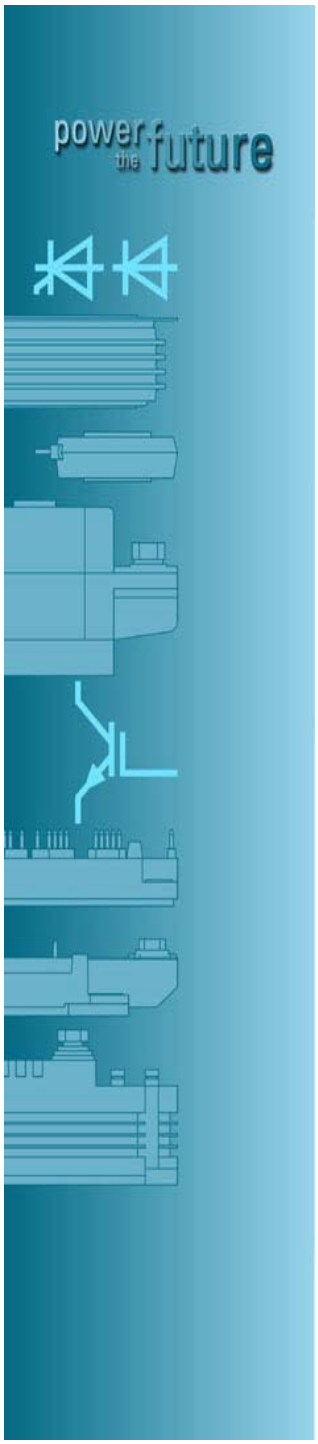
AN-Number: AN2002-04

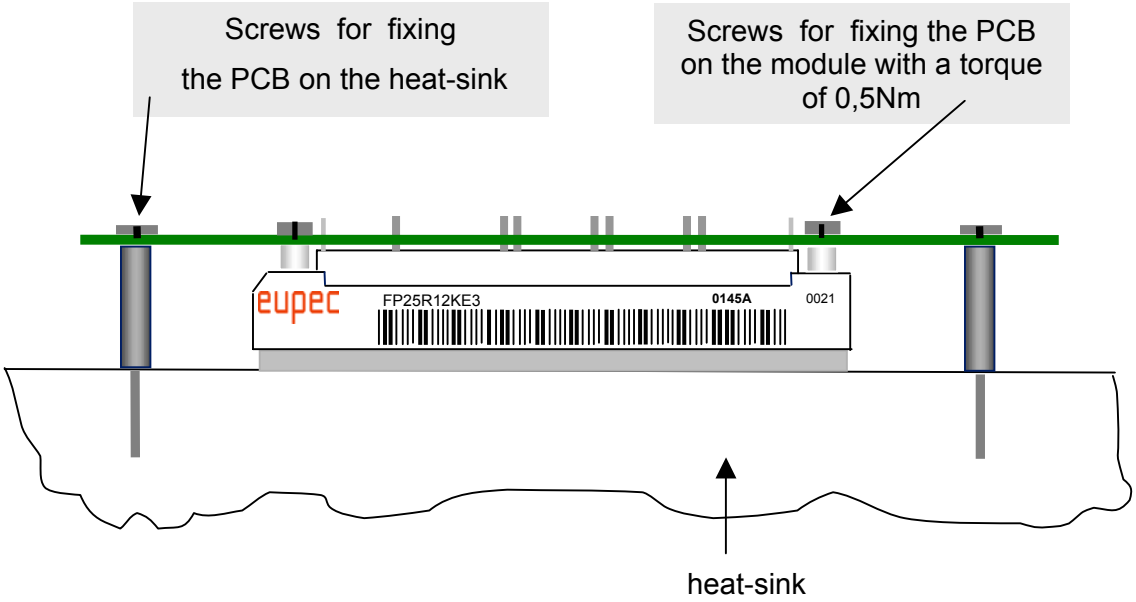
Econo Modules : Mechanical Attributes for new FS und FP Econo- series



1. PCB mounting on Econo modules

Econo modules such as EconoPIM and EconoPack series are designed for high reliability and high flexibility purposes. Customer optimised pin-configuration can easily be achieved with the patented housing concept. Terminal pins are plugged-in at the circumferential slot positions in the plastic and are fixed by clamping. An additional positioning of the pins is achieved by the plastic cover. In contrary to the Econo2 and Econo3 modules with injection-moulded terminals, these plug-in pins are not completely enclosed.

It is not permitted to transfer any forces via the PCB to the pin in the assembly of the converters. PCB`s should be screwed onto the module and additionally it should get a strut between PCB and heat-sink to minimise relative movements between the soldered-in terminals and the plastic case.



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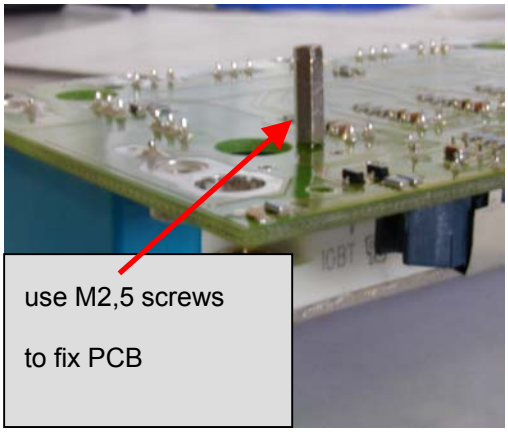
PCB`s can be fixed directly on the module on the 4 stand-off`s with metrical screws M2,5 mm.

The effective length of the screws should be 4mm minimum for light PCB`s and 7mm for heavy PCB`s. Fore this a mounting torque less than 0,5 Nm is necessary. If bending moments are applied to the PCB, separate stand-off`s are required. The thread is taped by the screw itself.

Take into account that the first 1,5mm of the designated dome act as guideway and will not transfer any forces.

We recommend metrical screws **M2,5x8** for the use with 1mm PCB`s and **M2,5x10** with 2mm PCB`s

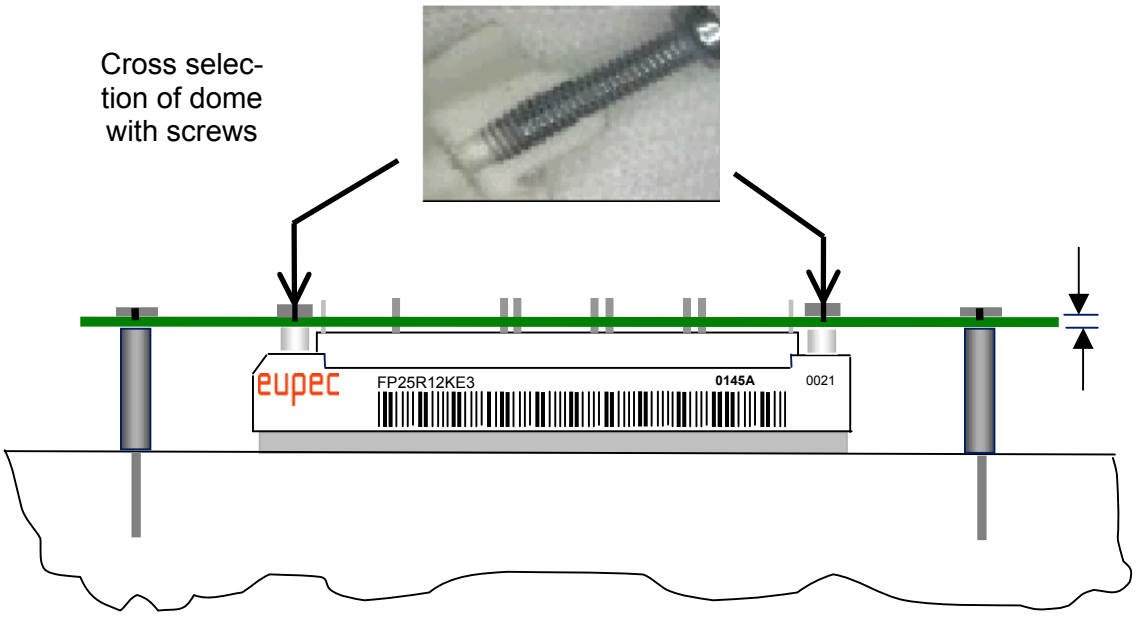


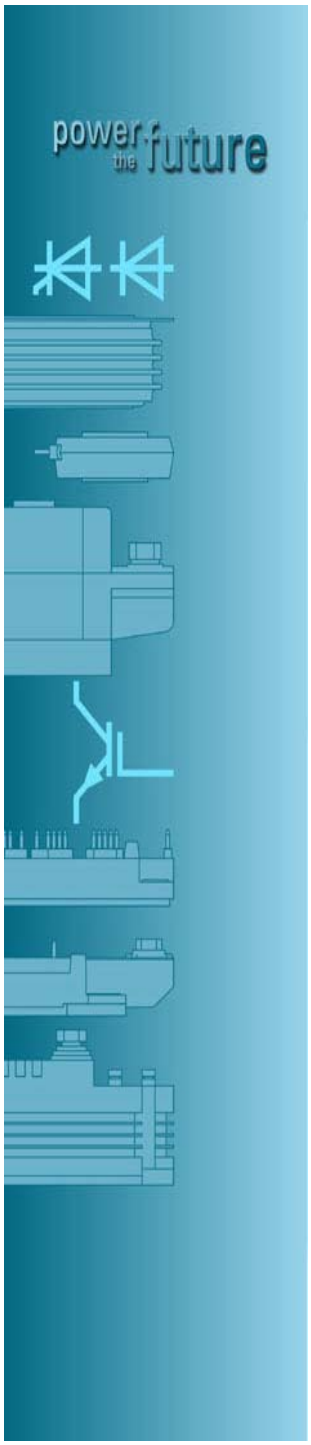
use M2,5 screws

to fix PCB

Metrical screw M2,5

Cross selec-tion of dome with screws





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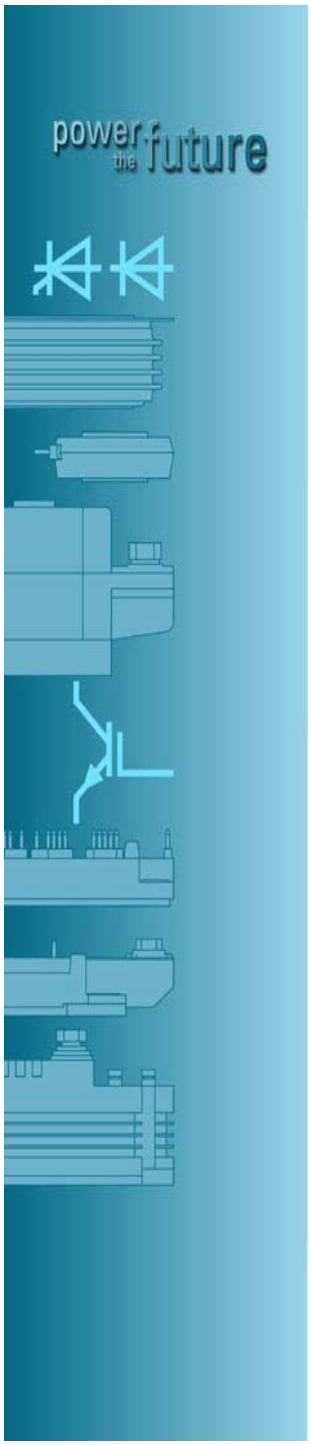

2. Flatness and cavity of base plate

Econo modules have a base plate optimized for their power density. Temperature impacts during production of the modules modify the base plates` original condition. If you later on want to assemble the modules on heat-sinks, cavities below the modules might result.

In order to guarantee a constant quality, during tests carried out at random the cavity and the bow are measured. The values given below apply to the modules` final test. Slight changes might result from the relaxation of the modules` base plates during storage or from differences in the measuring procedure.

	Cavity	Bow
EconoPACK/PIM2	max. 100 µm	0 – 190 µm
EconoPACK/PIM3	max. 70 µm	- 20 – 200 µm

table 1

All resulting data are used for a continuous improvement based on the statistic control (SPC). Straying of thermal resistance values from the modules to the heat-sinks this way could be reduced essentially, so that the modules can be used in a more efficient way.

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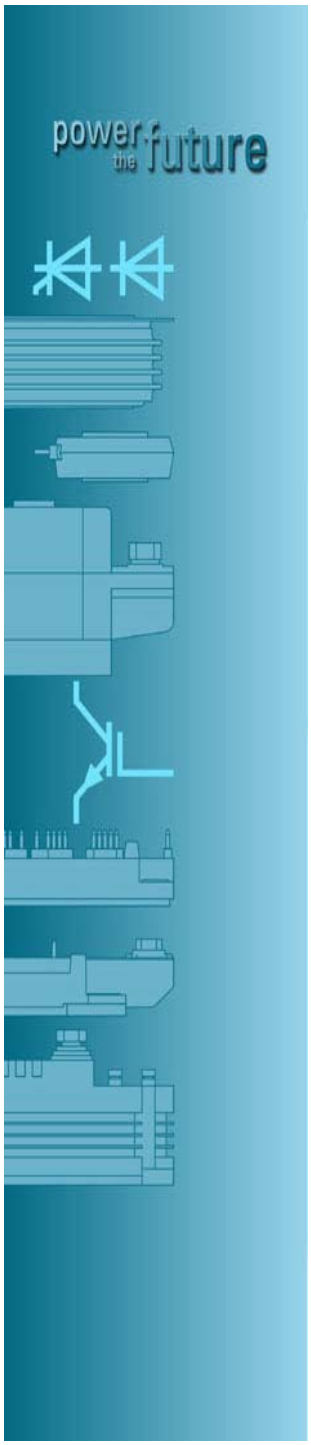
3. Requirements on base plate and heat sink



The quality of the heat-sink surface in combination with the base plate characteristic is essential for the thermal dissipation of the whole system.

The module mounting area of the heat-sink surface should not exceed the following flatness and roughness values.

	Flatness	Roughness R_z
Econo2	<=25 µm at 100 mm	<= 10 µm
Econo3	<=25 µm at 100 mm	<= 10 µm

table 2

Point-shaped and line-shaped scrapings exceeding the values specified in table 2 are not critical if they cover up to 2% of the total surface. Disruptions in the galvanic surface between base plate and heat-sink do not have a negative impact on functionality. Spike-like protrusions, however, lead to improper thermal coupling and should therefore be removed before mounting.

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4. Module height

The module has a mounting height of 17 mm with a tolerance of ± 0,5 mm.

If more than one module is mounted on a PCB it is necessary to assure that the various base plates are on one level otherwise there will be mechanical tensions in the PCB which can destroy the construction..

5. Pin positions

The outlines of the Econo modules are shown in the corresponding data sheet. The center position of each pin can deviate from the ideal position by a diameter of 400/500 µm as shown in figure 2.

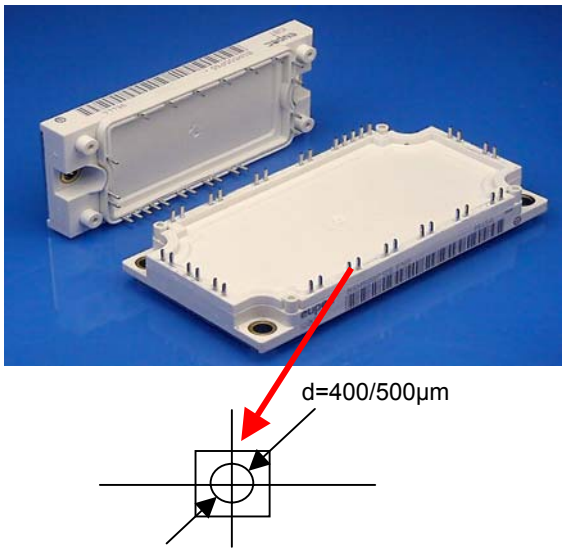
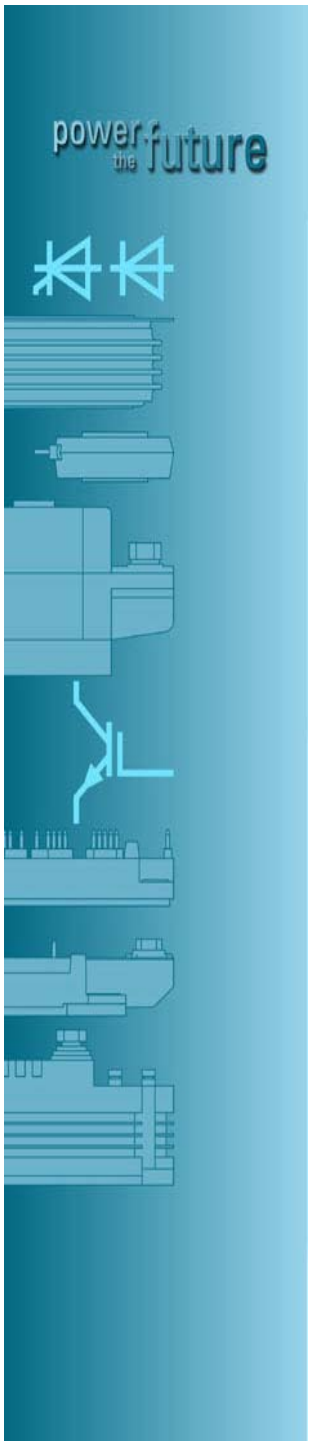


figure 2

tolerance for pin center position



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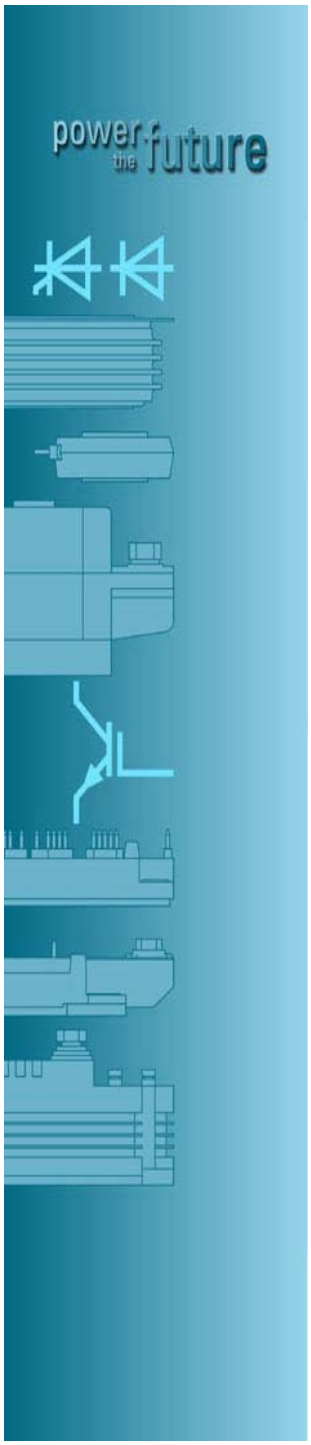

6. Dimensioning of copper layer on PCB

The PCB traces should be dimensioned in that way, that at maximum current no excessive heating occurs. The conditions can be improved with forced air cooling. Usually a trace thickness of 105 µm is used. The width of the trace depends on the current level.

A local reduction of the copper cross section should be avoided because it would cause a rise in temperature at this point. It is recommended to simulate worst case conditions on a prototype.

7. Soldering

A good solder joint with low transfer resistance is necessary for proper thermal dissipation and conduction from pin to PCB trace. For efficient production a wave soldering process can be used. Of course, the thermal limits for all devices should not be exceeded. A visual quality control of the soldering is usually sufficient. A well-balanced layer of solder should be surrounding every pin.

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8. Mounting to heat-sink

A thermal grease with permanent elastic properties should be selected for a lifelong constant thermal resistance between base plate and heat-sink. Low viscosity at mounting conditions is required to prevent mechanical stress to the base plate. Low thermal resistance is necessary for a proper power dissipation.

A layer of approximate 100 µm thermal grease is to be applied evenly to the base plate. The thickness of the layer is appropriate if a small rim thermal grease can be observed around the mounted module. Cleanliness is particularly important by the use of the thermal grease, since particles worsen the heat dissipation.

The entire arrangement of PCB and Econo modules is placed onto the heat-sink. First, all mounting screws have to be tightened with 0,5 Nm (hand-screwed) criss crossed. Then screws thightening with nominal torque. (torque values: see table 3) in the same sequence.

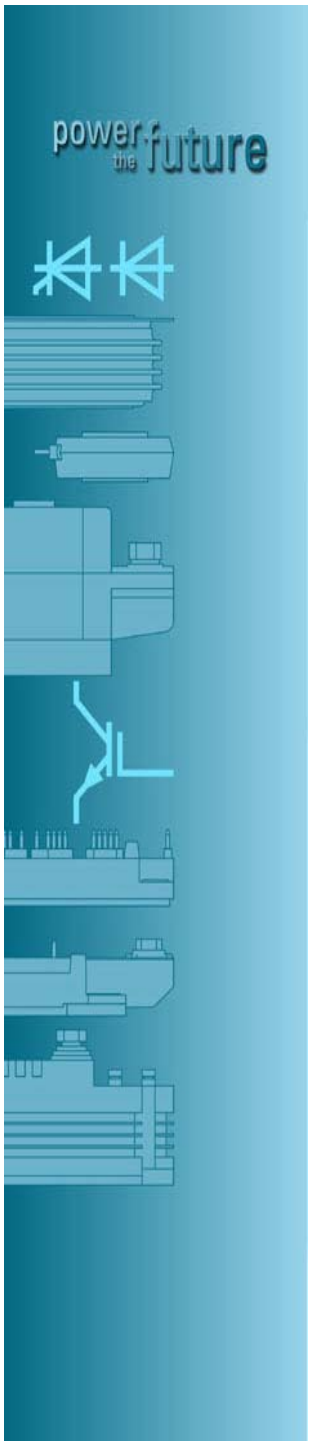
Tork instruction to the heat-sink:

	Screws	Values min. und max.
EconoPACK/PIM2	M5	3-6 Nm
EconoPACK/PIM3	M5	3-6 Nm

table 3

It might be necessary to repeat the last step after an appropriate setting time. The allowed torque for the screws depends on the heat-sink material. The

Formula shows the dependency of torque and friction coefficient µ to the resulting force.



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$$F_V = \frac{M_A}{(0{,}159\ P + \mu_G\ 0{,}557\ d_2 + D_{km}\ \mu_K\ /2}$$

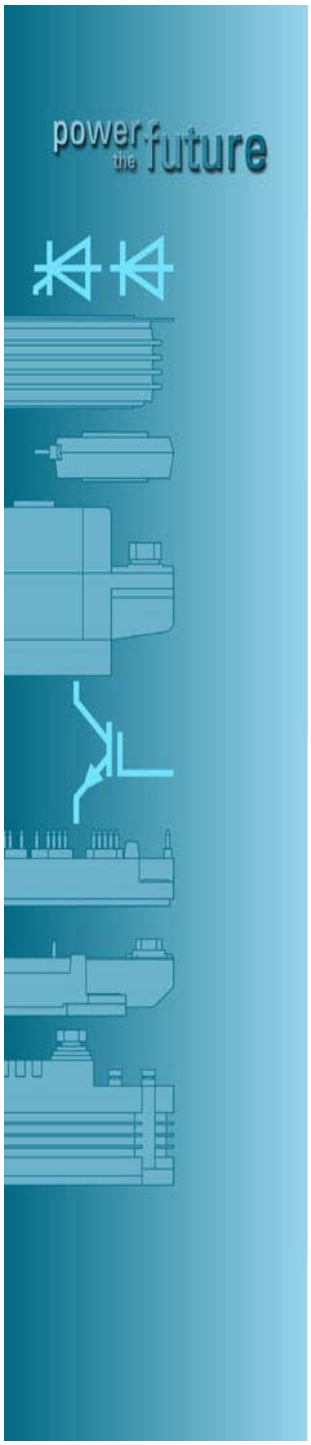
M_A =	mounting torque
F_V =	preload force (resulting force per screwhole)
D_{km} =	active diameter as (d_W+d_h)/2
μ_K =	friction coefficient (screw head
μ_G =	friction coefficient (thread in heatsink)
d_2 =	screw thread diameter
P =	thread pitch

An example is shown for steel screws in aluminium heatsink with M5 thread:

M5 cheese head screw according to DIN84 or M5 hexagon head screw according to DIN931 or to DIN933.

	F(M_A = 3 Nm)	F(M_A = 6 Nm)
typ. values μ_K	0,15	0,15
typ. values μ_G	0,2	0,2
steel to aluminium	2,5 – 3,9 KN	5 – 7,7 KN

The result depends strictly on the mounting conditions.
The torque has to be adjusted accordingly.



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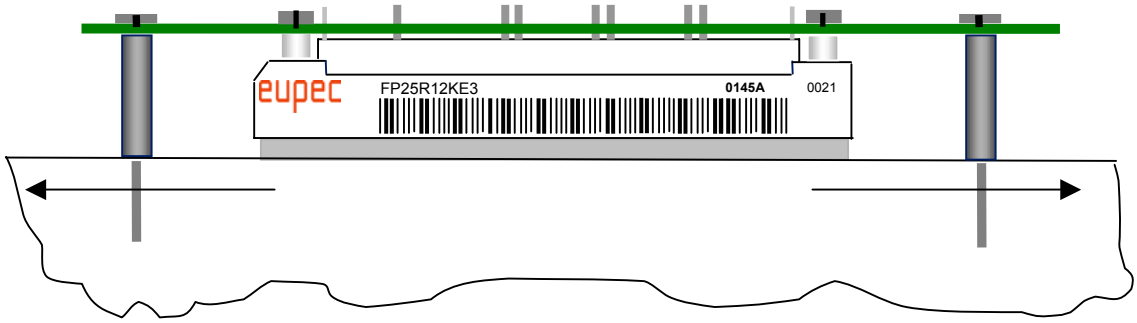
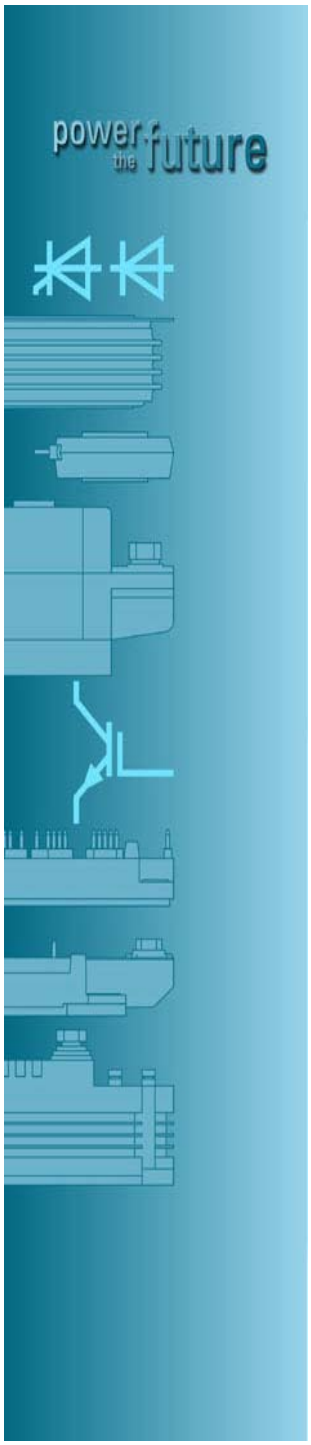
9. Demounting

The screws for the connection of module and heat-sink have to be removed. The heat-sink has to be removed to the side. Pulling could disconnect the base plate from the housing due to the adhesive force of the thermal grease.



The pins can be desoldered with suitable facilities.



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