

## Basic Instructions

Semiconductors should be mounted so that they are not heated up by adjacent parts.

In case of natural convection heatsink fins must be arranged so that the air can flow freely from the bottom to the top.

In case of forced convection by air or liquid the power semiconductor can be mounted in any position as long as the cooling medium amount is sufficient for the load.

The cross-section area of leads must be adequate to prevent the power semiconductors from being heated up. Power semiconductors should not be subject to tension or pressure by busbars, heatsinks or leads.

The semiconductor should be mounted so that mechanical vibrations cannot cause short circuits between leads.

Leads should not be soldered to the case, except on housings with solder lugs.

## Moulded Discretes

The mounting planes or tabs of standard Discretes are electrically non-isolated. Mounting orientation is not critical. If it is necessary to bend the terminals, a bending tool should be used. If bending is done manually, then the terminal should be gripped between the bending zone and the case. Nicking and repeated bending of the terminals must be avoided.

**In case of insulated mounting, increased thermal resistance between case and heatsink must be taken into account.**

For our isolated ISOPLUS247™ and ISOPLUS i4-PAC™ series only spring clip assembly is recommended.

None of the mounting accessories mentioned below are part of our range of products. Please contact the respective distributors.

### Screw mounting

The heatsink thickness at the mounting base must be at least 2 mm in the case of aluminium or 1.2 mm for copper. The mounting hole must be burr free. The maximum diameter of the hole must not exceed 3.7 mm, that of additional countersinking 4 mm. The screw head must not press directly onto the case; a washer for spreading the pressure must be used. The mating

surface must be levelled up to the edge of the hole. The thermal resistance between metal case and cooling area can be minimized to the value in the data sheets by applying e.g. a metal oxide compound between the contact surfaces. Contact surfaces must be free of dirt. The nut must be secured by means of a lock washer DIN 137. The tool for tightening the screw must not touch the moulded case. For that reason, Philips screws should be used.

### Additional information for insulated mounting

The hole in the heatsink may be of 3.8 to 5.5 mm in diameter. Any burr must be removed. During mounting, in particular while inserting the screw through the insulator, great care is required so that this insulator is not damaged.

For dimensioning of strike and creep distance the relevant standards have to be considered:

IEC 664-1, EN 50178, VDE 0110 part 2.

### Mounting with spring clips

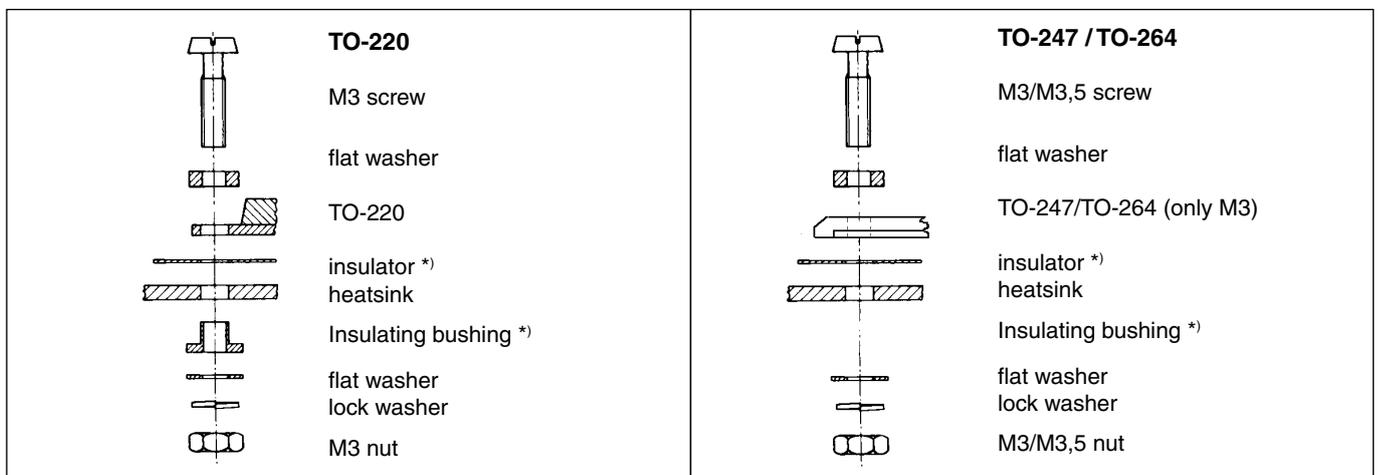
	TO-220 DS(A)1	TO-247 / TO-264 ISOPLUS247™ ISOPLUS i4-PAC™
Chassis thickness [mm]:	1 - 2	1.9 - 2.1
Mounting force [N]:	10 - 50	1.9 - 2.1

For mounting with insulator foils higher mounting forces might be required. Please refer to recommendations given by the manufacturers.

### Soldering of terminals

If the electrical connection is made by soldering, great care must be taken to avoid overheating of the device. In this case the following is recommended:

soldering temperature	distance from case	maximum soldering time
< 260°C	< 3 mm	3 s
< 260°C	> 3 mm	5 s



\*) Not used for non-isolated mounting

## Mechanical load on terminals

The forces on the terminals (push or pull) must not exceed:

TO-220/DS(A)1 package: 4 N

TO-247 and TO-264 package: 8 N

## Surface Mount Technology (SMT)

IXYS now offers semiconductors in several, SMT packages, e.g. TO-252 / D-pack, TO-263 / D2-pack, TO-268 / D3-pack SMD-247 and SMD-264. However, IXYS does not have manufacturing capability for surface mounting. As a guideline use our SMT soldering recommendations ([www.ixys.com](http://www.ixys.com)).

## Discrete metal can



Threaded holes in the heatsink must be at right angles to contact surface and deep enough to accommodate the threaded stud of the power semiconductor device; this ensures that the contact surface which serves for heat dissipation mates tightly to the heatsink. The threaded holes must comply with tolerance class 6H in ISO 262 and ISO 965 / 2. The thermal resistance values given in the data sheets apply to the torque values listed in the reverse side using thermal grease.

The contact surfaces (flat base) and thread of the stud and heatsink must be clean, in good condition and free from damage and corrosion before mounting can begin.

The following values to DIN ISO 1302 should be maintained at the heatsink contact surface:

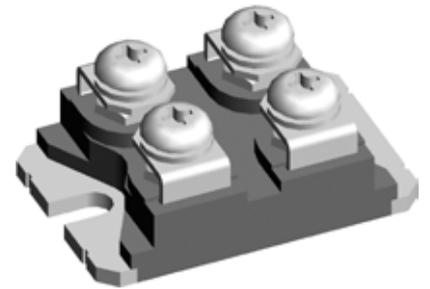
- Flatness  $R_t \leq 16 \mu\text{m}$  (reference length 0.8 mm to DIN ISO 1302)
- Surface finish  $E \leq 0.02 \text{ mm}$

To maintain the thermal resistance a thin coat of thermal grease should be applied to contact surfaces and thread before mounting. Thermal grease DC 340 (Dow Corning) is recommended for use.

The socket wrench should be held vertically when mounting the stud type semiconductor. If the wrench is not held properly bending forces are exerted on the semiconductor causing damage to the case.

Compressed-air screwdrivers and ratchets should not be used.

## miniBLOC™



## Mounting to heat sink

Flatness of the mounting area: 0.05 mm maximum per 40 mm. Mounting holes must be deburred.

Use only M4 screws. Maximum torque to avoid damage to the device is 13 lb.in./1.5 Nm. Minimum torque is 9 lb.in/1.1 Nm.

Do not use self-tapping screws.

The device is already fully insulated between the mounting base and all terminals.

The thermal resistance between mounting base and heatsink can be minimized by applying a metallic oxide compound between the contact surfaces. Dow Corning 340 Heatsink compound is recommended.

## Connection to Terminals

Use supplied M4 x 8 mm screws (4x). To avoid damage by mounting flexible wires, a torque of  $1 \pm 0.2 \text{ Nm}$  is recommended. For connecting to printed circuit boards, the recommended copper film thickness on the PCB is 70  $\mu\text{m}$ . Use of a slotted washer is recommended also for high currents.

## Modules

IXYS modules are 100% tested prior to leaving the factory. Proper mounting is a prerequisite for reliable and trouble-free operation. The following procedure must be used.

Contact surfaces must be free of dirt and be undamaged. The heatsink contact surface must have a flatness of  $\leq 0.03$  mm ( $\leq 1.2$  mil) and a levelling depth of  $\leq 0.02$  mm ( $\leq 0.8$  mil). Apply a thin layer of heat transfer paste evenly to the module's base plate just sufficient to cover the entire base plate to heat sink. It is recommended to apply DC 340 (Dow Corning) or the silicone free Electrolube HTCP, or equivalent and to use a roller.

The minimum thickness of grease is best controlled by removing some modules from heat sink after mounting and to inspect the entire area of the metal base plate. The modules bottom surface must have wetted completely with thermal grease.

The minimum required depth of thread in aluminium heatsinks is 12 mm and 10 mm in copper heat sinks.

All mounting holes must be free from burrs.

First tighten all mounting and terminal screws stepwise. Then use a torque wrench to apply the tightening torques given on the data sheet. Make sure, that the screws fit easily into the threads. Otherwise the total tightening torque will be reached without the necessary contact being obtained.

Do not pull or push on the terminals when making the electrical connections. Make sure that no permanent tensile force is exerted on the terminals.

Use only standard push-on connectors for auxiliary contacts (size is given in the product drawing) or use a special keyed twin plug available as an accessory.

### Modules supplied with solder leads

These should be soldered at iron or solder bath temperatures of  $250 \pm 10^\circ\text{C}$ . The maximum allowable soldering time is 10 seconds. Do not exert any axial force on the leads. Make sure that the distance between the bending axis and package is  $\geq 5$  mm, with the bending radius  $\geq 2$  mm. Avoid repeated bending. The distance between solder leads and package should be  $\geq 10$  mm.

### Modules with tab connectors

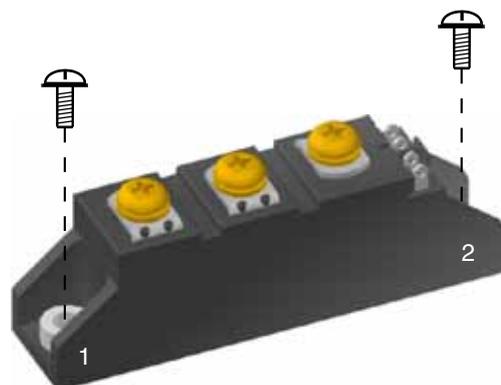
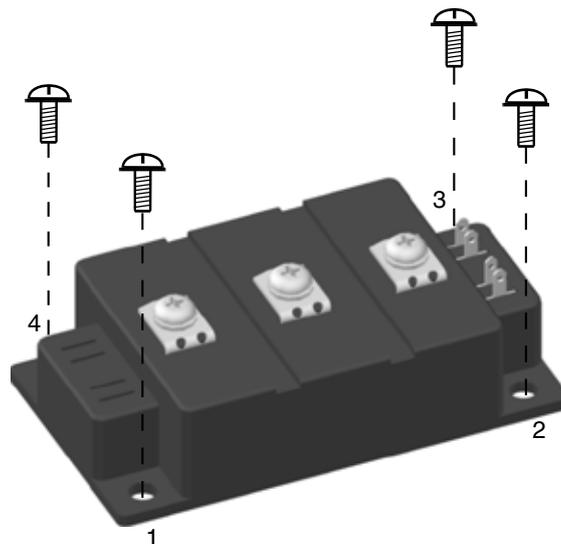
For establishing contacts, use Nickel-plated tab receptacles with insulated sleeves (IEC 48 B). Make sure that the supply leads used have a cross-section according to IEC 48 B.

For currents  $\geq 30$  A, solder plug-type connections with a soldering temperature of max.  $250^\circ\text{C}$  for a maximum 10 s.

### Modules with spacers and holes for PCB mounting

EJOT PT® DS self cutting screws of the dimension K25 are recommended for the mechanical connection between module and PCB. Choose the right length according to your board thickness at a maximum depth of 9 mm of the module holes. The recommended mounting torque is 1.5 Nm.

## Mounting screw fastening procedures



	Four screw mounting	Two screw mounting
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Initial tightening :	1 → 4 → 2 → 3	1 → 2
Final tightening :	1 → 4 → 2 → 3	1 → 2

All mounting screws should have washers and spring washers.

IXYS provides additional mounting instructions through a video available upon request.

### TO-240 modules with DCB (Direct Copper Bonding) base plates

For an optimum application of thermal grease we recommend the following tools:

- cylindrical semi-soft rubber roller (no sponge type) like the ones used to smooth wallpaper joints; for more information please contact your local sales service
- flat solid plate ( $>25 \times 25 \text{ cm}^2$  /  $\sim 10 \times 10 \text{ inch}^2$ ) from which the grease will be picked up
- spatula to evenly distribute thermal compound on the plate
- industrial pneumatic or electric and calibrated torque wrench.

#### Execution

Prepare the tools. Take care that no foreign particles are on the surface of roller and plate. Place a suitable amount of thermal compound on the plate and spread it by means of the spatula. Take care that not too much compound is on the plate. Pick up some compound with the roller from the plate and apply a thin layer evenly to the module's base plate just sufficient to contact the entire DCB base plate to heat sink. Best results are achieved when the thermal grease thickness is between  $30 \mu\text{m}$  and  $50 \mu\text{m}$ ; thicker layers might increase risk of damage to the DCB base plate and internal die.

Advantageously, the thermal grease has to be applied by moving the roller in one direction (lengthwise) forth and back. This will guarantee that within every sweep another position of the roller touches the surface and a homogeneous distribution will be reached easily. After the module has been placed on the heatsink the screws have to be fastened with the specified torque between  $2.5 \text{ Nm}$  and  $4 \text{ Nm}$ .

Take care to deposit the roller and the spatula on the workbench in such a way that they can not be polluted by foreign particles.

#### Verification

The thickness of thermal compound on the module's base plate can be measured periodically by use of a suitable gauge as for example detailed in annex B of standard IEC 60747-15. During production it is recommendable to periodically dismount some modules to check the complete wetting of the DCB base on heatsink surface. A quick and easy way to get an impression of the thickness –independently from the above given recommendations– is by comparison of the mounted device with reference to figures given on page 2. On the long sides of the modules thermal grease should be squeezed out slightly.

Fig. 1: Mounted device with a thickness of  $20 \mu\text{m}$  thermal grease. No thermal grease squeezed out.



Fig. 2: Mounted device with a thickness of  $40 \mu\text{m}$  thermal grease. Thermal grease squeezed out slightly.



Fig. 3: Mounted device with a thickness of  $60 \mu\text{m}$  thermal grease. That is a strong hint for too much thermal grease.

