AN1911

Application Note

Mounting Instruction for SP6 Low Inductance Power Module

Final

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Microsemi

Power Matters.™

Contents

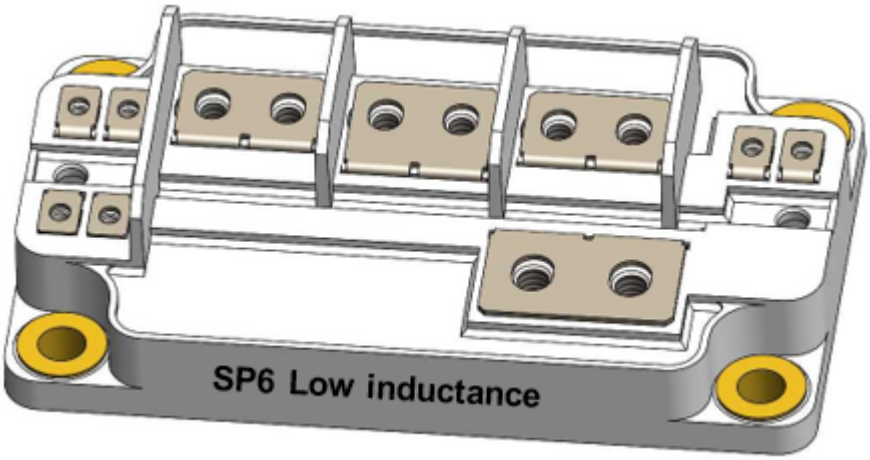
1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 1.0

Revision 1.0 was published in May 2018. This is the first publication of the document.

2 Introduction



This application note provides information to correctly mount the SP6 low-inductance power module onto the heat sink and connect the bus bars and PCBs.

It is very important to follow the mounting instructions to limit both thermal and mechanical stresses.

2.1 Power Module Mounting onto the 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 is greater than 50 µm for 100 mm continuous, recommended roughness is Rz 10) and clean (no dirt, no corrosion, no damage) in order to avoid mechanical stress when the power module is mounted, and also to avoid an increase in thermal resistance.

2.1.1 Thermal Grease Application

To reduce thermal resistance, apply a thin layer of thermal grease between the power module and the heat sink.

It is recommended to use a screen printing technique to ensure a uniform deposition of the minimum thickness of 100 µm (3.9 mils) on the heat sink (see Figure 1 (see page 3)). The thermal interface between the module and the heat sink can also be made with other types of conductive thermal interface material, such as phase-change compound (screen-printed or adhesive layer).

Figure 1 • Grease on the heat sink before assembly

2.1.2 Mounting the Power Module onto the Heat Sink

1. Place the power module above heat sink holes and apply a small amount of pressure.
2. Insert the M6 screw with lock and flat washers in each mounting hole—a #12 screw can be used instead of M6. The screw length must be at least 16 mm (0.6 in).
3. Lightly tighten the four mounting screws. Tighten the screws until their final torque value is reached—see the product datasheet for the maximum torque allowed.

A screwdriver with controlled torque is recommended for this operation. If necessary, 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 after it has been bolted down onto the heat sink with the appropriate mounting torque.

In any case, the module bottom surface must be wet with thermal grease. Refer to Figure 2 (see page 3) and Figure 3 (see page 4).

Figure 2 • Grease on the heat sink after removing the module

Figure 3 • Grease on the module after disassembling

2.2 Assembly with Bus Bars or PCB for Power Connections and PCB for Signal Connections

The assembly description is made with three low-inductance power modules in a three-phase configuration.

2.2.1 Power Connections

It is crucial to route DC bus connections to the module with low-parasitic inductance.

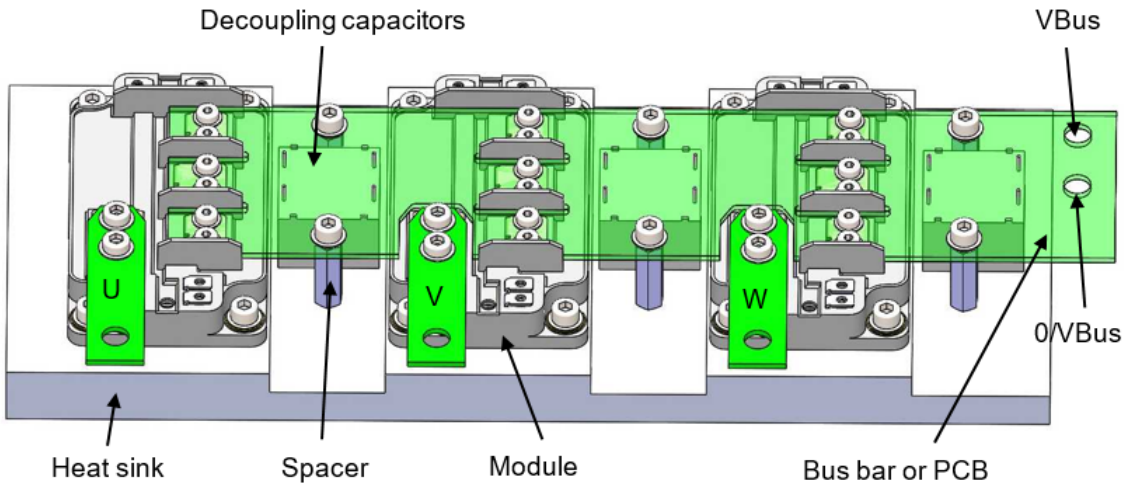
To achieve this goal, a near-zero parasitic inductance capacitor bank must be designed with a strip line DC bus bar fitted with electrolytic capacitors, or a strip line PCB fitted with electrolytic, film, and ceramic capacitors.

2.2.1.1 First Configuration

The low-inductance modules are placed side by side in the width. See Figure 4 (see page 5).

The +DC and –DC link is distributed via bus bars, or PCB, in strip line. Capacitors can be added between the power module.

Figure 4 • 3 Phase Bridge Low Inductance Modules Placed in the Width



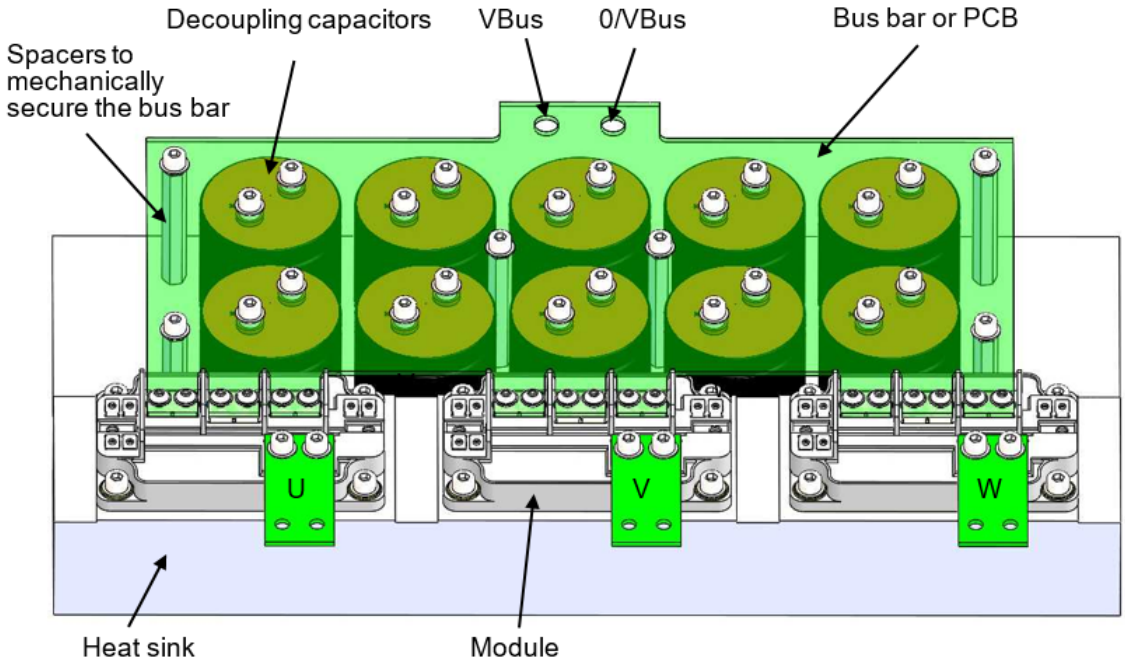
2.2.1.2 Second Configuration

The low-inductance modules are placed side by side in the length. See Figure 5 (see page 5).

The +DC and –DC link is distributed via bus bars, or PCB, in strip line that includes the capacitor bank.

In this configuration, the DC link distribution is symmetrical, which leads to a much better decoupling of the modules and achieves the lowest parasitic inductance.

Figure 5 • 3 Phase Bridge Low Inductance Module Placed in the Length



2.2.1.3 For Both Configuration

The DC bus bars, or PCB, must be mounted onto the power module and screwed onto the power terminals.

Put an M4 screw with an M4 flat washer in each power terminal.

The screw length depends on both the bus bar (or PCB thickness) and the washers. See the product datasheet for the maximum torque and max length into the power terminal allowed.

The output power connector must be screwed with an M5 screw with an M5 flat washer in each output terminal. See the product datasheet for the maximum torque and max length into the output terminal allowed.

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

Additional spacers must be added to avoid vibration and shock issues. See the product datasheet for the power module dimension.

2.2.2 Signal Connections

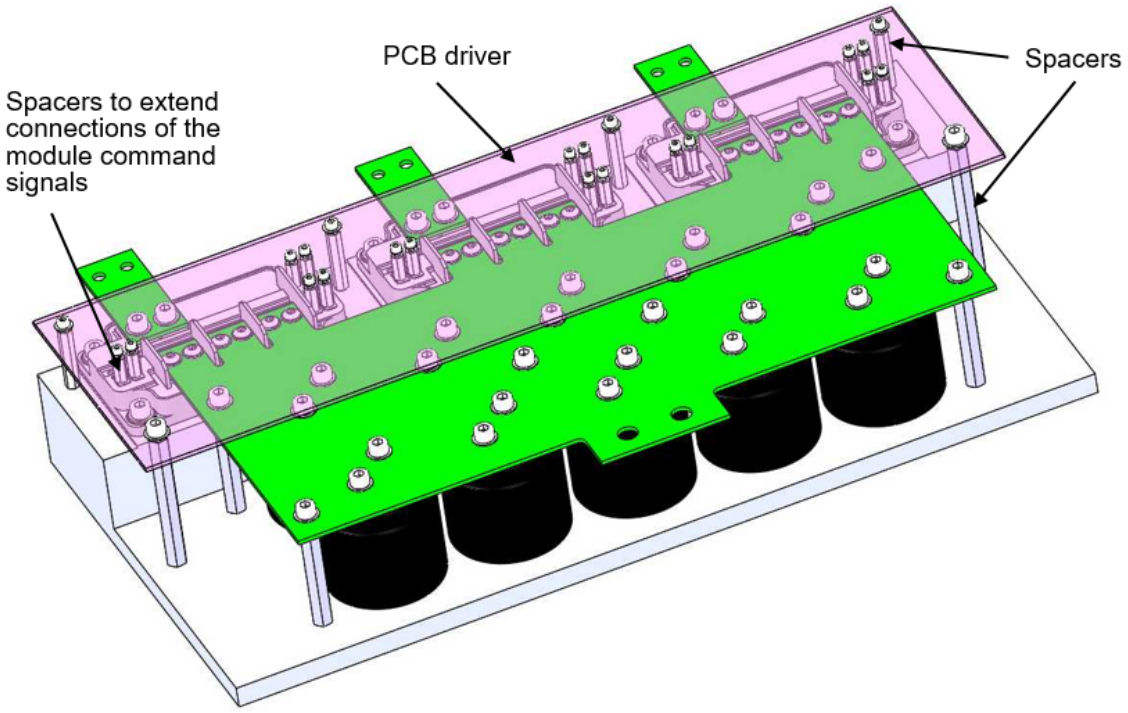
To save space on the final assembly, the PCB driver may be added just above the DC bus bars or PCB.

In this configuration, additional spacers must be used between the PCB driver and the power module signal connections. See Figure 6 (see page 6) and Figure 7 (see page 7).

The PCB driver must be screwed onto both the spacers and the signal terminals. Put an M2.5 screw with an M2.5 flat washer in each signal terminal. See the product datasheet for the maximum torque and max length into the signal terminal allowed.

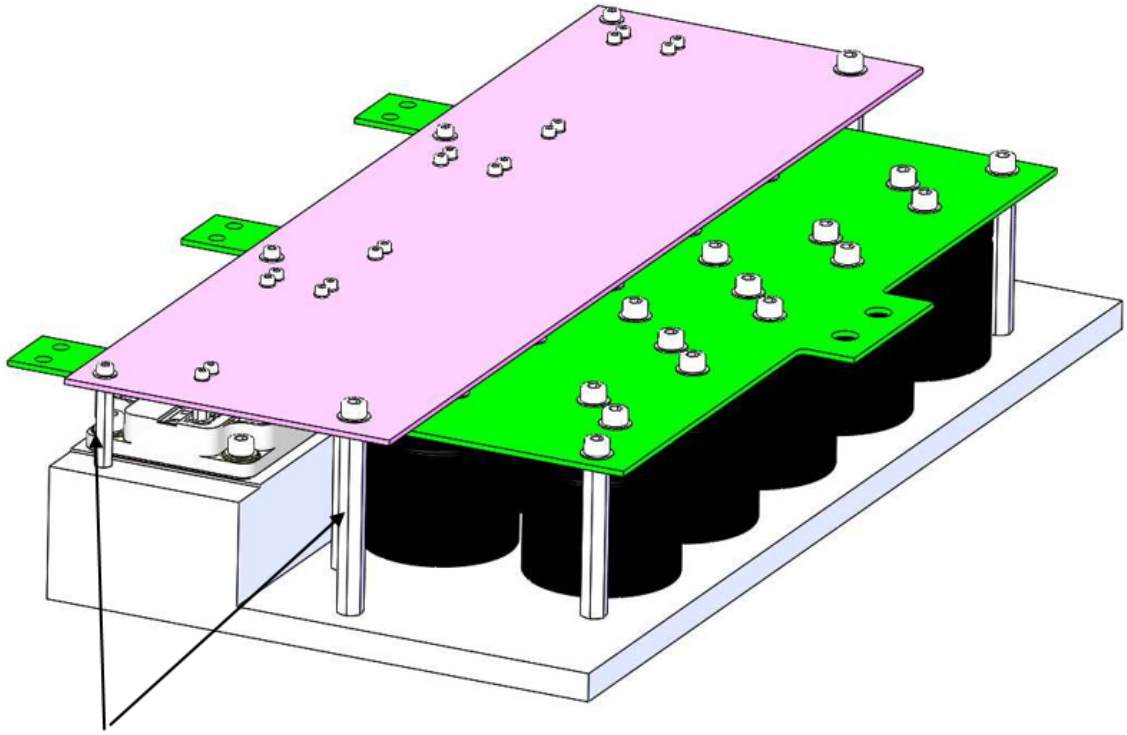
Additional spacers are necessary to avoid a deformation of the PCB or any mechanical stress on the components, PCB tracks, and signal terminals, and to prevent the power module from supporting the weight of the driver board.

Figure 6 • PCB Driver Above the DC Bus Bar or PCB



The driver board may also be mechanically supported by spacers between the bus bar and the driver board instead of between heat sink and driver board.

Figure 7 • PCB Driver Above the DC Bus Bar or PCB



To mechanically secure the driver board, additional spacers may be implemented between the bus bar and driver board (if more practical).

2.3 Conclusion

Each application, bus bar, and PCB are different. The placement of the spacers must be evaluated on a case-by-case basis. The power module must not handle the weight of the components.

This application note provides important information regarding the mounting of the SP6 low-inductance power module. Following these instructions will help decrease the mechanical stress on the bus bar, PCB, and power module and will therefore ensure long term operation of the system. Mounting instructions of the heat sink must also be followed to achieve the lowest thermal resistance from the power chips down to the cooler. All of these operations are essential in order to guarantee the best system reliability.

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