

# TO-247 Package

National Semiconductor  
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TO-247 Package

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## Introduction

TO-247 is a through hole package family with multitude of merits. The package configuration is shown in *Figure 1*.

The package has the following advantages:

1. Provides space advantage over conventional power packages with a thinner and smaller molded body package outline.
2. Dissipates heat directly to an external heat sink through an exposed die attach pad on the back side of the package.
3. Minimizes the mechanical stress on the die during mounting of the molded package by screws rather than through soldering of the die attach pad.
4. Good Lead robustness (15 mils thickness). The standard through hole foot print and board hole sizes follow those of the existing TO-220 package family. The TO-247 package is not recommended for surface mounting.
5. High thermal conductive epoxy is used to attach the device to the die attach pad. The average measured  $\theta_{JC}$  is 2.96°C/W.

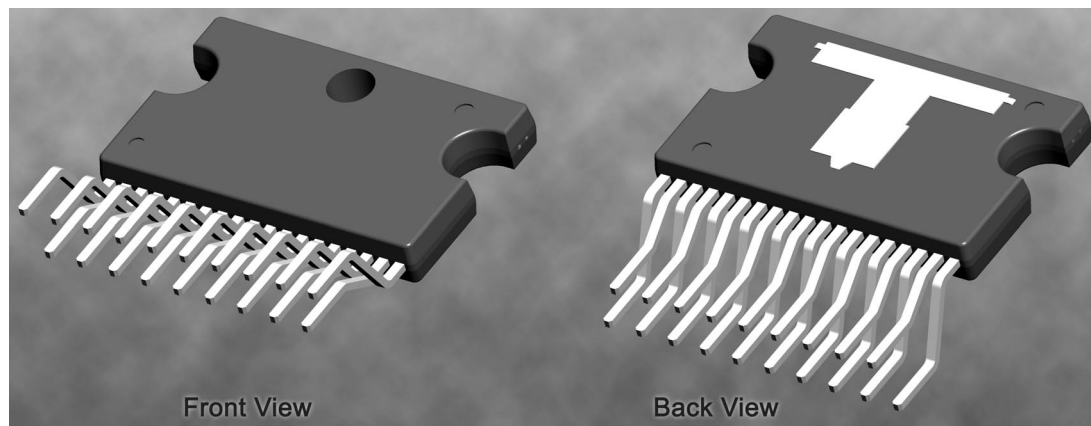
Three lots passed stringent reliability qualification under 260°C MSL1 preconditioning test, see *Table 1* and *Table 2*.

**TABLE 1. Environmental Test Duration**

Stress Type	Time Point 1	Time Point 2	Time Point 3
ACLV	96 hrs		
TMCL	500 cycles	1000 cycles	
THBT	168 hrs	500 hrs	1000 hrs
SOPL	168 hrs	500 hrs	1000 hrs

**TABLE 2. Stress Test Sample Size**

Stress Type	Lot A	Lot B	Lot C
ACLV	77	77	77
TMCL	77	77	77
THBT	77	77	77
SOPL	77	77	77



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**FIGURE 1. TO-247 Package Configuration**

## Package Mounting Guide

It is important that the packages are correctly mounted if full functionality is to be achieved. Mounting of the package to a heat sink must be done such that there is sufficient pressure from the mounting screws to insure good contact with the heat sink for efficient heat flow. Incorrect mounting may lead to both thermal and mechanical problems. Over tightening the mounting screws will cause the package to warp reducing the contact area with the heat sink and increasing the thermal resistance from the package case to the heat sink, resulting in higher operating die temperatures. Extreme over tightening of the mounting screws beyond the recommended torque force will cause severe physical stress resulting in cracked die and catastrophic IC failure. Though the reliability of the package is excellent, the use of inappropriate techniques or unsuitable tools during the mounting process can affect the long term reliability of the device and even damage it.

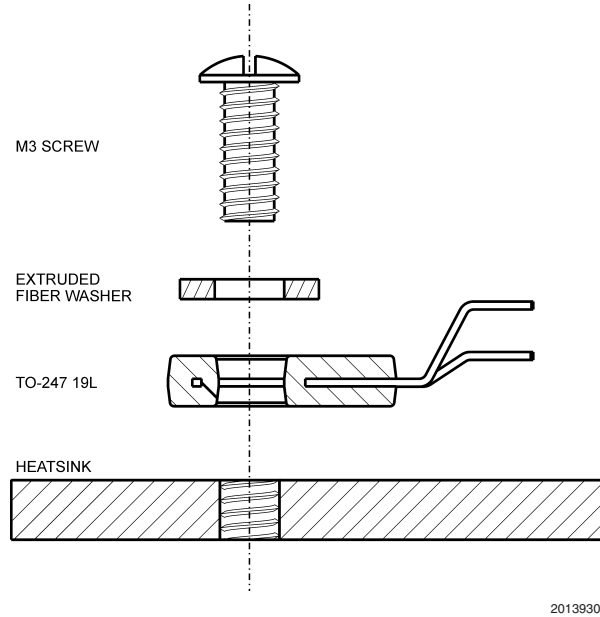
Screw Mounting:

- During mounting, it is important to ensure that the package back surface is free from contaminants.
- Screws can be used to mount the package onto an external heat sink. It is recommended to use 2 screws as shown in *Figure 4*.
- Use of an extruded fiber washer in between the package and the screw is recommended to prevent package chipping, see *Table 3*. This is also to distribute the force over a wider area, see *Figure 5*.
- The recommended use of proper mounting materials is shown in *Figure 2* and *Figure 3*.
- The maximum recommended torque force to mount a TO-247 package to an external heatsink or PCB board is 50N-cm (5.0kgf-cm), see *Figure 4*. Use of a rivet gun or exceeding the torque force can potentially damage the device, render it non-functional, and is not recommended.

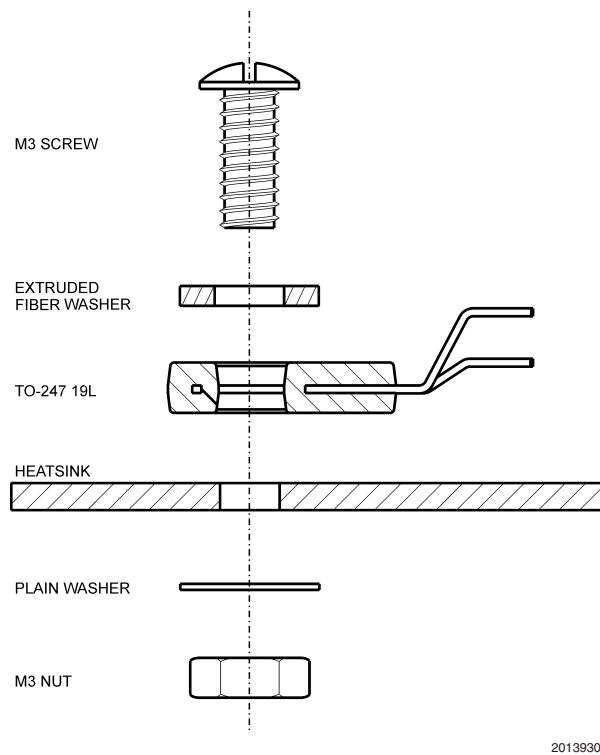
# Package Mounting Guide (Continued)

**TABLE 3. Recommended Extruded Fiber Washer**

Supplier:	SPC Technology
Description:	Extruded Fiber Washer
Part Number:	FSW-04-018
Specification:	Thickness 5/64", Outside Diameter 9/32", Inside Diameter 1/8"

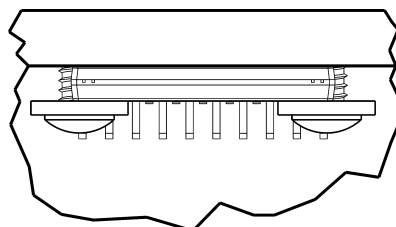


**FIGURE 2. Screw Mounting Into A Tapped Heatsink**

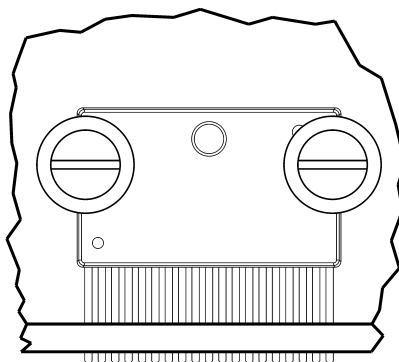


**FIGURE 3. Screw Mounting Through A Heat Sink Using A Nut**

## Package Mounting Guide (Continued)



TOP VIEW

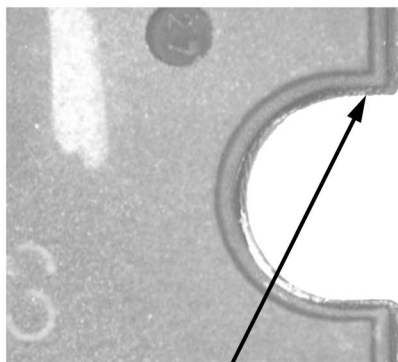


FRONT VIEW

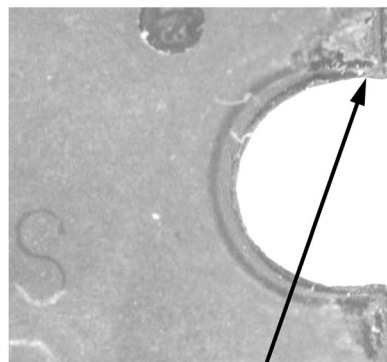
- Use 2 screws M3 with extruded fiber washers
- Maximum torque = 50N-cm

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**FIGURE 4. Recommended Type of Screw and Torque Force**



Good unit using  
extruded fiber washer



Package chip due to  
metal spring washer

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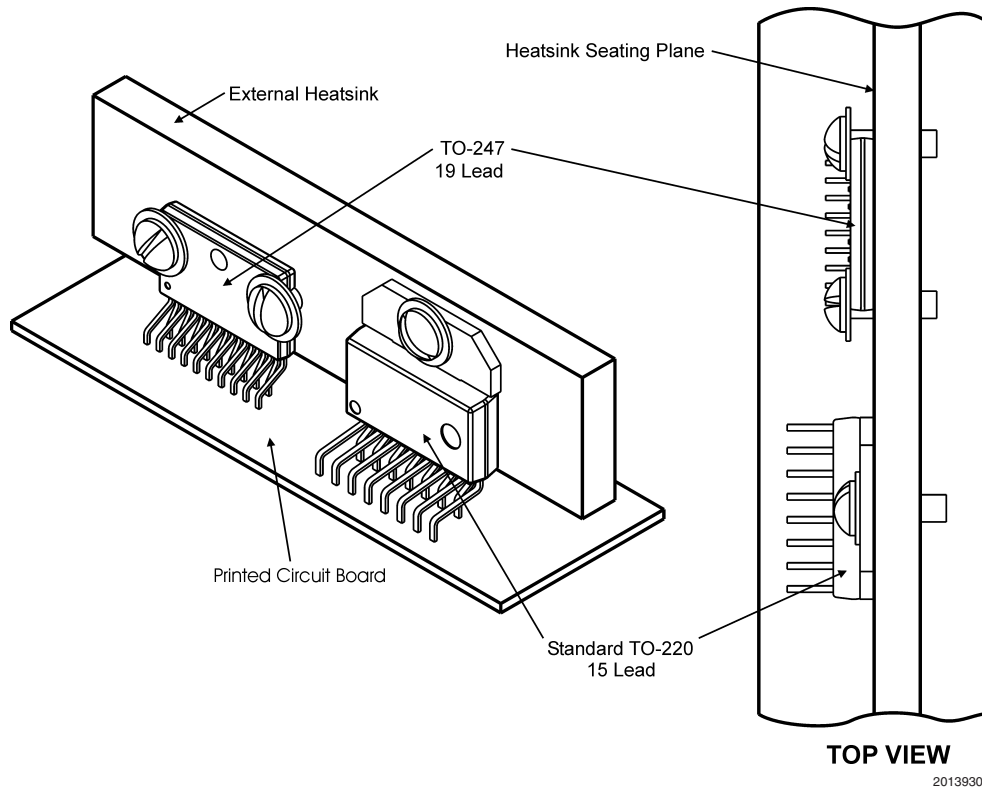
**FIGURE 5. Proper Washer Use**

### External Heatsink and PCB Leads Alignment Guidelines

For PCB holes designs to fit the package leads, proper PCB hole alignment is recommended to guarantee that the TO-

247 exposed pad will be mounted on the same external heatsink seating plane as that of other similar power packages of different thickness and size (e.g., TO-220), as shown in *Figure 6*. Soldering of TO-247 leads to the PCB should be done prior to heatsink final screw tightening.

## External Heatsink and PCB Leads Alignment Guidelines (Continued)



**FIGURE 6. External Heatsink and PCB Leads Alignment Seating Plane**  
**Mounting Figures are for Illustration Purpose Only**

### Package Lead Bend

National Semiconductor's TO-247 lead bend process requires an accurate set up and tight tooling controls. Additional lead bends are not recommended nor guaranteed, as an incorrect set up can potentially damage the device and render the device non-functional.

### Package Marketing Outline Drawing

The package with dimensions for PCB and heatsink design guidelines is shown in *Figure 7*.

# Package Marketing Outline Drawing (Continued)

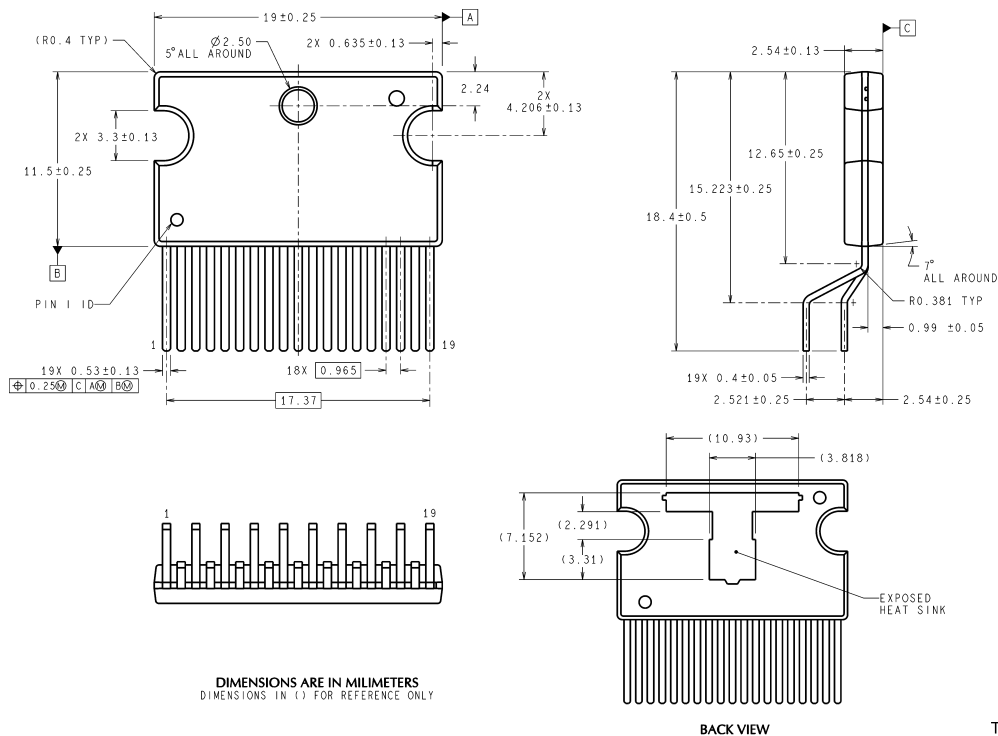


FIGURE 7. TO-247 Marketing Drawing TB19A

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