Assembly instructions for Infineon's Easy HD3 modules

About this document

Scope and purpose

This application note provides guidelines on how to use and implement the new Easy HD modules from Infineon. It includes the technical information necessary for users to realize a smooth system design with Easy HD modules. Please read through this document before working with the Easy HD modules.

Intended audience

The intended audiences for this document are design engineers, technicians, and developers of electronic systems.

Keypoints

Installation, soldering, clearance and creepage

About this product family

Product family

The Easy family is the best choice for customers who are looking for a flexible and scalable power module solution. We offer the package portfolio with 12mm height. The flexible pin grid system is a perfect fit for customizing layout and pinout.

Target applications

Photovoltaic, Energy storage systems

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1 General information

A new module type – Easy HD3 – has been integrated into Infineon’s Easy portfolio. This module is based on the advances observed in the Easy B and Easy C series of products.

The Easy 3B module is the benchmark used to develop the Easy HD3 module. The most significant modification is the incorporation of a baseplate within the module. The merits of the Easy family are complemented by the advantages inherent in the base plate. This new module helps customers support pin connections to printed circuit boards (PCBs) with higher output power. The Easy HD3 module is utilized in industrial and automotive applications. Figure 1 shows the complete Easy family comprising seven packages – Easy 1B, Easy 2B, Easy 3B, Easy 4B, Easy 1C, Easy 2C, and the new Easy HD3.

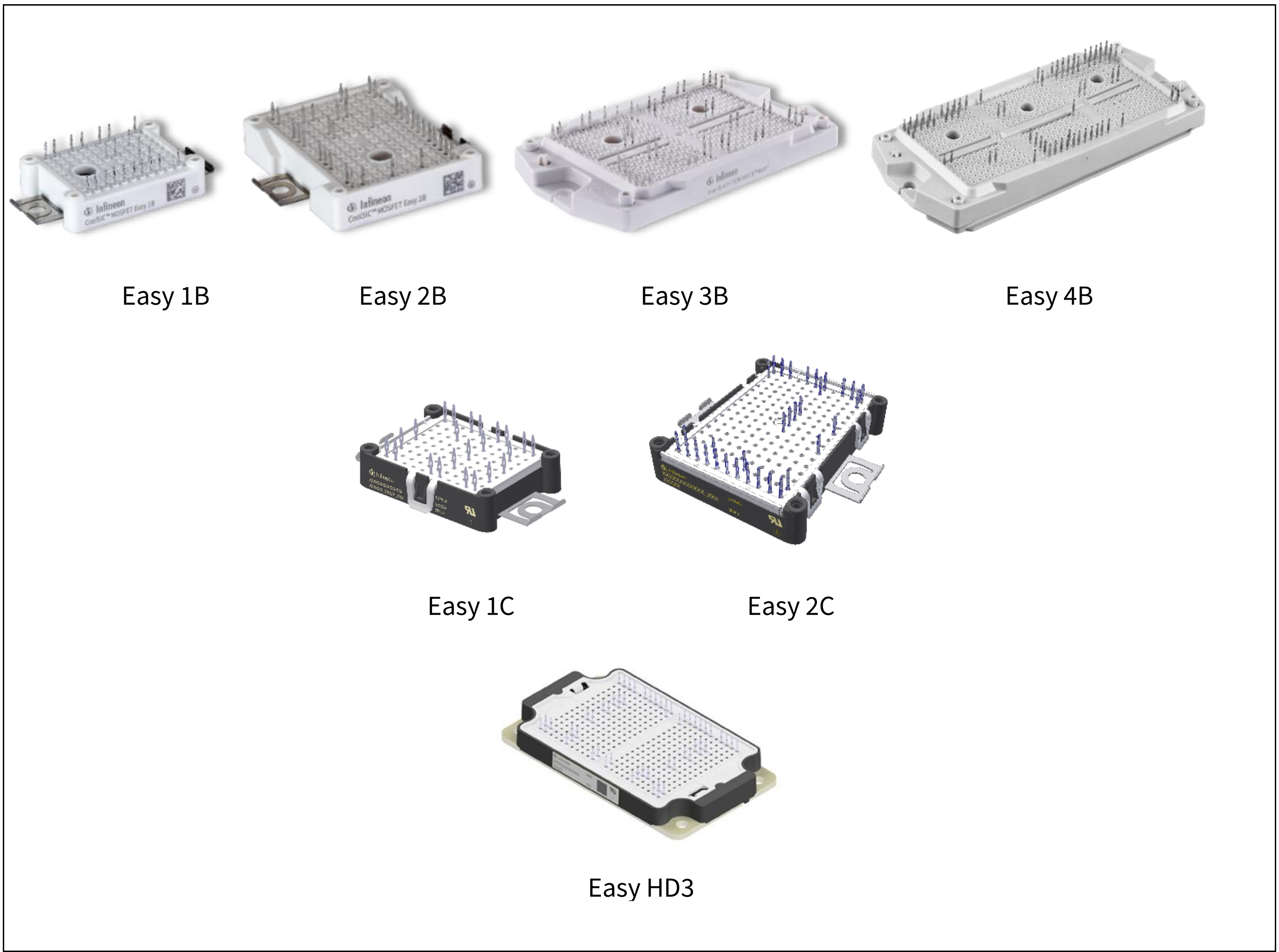


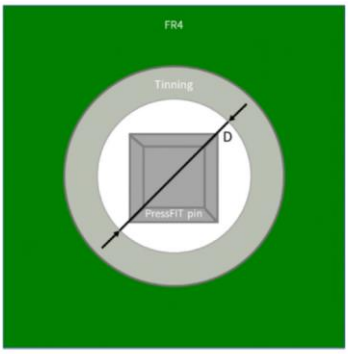
Figure 1 Products in the Easy family

2 Requirements for the printed circuit boards (PCBs)

The new Easy HD 3 modules with solder pins can be soldered onto PCBs with a thickness that can secure pin protrusion (refer to the IPC-A-610 standard).

The final minimum diameter of the through-hole is determined considering the pin circumference and tolerances. To fit the module mechanically into the printed circuit board through soldering, a final minimum hole diameter of 1.25 mm is recommended.

The final hole diameter of the plated through-holes is defined as D = 1.25 + X. Figure 2 shows a cross-section of the solder pin.



D = 1.25 mm + X

Figure 2 Cross-section of the solder pin

Due to the dependence on several factors, such as the PCB type, thickness, plating, production tolerances, solder process, or the solder alloy used, the parameter “X” must be determined by the customers. This will ensure good soldering results and a reliable long-term connection. Please refer to the IPC 2222 and IEC 61188-6-3 standards.

The final hole size must be defined carefully. If its diameter is too large, ensuring a solid electrical and mechanical connection between the pin and the board can become challenging. Creepage and clearance are also critical factors to be considered when determining the final hole size.

When assembling several modules on a single PCB, the height tolerance of the modules must also be considered during the mounting procedure. This will prevent mechanical deformation of the PCB or use of unwanted force on the modules.

PCB layout is also a considerable factor in helping system to achieve better thermal performance. For example, a thicker or a larger area of the copper layer minimizes losses and contributes to the heat transfer via the pins.

3 Condition of the heat sink for module assembly

The heat generated in the module during operation must be transferred into a heat sink to ensure that the module operates within the maximum temperature (T_{vjop}) specified for the semiconductors and the temperature limitations of the package material (RTI). This helps in achieving the intended electrical and lifetime performance.

The condition of the heat sink's surface where the module is to be mounted is very important. The interface between the heat sink and the module has a decisive influence on the heat transfer of the entire system.

The contact surfaces, the surface below the module, and the surface of the heat sink should not be degraded or contaminated to prevent excess mechanical stress on the module and avoid an increase in thermal resistance.

The contact surface between the module and the heat sink should not exceed the following values:

- Surface flatness based for 100 mm length ⩽ 50 µm
- Surface roughness Rz ⩽ 10 µm
- Steps ⩽ 10 µm

1. *The deviation from flatness of the heat sink should not exceed the value listed above. This area includes the entire module mounting area.*
2. *If the layer of thermal grease is too thick, for example due to cavities, the thermal resistance R_{th} between the module and the heat sink will increase.*

50 µm is the maximum value of surface deviation from flatness required to secure the thermal contact between the module and the heat sink. A lower value is recommended to achieve better heat transfer, which can lead to a better thermal performance of the system.

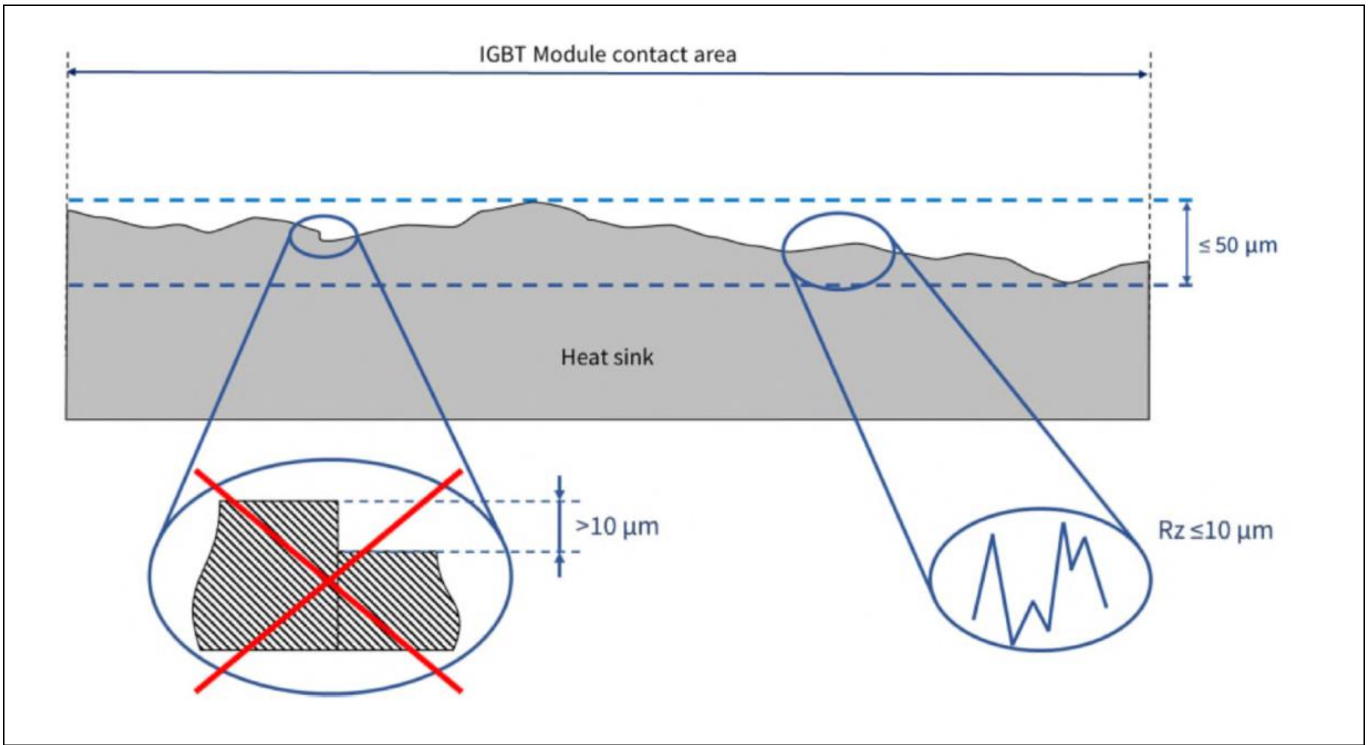


Figure 3 Recommendations to ensure the quality of the heat sink surface for module installation

4 Soldering process for Easy HD3 modules with solder pins

The terminals of the Easy HD modules have a solderable surface that allows contact through suitable soldering methods.

After placing the PCBs, the connection can be made through manual soldering, automatic selective soldering, wave soldering, or other methods.

If the modules are preheated before they are soldered to the printed circuit board, ensure that the maximum preheating temperature (T_{max} = 125°C) does not exceed t = 30 minutes.

During the entire soldering process, ensure that the process parameters, the solder temperature, or the time duration for which the modules are in touch with the contacts do not lead to deformation or damage of the plastic housing. A maximum soldering temperature of T = 260°C ± 3°C is permissible for a maximum duration of t_{max} < 10 s ± 1 s according to the IEC 60068-2-20 standards.

Users can test different process parameters at their own risk. These can also be evaluated in cooperation with Infineon. It is expected that the components are free from defects and are treated properly.

For more information about the soldering processes, please refer to AN2005-06.

5 Applying thermal grease

Due to individual surface states (e.g., roughness and flatness) of the heat sink and the module, direct contact between both metallic surface is only provided on a share of the total baseplate area. The localized separation between the two components cannot be avoided.

To dissipate the losses occurring in the module and to achieve a good flow of heat into the heat sink, all the localized cavities should be filled with a thermal compound. In such cases, a homogenous application of the heat-conductive paste must be assured.

A well-applied layer will fill all cavities and, at the same time, allow a metallic contact between the module's base and the heat sink's surface. A compound with permanent elastic attributes must be selected to ensure continuously favorable heat transfer and resistance.

Before mounting the module onto the heat sink, applying an even layer of thermal grease to the module's base or the heat sink, based on the module's size and the thermal grease used, is recommended. The quantity of thermal grease is considered sufficient if a small amount of grease is visible around the module after it is mounted on to the heat sink.

Based on multiple tests, a uniform, 80 – 130 µm thick layer of thermal grease on the baseplate of the module is considered sufficient. The user must select and qualify the thermal interface material and the process with respect to fitness for purpose and long-term stability at its own.

The following volumes can be used as a guideline for the amount of thermal paste required for a D = 130 µm thick layer will be V $\approx$ 0.515 cm^3 .

The recommended method to apply the thermal grease is using the screen print process. This process ensures an optimized and module-specific distribution of the heat-conductive paste. It also helps achieve a homogenous and reproducible layer thickness.

Further notes regarding the use of screen print templates for applying the thermal grease can be found in application note number AN2006-02: Application of silk screen.

The thickness of the thermal grease after application can be checked using a wet film comb or a wet film roller gauge, as shown in see Figure 4.

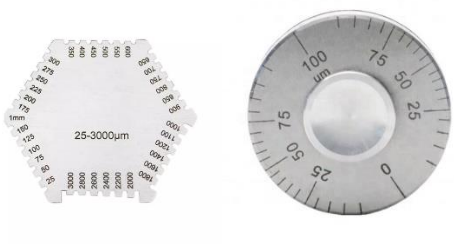


Figure 4 Wet film comb and wet film roller gauge for measuring the thickness of the thermal grease layer

Processing guidelines, thermal contact, and long-term stability of thermal materials should be considered. Users must take these aspects into account when selecting these materials depending on the process and the application at their own risk. They can also discuss these aspects with the thermal grease manufacturer, if necessary.

6 Assembling the module onto a heat sink

Depending on the application, one or many modules can be connected to a PCB. The connection between the PCB and the module(s) should ensure that the baseplate can be placed evenly on the heat sink in the final assembly. If two or more modules are connected to one PCB, their baseplates must be on the same level after the soldering process. This is critical for achieving the optimum connection between the baseplates and the heat sink.

Spacers between the PCB and the heat sink should be positioned such that the heavy components on the PCB do not affect the module and the desired vibration behavior of the entire device.

Modules must be mounted according to the mechanical tolerances specified in their datasheets. Module-specific case drawings can also be taken from the datasheets.

The screw connections for mounting the module onto the heat sink must be designed such that the total of all possible loads does not exceed the force limits of the assembled parts. Friction devices such as spring washers increase the elasticity of the connection and compensate for the settling effects. This maintains most of the preload force, preserving the connection.

The tightening torque must be selected such that the force applied preload leads to a purely frictional connection between the components. To determine the preload force and the tightening torque accurately, the friction coefficient µ must be known. The friction depends on several factors such as material combination, surface, lubrication, temperature, etc. For a typical, clean combination of an aluminum heat sink with a galvanized M5 steel screw, the estimated friction coefficient will be $\mu_G \approx 0.14$. If the actual coefficient of friction differs from this standard value, the tightening torque must be adapted accordingly.

Ideally, the screws should be tightened with a torque close to the maximum recommended torque, M_{max}. However, the maximum torque must not be exceeded.

Table 1 Specifications of the fastening screw

Description	Values	Comment
Fastening screw	M5	According to ISO 4762, a DIN 6912 or DIN 7984 in combination with a suitable flat washer (according to DIN 433 or DIN 125), or complete combination screws according to DIN 6900 are recommended for module mounting. Using a spring washer is also applicable.
Maximum recommended tightening torque	M_{max} = 6 Nm	Determined for a friction coefficient of $\mu_G = 0.14$ (screw clean and dry, aluminum heat sink, screw according to ISO 14581, galvanized, rolled thread). The torque applied should be based on the maximum torque.
Recommended strength class of the screw	8.8	At least 6.8
Minimum thread reaches into the heat sink	1.6 x dia. = 8 mm	For aluminum; according to the technical literature

Other material combinations of screws and/or heat sink material may require a modification of the mechanical parameters and an evaluation of the corrosion resistance.

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The module-mounting screws must be uniformly tightened crosswise using a torque within the specified limits.

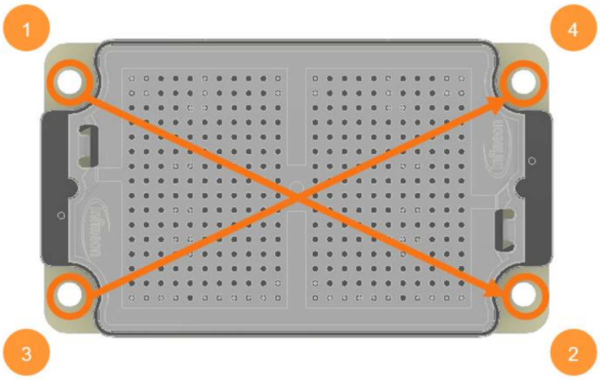

Figure 5 Screw sequence for module mounting

For optimal thermal contact of the module with the heat sink, use the following procedure (recommended) when tightening the screws - 1 to 4 for Easy HD3 modules (see Figure 5).

1. Apply thermal grease to the module.
2. Place this module onto a clean heat sink.
3. Screw in the screws to about half their length. Tighten all the screws crosswise using a torque of approximately 0.5 Nm in the sequence shown in Figure 5 (screw no. 1 - 2 - 3 - 4).
    a. Depending on the viscosity of the alternative material used (e.g., in case of high viscosity), pause for a while and then tighten the screws crosswise to approximately 0.5 Nm in the same sequence. This will allow the thermal grease to flow as the screws are tightened, adapting to the contours of the module's baseplate and the heat sink.

Note: The pause depends on the material used and must be determined by users based on their examinations/tests with the preferred material. Generally, for initial investigations during the development phase, a pause of 10 to 20 minutes can be assumed.

4. Tighten the screws crosswise to 3 – 6 Nm in the same sequence (screw no. 1 - 2 - 3 – 4).

Please check the tightening torque of the fixing screws after a heat test depending on the type of grease used. It is highly advisable to perform this step if phase change films are used for thermal conduction instead of thermal grease. Silicone films are not suitable for power devices and are therefore not recommended.

7 System considerations for mechanical robustness

To ensure low thermal resistance and optimal thermal flow between the module and the heat sink, the module must be mounted correctly onto the heat sink and to the PCB – the baseplate with the correct amount of thermal grease. As the PCB is connected to the module only by pins, suitable measures must be taken to ensure that vibrations are kept at a minimum. Any possible movement between the terminals and the module case must be avoided. Each pin may only be subjected to a maximum pull force of 6 N vertical to the heat sink, considering the vibration load and dynamic stress in transportation and operation. Therefore, the circuit board should additionally be fixed to the heat sink at a position close to the module. In principle, this can be done in several ways depending on the options of assembly sequence.

7.1 Soldering height of power modules

A nominal height of 12.2 mm is recommended as the soldering height for the Easy HD3 modules with solder pins. The gap between the PCB and the power module housing provides the space to release unavoidable deformation and stress in the system.

This gap is not necessary if users ensure the pin protrusion as per Chapter 2. In this case, users need to evaluate the stress conditions in the system.

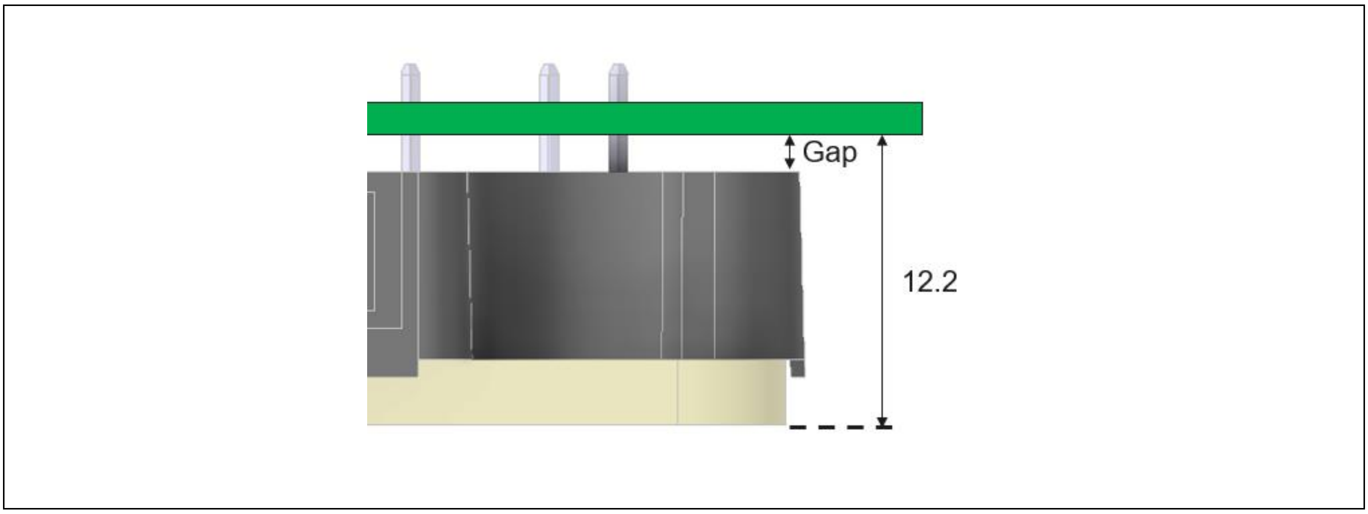

Figure 6 Soldering height and gap

7.2 Options of assembly sequence

Due to different applications and systems, there is no representative approach for the assembly process. Therefore, the impact from different options should be taken into account to avoid overstressing the modules and systems.

7.2.1 Assembling the heat sink after soldering

A soldering jig that can hold the power modules and PCB together can be used during the soldering process. This will maintain the relative position between the PCB and the modules, especially to keep the baseplates on the same level after the soldering process.

Before soldering, the power modules should be positioned and fastened to the jig ahead of the PCB. The soldering height, H_{solder}, will be based on the soldering jig's spacers.

To provide a predictable pre-pressure force from the PCB to the power module in the final assembly, there is an optional method for customer that the heat sink's spacers, H_{spacer} can be lesser than the height of soldering jig, H_{solder}. This approach will help the system achieve a design-to-force condition. It will also help control the height and thus, the stress within the PCB and components. Note that the arrangement of the solder spacers should be compatible with the heat sink spacers.

The horizontal distance, X, between the spacers and the power modules should be determined by customers, according to their applications, to ensure that the compression force on the pins does not exceed the maximum limit.

Another benefit of using a jig is to ensure the paralleling between the power module's base and the PCB, especially when several modules are soldered to one PCB. The jig acts like a critical role in simulating a heat sink to fix all the power modules on the same plane during the soldering process.

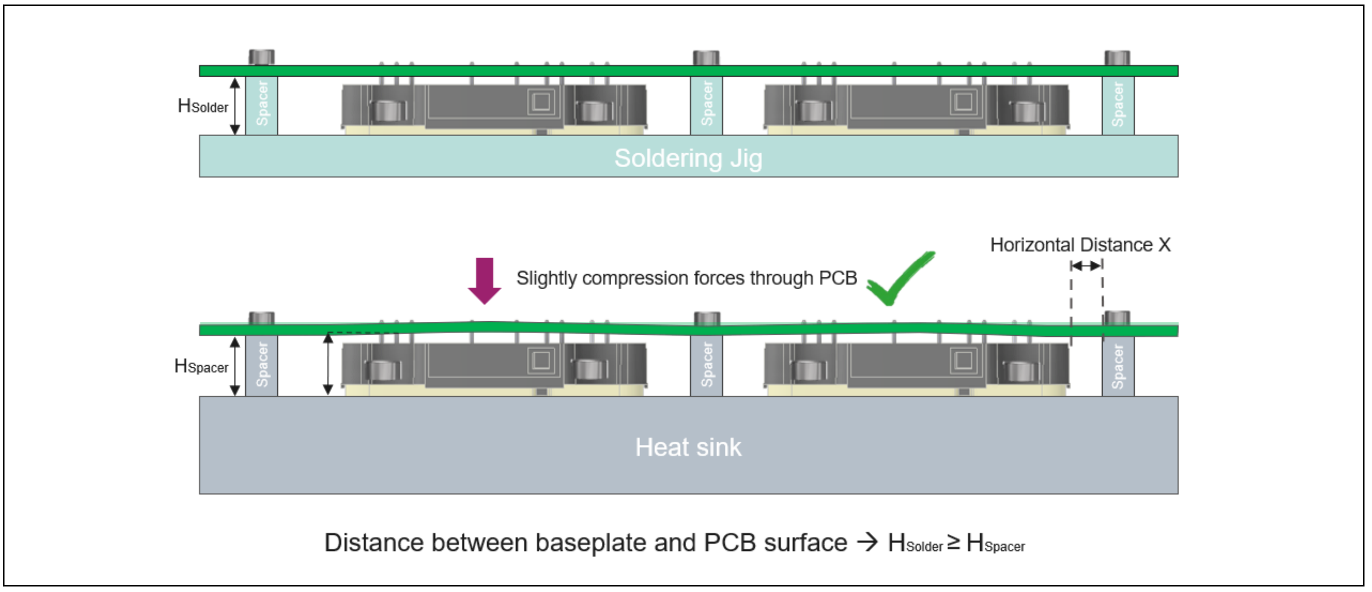

Figure 7 Using a soldering jig before assembling the heat sink

7.2.2 Assembling the heat sink before soldering

If the system tolerance and stress are well controlled, soldering after assembling the heat sink can also be a production sequence option.

Here, using a bottom soldering jig is strongly recommended for supporting the entire assembly and preventing deformation during the soldering process. It is useful for supporting the PCB evenly to achieve good connection, as shown in Figure 8.

However, for many applications and system designs the deformation and stress after the heat-sink assembly and soldering process is not easy to predict and handle.

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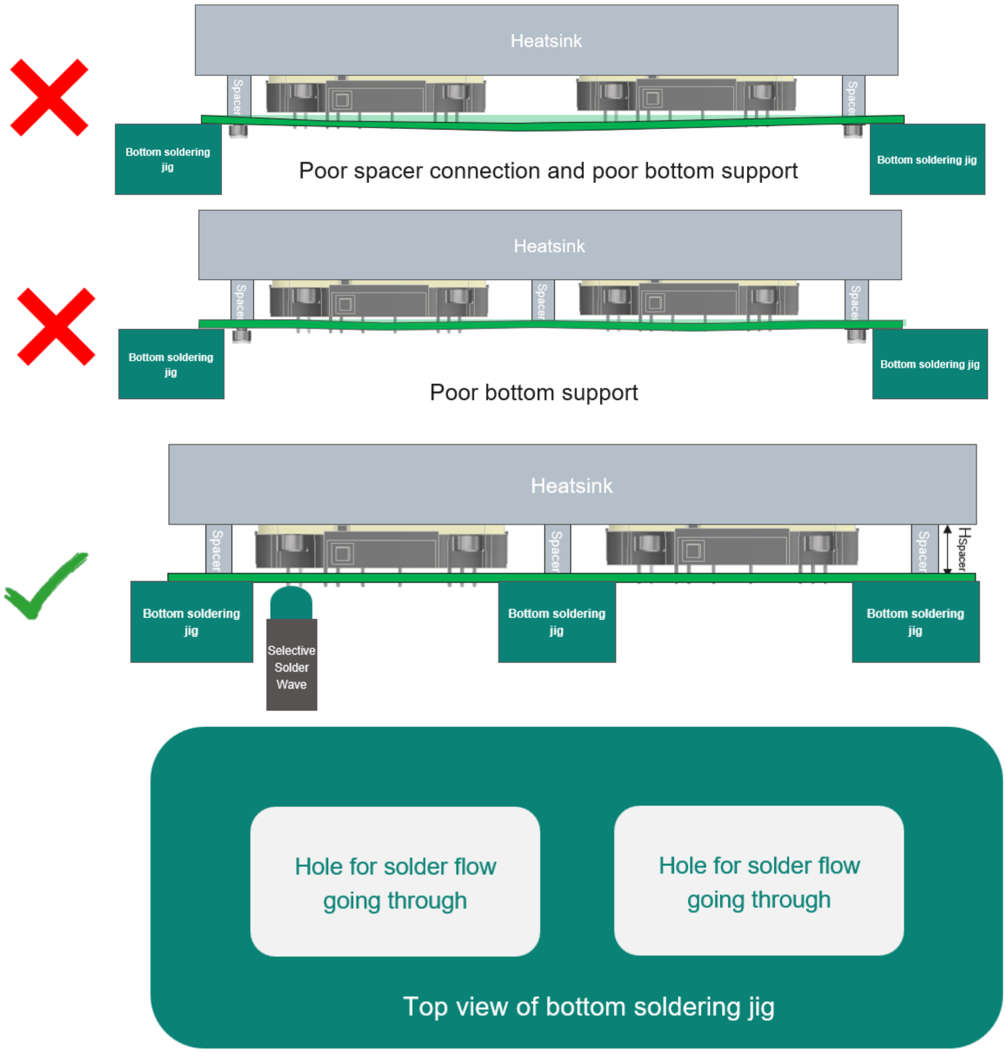

Figure 8 Benefits of using a bottom soldering jig

7.3 Using stand-offs between the PCB and the heat sink

Apart from considering the spacer’s height (according to applications), it is also important to consider other factors while using stand-offs.

7.3.1 Layout of stand-offs

Stand-offs or spacers between the PCB and the heat sinks not only control the force from the PCB to the power modules, but also the mechanical stress. They act like force and stress isolators between the modules, and between the modules and other large components. Using stand-offs can also lower the vibration load between the elements.

The amount and distribution of force between the PCB to the power modules should also be kept in mind. A limited and uniform distribution of the pulling or compressing force on the power module will protect the power modules and the system from significant tilting, twisting, and other deformations.

Different modules and components have different dimension and installation tolerances. Different coefficient of expansion also creates different deformations in the components on the PCB under temperature changes.

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Hence, using spacers between the modules and other components in the layout is strongly recommended for isolating mechanical stress.

Figure 9 shows how force is distributed, and stress is isolated with different stand-off layouts. Although the figures show symmetrical patterns, following strictly symmetrical positions is not necessary in customer design. The results of force distribution and components isolation can be achieved is the main target.

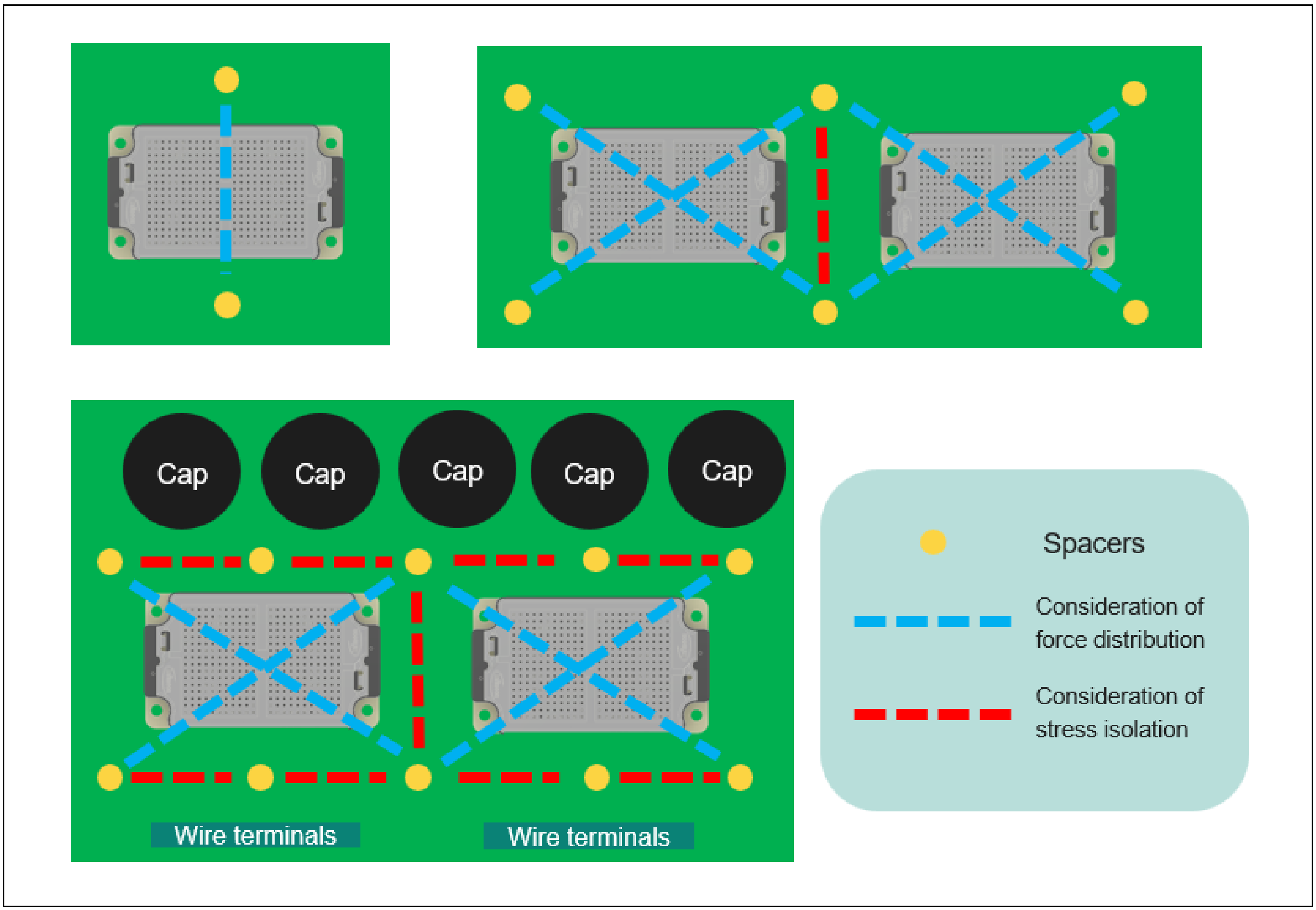

Figure 9 Considerations of stand-off layouts

8 Clearance and creepage distances

According to the third revision of IEC 60664-1, mechanical tolerances must be considered when calculating the clearance and creepage distance. This chapter provides an overview of the creepage distance and clearance for the Easy HD modules to enable a design based on the new requirements. These values can be used as an initial check for the fulfillment of application conditions. If the module clearance or creepage distance is not sufficient for an application, please contact the Infineon sales office for technical support.

8.1 Pin-to-pin creepage distance

The creepage distance is defined as the shortest distance along the surface of a solid insulating material. For the Easy modules, the outer and the inner surface of the housing are considered. The CTI (Comparative Tracking Index) value of this material is provided in the module datasheet.

Figure 10 shows the typical pin-to-pin creepage distance for the Easy HD package. The values below the pins indicate the creepage distance from the pin to the origin pin, assuming only unpopulated positions in between. The origin pin can be any pin in the Easy HD module. Based on the relative position to the origin pin, the pin-to-pin creepage distance can be easily read out and tolerances have been taken into account. In Easy HD, there are two DCBs (Direct Copper Bonding) in each module. The creepage distance across the DCBs is also shown.

Figure 10 The pin-to-pin creepage distance for high-current pins in Easy HD3 modules

8.2 Pin-to-pin clearance

The Easy HD modules must always be assembled on the PCB. Therefore, the pin-to-pin clearance is limited on the PCB side when the pad diameter is more than 1.5 mm. In such cases, the clearance must be checked on the PCB level.

8.3 Pin-to-heat sink clearance and creepage distance

The pin-to-heat sink clearance and creepage distance values provided do not consider the mounting hardware. For the overall system, the area of the screw, which is located under the PCB is also important. To meet the requirements for clearance and creepage distances, current-carrying devices or through-holes in this area should be avoided, or additional isolation measures must be considered.

The clearance distance between the screw and the PCB depends on the screw itself. For Easy HD packages, when the PCB reaches the module package at the recommended PCB design height of 12.2 mm, the distance from the heat sink to the PCB is 3.2 mm with a hexagon socket head M5 screw according to DIN 912, and an M5 washer according to DIN 125. The clamp is illustrated in Figure 11.

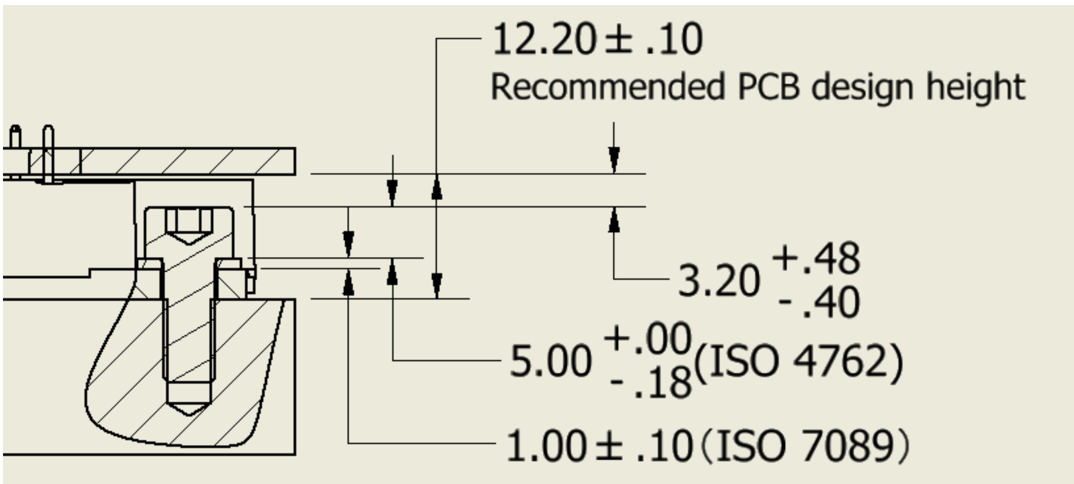

Figure 11 The clearance distance between the clip and the PCB in the EasyHD3 package

9 Disassembling the module from PCB and heat sink

A module soldered to the PCB should be desoldered according to the same temperature conditions as the soldering process to avoid damaging the module.

9.1 Disassembling the module from the heat sink

When disassembling a system, there must be no handling on the pins or on the plastic housing if a thermal interface material is applied.

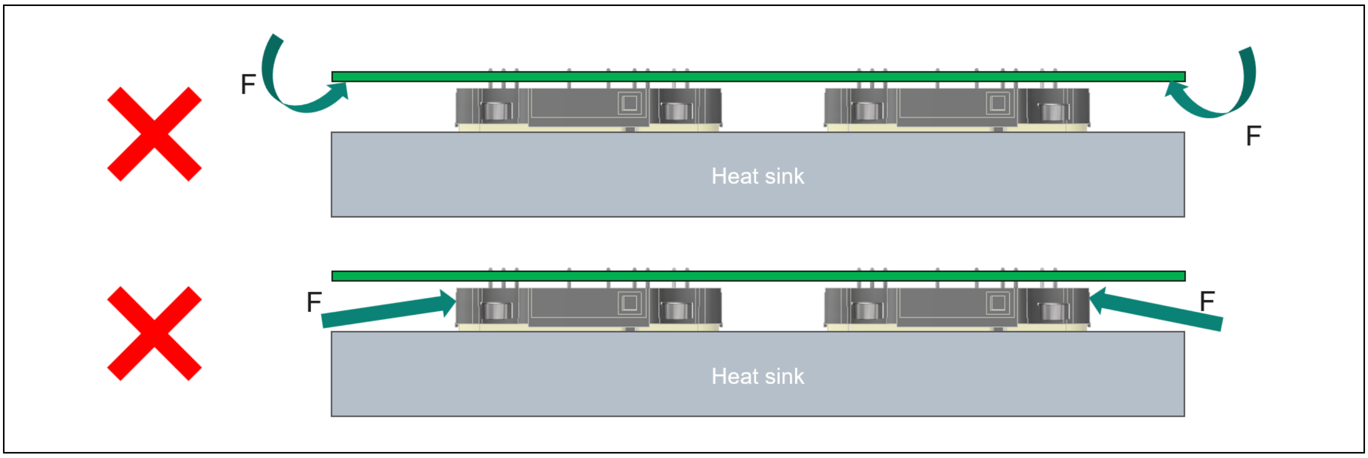

Figure 12 No handling on the pins or on the plastic housing

An optional safe way to disassemble the system is to cut the thermal grease off by a wire before lifting the modules. A polymer wire, for example fishing lines of 0.02 mm diameter can be used for this.

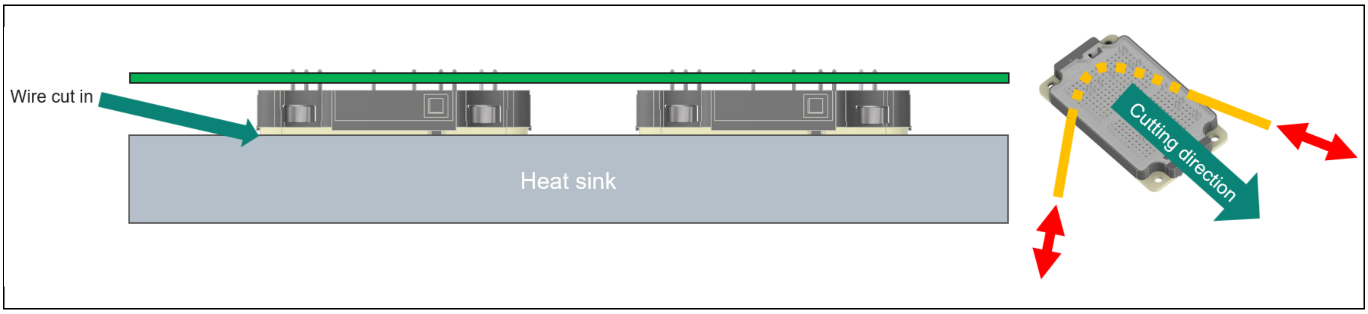

Figure 13 Cutting the thermal grease by wire

Revision history

Document revision	Date	Description of changes
1.0	23-Sep-2025	Initial release
1.1	15-Oct-2025	PCB design height update on Page 10, 15
1.2	11-Nov-2025	Spacer description update pn Page 11
1.3	24-Apr-2026	Public Version

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