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Application of screen print templates to paste thermal grease within IGBT modules

Introduction

When operating semiconductor modules the power losses need to be transferred to a heatsink in order not to exceed the maximum junction temperature of the components.
Thermal compound is normally used to aid thermal contact between module and heat sink. Both unevenness of the base plate and surface roughness of the heat sink are thus compensated.
The following introduces the screen print process to apply thermal compounds.

Screen print template

Contrary to conventional methods of paste application this procedure applies the thermal compound only to areas where it is required.
To begin with, a surface scan of the base plate was used to determine the quantity of thermal compound required.
Figure 1 shows the base plate surface structure of a mounted EconoDUAL™ module (FF450R12ME3).

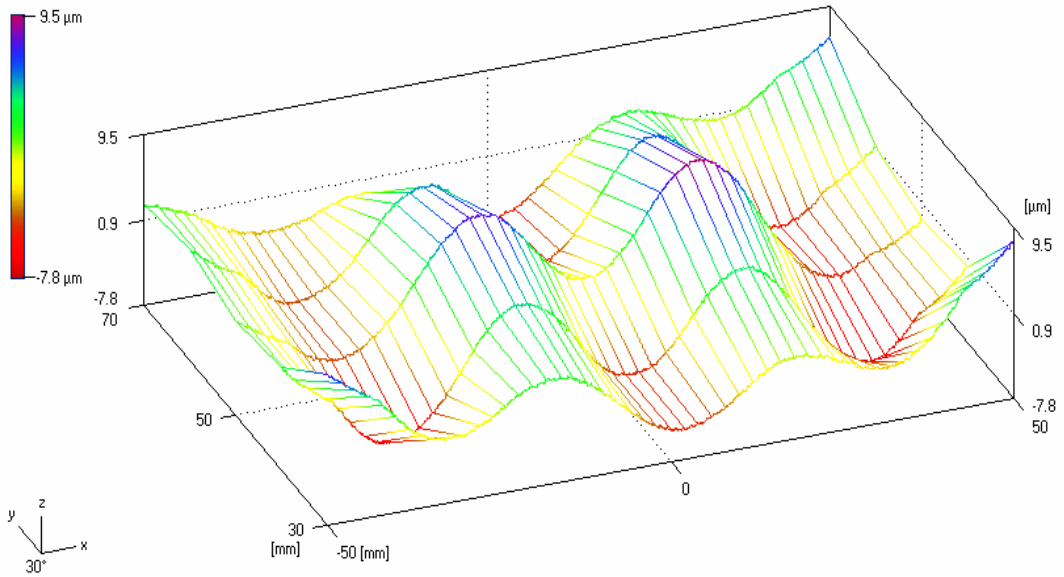

Fig.1: Surface of a mounted EconoDUAL™ baseplate.

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Typically the unevenness of this base plate is 25 µm.
Blue or violet lines symbolise metallic contact to the heat sink. Red lines indicate areas which do not show thermal contact to the heat sink. These cavities need to be filled with thermal compound.
To determine the required paste the surface scan is divided into a grid. For each raster point the sufficient amount of paste is to be determined. The result of this procedure shows the screen print template in figure 2.

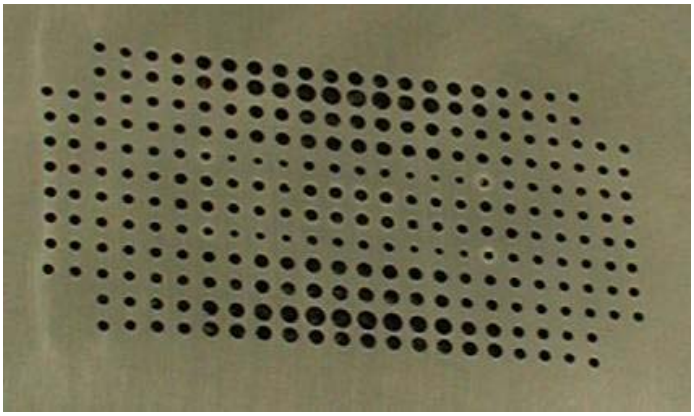

Fig. 2: Screen print template for an EconoDUAL™ base plate

The corresponding drawing for a module type is available in CAD format and may be ordered from your sales partner.

Application of the thermal compound

The process of screen printing to apply the thermal compound to an EconoPACK™ module is shown in the followed example.

Step 1: Cleaning of the heatsink and the template from dirt and residues. Suitable for this is for example isopropyl or ethylene alcohol.

Fig. 3: Cleaning of the screen print template

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Step 2: Aligning of the template and the module. For example, with a jig in which the module is placed.

Fig. 4: Alignment of the module

Step 3: For the application it is recommended to squeeze the paste on the template into the holes with a putty knife.

Fig. 5: Blade squeezing

Step 4: Print image of the thermal compound on the module base plate.

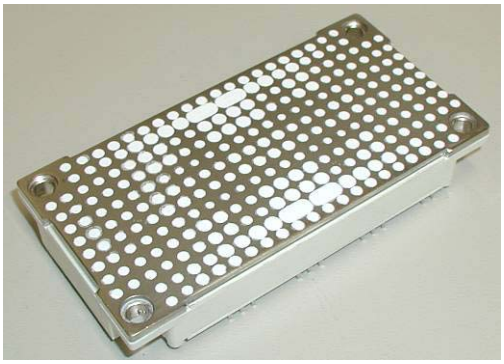

Fig. 6: Print image after blade squeezing

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Step 5: Excess thermal compound is squeezed out after the module is mounted.

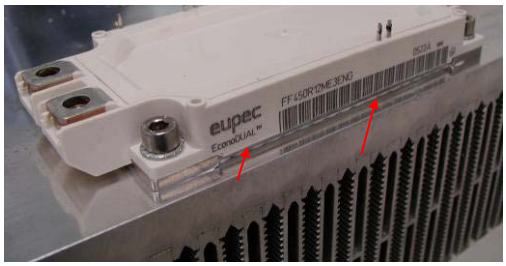

Fig. 7: Mounted module

Advantages of the screen printing process

Contrary to conventional methods of paste application this process assures that:

- the thermal compound is only applied to areas where it is required
- the application is repeatable
- a better thermal coupling is achieved
- thermal compound is saved on

Figure 8 and 9 each show a print image. In the left figure the paste has been applied to the module by screen printing. The printing image of a module to which the paste has been applied with a roller can be seen in figure 9.

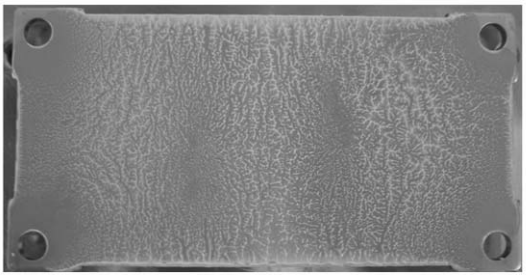

Fig. 8: Applied with a template

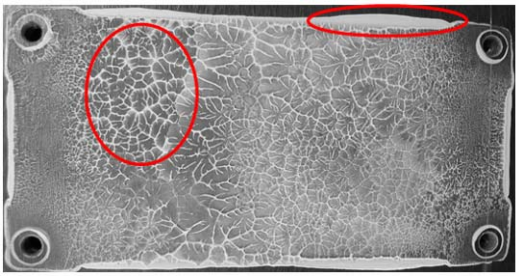

Fig. 9: Applied with a roller

Areas with a red circle show excess thermal compound and rough structure.
This makes it obvious that application of the thermal compound by screen printing assures optimal distribution and structure of the compound.

For penetration levels lower 370 according to DIN ISO 2137 it is recommended to check the print image of a module or heat sink in cold and warm condition.

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