

APPLICATION NOTE
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Through-Hole Lead Bending

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Introduction

It is often necessary for board assemblers to bend the leads of a through-hole technology (THT) device when constrained by heat sink orientation, board and system space, etc. While the package may be formed into different configurations for board mounting, care must be taken in order to avoid damage such as plating strip-off, cracked package, or delamination. This application note contains options and guidelines for reliable lead bending.



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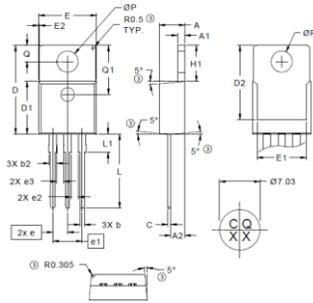


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Background

This application note covers all UnitedSiC THT devices, including TO-220, TO-247 3-lead, TO-247 4-lead, TO-264, and other devices. The UnitedSiC THT packages are designed according to JEDEC standard unless otherwise noted in the datasheet. The THT device package leads are made of copper, which is known to be a hard metal. The copper is alloyed and tempered to ½ hard, making it suitable for a semiconductor package assembly. The leads are electroplated with pure Sn with thickness ranging from 300 to 1200 µin, producing a matte surface finish. Minimum and maximum lead thickness is specified in a package outline drawing. The plastic in the package is made of epoxy mold compound (EMC).

Figure 1 shows the TO-247 4-lead package structure highlighting critical areas that need to be protected or observed during package lead bending. Other THT packages have the same features.



Device drawings are found on the [UnitedSiC website](https://www.unitedsic.com) product information pages.

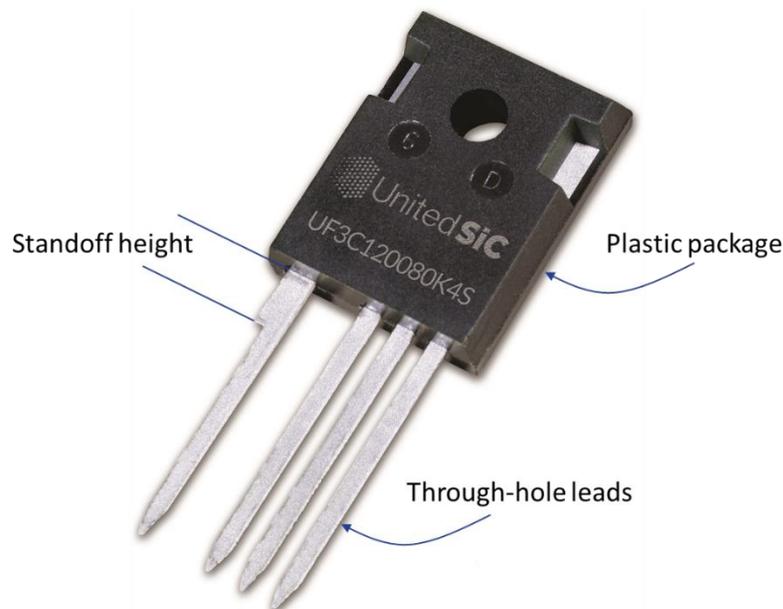


Figure 1 Package structure, TO-247 4-lead shown here as example

Types of Bending

A THT package may be formed in any of the following recommended configurations, as shown below in Figure 2.

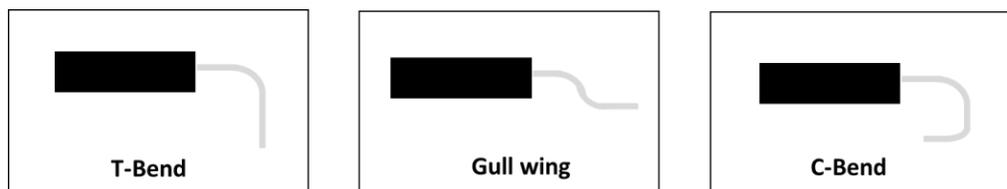


Figure 2 Lead bending configurations

The package lead is not allowed to be formed sideways or laterally (package marking face-up) as this could cause package delamination. See Figure 3. High mechanical stress due to sideways bending could create openings, making it possible for moisture intrusion.



Figure 3 Sideways bending may cause damage

Lead Bending Guidelines

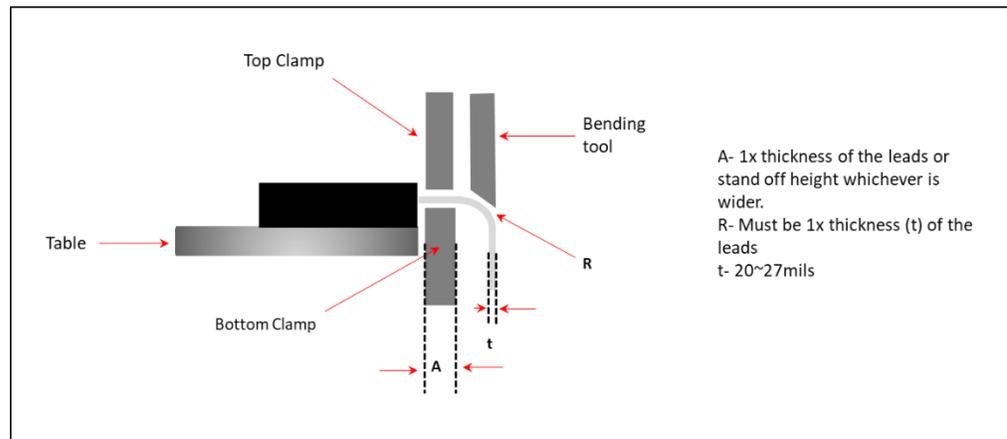


Figure 4 Lead bending dimensions

To safely bend the THT package lead, it is important to have clearance from the plastic. A minimum radius of the bend as depicted in Figure 4 must also be maintained to avoid weakening or cracking the leads.

Automated Tool

- Maintain the safe distance as stated in Figure 4.
- Top and bottom leads clamp must not touch the package plastic body or pinch the Sn that could expose the copper. Note: Clamps should not be abrasive.
- Ensure that package body (the plastic) is properly nested onto a flat surface. An ionizer or blower will be good to have to keep clear any debris that could create fulcrum effect when package body is clamped that could result to package crack, dent, scratch, etc.
- In clamping the package plastic body, use of rubber would be the preferred option instead of metal.
- Ensure that equipment is properly grounded for ESD protection.

Manual Tool / Hand-Held

- Maintain the safe distance as stated in Figure 4.
- Use appropriate ESD protection gear, for example, wrist strap, anti-static mat, etc.
- Use a tool to clamp the leads. Avoid putting any force on the plastic body as it could cause package delamination. Use of non-abrasive hand-held tools is preferred.
- For best results, use another tool to bend the leads.

Other Considerations

Before doing any lead bending, below are some important items for consideration:

- In general, THT devices are not meant to be surface-mounted, nor to replace an equivalent surface-mount device.
- The package is not moisture sensitivity level (MSL) rated.
- Any device with a fracture or breakage from bending should not be used due to reliability risk.
- Multiple bend cycles should be avoided. Package lead fatigue tests passed up to three bending cycles.



D2PAK-7Lead



DFN8x8

UnitedSiC has a broad selection of surface-mount packages. Shown here are two examples.