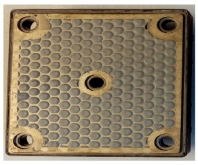

MICROCHIP AN4306 Mounting Instruction for Baseless Power Module User Guide

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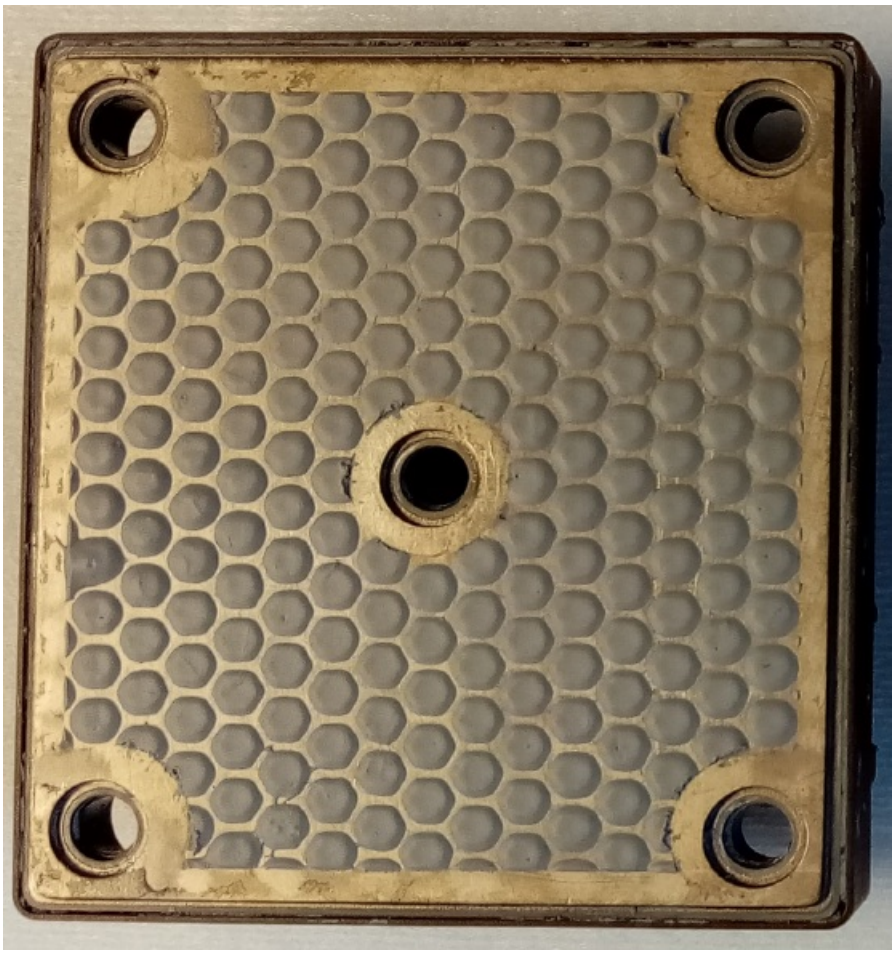
MICROCHIP AN4306 Mounting Instruction for Baseless Power Module



Introduction

Figure 1. BL1 Power Module

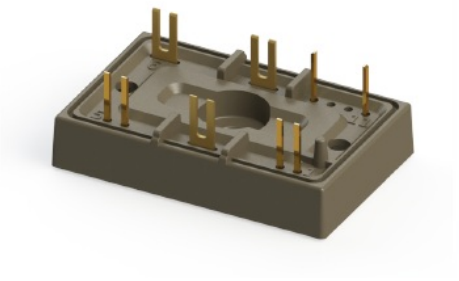


Figure 2. BL2 Power Module

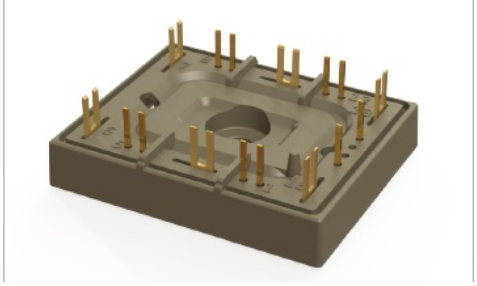
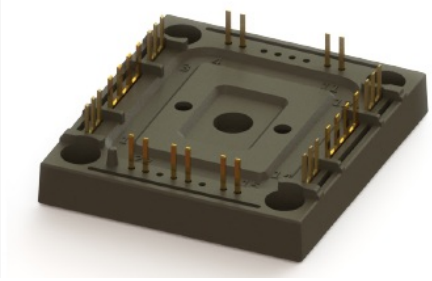


Figure 3. BL3 Power Module



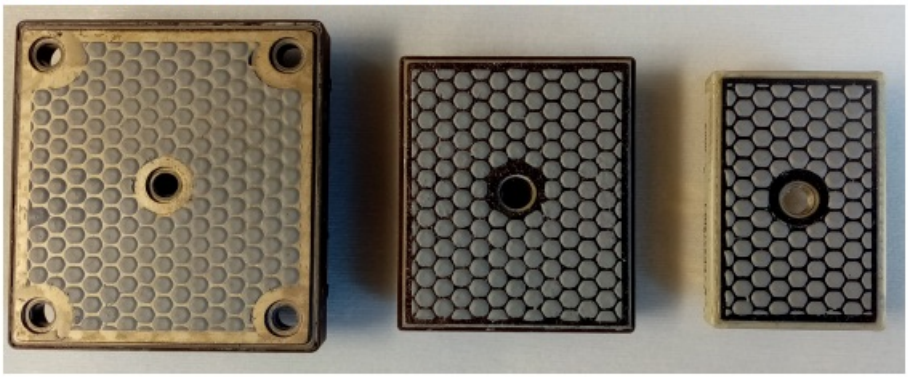
This application note provides recommendations to appropriately mount the baseless power module to the heat sink and PCB. Follow the mounting instructions to limit both the thermal and mechanical stresses.

Interface Between Baseless Power Module and Heat Sink

This section describes the interface between baseless power module and heat sink.

Phase Change Material (PCM) Deposition

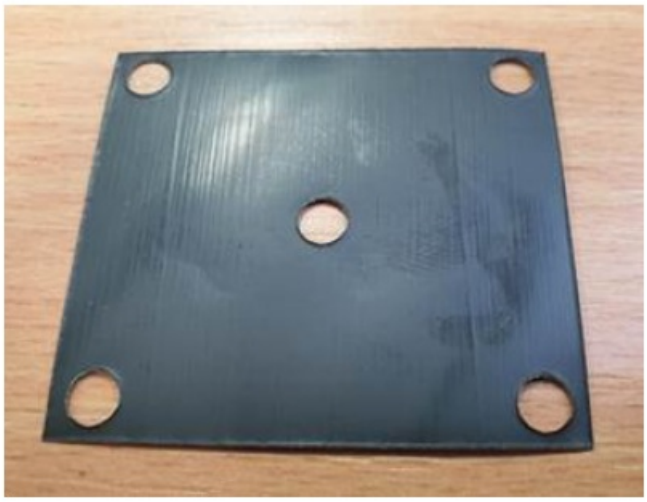
Figure 1-1. PCM Deposition on Baseless Power Module Before Assembly to the Heat Sink



To achieve the lowest case to heat sink thermal resistance, a phase change material deposition in honeycomb can be applied on the baseless power module. Use a screen-printing technique to ensure a uniform deposition of a minimum thickness of 150 µm to 200 µm (5.9 mils to 7.8 mils) on the baseless power module, as shown in the following figure. Microchip recommends Loctite PSX-Pe. This kind of thermal interface minimizes the pump-out. pump-out is caused from thermal cycling that occurs between the two mating surfaces.

Aluminum Foils with PCM

Figure 1-2. Aluminum Foil with PCM on Both Sides (Kunze Crayotherm - KU-ALF5) for a BL3 Baseless Module



To achieve the lowest case-to-heat sink thermal resistance, the aluminum foil with PCM on both the sides (Kunze Crayotherm—KU-ALF5) can be applied between the baseless power module and the heat sink as shown in the following figure.

Mounting the Baseless Module to the Heat Sink

Proper mounting of the baseless power module to the heat sink is essential to guarantee good heat transfer. The heat sink and the baseless power module contact surface must be flat and clean (no dirt, no corrosion, and no damage) to avoid mechanical stress when the baseless power module is mounted and to avoid an increase in thermal resistance.

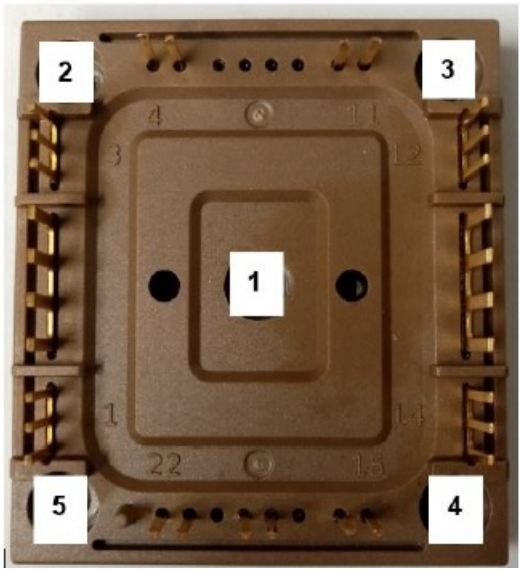
Note: Recommended flatness is <50 µm for 100 mm continuous and recommended roughness is Rz 10. Place the baseless power module with the PCM or the aluminum foil with PCM above the heat sink holes and apply a small pressure to it.

- For the BL1 and BL2 baseless power module:

- Insert the M4 screw and the spring washer (DIN 137A) in the mounting hole. The screw head and washer diameter must be at 8 mm typical. Tighten the screw until this final torque value is reached. (See the product datasheet for the maximum torque allowed).

- For the BL3 baseless power module:
  - Insert the M3 screws and the spring washers (DIN 137A) in the mounting holes. The screw head and washer diameter must be at 6 mm typical.

Figure 2-1. BL3 Baseless Power Module



- The five M3 screws must be torqued to 1/3 of the final torque. Order: 1 – 2 – 4 – 3 – 5.
- The five M3 screws must be torqued to 2/3 of the final torque. Order: 1 – 5 – 3 – 4 – 2.
- The five M3 screws must be torqued to the final torque. Order: 3 – 5 – 4 – 2 – 1.

See the product datasheet for the maximum torque allowed. To perform this operation for all the baseless power modules, use a screwdriver with controlled torque.

PCB Assembly on the Baseless Power Module

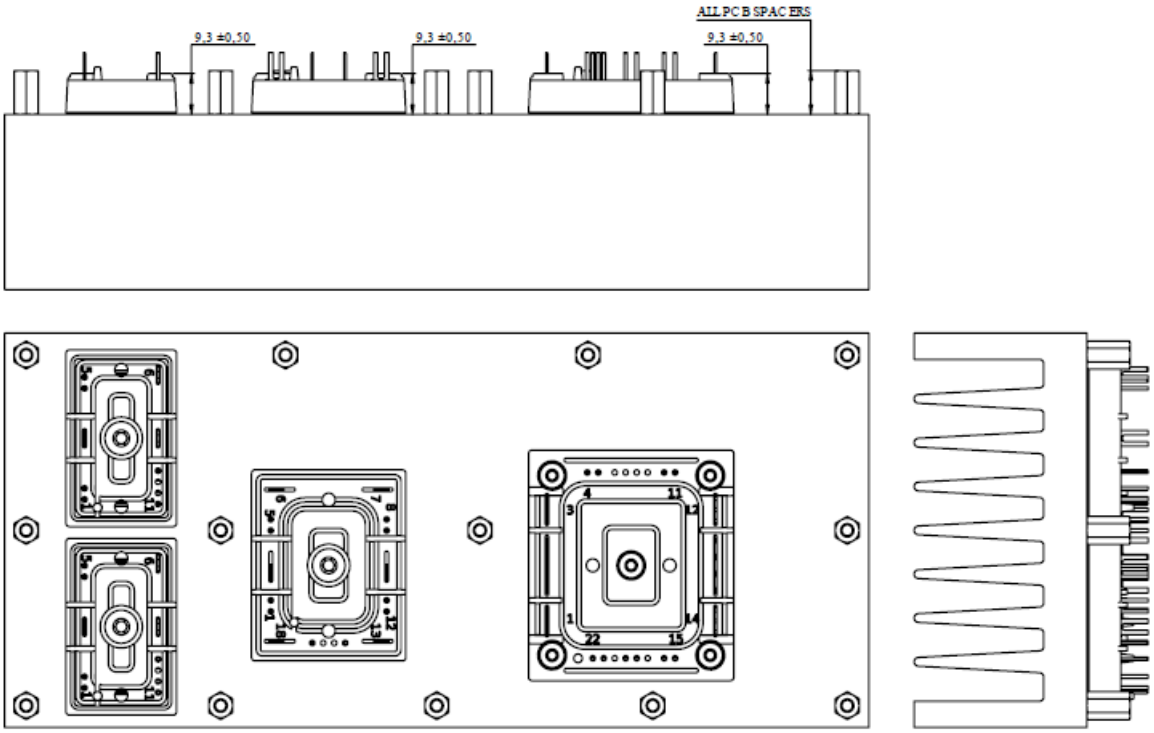
The following are the steps to assemble PCB on the baseless power module.

1. Place the spacers on the heat sink close to the baseless power module. The spacers must be at 10±0.1 mm tall.
   - **Note:** The baseless module is 9.3 mm tall. The spacers must be close to the baseless power modules to avoid any vibrations while respecting insulation requirements, as shown in the following figure. The PCB must be mounted to the baseless power module and screwed to the spacers. A mounting torque of 0.6 N.m (5 lbf·in) is recommended.
2. Solder 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.

Note: Do not reverse these two steps, because if all pins are soldered first to the PCB, screwing the PCB onto the spacers creates a deformation of the PCB, leading to mechanical stress that can damage the tracks or break the components on the PCB.

For efficient production, a wave soldering process can be used to solder the terminals to the PCB. 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 must surround each pin.

Figure 3-1. General Assembly View

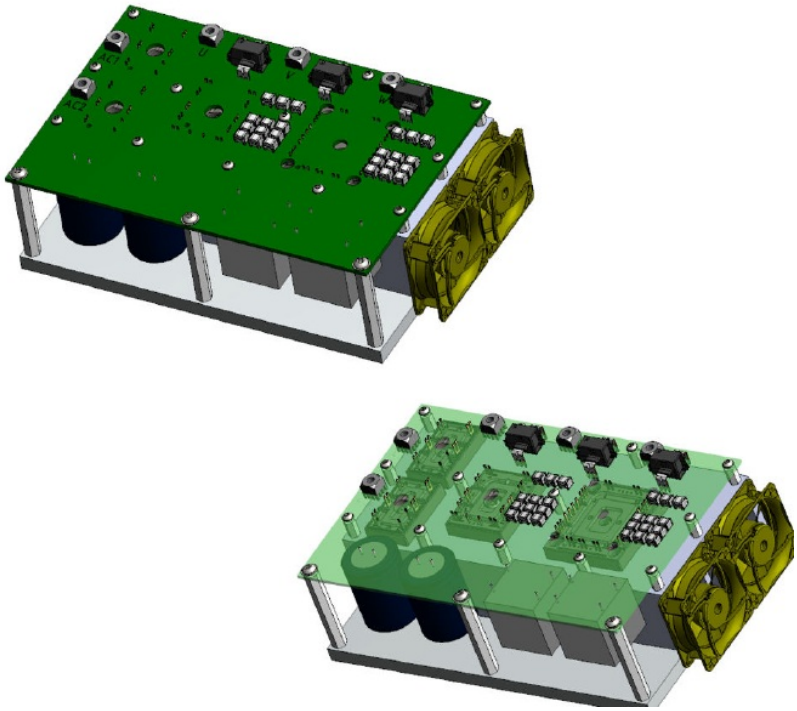


Holes in the PCB (see Figure 4-1) are necessary to remove the mounting screws that bolt down the baseless power module to the heat sink. These access holes must be large for the screw head and washers to pass through freely, allowing for normal tolerance in PCB hole location.

The gap between the bottom of the PCB and the baseless power module is very low. Microchip does not recommend using through hole components above the module. To reduce the switching over voltages, SMD decoupling capacitors of the power terminals VBUS and 0/VBUS can be used. (See Figure 4-1). Ensure safety while handling heavy components like electrolytic or polypropylene capacitors, transformers, or inductors placed around the power module. If these components are in the same area, add spacers such that the weight of these components on the board is not handled by the baseless power module but by the spacers. The pin out can change according to the configuration. See the product datasheet for the pin out location. Each application, PCM, PCB, and spacers placement is different and must be evaluated on a case-by-case basis.

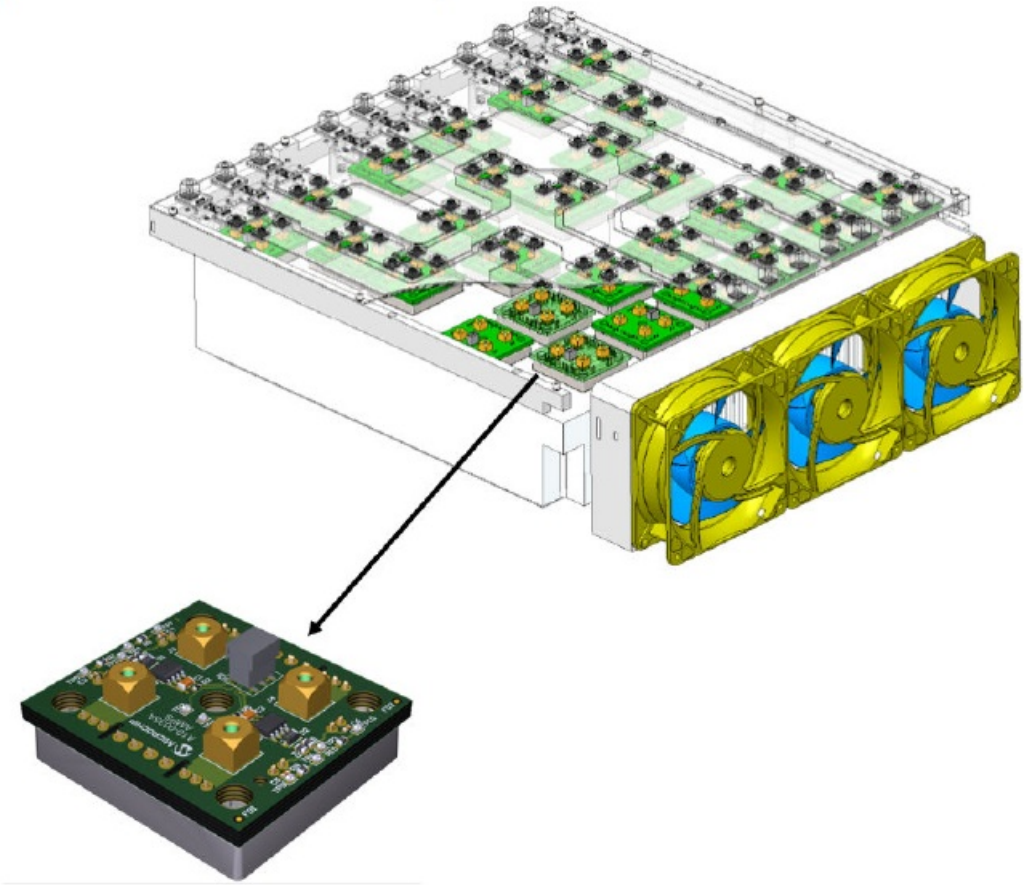
BL1, BL2, and BL3 Assembly on the Same PCB

Figure 4-1. Baseless Modules Assembly on the Same PCB



1. Assembly description is made of three baseless power modules: Two BL1 baseless power modules for the rectifier bridge, one BL2, and one BL3 baseless power module for the three-phase bridge configuration.

Figure 4-2. BL3 Baseless Modules Assembly for a Dual AC Switch on the Same PCB



- Assembly for a dual AC switch on a BL3 power module to perform a contact matrix for aircraft power generation (up to 50 kW).

Conclusion

This application note provides recommendations regarding the mounting of the baseless module. Applying these instructions will help decreasing the mechanical stress on PCB and baseless power module to 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.

Revision History

Revision	Date	Description
A	11/2021	The following changes are made in this revision: • Updated the document as per Microchip standards. • The document number was updated to DS00004306. • The application note number was updated to AN4306.

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