

Application Note

AN-TO220 Full PAK

*Mounting considerations for TO220 Full PAK
- fully isolated package*

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Power Management & Drives



N e v e r s t o p t h i n k i n g



Revision History	
Actual Release: Rev. 2.0 2006-12	Previous Release: - Rev. 1.0 2000-07
Revised instructions	
Screw M2.5 instead of M3.0 on page 3	
Mounting torque 0.5 Nm instead of 1.0 Nm on page 3	

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1 Introduction

It is important that power semiconductors are correctly mounted if full functionality is to be achieved. Incorrect mounting may lead to both thermal and mechanical problems as well as deratings in performance.

2 Correct mounting procedures

2.1 General

- Care should be taken not to cause any mechanical damage to the package.

2.2 Screw mounting

- Self tapping screws should not be used.
- It is recommended that a rectangular washer is inserted between the screw head and the mounting tab. Care must be taken to ensure that the washer does not damage the plastic body of the package during the mounting process.
- The recommended mounting torque is 0.5 Nm. This should not be exceeded.

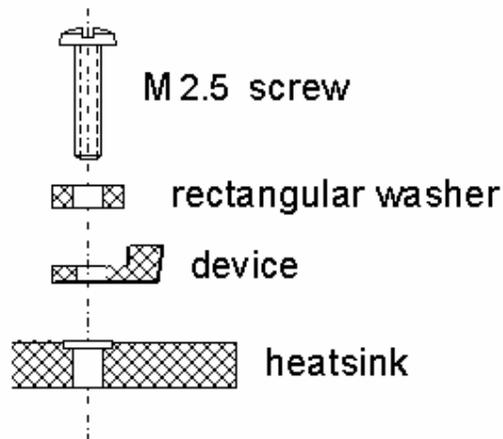


Figure 1: Screw mounting into a tapped heatsink

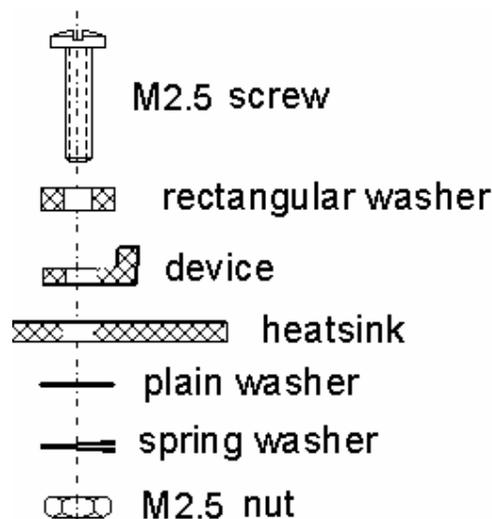


Figure 2: Screw mounting through a heatsink using a nut

2.3 Clip mounting

Using clip mounting ensures that the force is applied above the silicon and the thermal contact is good.

- For heatsinks less than 5 mm in thickness saddle clips should be used (see Fig. 3). These provide contact forces between 15 N and 50 N according to their specification.
- For heatsink greater than 5 mm in thickness, U clips are used. These produce contact forces between 15 N and 50 N according to their specification.
- There are a number of proprietary clip solutions, where the clip is anchored in a feature in an extruded heatsink. Contact forces between 25 N and 50 N can be achieved.

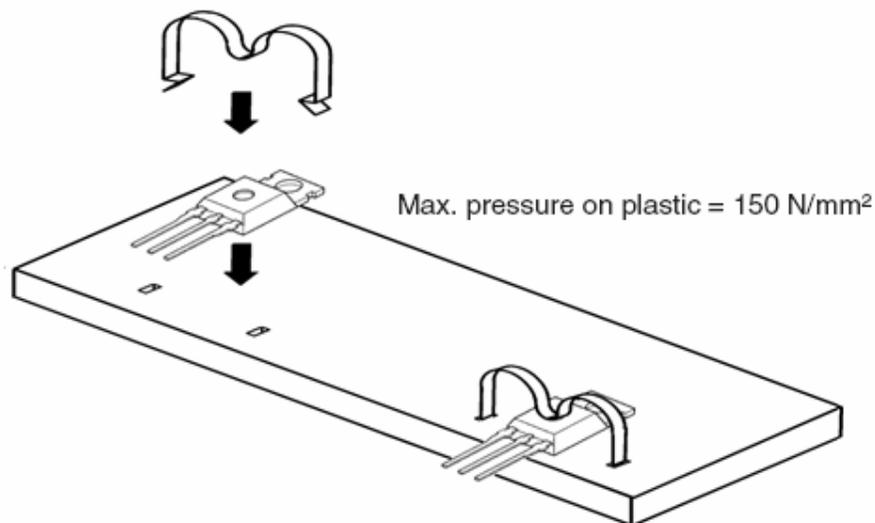


Figure 3: Example of clip mounting (saddle-clip)

3 Thermal Performance

The overall thermal performance of a package with a heatsink is characterized by a junction to ambient thermal resistance R_{thJA} . The R_{thJA} can be calculated with equation (1) (see Fig. 4).

$$R_{thJA} = R_{thJC} + R_{thCS} + R_{thS} + R_{thSA} \quad (1)$$

R_{thJA} thermal resistance junction – ambient
 R_{thJC} thermal resistance junction – case
 R_{thCS} thermal resistance case – sink
 R_{thS} thermal resistance sink
 R_{thSA} thermal resistance sink - ambient

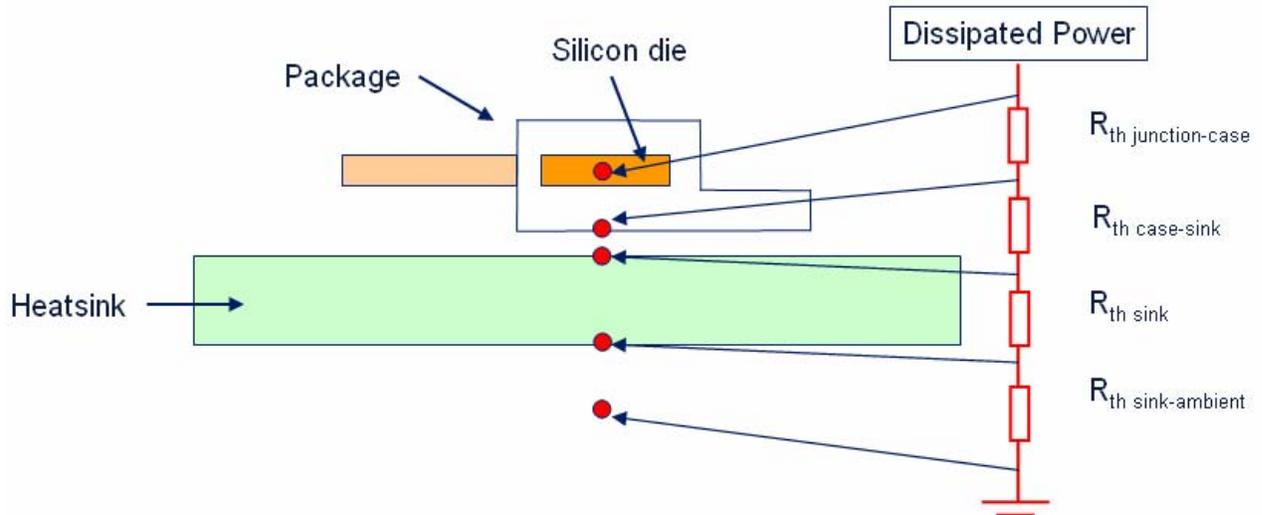


Figure 4: Thermal model

When mounting the package on a heatsink, it is important to consider the interface resistance R_{Tcs} . In ideal case R_{Tcs} is zero, because the planarity and the roughness of the package as well as the heatsink are ideal. However, it is not possible to manufacture such ideal packages even under all measures of precision. A small air gap is therefore given. This results in a thermal resistance case to heatsink R_{thCS} , which is different from zero.

Since air is a good insulator, the air gap significantly increases the thermal resistance. To improve the conduction behaviour this air gap shall be filled with an interface material having better thermal conductivity than air.

Measurements show that the usage of thermal grease results in a reduction of the interface resistance in the range of 1.2-1.5 K/W. Thus, the usage of thermal grease is highly recommended.

4 Heatsink requirements

The contact area of the package and the heat sink must be free of any particles and damages as well as any other contamination. The following surface conditions are recommended:

Heatsink Roughness	$R_z \leq 10 \mu\text{m}$
Heatsink Flatness	$\leq 10 \mu\text{m}$ (reference length 15 mm)

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