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In this paper, a new type of large size module with copper base plate and flexible pinout is introduced, including its external size, high power density and excellent reliability. The package is used in Photovoltaic PV inverters and Power Conversion System (PCS) It can reduce the weight and cost of the whole machine compared to the previous module. The package uses a mix of the latest IGBT chip and SiC devices to improve efficiency by more than 0.2%.

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With the increasing power of Photovoltaic PV inverters and Power Conversion System (PCS), the size of power devices in this field is also increasing. At the same time, the switching speed of the chip is getting faster and faster, so this flexible pinout hybrid modules are needed to reduce the drive loop area. This will avoid the shock of the fast chip.

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2.1 N ai ec qc

The package has mounting holes and PCB self-tapping s are four each, and the top column stance from the module cover. tates the addition of components to the PCB at the top of the module, avoiding insulation problems caused by the pins on the back of the PCB entering the module. The diagram is shown in **Fig.1**.

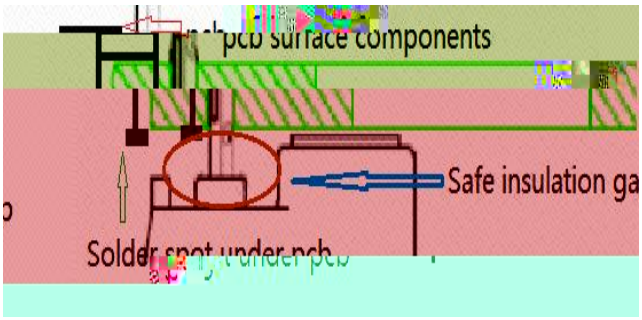
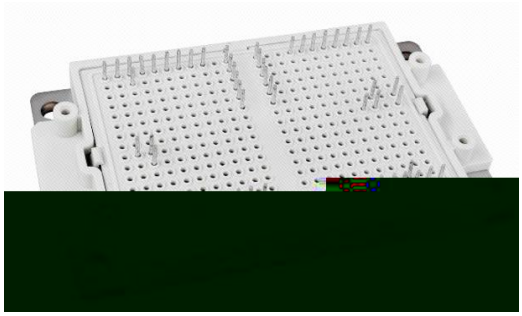


Fig.1 Avoid insulation problems schematic

The cover plate of the package has holes for fixed clearance distances, which facilitate pin according to customized requirements. The advantage of this pinout method is to reduce the Ls of the module and reduce the area of the drive loop. At the same time, this method of pinout can reduce concussion. A physical diagram of the package is shown in **Fig. 2**.



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The package is 112mm in length, 62mm in width and 12mm in height. The screw hole aperture of the base plate is 6mm and the hole aperture of the self-tapping screw hole is 2.3mm. See **Fig. 3** for details.

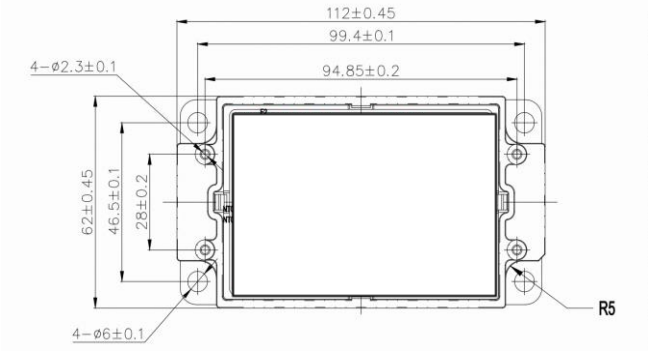

Fig. 3 (a) Top view

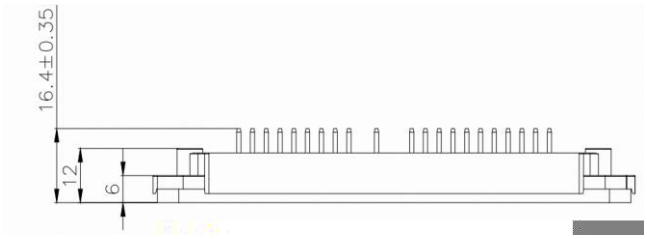

Fig. 3 (b) Side view

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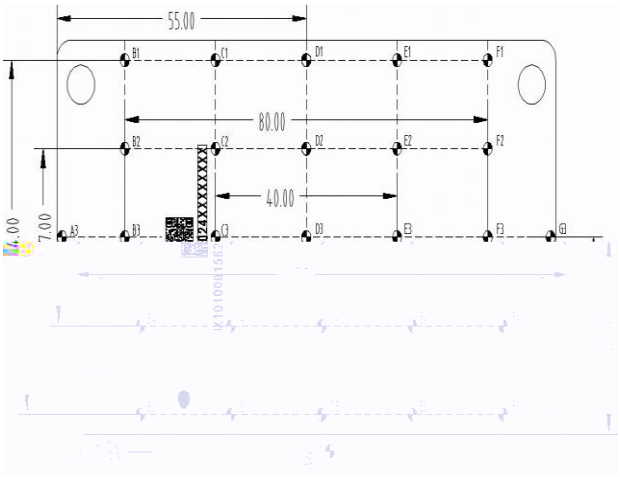

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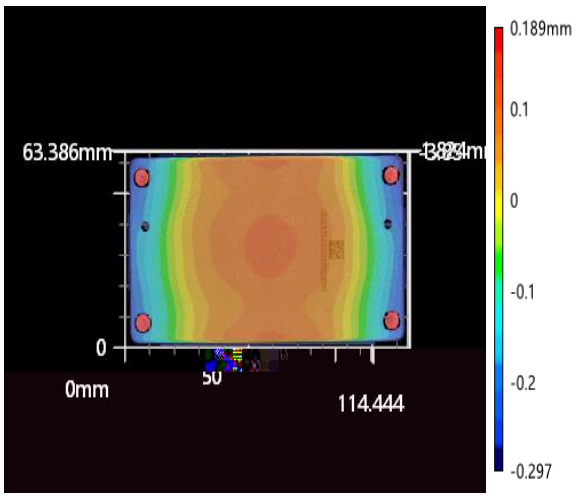

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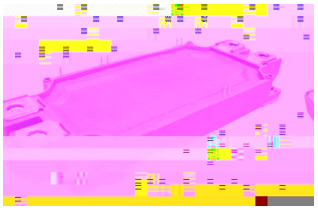

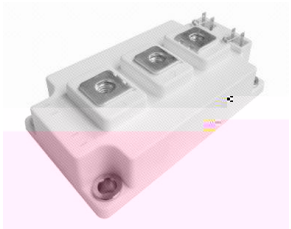

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a. High power density and low cost. requires three pieces of the ANPC topology. The package can be replaced singly. Three modules to spell ANPC are shown in **Fig. 6**.

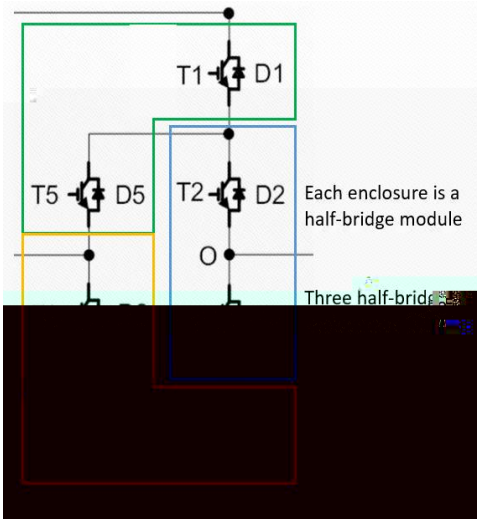

Fig. 6))

b. The module is . The package is easy to configure Kelvin pins and has fewer shocks. The package facilitates the addition of absorption between C and E at three levels. The reason why the package can is shown in the **Fig.7.**

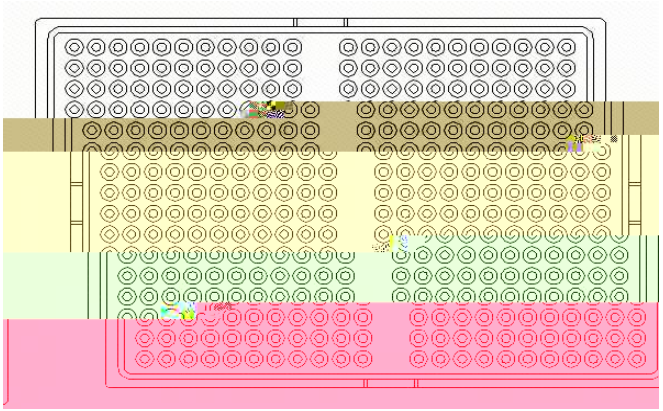

Fig.7 Package cover plate example

c. Module gate s leads are short. The package can be configured with fast chip, reduce the power loss and improve the efficiency of the whole machine. But are prone to shock with fast chips due to long

gate control leads. The influence of gate loop on drive oscillation is shown in **Fig.8**.

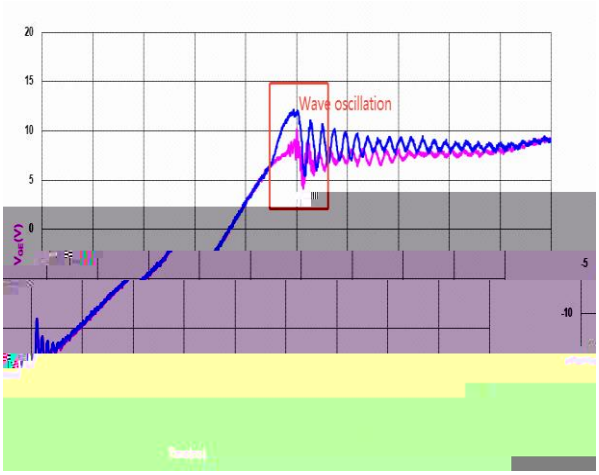

Fig.8 The gate waveform is different due to the length of drive circuit

d. Suitable for mixing SiC. The package can be configured with fast chips and can take advantage of SiC MOS and SiC SBD.

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The package can be adapted to fast chips, which can reduce module loss in applications. At the same time, the package is large in size and has a copper base plate, which has good heat dissipation capacity. Therefore, the package has a high-power density.

1100V PV inverter power increased to 150KW. A 150KW PV inverter single-phase can be achieved using one of these packages. Product specification 560A 1200V, circuit topology is NPC-T.

The simulation data are shown in **Fig. 9**

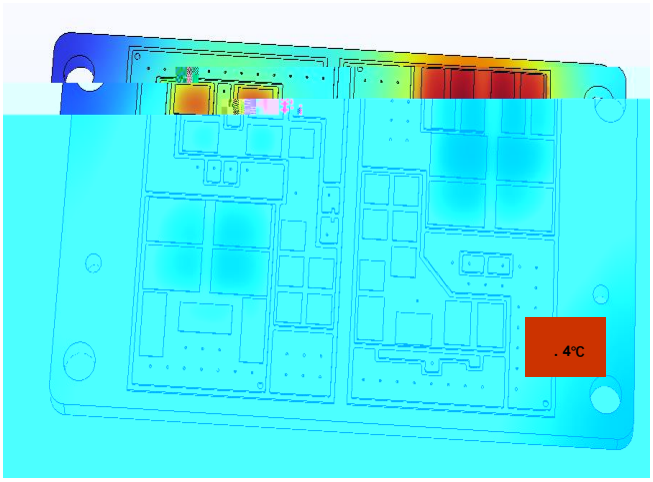

Fig. 9 Thermal simulation of 150KW module

From the simulation results, it can be seen that the heat dissipation of the package with copper base plate is uniform, and the maximum junction temperature is lower than 110℃, which meets the application.

High power density and excellent heat dissipation are the advantages of this large package。

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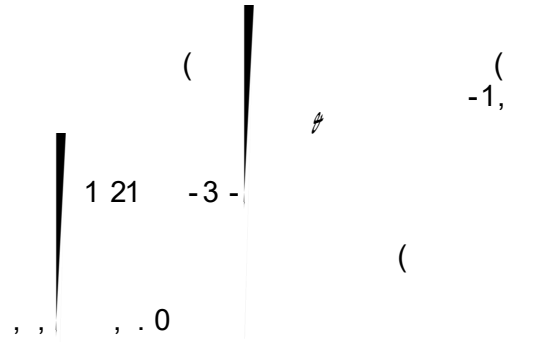

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[1] E. U. Krafft, B. Laska, A. Nagel and J. Weigel, "A new standard IGBT housing for high-power converters," 2015 17th European Conference on Power Electronics and Applications (EPE'15 ECCE-Europe), Geneva, Switzerland, 2015.

[2] A. Bouzida, R. Abdelli and M. Ouadah, "Calculation of IGBT power losses and junction temperature in inverter drive," *2016 8th International Conference on Modelling, Identification and Control (ICMIC)*, Algiers, Algeria, 2016.

[3] J. Liu *et al*., "The analysis of IGBT module based on thermal simulation technology," *2022 23rd International Conference on Electronic Packaging Technology (ICEPT)*, Dalian, China, 2022.

[4] J. Wu, "The Development and Application of Semiconductor Materials," *2020 7th International Forum on Electrical Engineering and Automation (IFEEA)*, Hefei, China, 2020.