Mounting Instruction
SEMITRANS® 10

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1. Introduction

This mounting instruction provides some recommendations for handling of the SEMITRANS®10 and SEMITRANS®10+ power modules, surface specifications, applying thermal paste as well recommended mounting procedures.
Not all information shown in this instruction are binding. The data provided cannot anticipate and take into account each and every individual application. The herewith-described recommendations do not replace a detailed evaluation and examination by the customer.

2. ESD Protection

SEMITRANS®10 and SEMITRANS®10+ modules are sensitive to an electrostatic discharge (ESD), which can damage or destroy the sensitive semiconductors inside. For the transport, the SEMITRANS®10 and SEMITRANS®10+ modules are ESD protected via an ESD protecting shipment box (blister). Wearing a grounded wrist strap and using a grounded workstation is mandatory when opening the shipment box, handling and installing modules.

Further information can be found in the currently valid standards:

- IEC 61340-5-2, Electrostatics–protection of electronic devices from electrostatic phenomena – general requirements
- ANSI/ESD S2020
- MIL-STD 883C, Method 3015.6 for testing and Classification
- DIN VDE 0843 T2, identical with IEC801-2

Figure 1: ESD attention label

All staff should be trained for the correct ESD handling. The user must use all precautions in order to avoid electrostatic discharge during handling, movement and packing of these components.

Figure 2: Enclosed inner ESD package with SEMIKRON Logo (1), ESD protection blister (2) and with ESD (electrostatic sensible device) marking tape (3)

Figure 3: Enclosed outer package with ESD (electrostatic sensible device) marking tape (1) and with package label (2), left side of the package

Figure 4: SEMITRANS®10/SEMITRANS®10+ Description of outer package box label

Table 1: Description of outer package box label	
1.	Type designation
2.	Blue Dot – Incomplete Package Marking (One Module Only)
3.	Lot Number
4.	DMX Code
5.	Pictogram - Electrostatic Sensitive Device
6.	SEMIKRON Part Number
7.	SEMIKRON Part Number Bar Code
8.	SEMIKRON Logo
9.	Date Code
10.	Quantity
11.	Quantity Bar Code
12.	Country of Origin

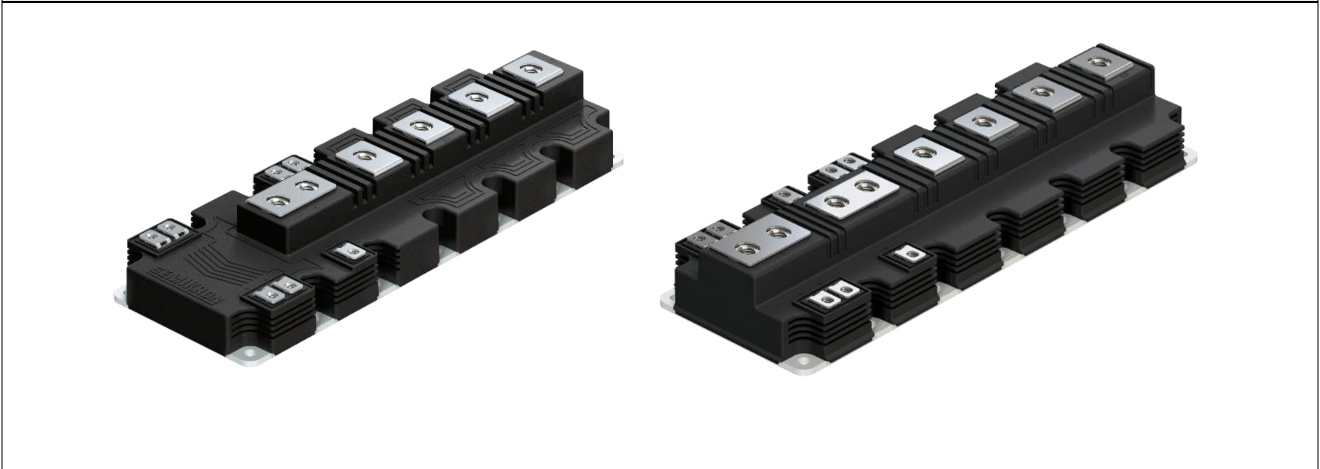
3. Storage and transport

Storage of SEMITRANS®10 and SEMITRANS®10+ modules in unpacked / unmounted condition at the temperature limits specified in the data sheet is permissible but not recommended. ESD protection must be ensured.

4. Module labeling and RoHS

SEMITRANS®10 and SEMITRANS®10+ power semiconductor modules comply with RoHS directive. Datasheets and Material Content Data Sheets (MCDS) are available online from Semikron Danfoss on the respective product page.

Figure 5: SEMITRANS®10 and SEMITRANS®10+ package differences



4.1 Module label description

Figure 6: SEMITRANS®10/SEMITRANS®10+ GB label design with example of standard module label (old and new design)

Old design (before Q2/2025)

New design (after Q2/2025)

Table 2: Description of module label (old design)	
1.	SEMIKRON Logo,
2.	Module Type Description,
3.	Module Item/Article Number,
4.	Consecutive Number,
5.	Circuit Diagram,
6.	Date Code (5 digits, YYWWL - YY = Year, WW = Week, L = Lot of same type per week), Date code might be followed by: „R" indicates that module complies with the RoHS directive, „E" indicates engineering samples marking
7.	DMX Code – Data Matrix Code,
8.	UL logo, SEMTRANS is UL recognized, file name: E63532,
9.	$V_{CE(sat)}$/V_f Value Information (11 digits, 2324252627T, 23 = $V_{CE(sat)}$ for T1/T4, 24 = V_f for D1/D4, 25 = $V_{CE(sat)}$ for T2/T3, 26 = V_f for D2/D3, 27 = V_f for D5/D6 of MLI, T = Temperature of Measurement),

Table 3: Description module label (new design)	
1.	Semikron Danfoss logo
2.	batch number
3.	product name
4.	production site identifier
5.	date code (YYWW)
6.	product status in case of non-serial product „R" indicates that module complies with the RoHS directive, „E" indicates engineering samples marking
7.	DMX Code – Data Matrix Code,
8.	Internal code (optional)

SEMITRANS®10 and SEMITRANS®10+ share the same label design

Figure 7: SEMITRANS®10 MLI label old design with example of standard module label

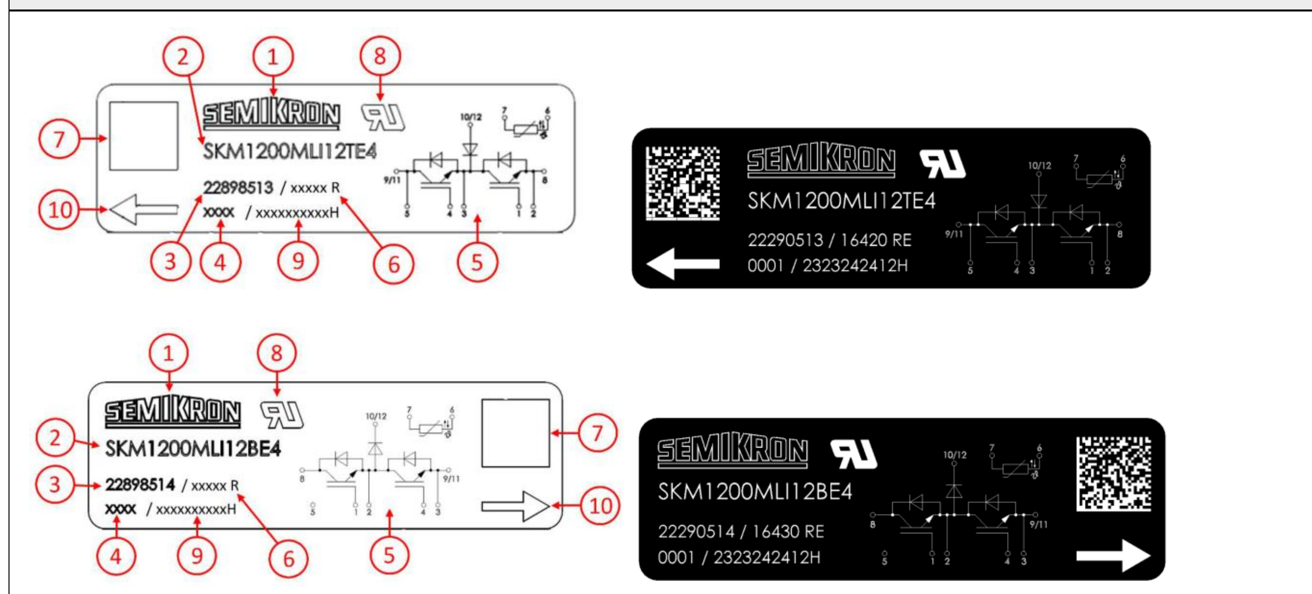


Table 4: Description of outer package box label	
1.	SEMIKRON Logo,
2.	Module Type Description,
3.	Module Item/Article Number,
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5.	Circuit Diagram,
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7.	DMX Code – Data Matrix Code,
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10.	Module Orientation Marking (used only for split (MLI, T-MLI) modules),

Table 5: Data matrix code description, Data Matrix Code contains the following information	
Old type	New Type
1. Part name	1. Part name
2. Blank	2. Blank
3. Part number	3. Part number+2 blanks
4. Production tracking number	4. Production tracking number+2 blanks
5. Blank	5. Blank
6. Measurement number	6. Measurement number
7. Line identifier	7. Line identifier
8. Blank	8. Blank
9. Serial number	9. Serial number
10. Blank	10. Blank
11. Date code – 5 digits: YYWWL (YY = Year, WW = Week, L = LOT of same type per week)	11. Production Site identifier
	12. Date code – 4 digits: YYWW (YY = Year, WW = Week)

Table 6: DMX read example

Old DMX

Part name		Part number	Production tracking number		Measurement number	Line identifier		Serial number		Date code with Seq. LOT Number
SKM1000GB17R8		22290422	18DE50356101		1	Z		0004		18190
SKM1000GB17R8		22898422	911SK0173003		1	M		0109		20022
SKM1400GB12P4		22898312	911SK0193305		4	M		0193		20121

New DMX

Part name		Part number			Production tracking number				Measurement number	Line identifier		Serial number		Production Site identifie	Date code
SKM1000GB17R8		22290422			18DE50356101				1	Z		0004		V	2516
SKM1000GB17R8		22898422			911SK0173003				1	M		0109		V	2517
SKM1400GB12P4		22898312			911SK0193305				4	M		0193		V	2522

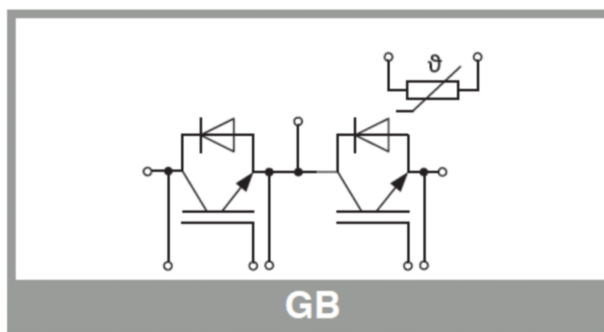
5. Module selection

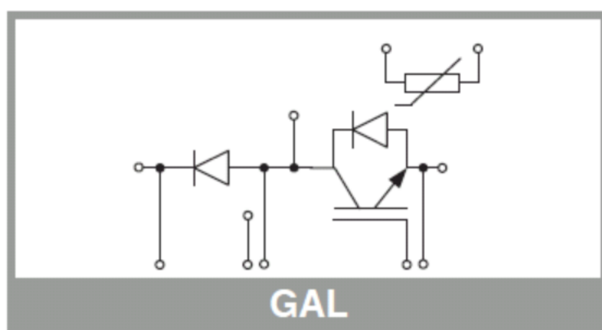
SEMITRANS®10 and SEMITRANS®10+ modules are available in various configurations as well as voltages and current classes with differently optimized IGBT and diodes.
The overall product spectrum including datasheets and simulation program SEMISEL is available online on www.semikron-danfoss.com .
Values in the product data sheets and application notes are maximum allowed values, which - even for brief periods - must not be exceeded, as this may cause pre-damage or destruction of the components. Selecting the most suitable component requires the consideration of various criteria. The overview in Table 6 displays the different configurations of available products.[1]

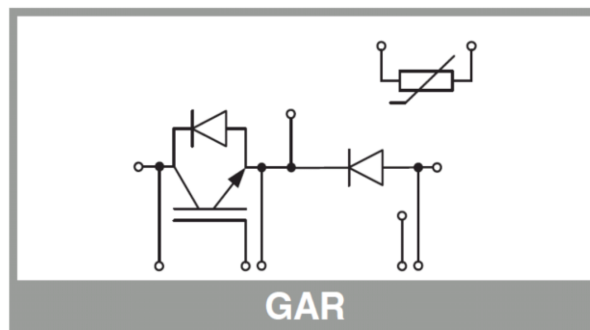
[1] Not every combination of current, topology, voltage and chip available

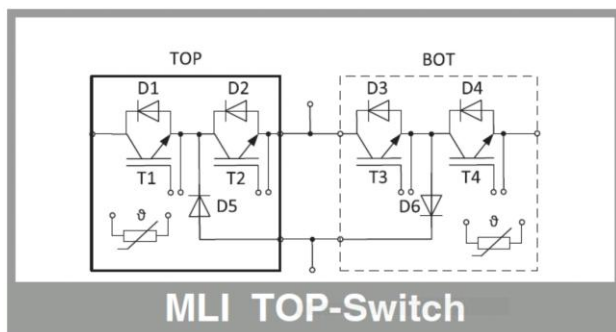
Table 7: SEMITRANS®10/SEMITRANS®10+ module type designation overview						
SKM	1400	GB	12	P	4	Description
SKM						SEMIKRON Module
DC collector current in A						
	1400					1400A
	1200					1200A
	1000					1000A
	1800					1800A
	2400					2400A
Topology						
		GB				Dual switch
		MLI				Multi-Level Inverter
		GAR				Chopper (diode on BOT side)
		GAL				Chopper (diode on TOP side)
Collector – Emitter voltage (*100)						
			12			1200V
			17			1700V
			23			2300V
IGBT Chip characteristic						
				P		IFX, Soft switching high power IGBT
				E		IFX, Soft switching medium power IGBT
				M		MITSUBISHI, IGBT
				R		RENESAS, H-Type IGBT
Internal reference number, e.g. 4 = IGBT 4th generation						
					4	4 = IGBT 4th generation
					7	7 = IGBT 7th generation
					8	8 = IGBT 8th generation

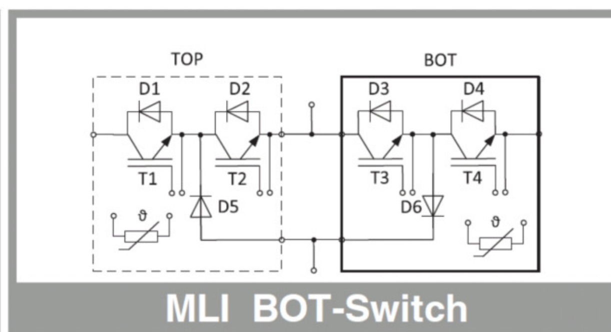
Figure 8: SEMITRANS®10/SEMITRANS®10+ Topology circuit diagram drawing











6. Heatsink Specifications

The thermal energy generated by power losses must be dissipated by a suitable heat sink in order not to exceed the maximum temperature during switching operation. The quality of the heatsink and heatsink surface in the mounting area is of great importance for thermal conductivity and distribution of the thermal energy. Minimal requirements for heatsink mounting and material specification are summarized in this section.

Table 8: Minimum recommended heatsink material properties

Heatsink material	R_m [N/mm²]	R_e [N/mm²]	Note
EN AW-5754	180	80	Recommendation for minimal material properties

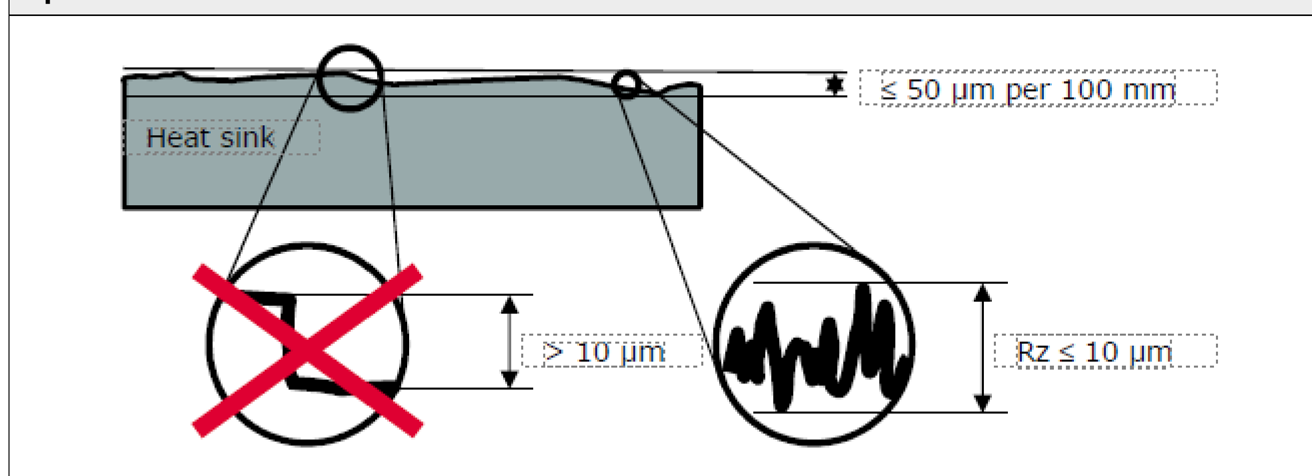
6.1.1 Surface Specifications

To obtain the maximum thermal conductivity, the bottom side of the module must be free of grease and particles. It is recommended to clean the mounting surface with lint-free wipes and a fat-dissolving solvent (e.g. isopropyl alcohol). Furthermore, all electrical contacts shall be kept clean at all times and should never be touched by hand.

The heat sink must fulfil the following specifications:

- 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)
- The heat sink must be free from grease and particles
- Tap holes must be free of turnings
- It is recommended to clean the surface with lint-free wipes and a fat-dissolving solvent (e.g. isopropyl alcohol)
-

Figure 9: Heat sink surface graphical explanation and heat sing surface roughness specifications



The condition of the heat sink contact area should not exceed the values in Table 8, otherwise inhomogeneous heat dissipation can lead to partial overheating of the semiconductors

Table 9: Heat sink surface requirements for SEMITRANS®10/SEMITRANS®10+ module

Baseplate Size	Surface roughness	Surface flatness	Note
SEMITRANS®10: 250mm x 89mm SEMITRANS®10+: 250mm x 89mm	R_z 10	≤50µm/100mm ⏥ 0,05/100 ≤10µm/10mm ⏥ 0,01/10	Roughness: DIN EN ISO 1302 Flatness: DIN EN ISO 1101

7. Thermal interface material

Semikron Danfoss recommends the use of SEMITRANS®10 and SEMITRANS®10+ modules with pre-applied Phase Change Material (PCM). These modules with pre-applied PCM are printed in a clean environment on an automated and SPC controlled stencil printing line. The amount of Thermal Interface Material (TIM) printed on the module surface is specified in the data sheets as "typical weight", where an inhomogeneous pattern is applied to the module. For these patterns, it is not possible to define the amount of TIM material by a thickness because the calculated resulting thickness is not constant over the printed surface.

Reliability and lifetime qualification tests for SEMITRANS®10 and SEMITRANS®10+ modules are carried out with pre-applied High Performance Phase Change Material (HP-PCM) if the test parameters are within the specified values of the HP-PCM.
For detailed information about High Performance Phase Change Material (HP-PCN) "Technical Explanation Thermal Interface Materials (TIM) Rev.4".

For customers who prefer to print the TIM material themselves:
A thin, homogeneous layer of thermal paste must be applied to the surface of the heat sink or the underside of the module. To achieve maximum thermal conductivity, the surfaces must be free of any grease and particles. Cleaning with lint-free cloths and a grease-dissolving solvent (e.g. isopropyl alcohol) is recommended.

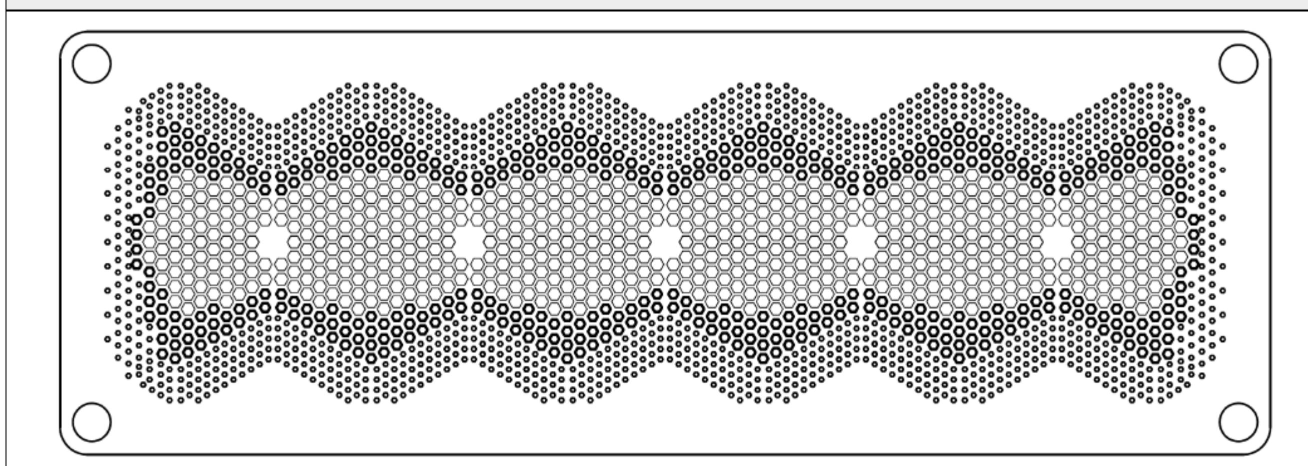
Semikron Danfoss recommends following pastes:

- Silicone paste: P12 from WACKER CHEMIE (www.wacker.com)
- Silicone-free paste: HTC from ELECTROLUBE (www.electrolube.com)

Screen printing is recommended for the application of thermal paste. A hard rubber roller might also be suitable. Attention has to be paid that no screw holes are polluted by thermal paste. Further information about applying thermal interface material you find in: Application Note AN 18-001.
A uniform layer thickness of 50 µm – 100 µm is recommended. The applied layer thickness can be determined by using a measurement gauge, e.g. the "Wet Film Wheel" (see figure 10).

Figure 10: Wet film thickness gauge

Figure 11: SEMITRANS®10/SEMITRANS®10+ PCM phase change material, thickness 90µm



Weight measurements (spot test) on module before and after thermal compound printing is a good possibility to apply statistical process control to the printing process without performing destructive testing with the film thickness gauge.
PCM phase change material features:

- · Inhomogeneous honeycomb structure,
- Optimized layer thickness,
- Enhanced heat dissipation,
- High process reliability due to automated screen/stencil printing process,

Table 10: PCM phase change material characteristics

Symbol	Conditions	Minimal	Typical	Maximal	Unit
Characteristics of printing process					
wtp	Material weight	850	985	1120	mg
Storage conditions					
t_{stg}	Storage time			12	month
T_{stg}	Storage temperature	-25		60	°C
RH_{stg}	Storage humidity	10		85	%
TIM material characteristic					
γ_{tp}	Specific gravity		2		g/cm³
R_{tp}	Resistivity		>50*10⁶		Ω/cm
λ_{tp}	Thermal conductivity		3		W/(K*m)
$T_{case,op.}$	Operation temperature				°C
	Filling material				Al, ZnO
R_{th}	R_{th} ≤ standard P12				

PCM material for high temperature support. Thermal performance comparable or better than standard TIM's.
Recommended for systems running with $T_{heatsink}$>100°C. This material withstands permanently case temperatures of T_c=125°C. Print pattern is optimized for each PCN / module combination.
For detail information, please see document Product Information No. MIF-PI 19-007 Rev. 00.pdf.

Figure 12: Application of PCM phase change material on SEMITRANS®10/SEMITRANS®10+ baseplate and inhomogeneous honeycomb structure.

8. Mounting to the Heat Sink

Semikron Danfoss recommends M5 (A2K) screws acc. ISO4762 of strength category 8.8 in combination with a DIN 125 washer. Use only dry screws threads and washers. Setting devices such as spring washers will increase the elasticity, reduce settling effects as well reduce mechanical stress. To comply with creepage and clearance distances it is suggested to check the resulting distances according to the relevant standards (DIN EN 50178, DIN EN 61800-5-1) when selecting a screw type. Threads have to be clean and not lubricated or contaminated by thermal paste.

To avoid unnecessary strain and tension of the base plate, the heat sink has to be sufficiently stiff and has to be distortion free during assembly and transportation. The SEMITRANS®10 or SEMITRANS®10+ has to be placed on the matching heat sink area and then all mounting screws have to be uniformly tightened with the specified mounting torque in the recommended screw mounting sequence.

Figure 13: Recommended mounting sequence for SEMITRANS®10/SEMITRANS®10+

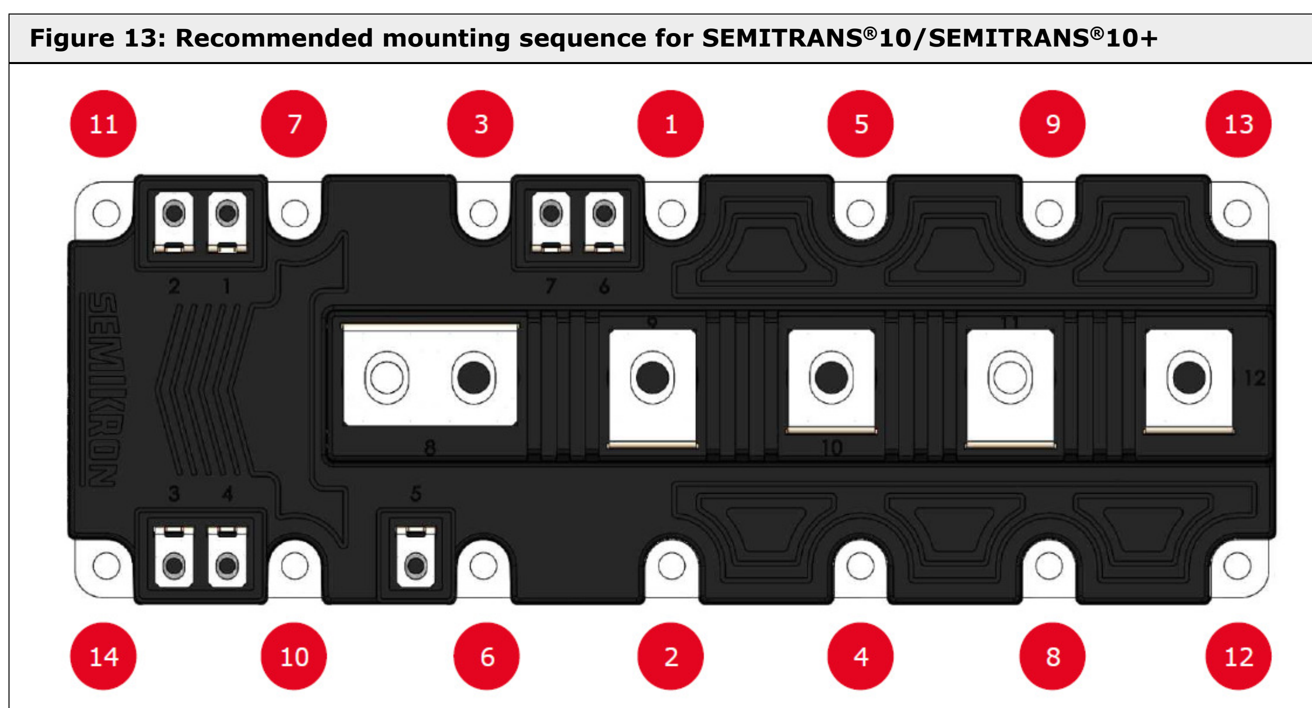


Table 11: Screw dimensions and torques

Location	Type	Torque min. [Nm]	Torque max. [Nm]	Note
Preload Torque	M5	1	2	
Final Torque	M5	4	6	

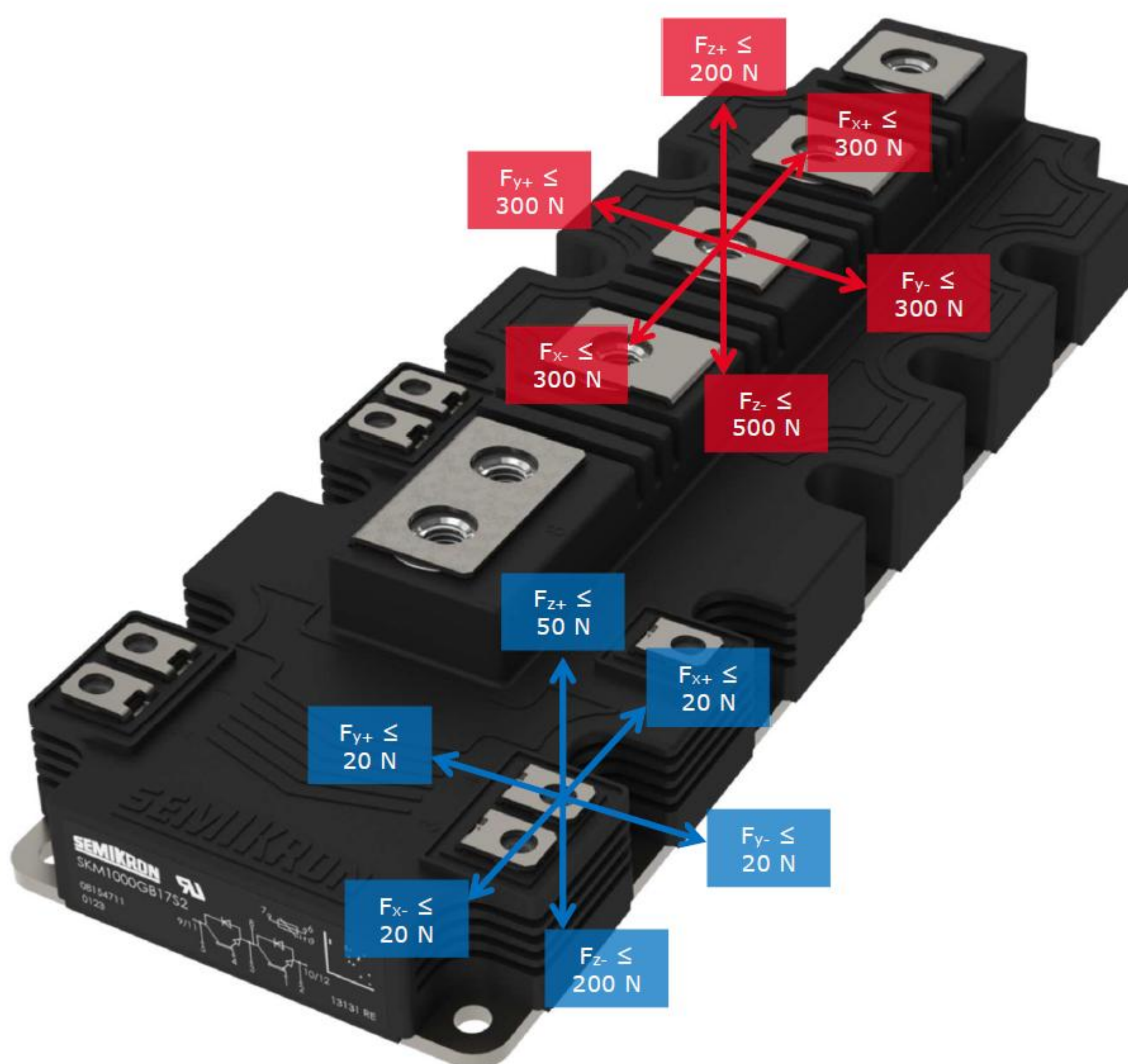
Screw length have to be calculated (preload force for each screw 2kN, see table 10).

The threads should be clean and not lubricated. Use only dry screws threads and washers.

9. Mounting to the terminals

The module must be connected within the permissible module tolerances specified in the outline drawings in the respective data sheet. The position and tolerance of adjacent components such as PCBs, DC-bus, mounting bolts or cables have to be defined in such a manner, that after the connection no sustained effect on the static and / or dynamic tensile forces are exerted to the terminals. The power terminals are built from copper with a nickel coating. The following recommendations are valid for copper busbars, bare or with suitable plating.
As SEMITRANS®10 and SEMITRANS®10+ are power modules and not part of the mechanical construction, the maximum mechanical forces on the main terminals as given in Figure 14 must not be exceeded throughout the entire mounting process and in operation.The screw mounting torque shall be within the specified ranges (**Table 12**).

Figure 14: Maximum allowable forces at the terminals



It is recommended to have a construction which leaves the power and auxiliary terminals permanently free of mechanical stress during operation. To achieve this in a wide temperature range it is advised to add suitable spacers.
It must be ensured that the direction of the force always acts towards the direction of the base plate. Static forces in other directions as well as exposure to vibration and / or thermal expansion should be avoided.
The auxiliary terminals have to be connected accordingly, observing the common ESD guidelines. No load current is permitted to flow through the auxiliary collector.

Table 12: Maximum permissible forces at the terminals of a SEMITRANS®10/SEMITRANS®10+ module		
Terminal type	Force orientation	Value [N]
Main power terminal	F_{x+}	300
	F_{y+}	300
	F_{z+}	200
	F_{x-}	300
	F_{y-}	300
	F_{z-}	500
Auxiliary power terminal	F_{x+}	20
	F_{y+}	20
	F_{z+}	50
	F_{x-}	20
	F_{y-}	20
	F_{z-}	200

9.1 Screw dimensions and torques

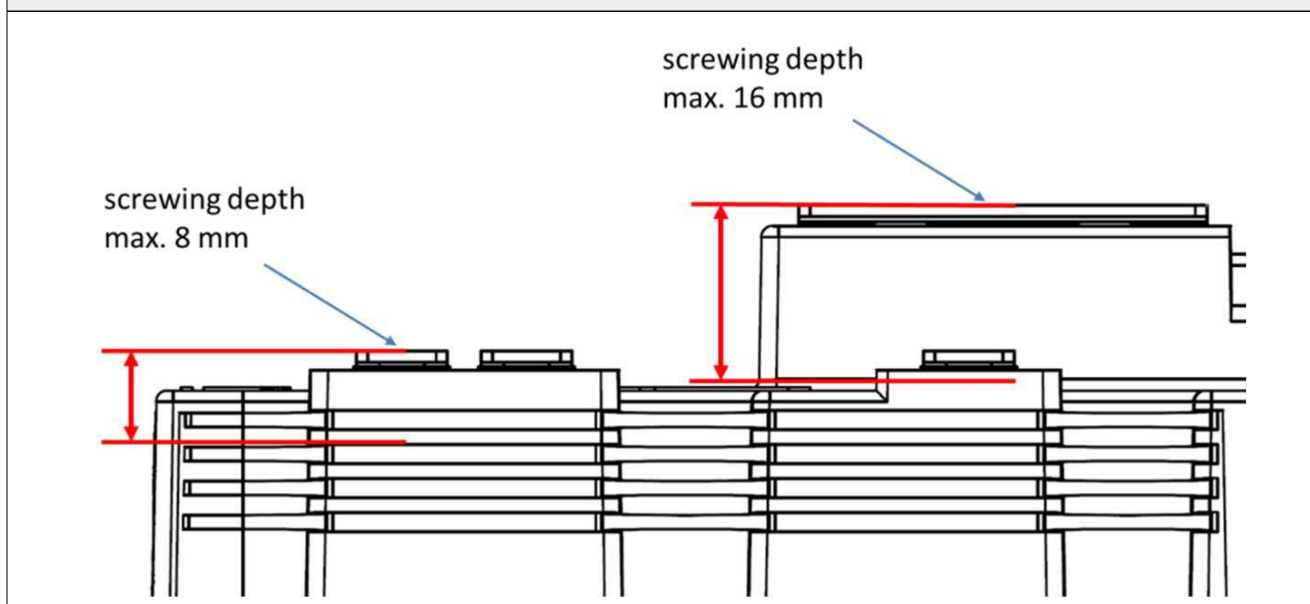
Table 12 displays the recommended values for the mounting torque of the power terminal connection.

Table 13: Maximum permissible forces at the terminals of a SEMITRANS®10/SEMITRANS®10+ module						
Location	Mounting bolt type	Maximal Screwing depth [mm]	Min. torque for condition no. 1 [Nm]	Max. torque for condition no. 1 [Nm]	Min. torque for condition no. 2 [Nm]	Max. torque for condition no. 2 [Nm]
Main terminal connection torque	M8	16	8	10	8	22
Auxiliary terminal Connection torque	M4	8	1.8	2.1	1.8	2.1

Condition no. 1:
If the torque is directly passing to the nut of the module and the full torque affects the plastic housing it is limited according to Table 12, condition no. 1. The upper limit given here assumes a worst-case condition when the fullapplied torque is passed into the nut insert inside the plastic housing.
Condition no. 2:
If the full torque is not directly passing to the nut of the module as described in condition no. 1 a higher mounting torque is allowed. This can be achieved by inserting bolts into all connections of a busbar prior to

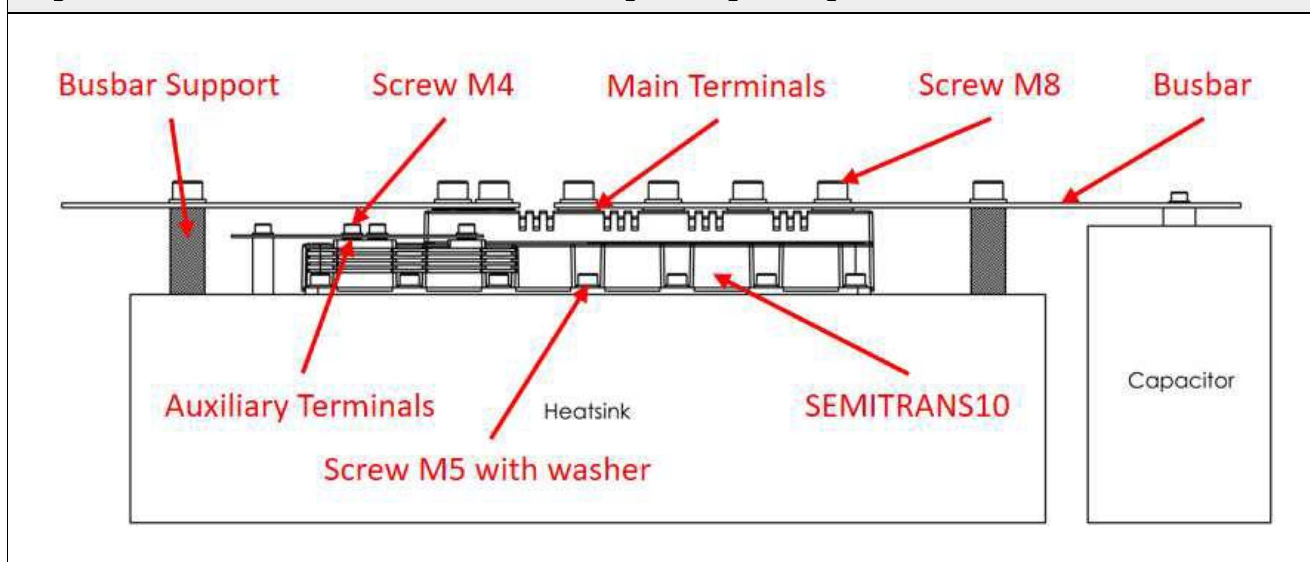
final tightening. Bolts can be fixed by hand prior to final tightening, for example. It has to be checked, if the maximum allowed contact pressure of the used busbar is not exceeded.

Figure 15: Maximal allowable screwing depth



When using an electrical screwdriver, screwing speed has to be limited to a maximum of 300 rpm and soft torque limitation is recommended. Semikron Danfoss do NOT recommend pneumatic screwdrivers due to clutch behavior with torque overshoots.

Figure 16: Condition no. 2: Main terminals tightening through busbar



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IMPORTANT INFORMATION AND WARNINGS

The information provided in this document may not be considered as any guarantee or assurance of product characteristics ("Beschaffenheitsgarantie"). This document describes only the usual characteristics of Semikron Danfoss products to be expected in typical applications, which may still vary depending on the specific application. Therefore, products must be tested for the respective application in advance. Resulting from this, application adjustments of any kind may be necessary. Any user of Semikron Danfoss products is responsible for the safety of their applications embedding Semikron Danfoss products and must take adequate safety measures to prevent the applications from causing any physical injury, fire or other problem, also if any Semikron Danfoss product becomes faulty. Any user is responsible for making sure that the application design and realization are compliant with all laws, regulations, norms and standards applicable to the scope of application. Unless otherwise explicitly approved by Semikron Danfoss in a written document signed by authorized representatives of Semikron Danfoss, Semikron Danfoss products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.
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