SEMITOP® Mounting instructions

ESD protection

IGBT and MOS circuits in SEMITOP® modules are sensitive to electrostatic charges. All SEMITOP® modules are ESD protected during transport, storage and mounting process with an ESD cover.
During the handling and assembly of the modules use a conductive grounded wristlet and working place.

Heat sink specification

The mounting area on the heatsink must be clean and free of grease and particles.
The mechanical specifications for the heat sink are (See Figure 1):

- Flatness: 20 µm per 100 mm
- Roughness Rz : 6,3 µm
- Machined without overlaps

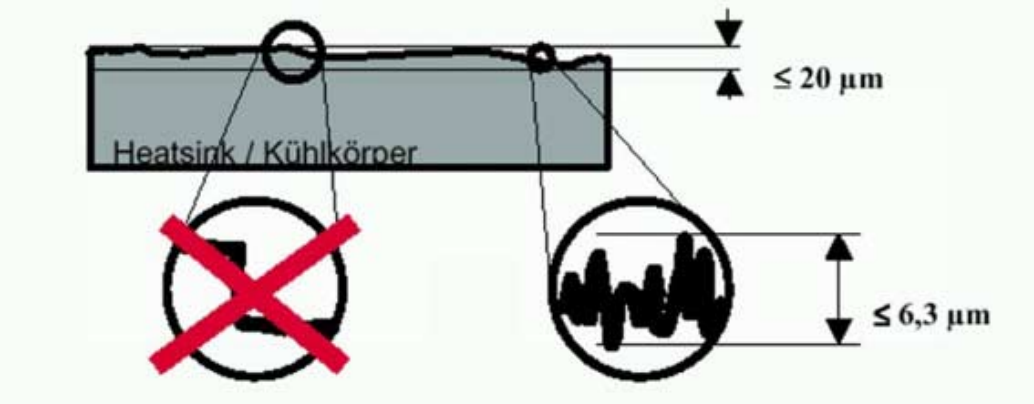

Figure 1 – Heatsink specifications

Mounting surface

- The mounting surface of SEMITOP module must be free from grease and particles.
- Fingerprints or on the bottom side do not affect the thermal behaviour.
- Due to the manufacturing process, the bottom side of the SEMITOP may exhibit scratches, holes or similar marks.
- Discoloration on the bottom side do not affect the thermal behaviour
- The following figures (Figure 2 and Figure 3) define surface characteristics, which do not affect the thermal behaviour.

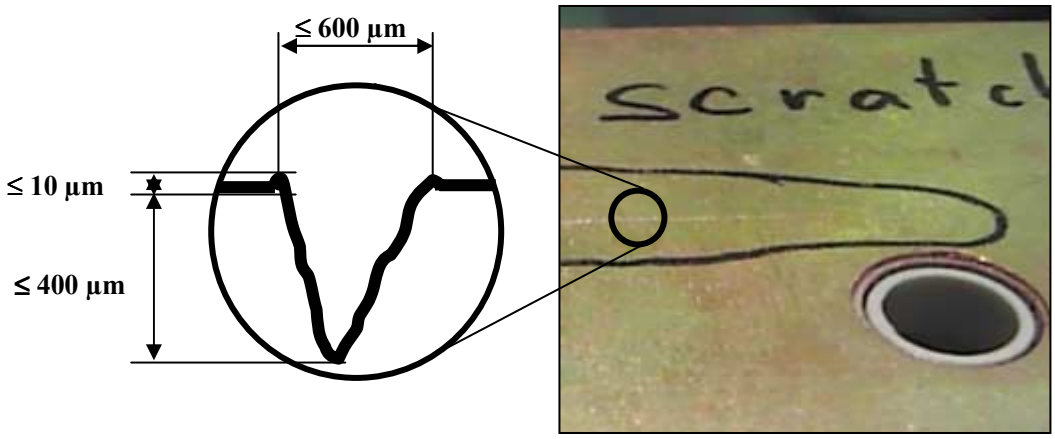

Figure 2 - Scratches on the SEMITOP bottom surface

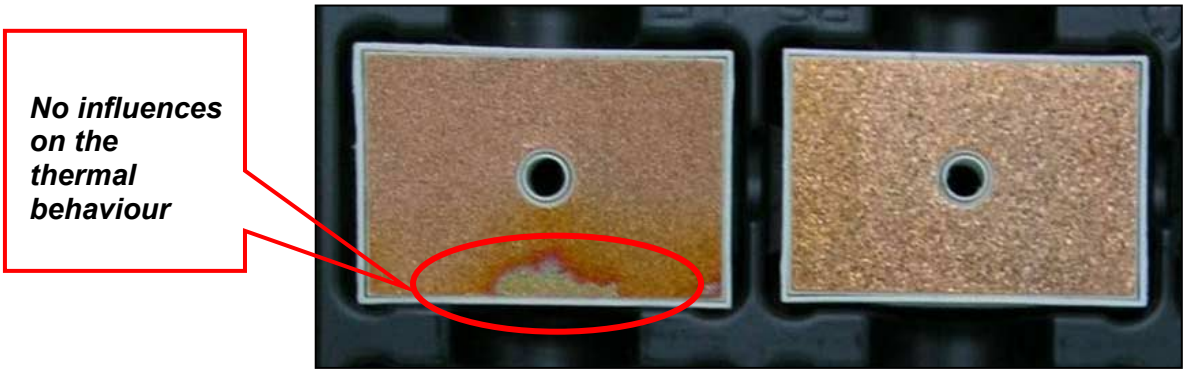

Figure 3 – Discoloration on SEMITOP bottom surface

Assembling Steps

SEMITOP® modules could be assembled by either starting soldering the modules to the PCB (Figure 4) and then fix the subsystem PCB+SEMITOP® to heat sink, or fixing SEMITOP® to the heat sink (Figure 5) and then solder to the PCB.

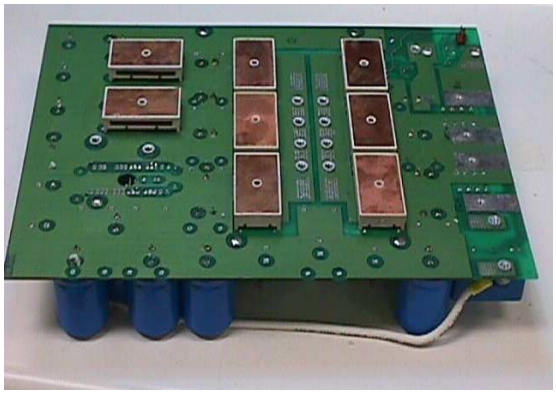

Figure 4 – PCB Assembly

Figure 5 – Heatsink assembly

To avoid any damage to the SEMITOP® modules, it is important to respect important operative conditions during the main assembling steps such as the application of thermal grease, the soldering process and the assembly to the heat sink.

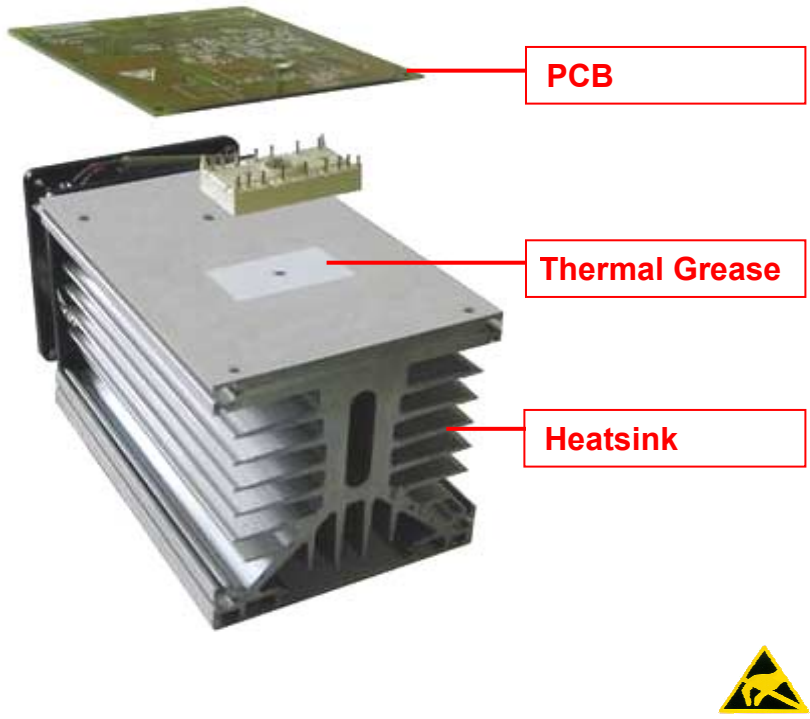

Figure 6 – Assembling steps

Thermal grease application

To avoid air gaps at the interface between the module and the heat sink a thermal grease must be applied.
The function of the grease is to flow according to the shape of the interface, allowing a metal-to-metal contact where it is possible, and filling the remaining gaps.
Recommended thermal grease material is Wacker-Chemie P 12.

SEMIKRON recommends a hard rubber roller or a screen print for an even distribution of the grease.

The thickness of the applied grease layer should be:

Module	Thermal Grease Thickness
SEMITOP® 1	20 – 25 µm (Wacker P12)
SEMITOP® 2	30 – 35 µm (Wacker P12)
SEMITOP® 3	50 – 55 µm (Wacker P12)

The thickness of the applied grease can be checked by a measuring gauge (e.g. Fa. ELCOMETER Instruments GmbH, Himmlingstr. 18, 73434 Aalen, Tel. +49-7366-919283: Sechseck-Kamm 5 - 150 µm).

Assembly on heat sink
After applying the recommended thickness of thermal grease on the heat sink, tighten the screw with the corresponding mounting torque:

Module	Screw	Washer	Maximum Mounting Torque
SEMITOP® 1	DIN 912-M-4x16	DIN 6798 Form A + DIN 125	1,5 Nm
SEMITOP® 2	DIN 912-M-4x16	DIN 6798 Form A + DIN 125	2,0 Nm
SEMITOP® 3	DIN 912-M-4x16	DIN 6798 Form A + DIN 125	2,5 Nm

SEMIKRON recommends:

- a torque wrench with automatic control;
- the above recommended screws and washers;
- tighten the screws only once. After the mounting do not re-tighten the screws to the nominal mounting torque value.
  Due to relaxation of the housing and flow of thermal paste, the loosening torque is lower than the mounting torque. However, the construction of the housing, the washers and the adhesion of the thermal paste still ensure sufficient thermal coupling of the module to the heat sink.
- Do not exceed the mounting torque because a further increase of the maximum mounting torque will not improve the thermal contact but could only damage the module.

Connecting SEMITOP® – PCB

Use plastic anchor pins in each corner on the top of the SEMITOP® for mechanical connection between PCB and SEMITOP®.
To avoid mechanical stress to the soldering pins, the PCB has to be additionally supported (e.g. using spacers).
Suggested hole diameter for the soldering pins and the mounting pins in the PCB is 2mm.

Soldering on PCB

SEMITOP® modules could be soldered to the PCB using the most common soldering process:

- Hand iron;
- Wave soldering process.

Independent of the soldering process used to solder SEMITOP® modules to the PCB, SEMIKRON recommends a thorough evaluation of the solder joints to ensure an optimal connection between SEMITOP® and the PCB.
Figure 7 shows a profile of a good soldered joint. Notice that the solder forms a concave meniscus between pin and pad. This is an example of a properly formed meniscus and it is a result of good wetting during the soldering process.

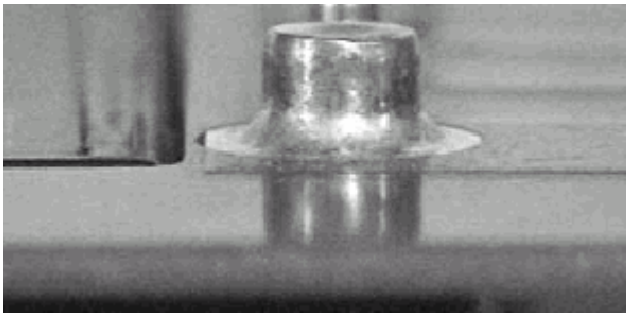

Figure 7 - Good soldered joint profile

In both Figure 7 and Figure 8 it can also be seen that the soldering covers a good deal of the surface area of the pin and of the pad. This is also evidence of good wetting. Notice that the soldering joint has a smooth surface with a silver colour. This is the result of good immobilization of the joint during cooling as well as good cleaning of the board prior to soldering. All soldering connections should exhibit similar characteristics regardless whether they are soldered by hand iron or wave soldering process.

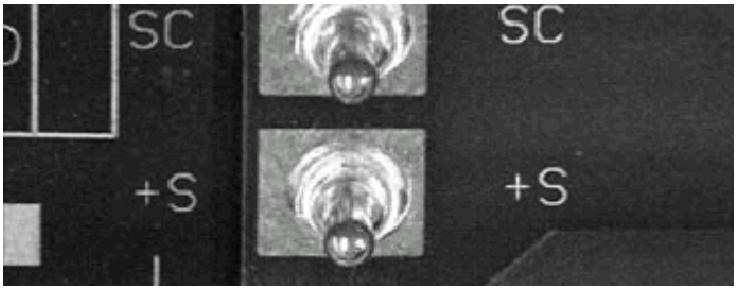

Figure 8 - Details

The time required to create a robust connection depend on several parameters:

a) PCB thickness: When increasing the PCB thickness, the heat dissipation capability of the PCB itself will be the higher, and thus it will require a longer soldering time.

b) Copper wire area: Pins require large copper wire to minimize resistive power losses during the current flowing.
Since copper has a good heat transmission coefficient, the size of these copper wires directly affects the soldering time necessary to heat the PCB pad.

c) Hand iron power: power, tip size and working temperature of the hand iron affect the soldering time. These parameters have to be adjusted in order to keep the maximum temperature within the specified limit.

SEMIKRON recommends that the soldering joints should be thoroughly checked to ensure a high quality soldering joint. If necessary, different parameters should be adjusted in order to optimise the process.

Hand Soldering
SEMIKRON recommends to not exceed the maximum temperature of 260°C for a soldering time of 10seconds.

Wave Soldering Profile
SEMIKRON recommends:

- do not exceed the maximum wave soldering profile of figure 9;
- the maximum preheating temperature has to be kept under or equal to the maximum storage temperature (125°C);
- do not exceed the maximum preheating time of 100seconds;
- during the soldering phase, do not exceed the maximum soldering time of 10 seconds at the maximum temperature of 260°.

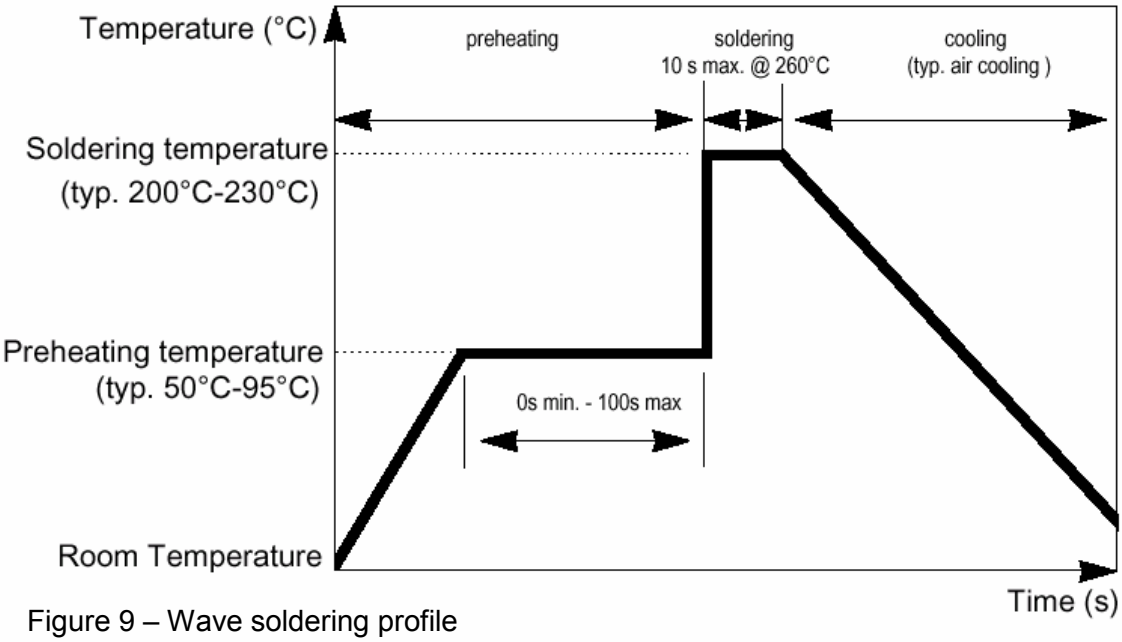

Figure 9 – Wave soldering profile