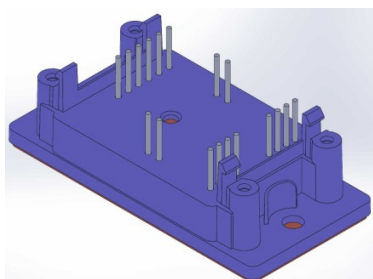


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## Mounting instruction for phase leg & full bridge SP2 power module

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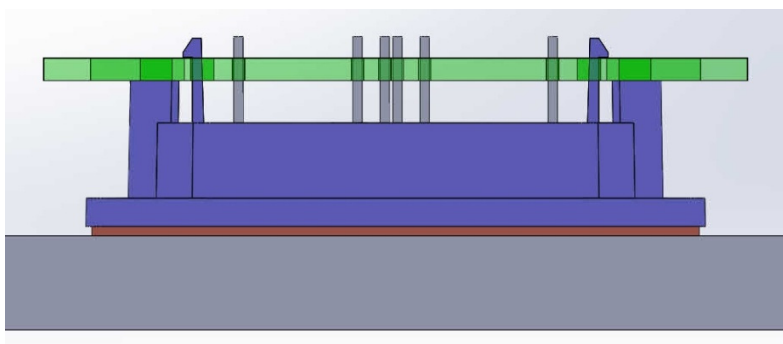
Pierre-Laurent Doumergue  
R&D Engineer  
Microsemi Power Module Products  
26 rue de Campilleau  
33 520 Bruges, France

### Introduction:

This application note gives the main recommendations to appropriately connect the phase leg and full bridge SP2 power module to the PCB (Printed Circuit Board) and mount the power module onto the heat sink. It is very important to follow the mounting instructions to limit both the thermal and mechanical stresses.

### 1. PCB mounting instruction on the power module.

➔ **The first step** consists of clipping the power module to the PCB. (See picture 1).

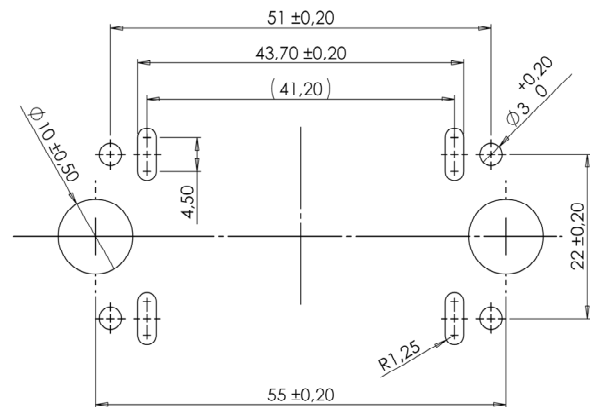
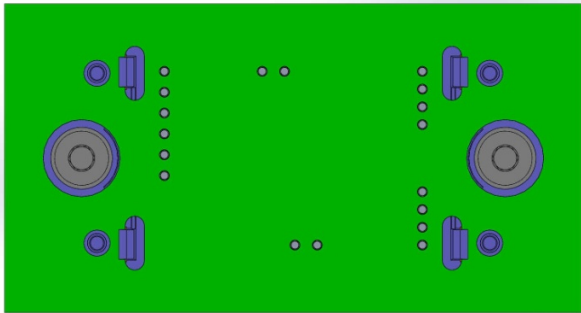


Picture1: SP2 power module mounted on the PCB.

Holes and windows in the PCB (see pictures 2 & 3) are necessary to clip the module onto the PCB, to bolt down the power module to the heat sink and to screw if necessary the PCB to the module standoffs.

These access windows must be large enough for the clips, screws head and washers to pass through freely, allowing for normal tolerance in PCB holes location.

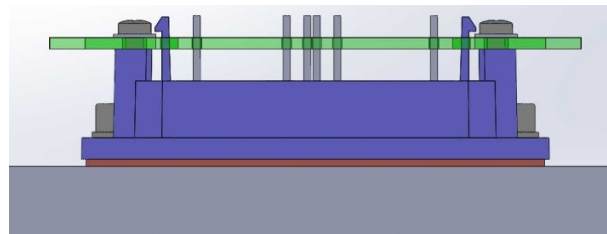
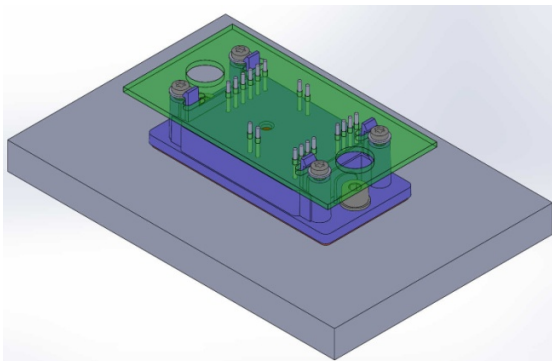
The PCB holes diameter for the pins is recommended to be 1.5mm.



Pictures 2 &amp; 3: holes and windows dimensions

For a good match between the PCB and the power module, Microsemi recommends a 2.4mm thick PCB.

The customer can use a PCB thinner than 2.4mm. In this case, after clipping the module to the PCB, Microsemi recommends screwing the PCB to the module standoffs with a self-tapering plastite screw with a nominal diameter of 2.5 mm. (see pictures 4 & 5).



Pictures 4 &amp; 5: screws + 1.6mm thick PCB

A plastite screw is a type of screw specifically designed for use with plastic and other low density materials. (See picture 6). The screw length depends on the PCB thickness. With a 1.6 mm (0.063") thick PCB, use a plastite screw 6 mm (0.24") long. The maximum mounting torque is 0.6Nm (5 lbf·in). In any case, the customer must check the integrity of the plastic post after screwing.



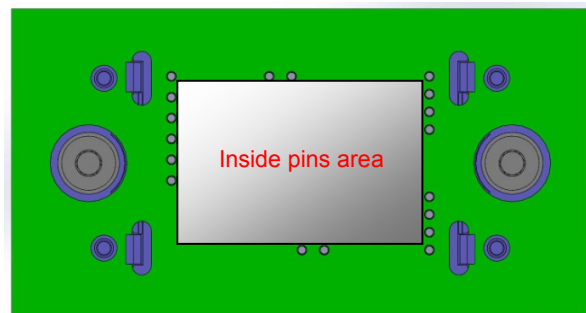
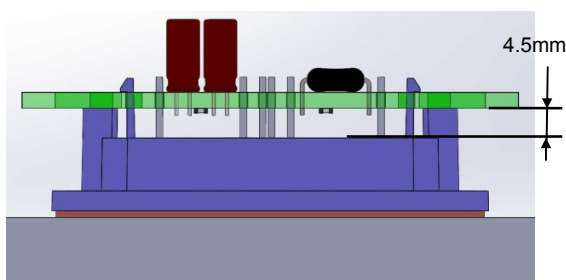
Picture 6: plastite screw.

→ **The second step** consists of soldering all electrical pins of the power module to the PCB. No-clean solder flux is required to attach the PCB onto the module since aqueous module cleaning is not allowed.

When using a PCB thinner than 2.4mm, don't forget to screw the PCB to the module standoffs before soldering the pins, because if all pins are soldered first to the PCB, screwing the PCB onto the standoffs will create a deformation of the PCB, leading to some mechanical stress that can damage the tracks or break the components on the PCB.

A wave soldering process can be used to solder the terminals to the PCB if the placement of the others components of the PCB allows it. Each application, heat sink and PCB can be different; wave soldering must be evaluated on a case-by-case basis. In any case, a well-balanced layer of solder should surround each pin.

The gap inside the pins area between the bottom of the PCB and the power module (see pictures 7 & 8) is 4.5 mm allowing the utilization of through holes components on the PCB top side and SMD components on the PCB bottom side.



Pictures 7 & 8: components on both PCB sides

SP2 pinout can change according to the electrical configuration. See the product datasheet to see the pin out location.

## 2. Power module mounting instruction onto heat sink.

Proper mounting of the module base plate onto the heat sink is essential to guarantee good heat transfer. The heat sink and the power module contact surface must be flat (recommended flatness  $<50\mu\text{m}$  for 100mm continuous, recommended roughness Rz 10) and clean (no dirt, no corrosion, no damage) in order to avoid mechanical stress when power module is mounted and to avoid an increase in thermal resistance.

### → Thermal grease application.

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

It is recommended to use screen printing technique to ensure a uniform deposition of a minimum thickness of  $60\mu\text{m}$  (2.4 mils) on the heat sink (see picture 9). The thermal interface between the module and the heat sink can also be made with other type of conductive thermal interface material such as phase change compound (screen-printed or adhesive layer).



Picture 9: Grease on the heat sink before assembly

**→ Mounting the power module onto the heat sink.**

Place the power module above heat sink holes, and apply a small 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). The screw length must be at least 12 mm (0.5”).

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

It is recommended to use 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 onto the heat sink with the appropriate mounting torque. In any case, the module bottom surface must be completely wetted with thermal grease. (See pictures 10 & 11).



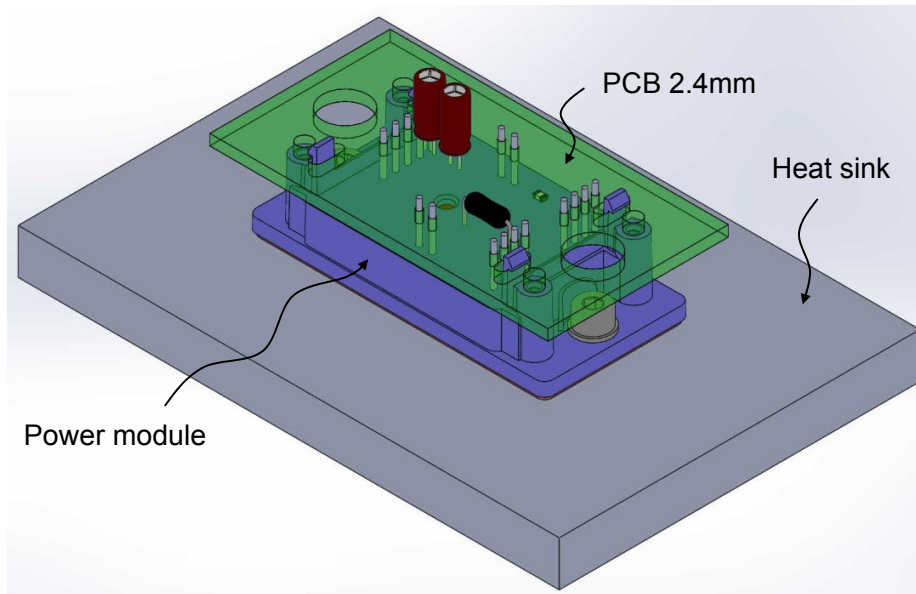
Picture 10: Grease on the heat sink after removing the module



Picture 11: Grease on the module after disassembling

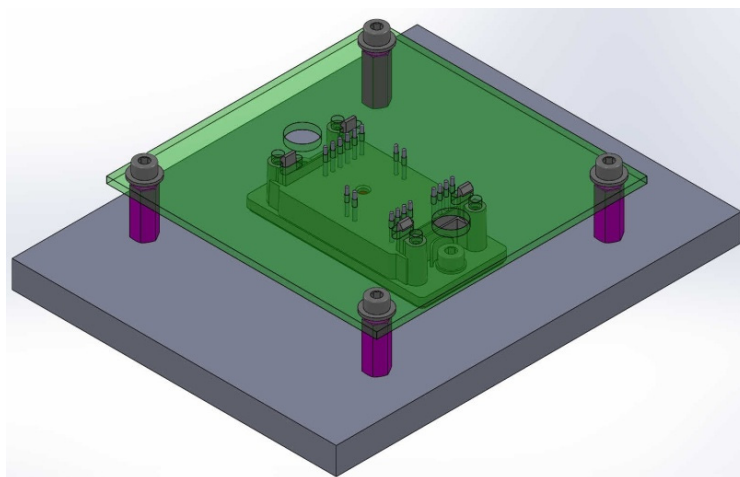
The gap between the screws top height and the nearest terminal must be checked in order to maintain safe insulation spacing.

### 3. General assembly view.



Picture 12: General assembly view.

If a large PCB is used, additional spacers between the PCB and the heat sink are necessary. It is recommended to keep a distance of at least 5 cm between the power module and the spacers (see picture 13). The spacers must have the same height as the module standoffs ( $16.5^{+0.2}$  mm).



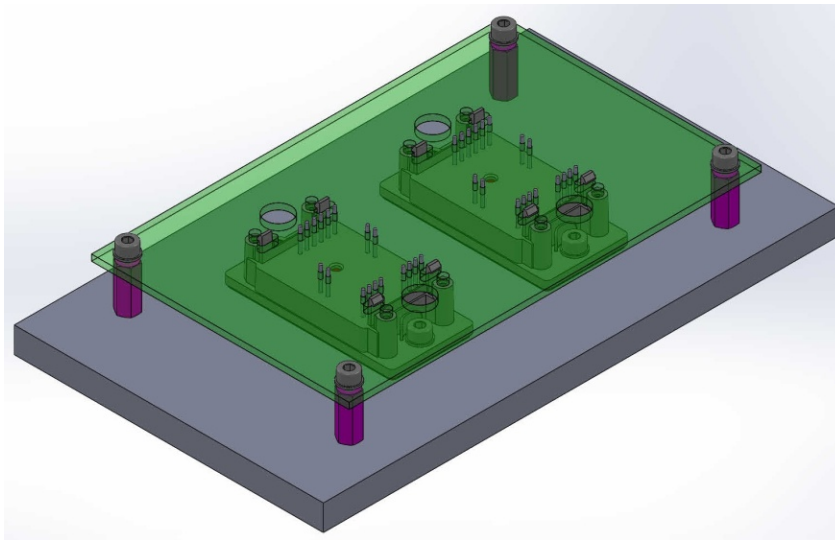
Picture 13: General assembly view with large PCB

On the same PCB, if several SP2 power modules are used and if the distance between the two power modules does not exceed 5 cm, it is not necessary to install the spacer. (See picture 14).

Be careful with the heavy components like electrolytic or polypropylene capacitors, transformers or inductors. If these components are located in the same area, it is recommended to add spacers such that the weight of these components on the board is not handled by the power module but by the spacers.

Additional spacers must be also added for large boards to avoid vibration and shock issues.

Each application and PCB can be different; the spacers placement must be evaluated on a case-by-case basis. In any case, the power module does not handle the PCB components weight.



Picture 14: General assembly view with several modules

### **Conclusion:**

This application note gives the main recommendations regarding the mounting of phase leg and full bridge SP2 module. Applying these instructions will help decreasing the mechanical stress both on PCB and power module and therefore will ensure 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 cooler. All these operations are essential to guarantee the best system reliability.



**Microsemi Corporate Headquarters**  
One Enterprise, Aliso Viejo CA 92656 USA  
Within the USA: +1(949) 380-6100  
Sales: +1 (949) 380-6136  
Fax: +1 (949) 215-4996

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