



onsemi SiC E1B Modules User Guide



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Scope

onsemi has pioneered the introduction of SiC JFETs in a cascode configuration with gate drive compatibility to Si MOSFETs, IGBTs, and SiC MOSFETs, based on the 5 V threshold voltage and wide gate operating range of ± 25 V.

These devices are inherently very fast switching, with excellent body diode

characteristics. onsemi has combined the advantageous SiC JFET based power device with an industry standard power module package, E1B, to further enhance power density, efficiency, cost-effectiveness, and ease of use for industrial power systems.

This application note introduces mounting guideline (PCB and heatsink) for onsemi's latest E1B power module packages (half-bridge and full bridge).

IMPORTANT: Snubbers are strongly recommended for SiC E1B modules due to their intrinsic fast-switching speed. Also, snubber greatly reduces turn-off switching loss making SiC E1B modules extremely attractive in ZVS (zero voltage turn-on) soft-switching applications such as phase-shifted full-bridge (PSFB), LLC, etc.

This product is recommended for use with solder pin attach and phase change thermal interface materials, and not recommended for implementations using press fit and application of thermal grease. Please refer to mounting guidelines and user guide documents associated with this product for detailed information.

This application note also provides resource links to simulation models, assembly guidelines, thermal characteristics, reliability, and qualification documents.

Resource and Reference

1. [SiC E1B Modules Technical Overview](#)
2. [SiC E1B Modules Mounting Guideline](#)
3. [SiC Cascode JFET & Module User Guide](#)
4. [SiC E1B Modules DPT EVB User Guide](#)
5. **onsemi SiC Module Link:** [SiC Modules](#)
6. [EliteSiC Power Simulator](#)
7. **onsemi** [SiC power solution central hub](#)
8. [Origins of SiC JFETs and Their Evolution Towards the Perfect Switch](#)

E1B Module Information

The primary cause of power semiconductor module failure is improper mounting. Poor mounting will result in elevated or excessive junction temperature, which will significantly limit the module's operational lifetime. As a result, proper module installation is critical to

achieving reliable heat transfer from SiC device junction to the cooling channel.

The E1B modules are designed to be soldered to a printed circuit board (PCB) and attached to a heat sink with pre-assembled screws and washers, as shown in **Figure 1** and **Figure 2**. More extensive information on dimensions and tolerances for designing hardware for these systems can be found in the module datasheets.

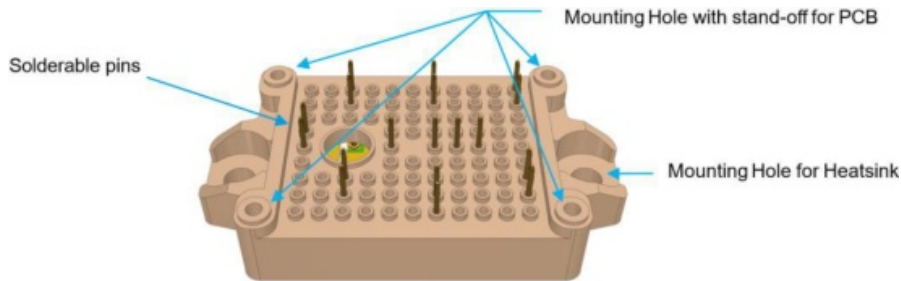


Figure 1. Module Mounting Screw Location (Top View)

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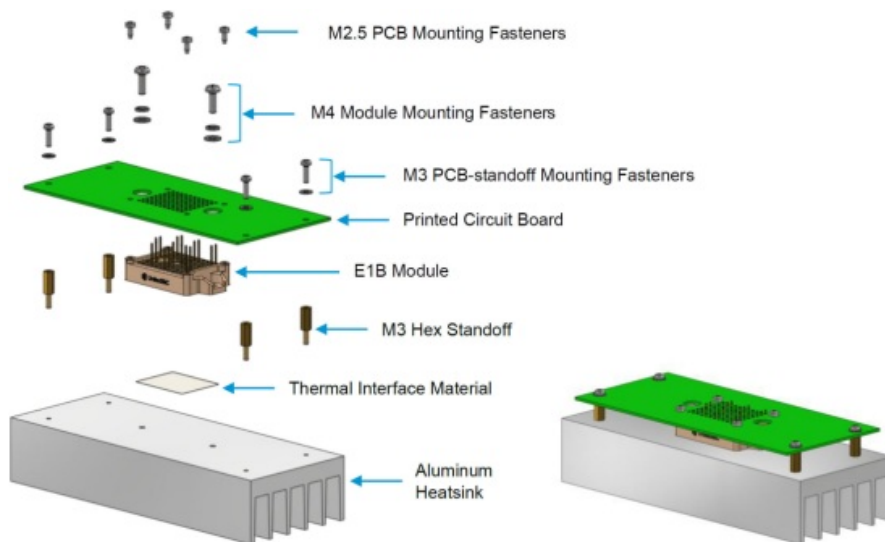


Figure 2. Module Mounting with PCB and Heatsink (Assembly Exploded View)

Recommended Mounting Sequence

onsemi recommends following mounting sequence for better thermal performance and lifetime of SiC E1B module:

1. Solder the module pin to the Printed Circuit Board (PCB)
2. Mount the PCB onto the module
3. Mount the module to the heat sink

With pre-assembled screw (combine screw, washer, and lock washer), fasten the

module onto the heat sink using limiting torque. It should be noted that the size and surface of the heatsink must be considered throughout the soldering process, as proper heat transfer between the module backside and the heatsink interface is critical to the overall performance of a package in a system (**see Figure 2**).

1. Solder the Module Pin to PCB

The Solderable pins used on the E1B module have been checked and qualified by onsemi for standard FR4 PCBs.

If the PCB requires a reflow soldering process for other components, it is recommended to reflow the PCB before mounting the module to avoid exposure to high temperatures.

A typical wave soldering profile is shown in Figure 4 and Table 1.

If other handling techniques are used in the manufacture of printed circuit boards, additional testing, inspection, and certification is required.

PCB Requirement

FR4 PCB with a maximum thickness of 2 mm.

Refer to IEC 61249-2-7:2002 to check if PCB material meets the standard requirements.

User to determine the optimum conductive layers for proper design of PCB stack layers but need to ensure multi layer PCBs follows IEC 60249-2-11 or IEC 60249-2-1

If the customer will consider a double-sided PCBs refer to IEC 60249-2-4 or IEC 60249-2-5

Solder Pin Requirement

Key factors for achieving solder joints with high reliability is the PCB design.

The plated-through hole diameters on the PCB must be manufactured according to the soldering pin dimension (**see Figure 3**).

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If the PCB hole design is not correct, potential problems can occur.

If the final hole diameter is too small, it may not be properly inserted and will cause the pins to break and damage the PCB.

If the final hole diameter is too large, it may not result in good mechanical and electrical

performance after soldering. Solder quality should refer to IPC-A-610.
The recommended parameters for wave soldering process temperature profiles are based on IPC-7530, IPC-9502, IEC 61760-1:2006.

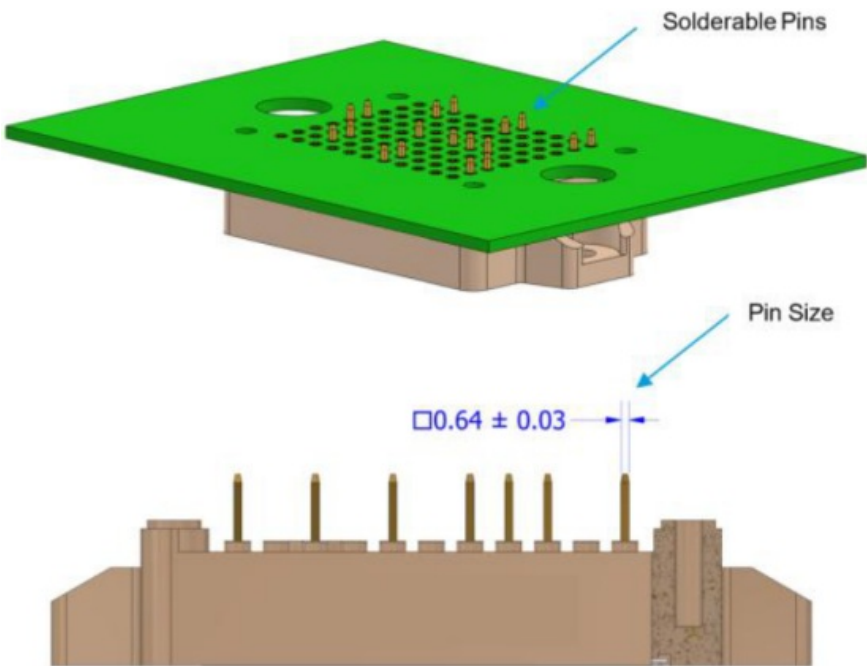


Figure 3. Module Mounting to PCB Prior Mounting to a Heat Sink

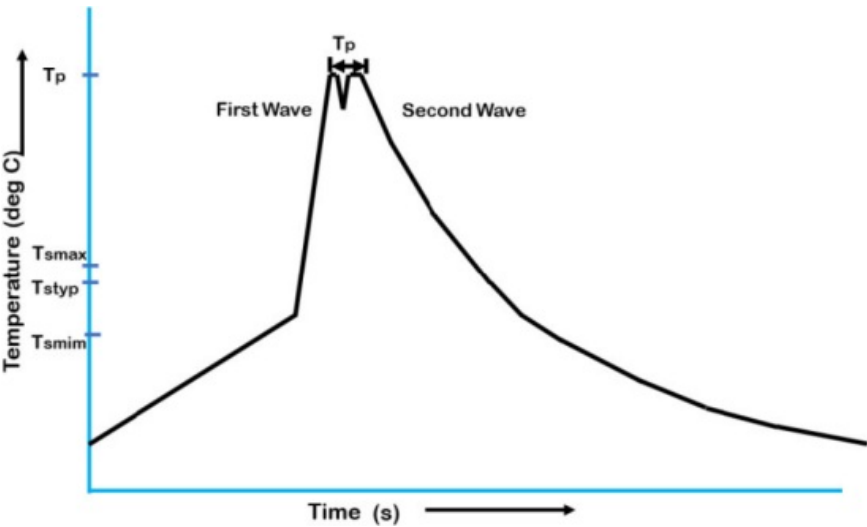
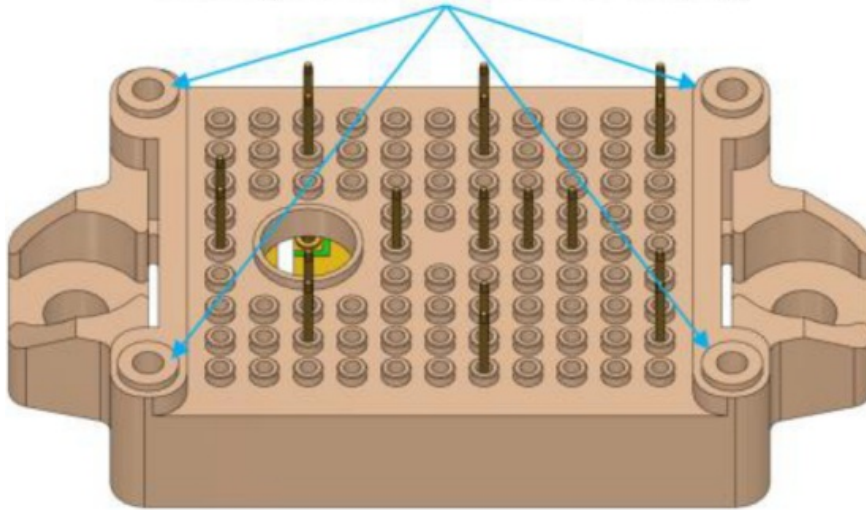


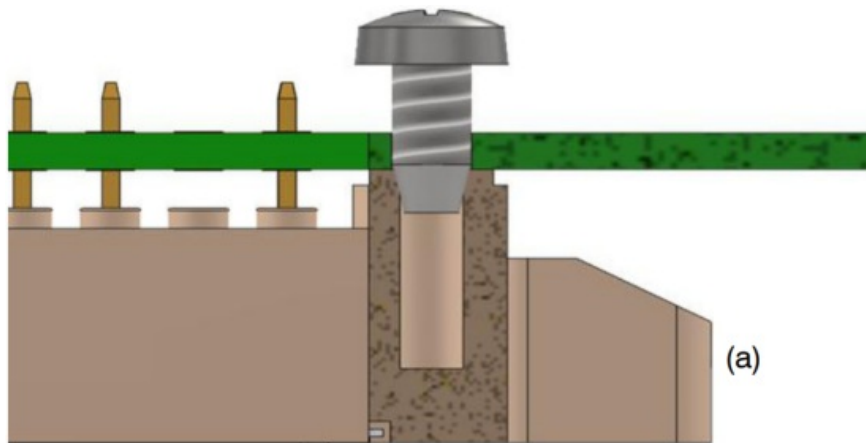
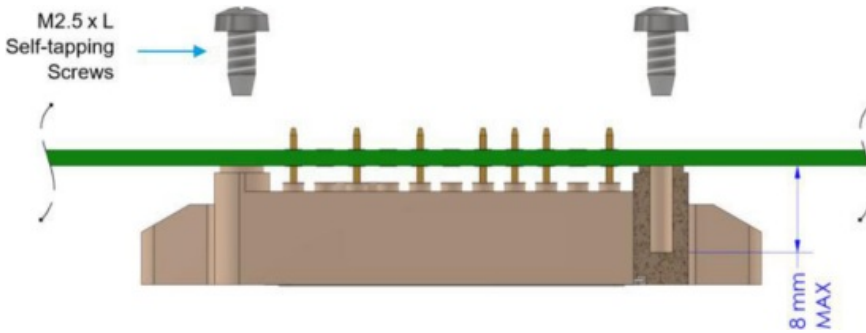
Figure 4. Typical Wave Soldering Profile (Reference EN EN 61760-1:2006)

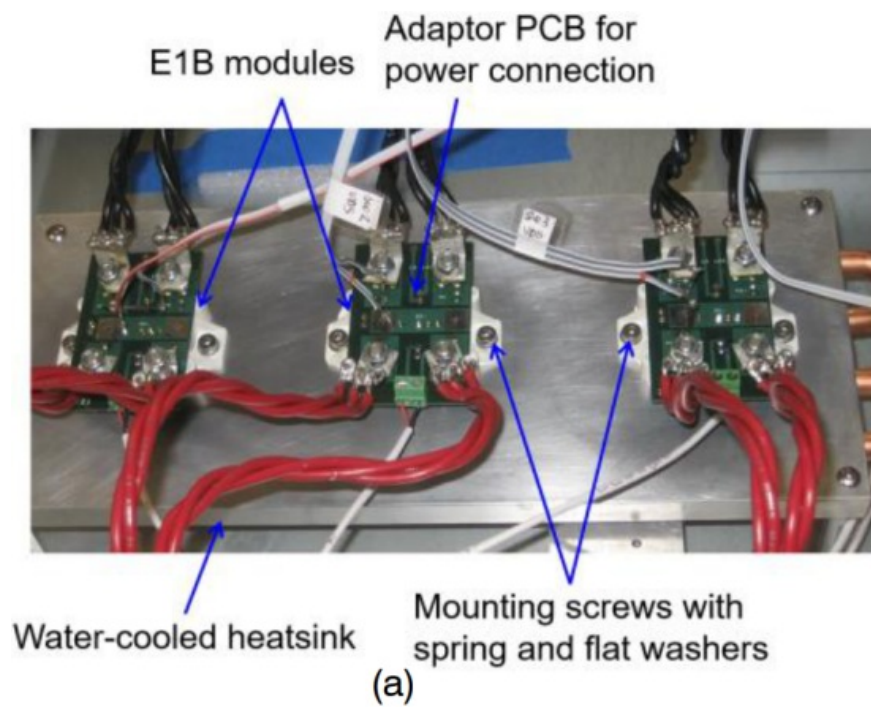
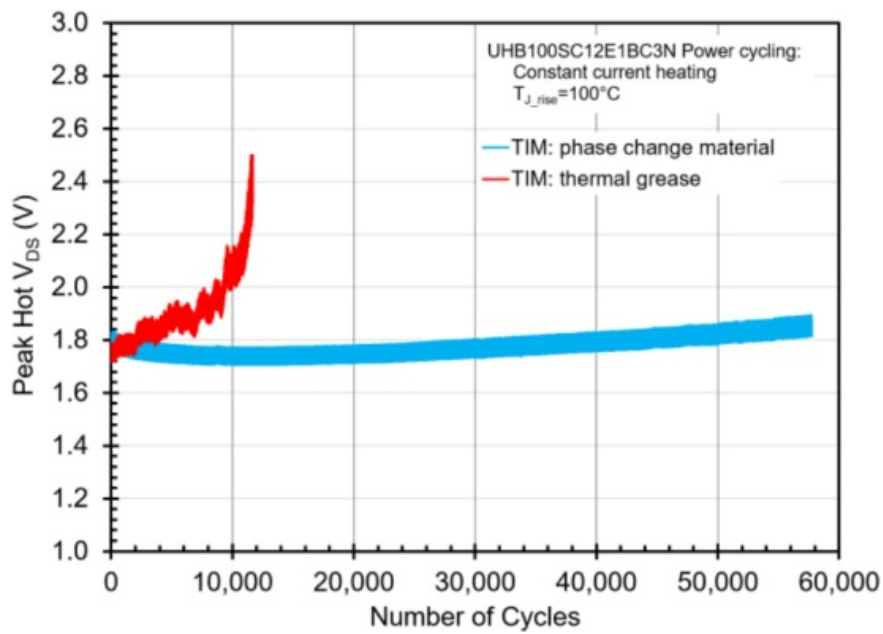
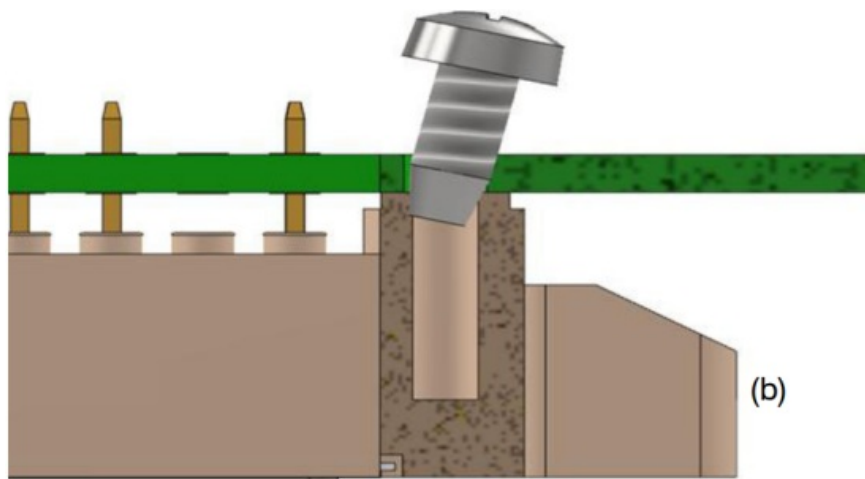
Table 1. TYPICAL WAVE SOLDERING PROFILE (Reference EN EN 61760-1:2006)

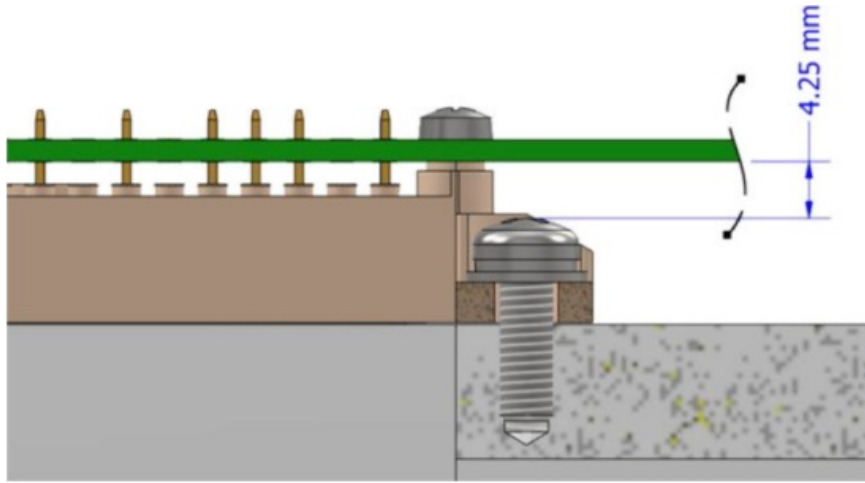
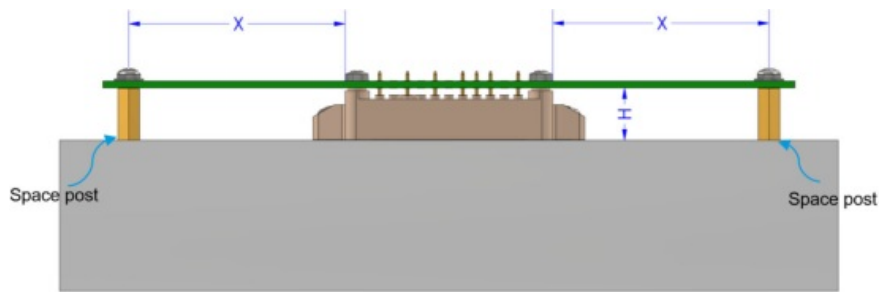
Mounting Hole with stand-off for PCB Mounting



M2.5 x L
Self-tapping
Screws

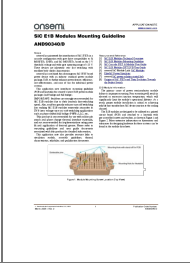






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Documents / Resources




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AND90340-D, SiC E1B Modules, SiC E1B, Modules

References

- [User Manual](#)

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