

## 1 General

The devices of the ISOPLUS-SMPD family are highly integrated power modules. Therefore it is necessary to follow some basic assembly rules.

In general semiconductors should be mounted so that adjacent parts do not heat the devices up.

Modules should be mounted in a way that tension, pressure or vibrations cannot cause mechanical stress to the connections between the device and the PCB.

Device marking is done on the module backside (DCB, Fig.1) so it is readable sitting in the packing unit as well as after board assembly.

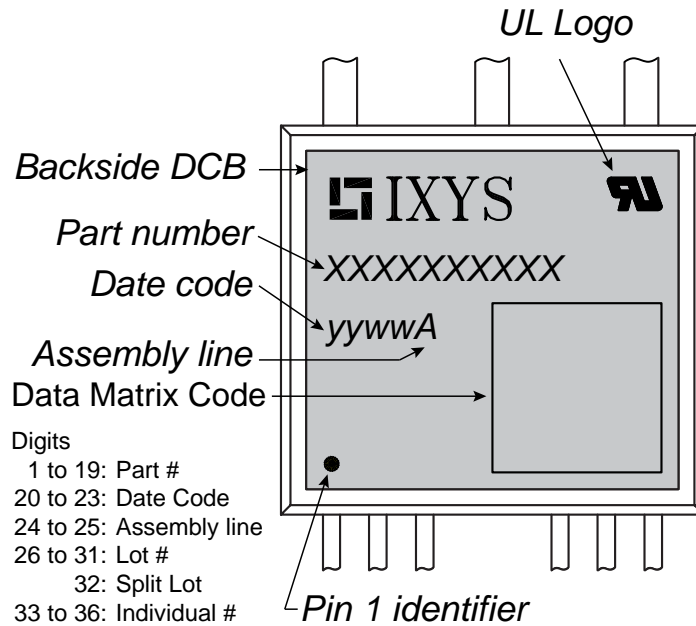
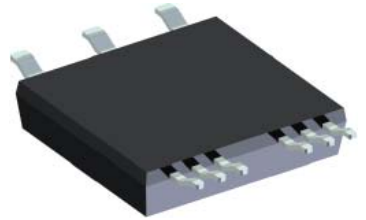


Fig.1 Example of marking on device backside

The numbering of the pins is counter-clockwise looking at the module backside, starting at pin 1 which is marked on the DCB with a dot (see Fig.1).

## 2 Design of the Printed Circuit Board

The maximum load current flow determines the cross section of the copper tracks required on the PCB. One needs to take into account that heat generated in the PCB may feed into the power module via the leads and heat up the power semiconductors in addition. Forced air-cooling for the PCB can improve the temperature situation.

Tension and mechanical stress to the solder joints of the module pins has to be avoided. Depending on the design of the power stage, additional support from the heat sink to the PCB might be necessary.

Figure 2 shows an example for the design of the solder pads for the ISOPLUS-SMPD devices on the PCB. One may use other pad designs depending on individual requirements on creepage distances or in case an additional isolating potting compound is used to cover those areas on the board.

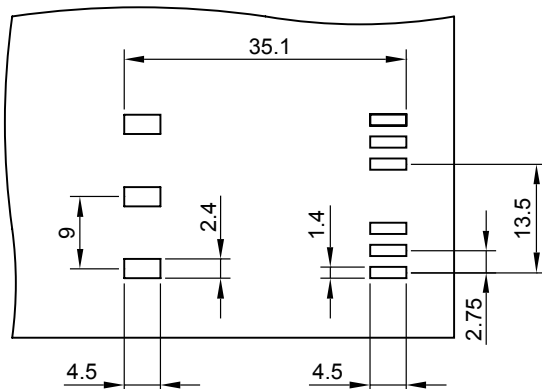


Fig. 2 Proposal for the pad design for pin soldering on a PCB

### 3 Board assembly and soldering

ISOPLUS-SMPD devices are available either in blister trays (version ...LB, 45 devices per tray) or Tape & Reel (version ...LB-TRR, 200 devices per reel). Ordering codes for the different versions are shown in the individual datasheets.

Both versions are suitable to be used in automated Pick & Place environments.



Fig. 3 Devices in blister tray

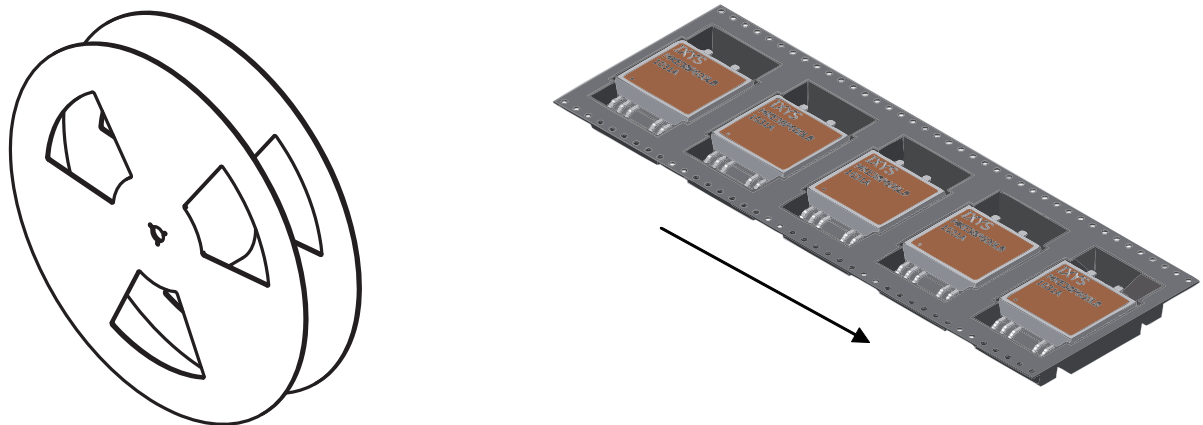


Fig. 4 Devices in Tape & Reel

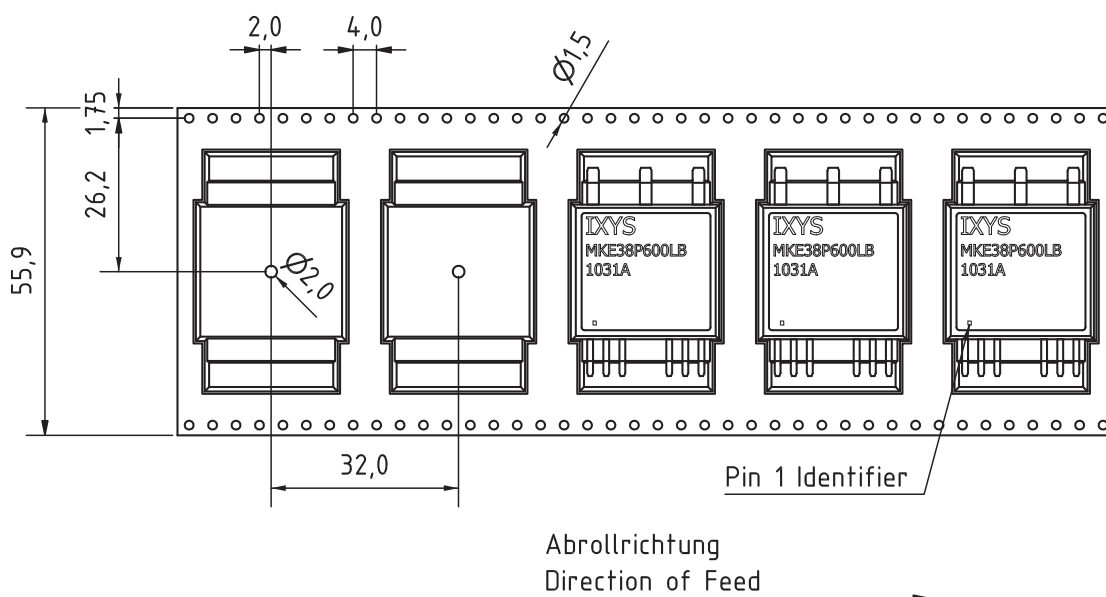


Fig. 5 Dimensions of the Tape

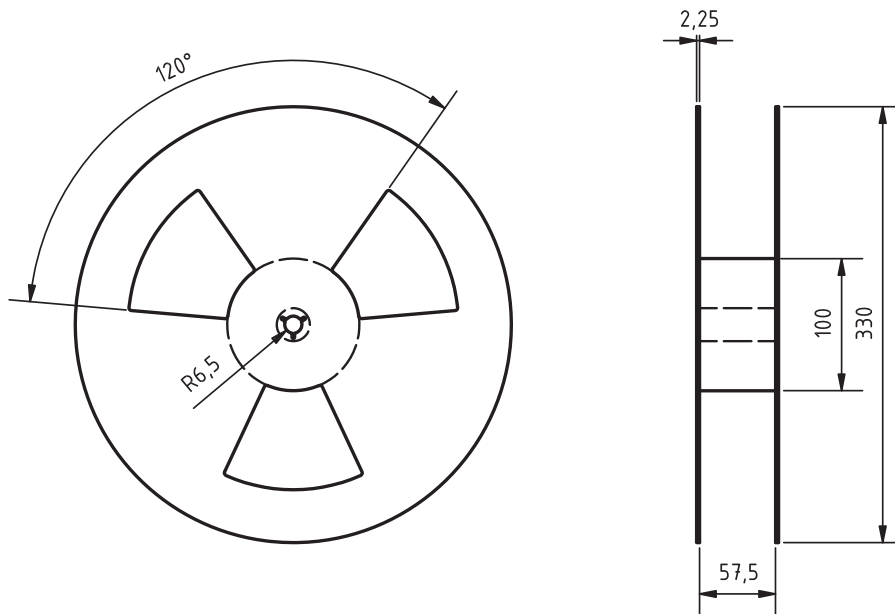


Fig. 6 Dimensions of the Reel

Devices are specified and packed according to MSL level 3, JEDEC J-STD-020C, J-STD-033B.1. This has to be taken into account for the handling procedures during board assembly.

The plating of the pins is 10...25  $\mu\text{m}$  matte tin over nickel.

Modules can be soldered in standard lead-free SMD lines with soldering profiles according to JEDEC J-STD-020C.

For reliable operation and to prevent mechanical stress to the leads in the final assembly an alignment parallel and with a gap between device body and printed circuit board as small as possible is needed.

#### 4 Application of thermal grease

The use of thermal grease is recommended to ensure low case-to-heat sink thermal resistance. We recommend using either DC340 or SC102 (both Dow Corning) or silicone free HTCP (Electrolube) or equivalent thermal grease.

Since the devices feature an internal isolation (DCB) it is not recommended to use an interface material with isolation (thermal pad) as these materials exhibit a higher thermal resistance compared to the materials mentioned above.

Application of the grease:

- Thermal grease should be applied evenly to either the module or the heat sink.
- Use of a roller is recommended, but stencil printing is also possible.
- Layer thickness should be in the range of about 60 to 80  $\mu\text{m}$ .
- Thickness measurement of the layer thickness by an adequate measurement gauge helps to avoid failures.

To verify the mounting procedure it is recommended to check on some first samples if the thermal grease was evenly distributed over the whole surface of the DCB / heat sink area. For this the devices should be mounted on the heat sink using the intended method and then removed again after some minutes of residence. If there is no complete contact it may be necessary to increase the thickness of the thermal grease layer.

Note: Thermal grease contact and distribution will improve during the first hours and after heating up the system for the first time if properly pressed to the heat sink.

For more information see our [online video](#).

## 5 Mounting to the heat sink

### 5.1 Surface Requirements

To ensure a good contact and thermal conductivity between module and heat sink the following points must to be considered:

- Surfaces of the module and the heat sink have to be free from any impurities, residues and particles which may come from the thermal grease, from heat sink machining or from package materials.
- Heat sink flatness in the mounting area to be  $\leq 50\mu\text{m}$  per 100mm (according to DIN EN ISO 1101)
- Heat sink roughness RZ to be  $\leq 10\ \mu\text{m}$  (measured according to DIN EN ISO 4287)
- No steps on heat sink surface  $> 10\ \mu\text{m}$  (measured according to DIN EN ISO 4287)

**Note:** In case of natural convection cooling, the heat sink fins must be arranged so that the air can flow freely from the bottom to the top. In case of forced convection cooling by air or liquid, the module can be mounted in any position as long as the amount of the cooling medium is sufficient for the load.

### 5.2 Mounting technique, examples

ISOPLUS-SMPD modules are a combination of a package which can be used in a PCB assembly in the style of standard SMD components and power semiconductors which need to be mounted on a heat sink.

This leads to the question about a proper mounting method.

The module(s) should be soldered to the PCB first and then the thermal grease would be applied to either the module or the heat sink. Then the PCB including the module(s) needs to be assembled to the heat sink.

It is mandatory to ensure that DCB (module base) and heat sink surfaces are parallel to each other.

Fig. 7 shows examples for different assembly designs.

To prevent mechanical stress to leads of the device or the connections between the device and the PCB additional support from the heat sink to the PCB might be necessary.

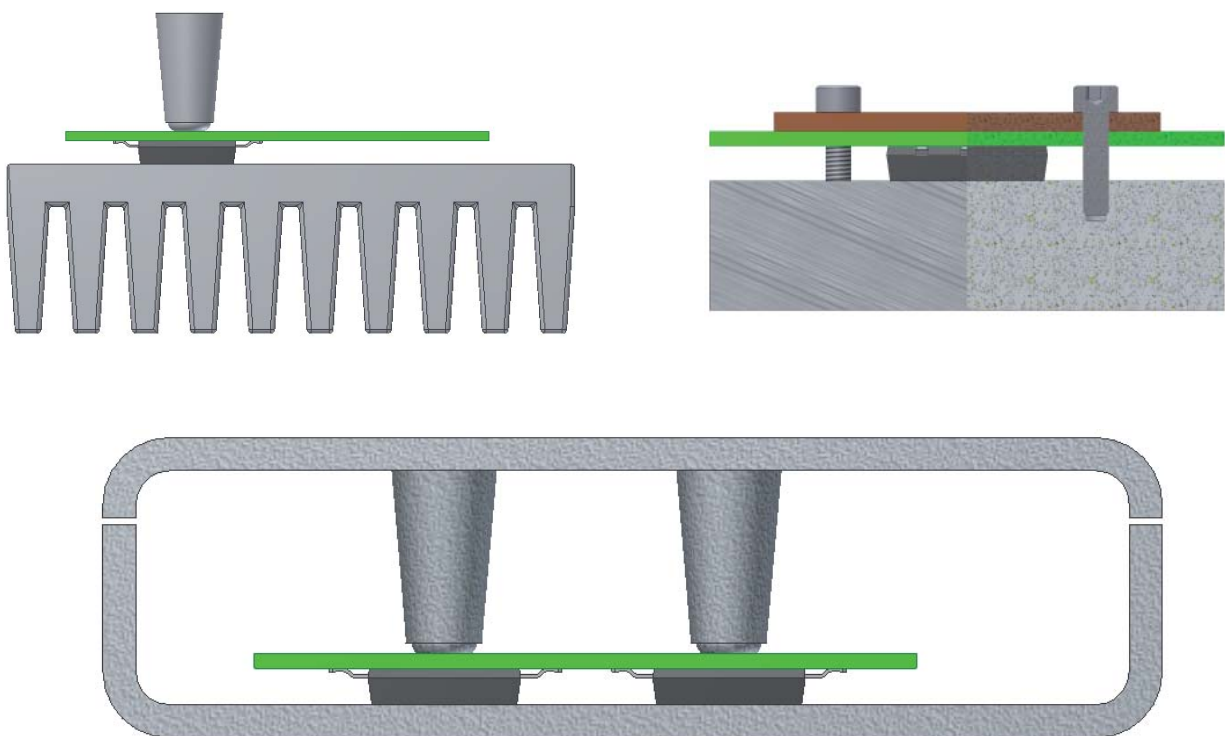


Fig. 7 Examples for the heat sink assembly

### 5.3 Mounting force

As mentioned above the thermal resistance of the whole system is significantly affected by the interface from module back side (DCB) to the heat sink. Besides the application of the right amount of thermal grease the pressure is an important criterion for a good contact between the two surfaces and with it for a low thermal resistance.

The mounting force should be in a range of 50N to 130N.

It is known that the thermal resistance of this interface is improving over time (Fig. 8). After mounting of the device the thermal grease needs time to spread and squeeze out part of the grease which is not necessary to provide a good contact.

This effect can be accelerated at elevated temperatures or using initially a higher pressure during the assembly. This allows reducing the mounting force in the final setup. Fig. 9 shows the dependency of the thermal resistance versus the mounting force. First the pressure was increased step by step; one can see how the thermal resistance is getting lower. Then the pressure was reduced again step by step but the thermal resistance remains low over a wide range..

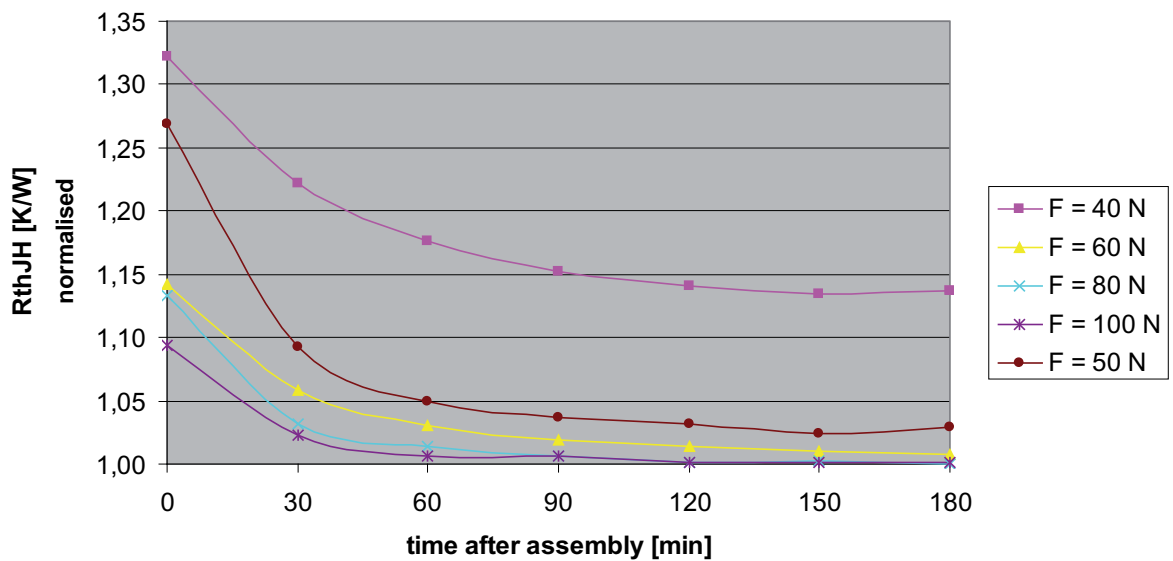


Fig. 8 Change of the thermal resistance junction to heat sink ( $R_{thJH}$ ) versus time and mounting force

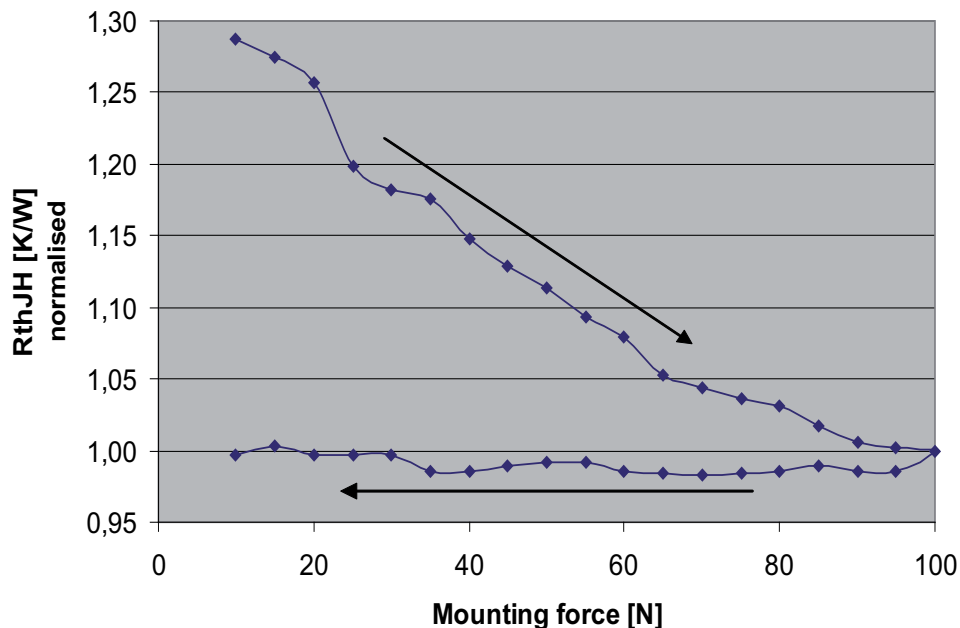


Fig. 9 Change of the thermal resistance junction to heat sink ( $R_{thJH}$ ) versus mounting force



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