

### Introduction

IXYS designates SOT-227B package as miniBLOC - a **miniature power BLOCK**. This application note gives instruction for using heat sinks with this package. One picture of the actual package is shown in Figure 1 and the mechanical outline is given in Figure 2. It has two mounting holes and four connection terminal leads.

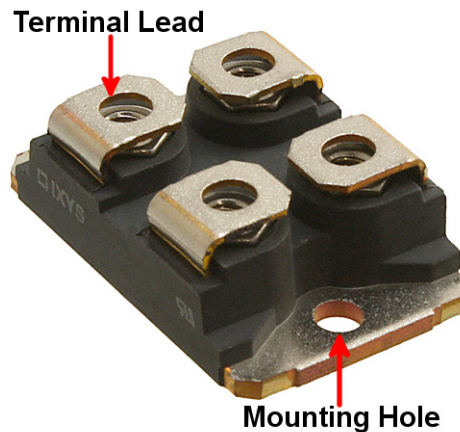
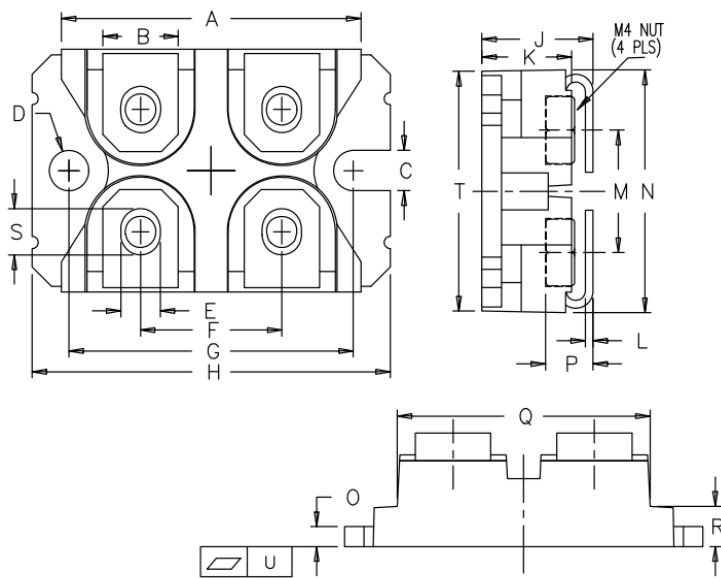


Figure 1: SOT-227B (miniBLOC) package diagram



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.240	1.255	31.50	31.88
B	.307	.323	7.80	8.20
C	.161	.169	4.09	4.29
D	.161	.169	4.09	4.29
E	.161	.169	4.09	4.29
F	.587	.595	14.91	15.11
G	1.186	1.193	30.12	30.30
H	1.496	1.505	38.00	38.23
J	.460	.481	11.68	12.22
K	.351	.378	8.92	9.60
L	.030	.033	0.76	0.84
M	.496	.506	12.60	12.85
N	.990	1.001	25.15	25.42
O	.078	.084	1.98	2.13
P	.195	.235	4.95	5.97
Q	1.045	1.059	26.54	26.90
R	.155	.174	3.94	4.42
S	.186	.191	4.72	4.85
T	.968	.987	24.59	25.07
U	-.002	.004	-0.05	0.1

Figure 2: SOT-227B (miniBLOC) package outline

Using this package, IXYS offers a wide variety of power devices including power MOSFETs, IGBTs, Fast Recovery Epitaxial Diodes (FREDs), Thyristors, and standard rectifiers among others.

### Key features of miniBLOC or SOT-227B package:

- Fully isolated from the metal base, allowing common heat sink.
- Wire-bonded internal connections
- Screw type electrical terminals secured against axial pull-outs.
- Low junction-to-case thermal resistance

### Recommended Torque:

The maximum allowable torque for mounting base is 1.5 Nm/13 lb.in. and the maximum terminal connection torque is 1.3 Nm/11.5 lb.in. The recommended torque for mounting screws and terminal leads are 1.3 Nm/11.5 lb.in. and 1.1 Nm/9 lb.in. respectively. A torque wrench, accurate in the specified range, must be used for mounting the module, in order to achieve optimum results. Over-tightening the mounting screw may lead to deformation of the package, which would then increase the thermal resistance and damage the semiconductors.

### Heat sink surface requirement:

The heat sink contact surface must be flat, with a recommended tolerance of <0.03mm (<1.18mils) and a leveling depth (surface roughness) of <0.02mm (<0.79mils), according to DIN/ISO 1302. The heat sink surface must be clean with no dirt, corrosion, or surface oxides. It is very important to keep the mounting surface free from particles exceeding 0.05mm (2 mils) in thickness.

### Screw and washer requirement:

Pan head M4 screws should be used with lock and flat washers for fastening the device to the heat sink as shown in Figure 3. The lock washer must sit above the flat washer. To mount to a heat sink, we recommend a minimum 10 mm thread depth and a minimum screw length of 12 mm. For example, JISB1188 screw with 12 mm length and maximum head/washer diameter of 8 mm. IXYS does not supply screws for mounting holes.

### Thermal compound application:

Coat uniformly the heat sink mounting surface and miniBLOC base plate with a good quality thermal compound. For the lowest case to heat sink thermal resistance ( $R_{thCS}$ ), a very thin layer of thermal compound is recommended between the base plate and the heat sink. The suggested thermal grease is DC340 (Dow Corning), silicone-free HTCP (Electrolube), or an equivalent. Screen printing, rubber rolling or spatula is the preferred methods for applying the grease. A final grease layer thickness in the range of 60um to 100 um is considered suitable for most applications. The  $R_{thCS}$  value at the recommended mounting torque is approximately 0.05 °C/W.

### Mounting Torque to Mounting Force Conversion:

To convert the maximum mounting torque mentioned in the datasheet into a mounting force if necessary, you can use the following formula:

$$F = \frac{2\pi.M}{P} \quad \text{Equation (1)}$$

Here  $F$  is the contact force in Newton (N),  $P$  is the pitch in meter (m) of the used screw and  $M$  is the torque applied to the screw in Newton-meter (Nm). The above relation states that the contact force is inversely proportional to the pitch of the used screw.

### Mounting Steps onto the heat sink:

Using the following steps, first fasten the device to the heat sink before connecting wires to the terminal leads:

- i) Place the SOT-227B package above heat sink holes, and insert the M4 screw with lock and flat washers in each mounting hole.
- ii) First lightly tighten the two mounting screws. Tighten alternatively the screws until their final torque value is reached. Full tightening of both of the screws can then be completed. The case to heat sink thermal resistance,  $R_{thCS}$  at the recommended mounting torque is  $0.05C/W$  for a greased surface.
- iii) It is recommended to use a screwdriver with controlled torque for this operation if possible.

### Common mistakes in mounting SOT-227B:

- Star washer under the screw head
- Small head screw without the washers
- Screw with too large a head
- Uneven torque on both screws
- Over-tightening the mounting screw may lead to deformation of the package, which would then increase the thermal resistance and damage the semiconductors.

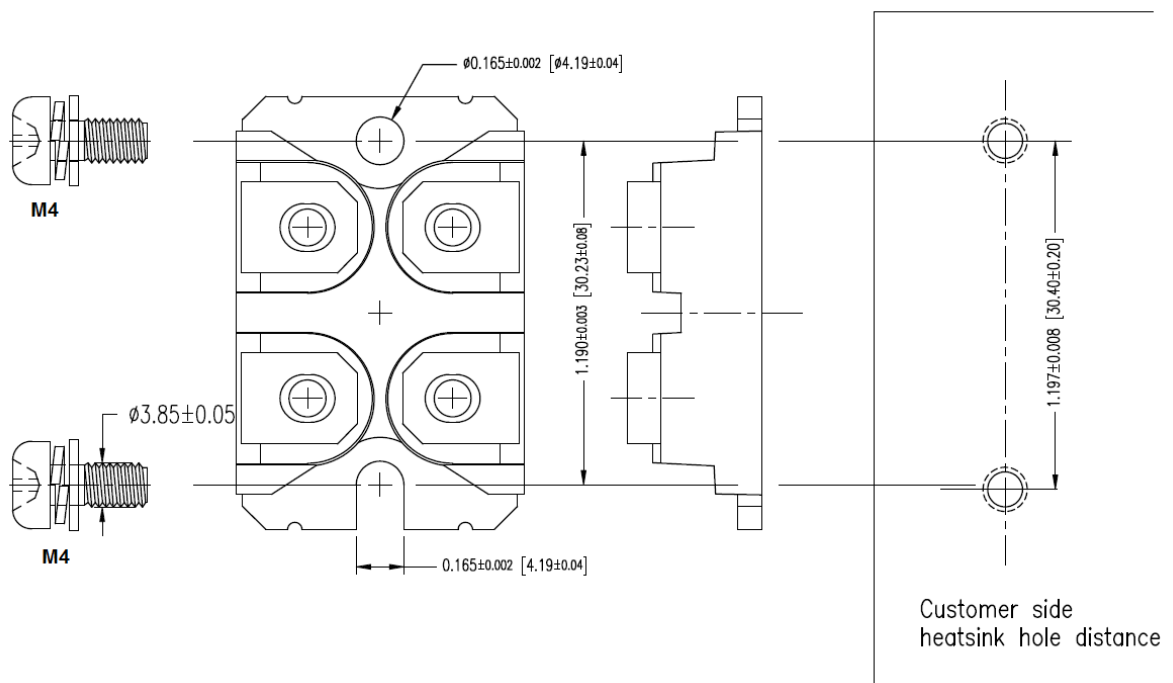


Figure 3: Mounting the Base to the Heat sink

**Connection to terminal leads:**

This package has four terminal leads as shown in Figure 1. For proper connection, it is recommended to use pan head M4 screws secured by a lock washer and flat washer shown in Figure 4. Use supplied four M4 X 8 mm screws for connecting wires to four terminal leads. As mentioned earlier, the recommended torque for mounting terminal leads is 1.1 Nm/9 lb.in.

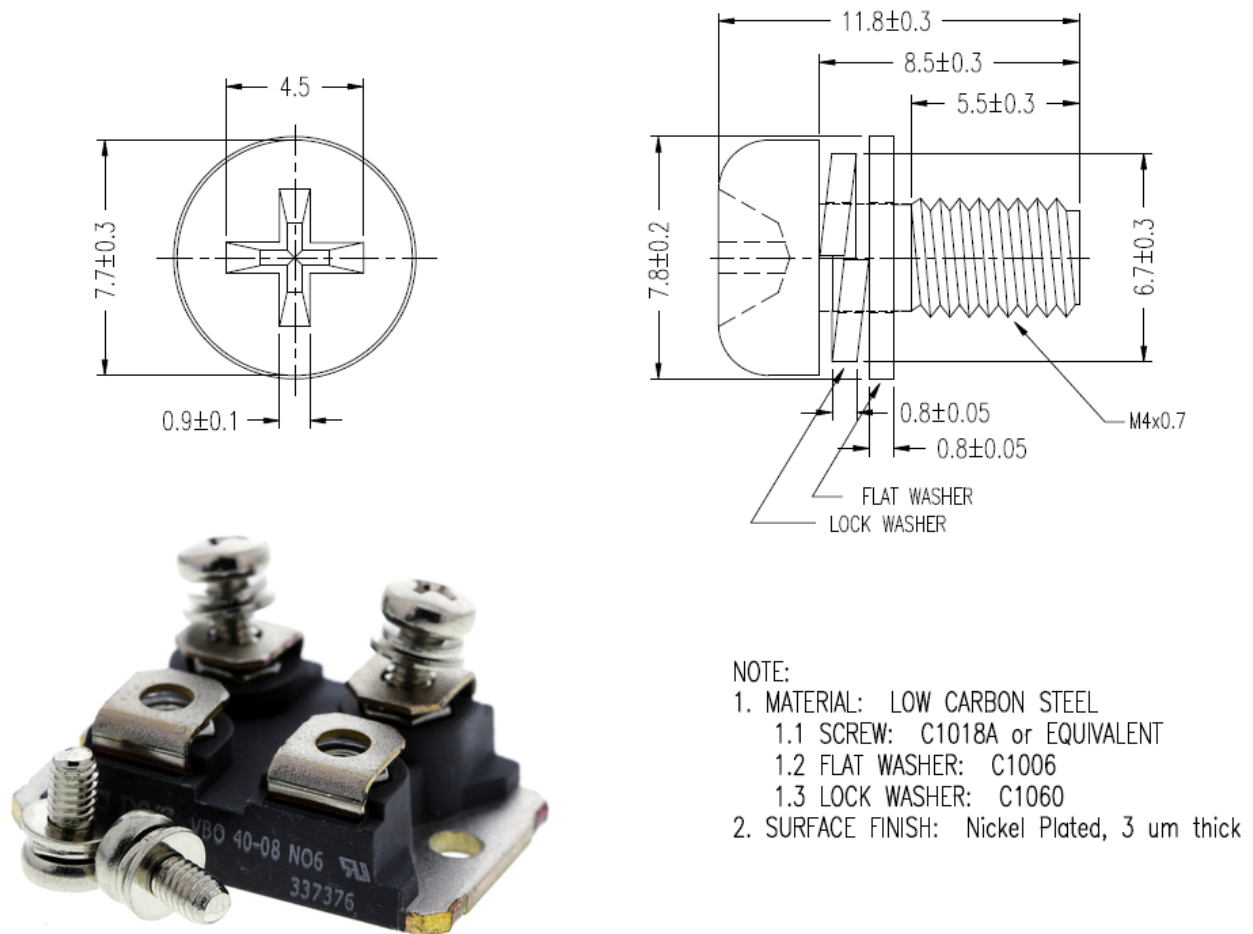


Figure 4: Recommended screws for terminal leads

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