AN4322

Mounting Instructions for SP1F and SP3F PressFIT Power Module

Introduction

This application note provides the main recommendations to appropriately connect the printed circuit board (PCB) to the SP1F and SP3F PressFIT power module and mount the power module to the heat sink. Follow the mounting instructions to limit both the thermal and mechanical stresses.

The PressFIT pin technology is a solderless connection method, with reliable mechanical and electrical contact that allows mounting the module on both sides of the PCB.

This application note does not cover each type of application and condition. The user is responsible for performing detailed qualification.

Figure 1. SP1F Power Module

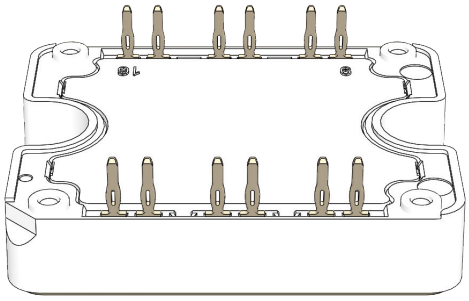
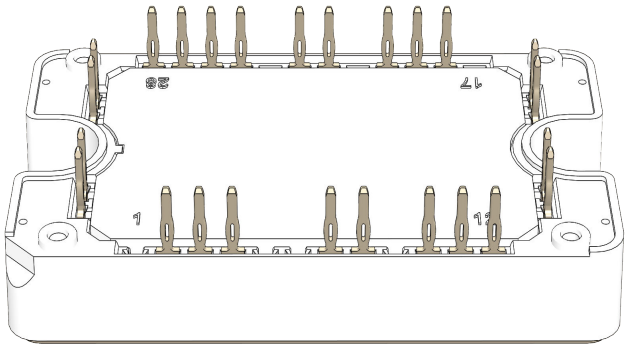


Figure 2. SP3F Power Module



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1. PCB Requirements

The PressFIT technology is tested and qualified according to IEC60352-5 per the PCB requirements shown in the following table. If other processing or thickness technologies are used for PCB manufacturing, it must be tested, examined, and qualified.

The PressFIT technology is qualified for FR4 PCB material.

Figure 1-1. PCB Construction

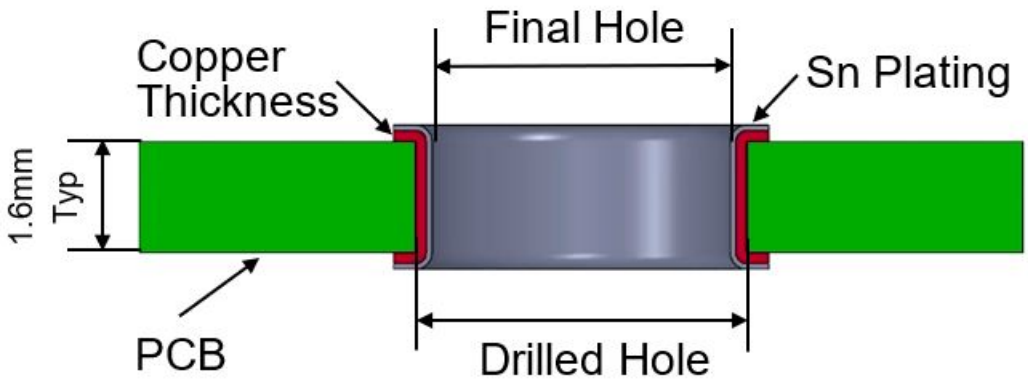

Table 1-1. PCB Requirements

Parameter	Minimum	Typical	Maximum	Unit
Drill hole diameter	1.5	1.55	1.6	mm
Final hole diameter	1.39	1.45	1.54	mm
Copper thickness in the hole	25	—	—	µm
Sn plating in the hole	4	—	10	µm
Copper thickness of the circuit board copper track	35	70	—	µm
PCB thickness	—	1.6	—	mm

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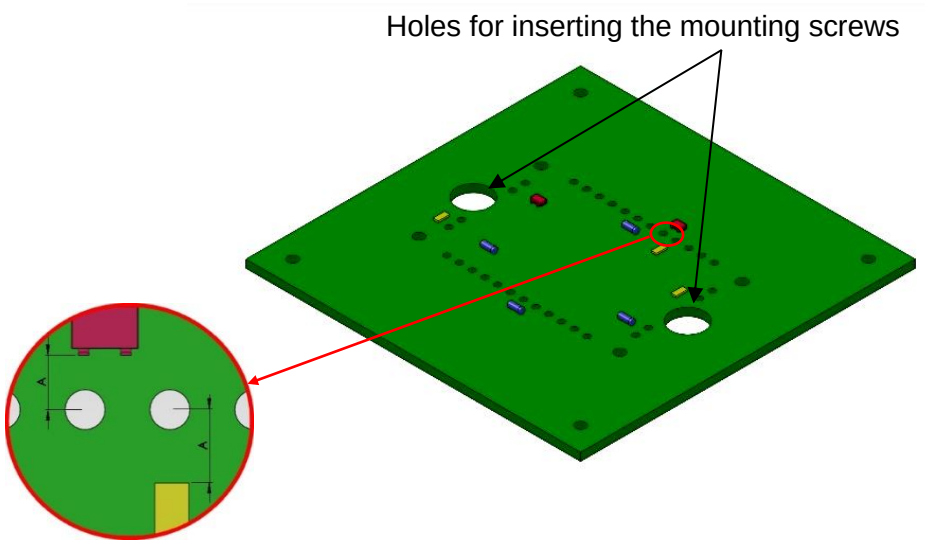
2. Components Next to Module Pins

Design rules must be used to place the components such as resistors, diodes, or capacitors near the PressFIT pins. The SMD capacitor is the most sensitive component to mechanical stresses.

Microchip recommends to leave at least A=4 mm between the center of the PressFIT pin and the edge of the component on both sides of the PCB. This allows enough space for the pressing tool to avoid damaging the components while inserting or removing the PressFIT pins.

Holes in the PCB are necessary to insert and tighten the mounting screws that bolt down the power module to the heat sink. These access holes must be large for the screw head and washers to pass freely, allowing for standard tolerance in the PCB hole location. See the following figure, for more information.

Figure 2-1. Distance Between Components and the Middle of the Pins



3. Tools for Inserting the PressFIT Pin into the PCB

Figure 3-1 shows the general mounting process for inserting the module in the PCB.

- The PCB is placed on the lower press-in tool. The PCB is well positioned with the help of spacers located on the lower press-in tool.
- The module is mounted on the PCB. See Figure 3-2.
- The machine exerts the force to push the PressFIT pins into the PCB. The module is well inserted when the module domes reach the PCB, see Figure 3-3.

The press process can be realized by an automatic machine. The insertion force per pin is 100N maximum and the recommended insertion speed is between 25 mm/min and 50 mm/min.

Figure 3-1. Tools for Inserting the PressFIT Pin into the PCB

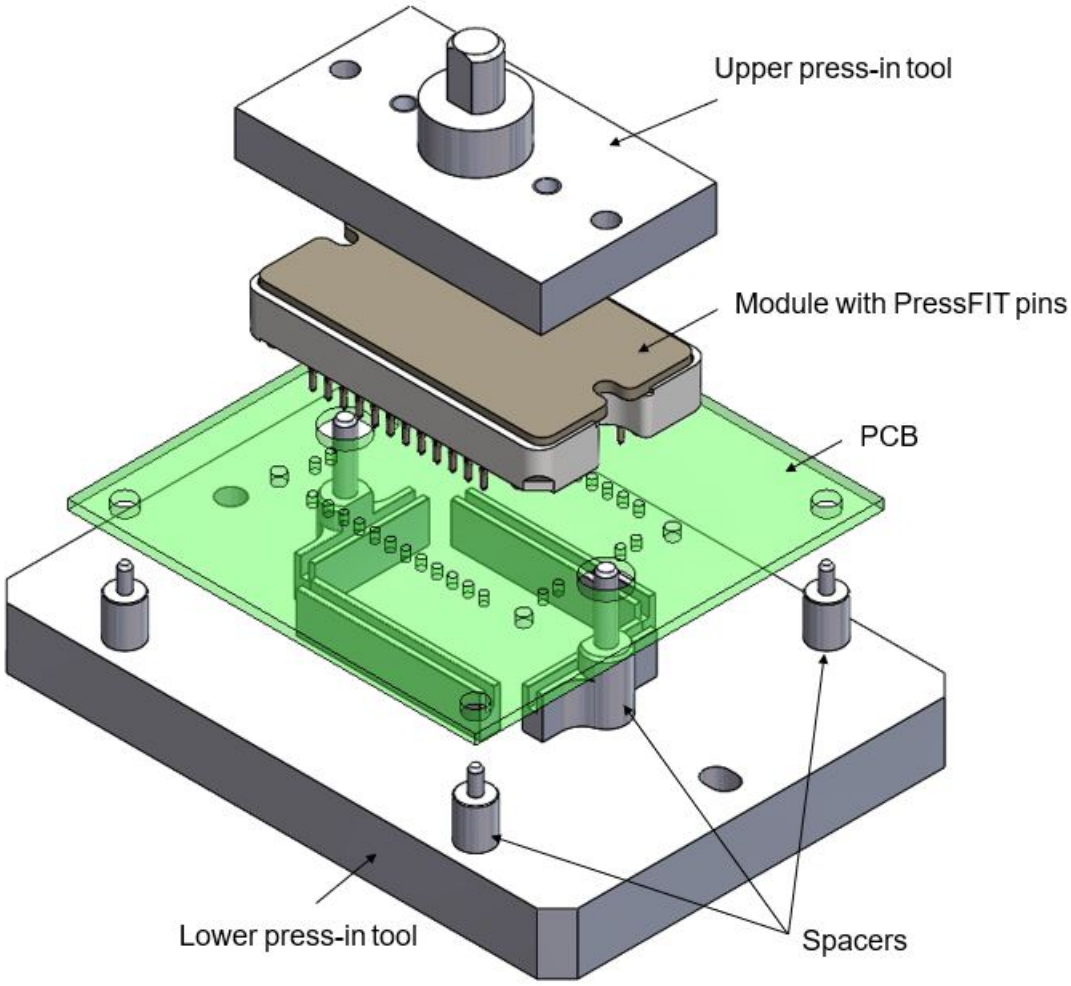


Figure 3-2. PCB with Module before the Insertion

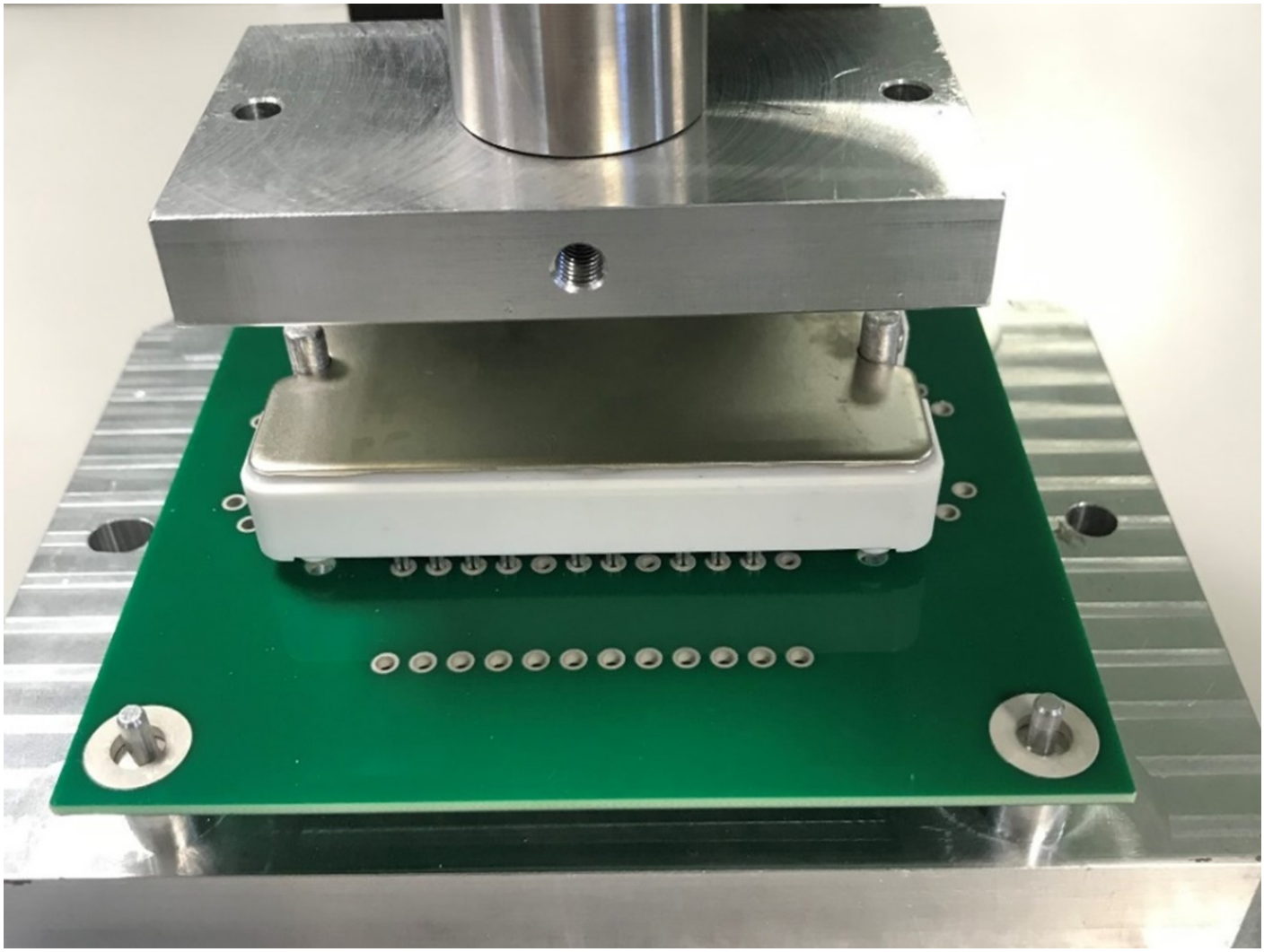
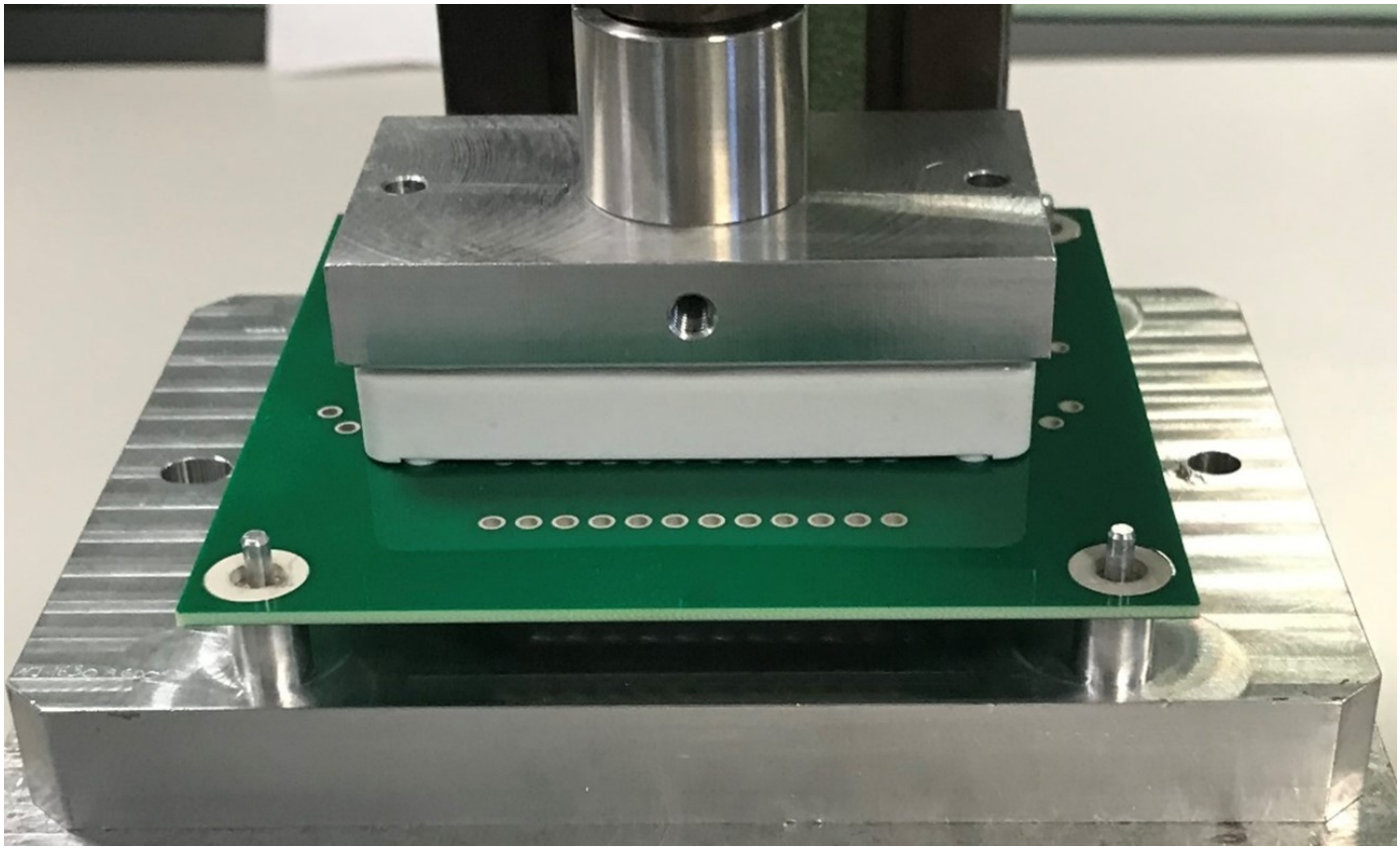


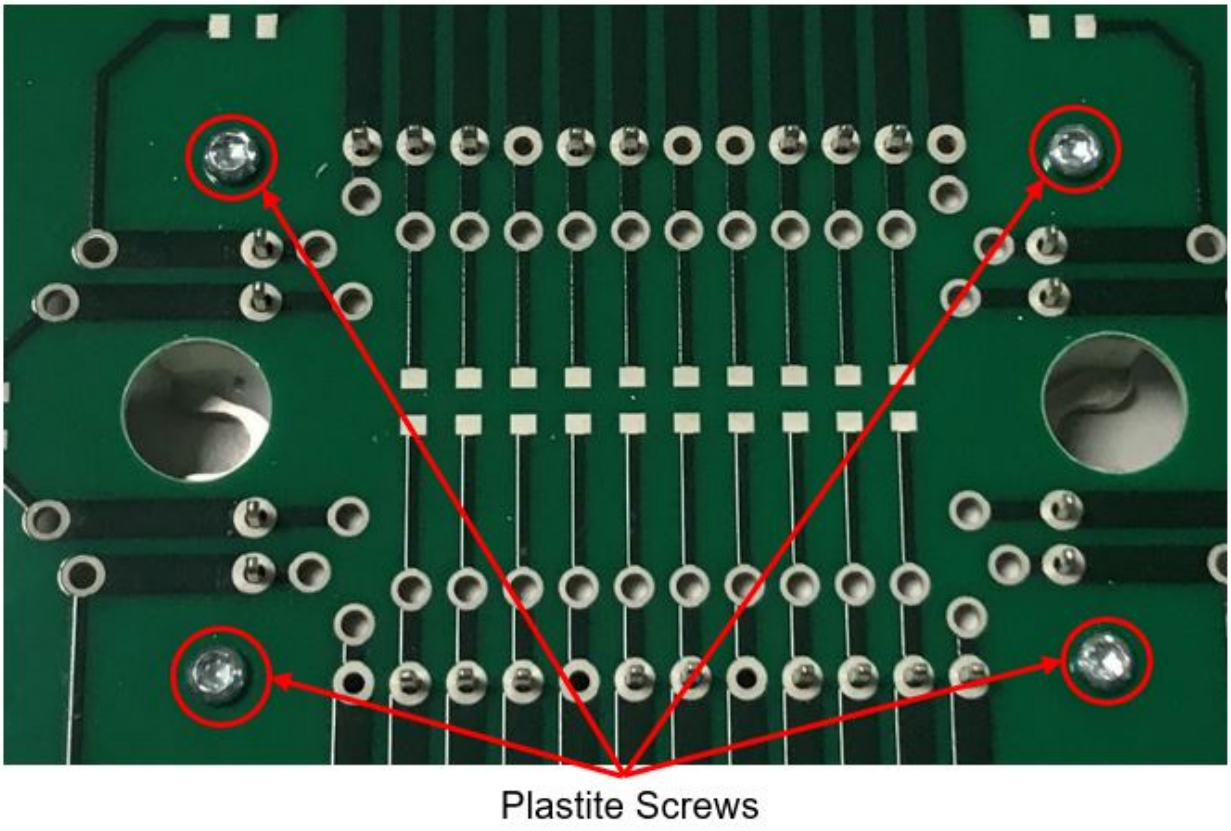
Figure 3-3. PressFIT Pins into the PCB



4. Using Plastite Screw

After the assembly process, the PressFIT contact between PCB and module must be mechanically relieved. Therefore, all the power modules must be screwed to the standoffs with plastite screws to reduce all mechanical stresses and minimize relative movements on the PressFIT contact. For more details, see the following figure.

Figure 4-1. Plastite Screws on Standoff



Microchip recommends a self-tapering plastite screw with a nominal diameter of 2.5 mm.

A plastite screw is a type of screw specifically designed for use with plastic and other low-density materials, see the following figure. The screw length depends on the PCB thickness. Use a plastite screw of 8 mm (0.32 inches) long on a PCB with a 1.6 mm (0.063 inches) thickness. Maximum mounting torque of 0.6 Nm (5 lbf*in) is recommended. The customer must check the integrity of the plastic post after screwing.

Figure 4-2. Example of Plastite Screw

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5. Heat Sink Characteristics

Proper mounting of the module base plate to the heat sink is essential to guarantee good heat transfer. The heat sink and the power module contact surface must be flat and clean (no dirt, corrosion, or damage) to avoid mechanical stress when the power module is mounted, and to avoid an increase in thermal resistance.
Note: Recommended flatness is <50 µm for 100 mm continuous and recommended roughness is Rz 10.

5.1 Thermal Grease Application

A thin layer of thermal grease must be applied between the power module and the heat sink to achieve the lowest case to heat sink thermal resistance.

Microchip recommends the use of screen printing technique to ensure uniform deposition of a minimum thickness of 60 µm (2.4 mils) on the heat sink, see the following figure.

The thermal interfacing between the module and the heat sink can be made with another type of conductive thermal interface material, such as a phase-change compound (screen-printed or adhesive layer).

Figure 5-1. Grease on the Heat Sink Prior to Assembling

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5.2 Mounting the Power Module to the Heat Sink

Place the power module above heat sink holes and apply slight pressure to it. Insert the M4 screw with lock and flat washers in each mounting hole (a #8 screw can be used instead of M4).

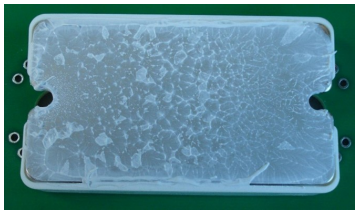
First, lightly tighten the mounting screws. Tighten the screws alternatively until their final torque value is reached. (See the *product datasheet* for the maximum torque allowed).

Microchip recommends the use of a screwdriver with controlled torque for this operation. If possible, screws can be tightened again after three hours.

The quantity of thermal grease is correct when a small amount of grease appears around the power module once it is bolted down into the heat sink with the appropriate mounting torque. In any case, the module bottom surface must be completely wet with thermal grease. See the following figure.

Figure 5-2. Grease on the Heat Sink After Removing the Module

Figure 5-3. Grease on the Module after Disassembling



Note: The gap between the screws top height and the nearest terminal must be checked to maintain safe insulation spacing.

6. Tools for extracting the PressFIT Pin from the PCB

Figure 6-1 show the general process for removing the module from the PCB.

1. Remove the plastite screws from the PCB.
2. Place the Module and the PCB on the lower press-out tool, as shown in Figure 6-2.
3. The machine exerts the force on the PressFIT pins in to push out the module from the PCB, see Figure 6-2 and Figure 6-3.

The press process can be realized by an automatic machine. The insertion force per pin is 100N maximum and the recommended insertion speed is between 25 mm/min and 50 mm/min.

Figure 6-1. Tools for Extracting the PressFIT Pin from the PCB

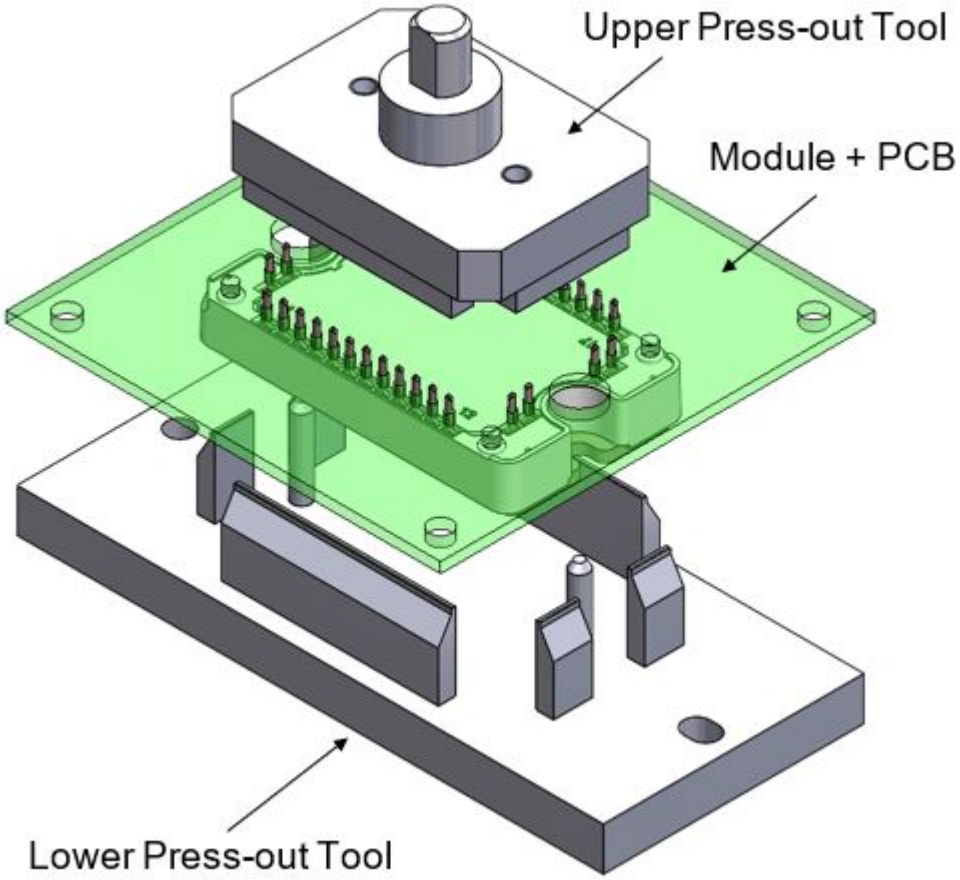


Figure 6-2. PCB with Module Before the Extraction

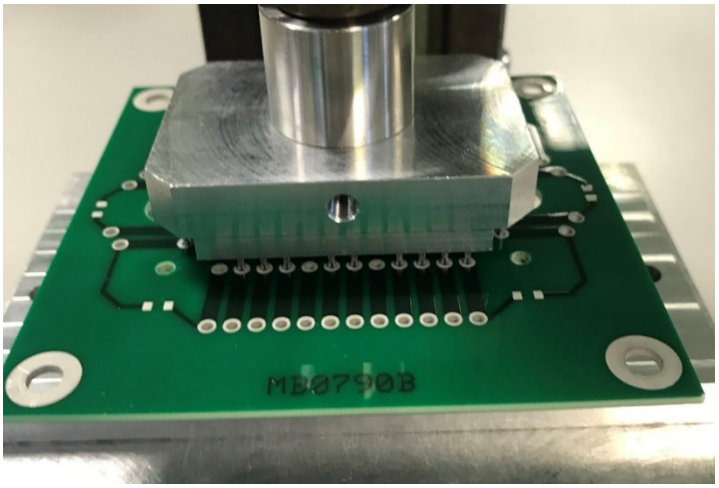
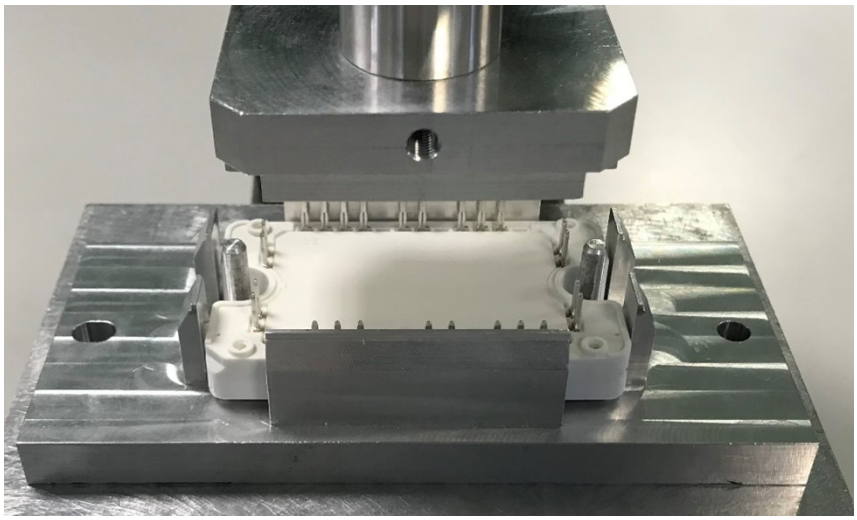


Figure 6-3. Module Removed



Conclusion

This application note provides main recommendations regarding the PressFIT mounting and dismounting instructions. Applying these instructions helps decrease the mechanical stress both on the PCB and the power module and therefore ensures the long-term operation of the system. Mounting instructions to the heat sink must also be followed to achieve the lowest thermal resistance from the power chips down to the cooling section. These operations are essential to guarantee the best system reliability and achieve the highest mean time between failure (MTBF).

After the PressFIT Power Module is pressed out and if it is electrically and mechanically good, this module can only be refitted by soldering to the PCB.

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7. Revision History

Revision	Date	Description
A	12/2021	The following changes are made in this revision: • Updated the document as per Microchip standards. • The document number was updated to DS00004322. • Application note number was updated to AN4322.

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ISBN: 978-1-5224-9406-5

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