMiX is a power-electric module and not part of the mechanical construction, the maximum mechanical forces on the main terminals as given in Fig. 1-5 must not be exceeded throughout the entire assembly procedure.

For the DC-link connection it is better to apply a slight pressure force in the $-Z$ direction rather than pull forces in the $+Z$ direction. In addition, the SEMiX module is not meant to support the DC-link, which is why additional mechanical components have to be arranged. Mechanical support is also needed for the AC-connection (e.g. motor cables) in order to keep mechanical forces and unnecessary vibration stress away from the module.

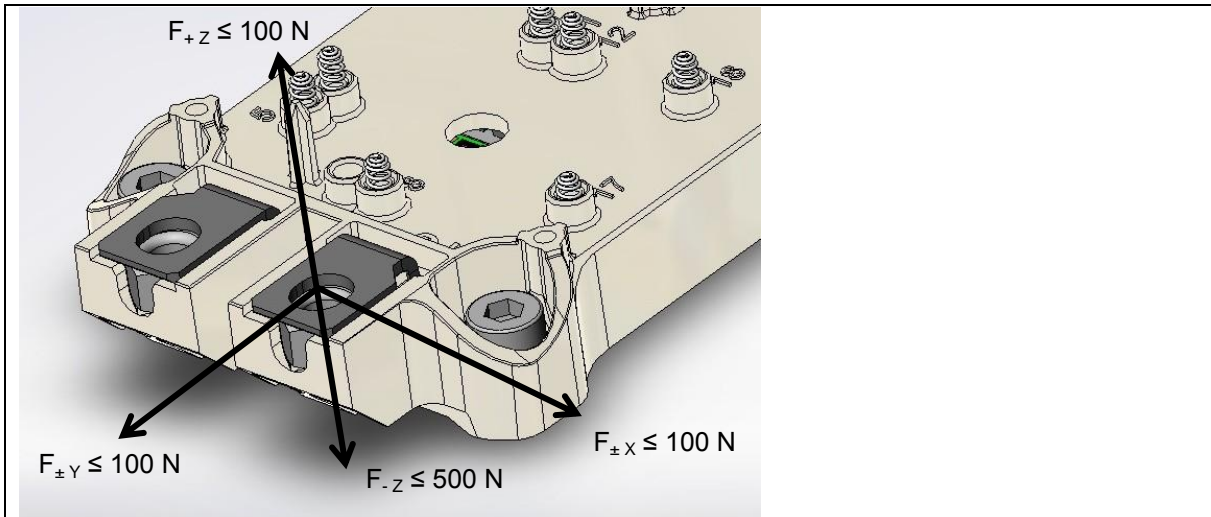


Fig. 1-5 Maximum forces at the main terminals

SEMIKRON recommends using the following type of screw:

- ◆ M6 - 8.8
- ◆ Strength of screw: 8.8
 - = Tensile strength - $R_m = 800 \text{ N / mm}^2$
 - = Yield point - $R_e = 640 \text{ N / mm}^2$
- ◆ The depth of the screw in the module has to be between min. 6.5 mm and max. 10.0 mm.
- ◆ The mounting torque M_t has to be between min. 2.5 Nm and max. 5.0 Nm, respectively $3.75 \text{ Nm} \pm 30\%$ (unless otherwise specified in the data sheet).

Internal paralleling of AC-Terminals

Inside the SEMiX module the two AC-terminals are paralleled as shown in Fig. 1-6. This means it is not necessary to connect both terminals. Even with just one screw at the terminal the maximum terminal current $I_{t(RMS)}$ as given in the data sheets can be achieved.

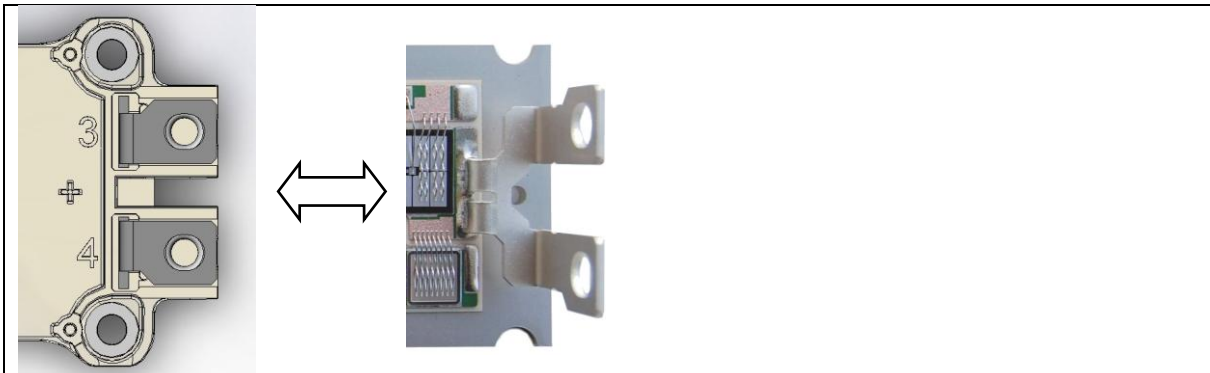


Fig. 1-6 Detail: AC terminal of SEMiX

1.2.4 Mounting the Printed Circuit Board to the SEMiX

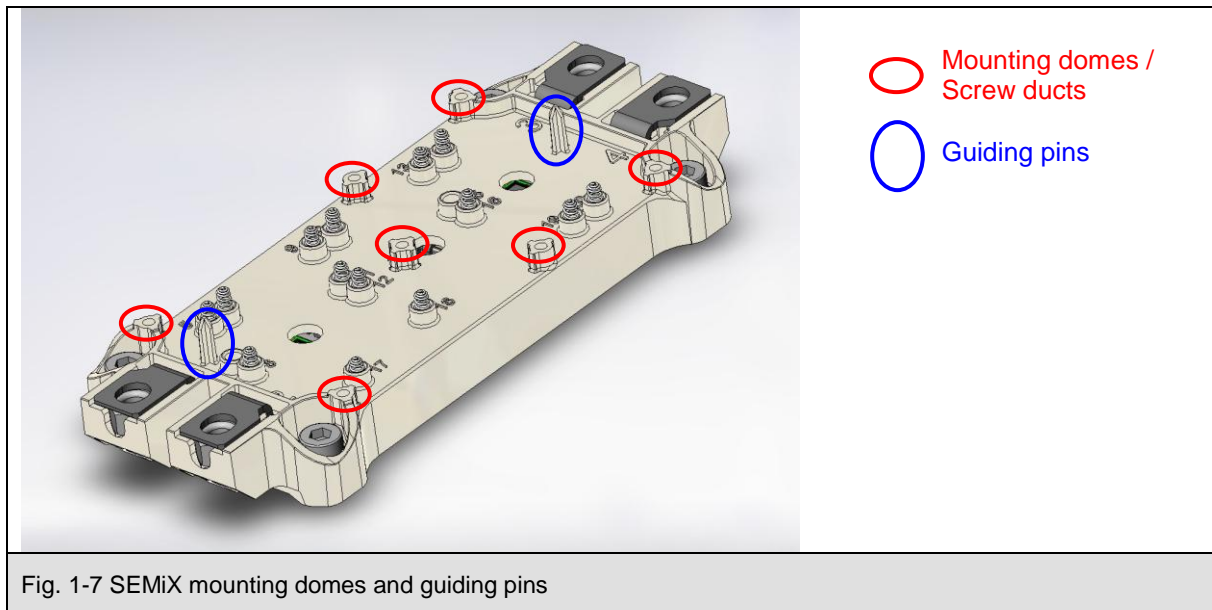


Fig. 1-7 SEMiX mounting domes and guiding pins

SEMIKRON recommends to use the following types of EJOT self-tapping screws (with A2F surface; www.ejot.de) with an automated screw driver (see also 1.2.5 Automated Screw Driver) at the defined mounting torques to assemble the printed circuit board on SEMiX modules:

housing material	housing type	mounting torque [Nm]		
		EJOT DELTA PT 25x10 TX8	EJOT PT 25x10 TX6	EJOT DELTA PT 25x8 TX8P
Makrolon (PC + 20% glass fibre)	SEMiX 2	---	---	0.75 ± 0.10
	SEMiX 3	---	---	0.75 ± 0.10
	SEMiX 4	---	---	0.75 ± 0.10
	SEMiX 4s	0.60 ± 0.10	0.60 ± 0.10	0.55 ± 0.10
	SEMiX 13	0.60 ± 0.10	0.60 ± 0.10	0.55 ± 0.10
	SEMiX 33c	0.60 ± 0.10	0.60 ± 0.10	0.55 ± 0.10
Crastin (PBT + 30% glass fibre)	SEMiX 1s	0.45 ± 0.10	0.40 ± 0.10	0.40 ± 0.10
	SEMiX 1R	0.45 ± 0.10	0.40 ± 0.10	0.40 ± 0.10
	SEMiX 2s	0.45 ± 0.10	0.40 ± 0.10	0.40 ± 0.10
	SEMiX 2R	0.45 ± 0.10	0.40 ± 0.10	0.40 ± 0.10
	SEMiX 3s	0.45 ± 0.10	0.40 ± 0.10	0.40 ± 0.10

Tab. 1-1 Torques for different screw types to mount a printed circuit board on SEMiX

The depth of the screw in the module has to be between min. 6.0 mm and max. 8.5 mm. Please refer to the data sheet drawings for the detailed depth of the screw ducts.

The number of times the driver may be assembled and disassembled depends very much on the screw surface and mounting torque. Under the aforementioned conditions, a driver can normally be assembled and disassembled three times.

The “SEMiX 3s” housing has 7 mounting domes (Fig. 1-7): four domes at the corners, one in the centre and two additional domes at the edges of the module. These two additional domes are meant for better resistance to shock and vibration. The use of these domes is optional.

For all other SEMiX modules it is necessary to use all available mounting domes to ensure a reliable connection between the contact springs and the PCB.

For the “SEMiX 33c” case (Fig. 1-4), the auxiliary contacts have to be soldered. During the solder process a maximum soldering temperature $T_{\text{solder}} = 265 \text{ °C}$ and a maximum soldering time $t_{\text{solder}} = 10 \text{ sec}$ must not be exceeded. For reasons of ESD protection, all soldering tools (e.g. soldering iron) have to be conductive grounded (refer also to chapter 1.3). Wave soldering is a valid soldering process in this context.

Since the electrical connections of SEMiX are made using spring contacts (SEMiX 33c has spring contacts inside), it is necessary to mount the module onto the heat sink (or a similar plate) before performing any electrical test. This also applies to any kind of incoming inspection.

1.2.5 Automated Screw Driver

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

For power screw drivers it is recommend to use an electric power screw driver. With pneumatic systems, the behaviour of the clutch can lead to a shock and a torque overshoot which would damage the SEMiX module.

The screwing speed has to be limited to a maximum speed of 300 rpm to gain the torques listed in Tab. 1-1.

1.3 ESD Protection

SEMiX IGBT modules are sensitive to electrostatic discharge, because discharge of this kind can damage or destroy the sensitive MOS structure of the gate. All SEMiX modules are ESD protected in the shipment box by conductive plastic trays.

When handling and assembling the modules it is recommended to wear a conductive grounded wristlet and to use a conductive grounded workplace. All staff should be suitably trained for correct ESD handling.

2 Disclaimer

The specifications of our components may not be considered as an assurance of component characteristics. Components have to be tested for the respective application. Adjustments may be necessary. The use of SEMIKRON products in life support appliances and systems is subject to prior specification and written approval by SEMIKRON. We therefore strongly recommend prior consultation of our personal.