Mounting and handling guidelines for pin through holes hermetic packages

Introduction

This document provides the main mounting instructions and recommendations to appropriately handle and mount pin through holes hermetic TO254, TO254AA and TO257 packages.

Inappropriate techniques or unsuitable tools during handling and mounting may impact the reliability and thermal dissipation or even damage them.

1 Packages overview and dimensions

TO254 and TO257

Figure 1. **TO254 and TO257 3D views**

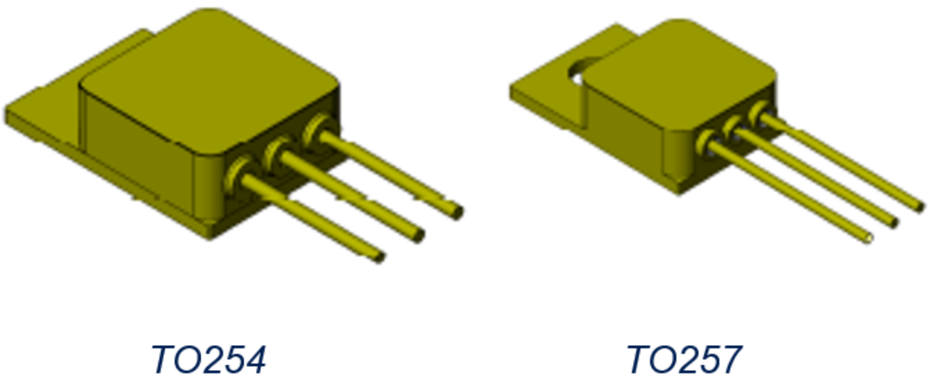


Figure 2. **TO-254 and TO-254AA package outline drawing**

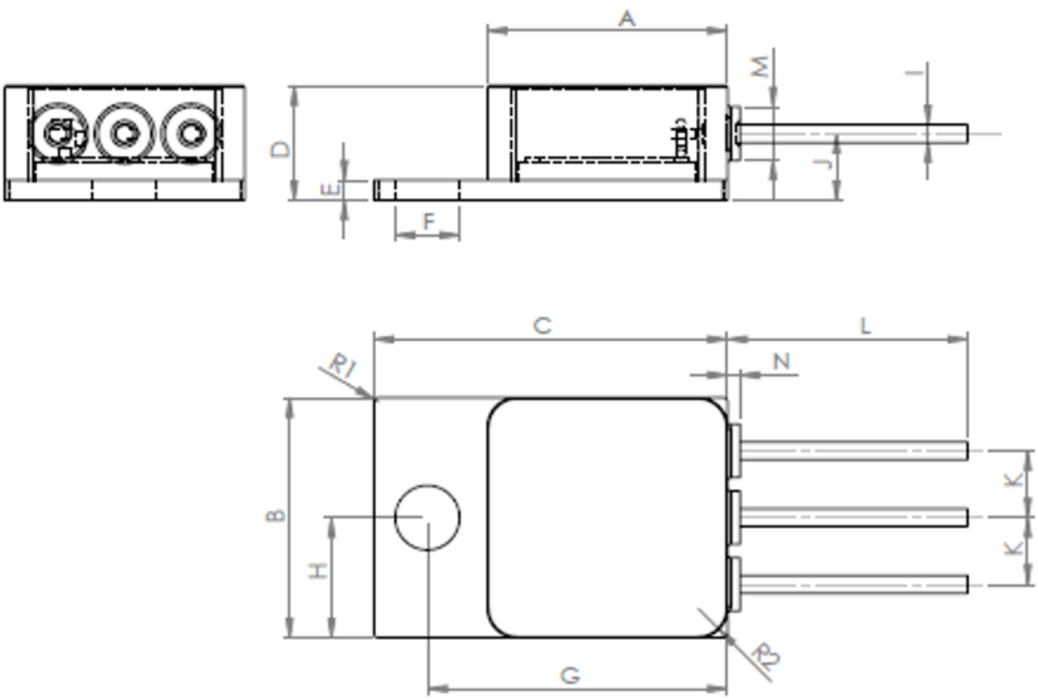


Table 1. TO-254 and TO-254AA package mechanical data

Symbols	Dimansions (mm)			Dimansions (inches)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	13.59		13.84	0.535		0.545
B	13.59		13.84	0.535		0.545
C	20.07		20.32	0.790		0.800
D	6.32		6.60	0.249		0.260
E	1.02		1.27	0.040		0.050
F	3.56		3.81	0.140		0.150
G	16.89		17.40	0.665		0.685
H	6.86 BSC			0.270 BSC		
I	1.02	0.89	1.14	0.035	0.040	0.045
J	3.81 BSC			0.150 BSC		
K	3.81 BSC			0.150 BSC		
L	12.95		14.5	0.510		0.571
M	2.92		3.18	0.114		0.126
N			0.71			0.028
R1			1.00			0.039
R2	1.52	1.65	1.78	0.060	0.065	0.070

Figure 3. TO-257 package outline drawing

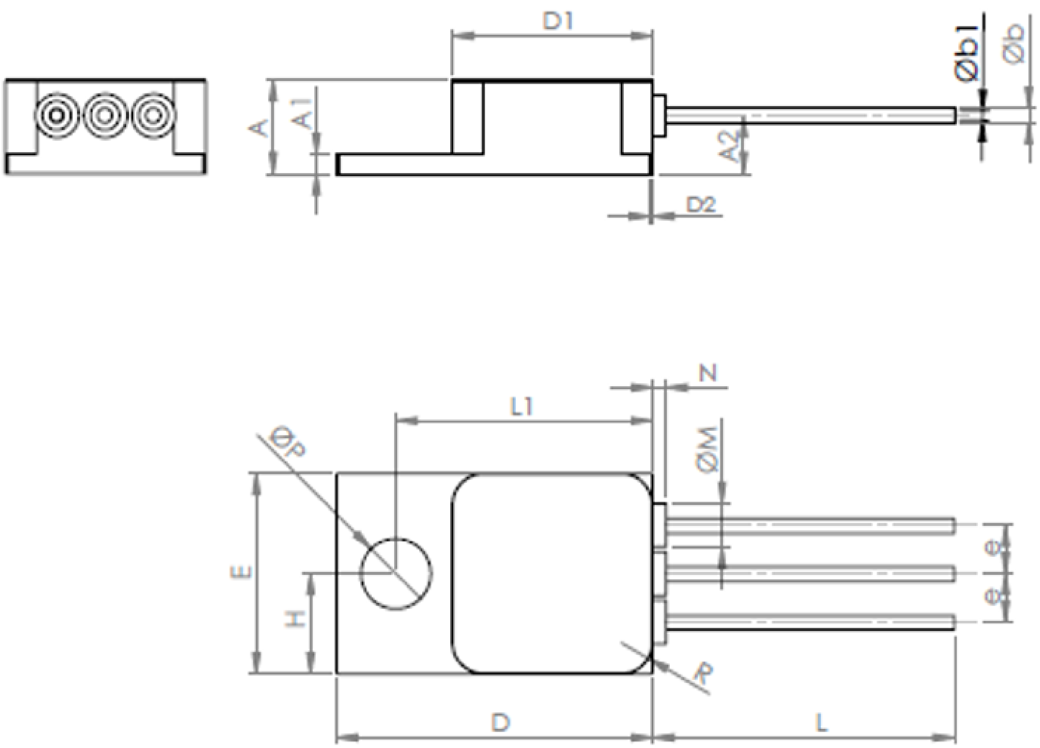


Table 2. TO-257 package mechanical data

Symbols	Dimansions (mm)			Dimansions (inches)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.83	4.95	5.08	0.190	0.195	0.200
A1	0.89	1.02	1.14	0.035	0.040	0.045
A2	2.91	3.05	3.18	0.115	0.120	0.125
b	0.64		1.02	0.025		0.040
b1	0.64	0.76	0.89	0.025	0.030	0.035
D	16.51	16.64	16.76	0.650	0.655	0.660
D1	10.41	10.54	10.67	0.410	0.415	0.420
D2			0.97			0.038
e	2.41	2.54	2.67	0.095	0.100	0.105
E	10.41	10.54	10.67	0.410	0.415	0.420
H	5.13	5.25	5.38	0.202	0.207	0.212
L	15.24	15.88	16.51	0.600	0.625	0.650
L1	13.39	13.51	13.64	0.527	0.532	0.537
M	2.16	2.29	2.41	0.085	0.090	0.095
N			0.71			0.028
P	3.56	3.68	3.81	0.140	0.145	0.150
R		1.65			0.065	

2 Bending and cutting leads

Lead bending is a delicate operation that requires appropriate tooling and training.

The lead must be firmly held between the package body and the bending point during the bending operation. If the package / lead interface is strained during lead bending, the hermetic sealing may be impacted.

There are several rules to consider:

- Never apply clamping or holding force on the package body during lead bending
- Clamp the leads firmly between the package body and the bending or cutting point
- Bend the leads at least 3mm away from the package body
- Never bend the leads laterally
- Never bend the leads at more than 90°, and never bend them more than once
- Make sure that the bending / cutting tool does not damage the leads

Please refer to the illustrations below.

Lead bending recommendation

Figure 4. **Correct (clamp only the leads)**

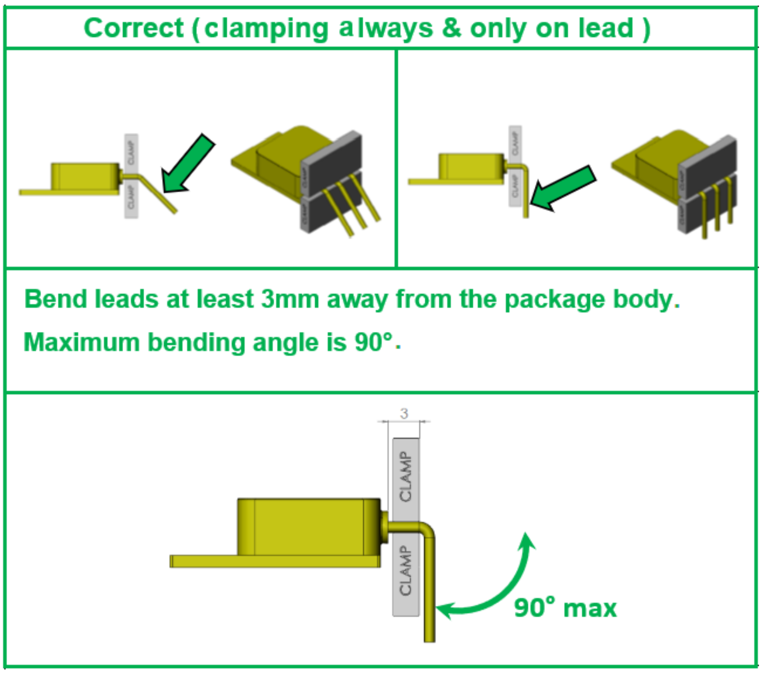
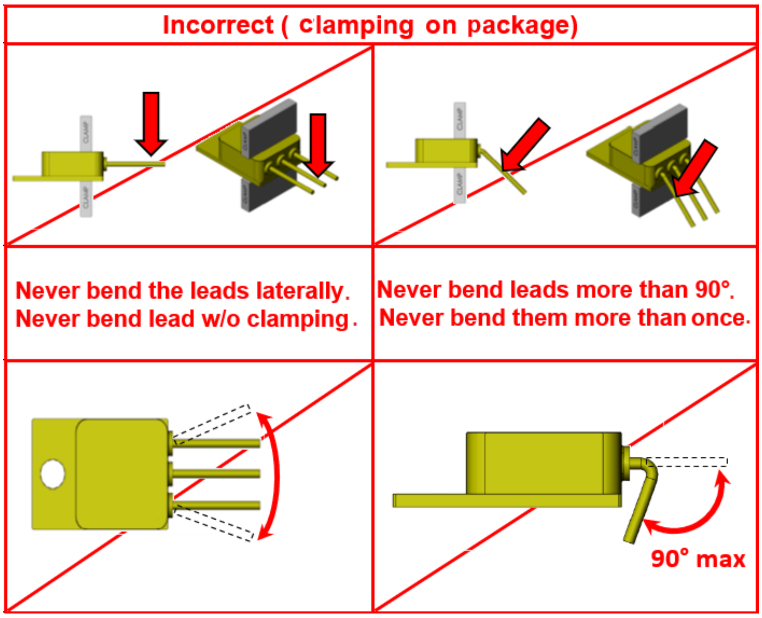


Figure 5. Incorrect (clamping on package)



Lead cutting recommendation

Figure 6. Correct (clamp only the leads)

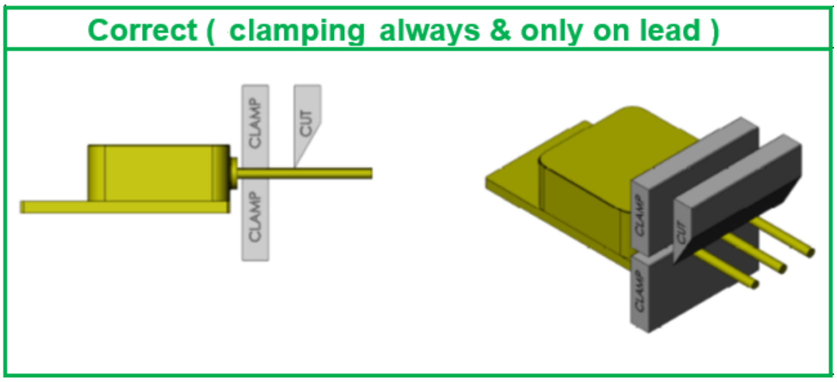
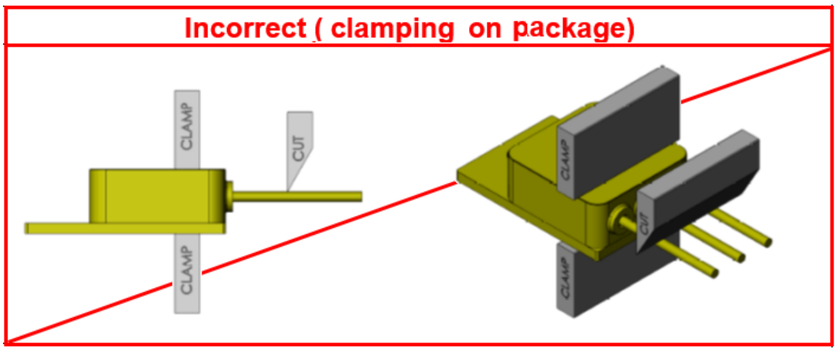


Figure 7. Incorrect (clamping the package)



Note: Make sure that the bending or cutting tool does not damage the leads.

3 Heatsink mounting

The most common (and efficient) way to dissipate heat generated by the device is to connect the package heatsink to an external heatsink. The heat dissipation will be done by conduction, making the device / heatsink contact essential to the dissipation performance.

Mounting surface preparation

- The mounting surface must be clean, flat and free of burrs or scratches
- The use of a thin layer of thermal interface material (thermal silicone grease for example) will help ensure a very low contact thermal resistance between the device and the heatsink. An excessively thick layer or an excessively viscous material may have opposite effect.
- The planarity of the contact surface between device and heatsink is essential and should be kept to less than 50 microns variations.

Insertion

If the heatsink is mounted and/or connected on the printed circuit board (PCB), it should be attached to the component before the soldering process of the leads.

Mounting techniques

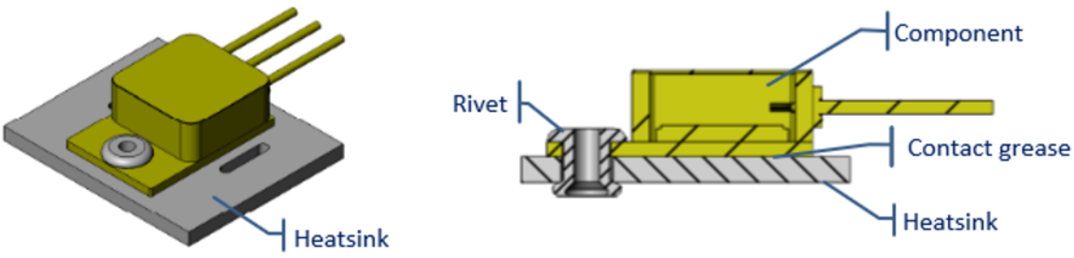
Mounting is another important part of the process. Excessive stress may induce deformation of the package tab, and as a consequence, potential hermeticity or reliability issues, and has a negative impact on the thermal dissipation.

- Package reflow

  While usually not recommended for pin through hole packages, reflow is a valid option to solder the package heatsink to an external one. It implies the removal of the gold finish from the package heatsink prior to the mounting (the presence of gold in the SnPb or SnAgCu solder alloy decreases the reliability of the mounting).
- With rivets

  Pop rivets should not be used, as the excessive expansion of the metal can generate deformation of package heatsink hole and high crimping shock may generate stress on the device. Press rivets may be used with caution as they are usually done by soft metal (aluminium).The crimping force must be applied slowly and carefully in order to avoid heatsink deformation.

Figure 8. **Rivets view**

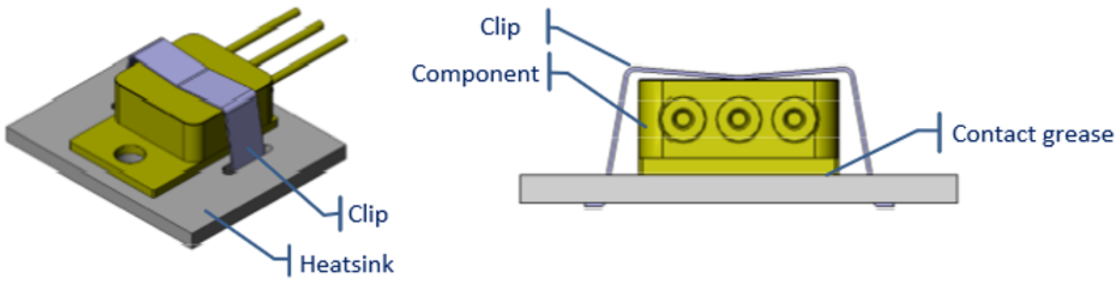


- With clips

Contact area between the package body and the clip must be taken into account. The maximum pressure allowed on the package top surface is 150 N/mm².

The clips must have a shape which will avoid concentrated force on the package body. The force applied on the component depends on the heatsink and the device thicknesses, so the clips must be designed to take these values into account.

Figure 9. **Clips view**

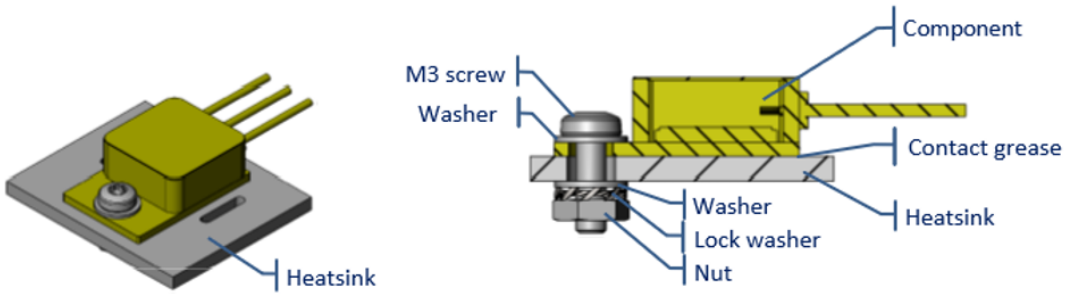


- With screws

The following precautions must be taken :

1. To avoid package tab deformation, washers should be placed between the screw head and the package, and a compression washer should be placed between the tab and the nut

Figure 10. **Screws view**



2. Avoid any mechanical shocks during the screwing process
3. Appropriate screwing torque should be used. Excessive screwing torque may cause package tab deformation and induce poor thermal contact. It may also impact package reliability performance
4. The thermal contact resistance depends on the force generated by the applied torque on the screw

Figure 11. **Force equation**

$$F = \frac{2 . T . \pi}{P + r . D . \pi}$$

Where:

- T is applied torque on the screw in N.m
- P is pitch in m
- D is screw diameter in m
- r is rubbing factor: # 0.12 for steel-steel with grease and # 0.2 for steel-aluminium

M3 screws are required for TO254 and TO257. We recommend a torque of 0.6 N.m (maximum 0.8 N.m) to provide the optimum thermal resistance between the package and the heatsink.

4 Through hole package wave soldering

ST package leads come with either a gold surface finish, which must be replaced by hot solder dip prior to the mounting, or with a ready to use hot solder dip surface finish, obtained by removing the gold and adding a SnPb surface finish before the final hermeticity and electrical tests.

The wave soldering technique is based on one or more hot solder waves used to mount components on the PCB.

In general, the wave soldering process induces lower thermal stress in the components compared to I_R reflow profile.The heat may not penetrate the device as much as in the case of I_R reflow. Nevertheless, wave soldering still present some higher load in TCE mismatch and peak temperature gradient. A suitable controlled pre-heating is thus recommended.

Wave soldering temperature profiles are mentioned below. These recommendations are only indications, the solder process engineer should always optimize the thermal profile for each circuit assembly based on its specific requirements.

Figure 12. Wave soldering profile

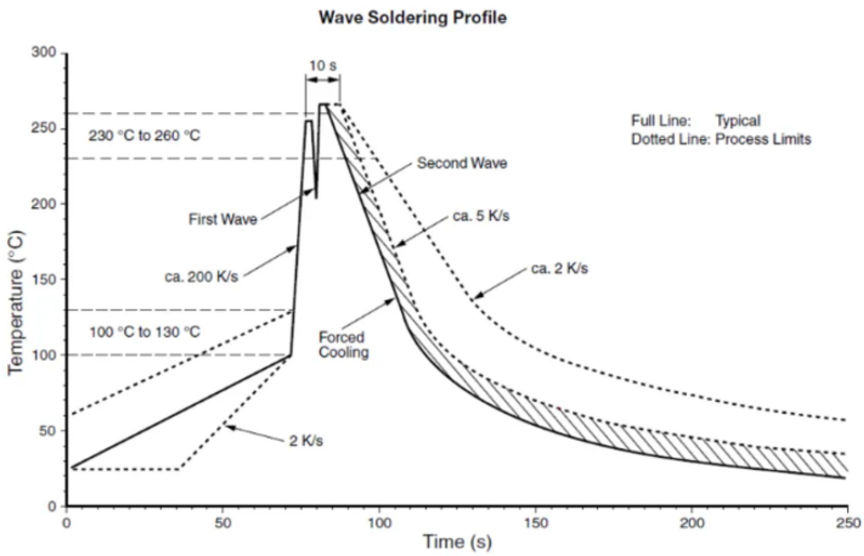


Table 3. Wave soldering temperature profile typical layout

Profile features		SnPb assembly
Preheat temperature (minimum)	T_S min.	100 °C
Preheat temperature (typical)	T_S typ.	120 °C
Preheat temperature (maximum)	T_S max.	130 °C
Preheat time (from T_S min. to T_S max.)		70 seconds
Peak temperature		235 - 260 °C
Time of actual peak temperature		3-6 seconds max.
Ramp down rate (minimum)		~2 °C/sec
Ramp down rate (typical)		~3.5 °C/sec
Ramp down rate (maximum)		5 °C/sec
Process time (from 25 °C to 25 °C)		4 minutes
Applied cycles		1 cycle max

Revision history

Table 4. **Document revision history**

Date	Version	Changes
23-Dec-2020	1	Initial release.

Contents

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