Small IPM (Intelligent Power Module)

P633A Series

6MBP**XS*060-50

Application Manual

June 2022

Fuji Electric Co., Ltd.

⚠ Cautions

This Instruction contains the product specifications, characteristics, data, materials, and structures as of June 2022. The contents are subject to change without notice for specification changes or other reason. When using a product listed in this Instruction be sure to obtain the latest specifications.

The application examples in this note show the typical examples of using Fuji products and this note shall neither assure to enforce the industrial property including some other rights nor grant the license.

Although Fuji Electric Co., Ltd. continually strives to enhance product quality and reliability, a small percentage of semiconductor products may become faulty. When using Fuji Electric semiconductor products in your equipment, be sure to take adequate safety measures such as redundant, flame-retardant and fail-safe design in order to prevent a semiconductor product failure from leading to a physical injury, property damage or other problems.

The products described in this application manual are manufactured with the intention of being used in the following industrial electronic and electrical devices that require normal reliability.

- ・Compressor motor inverter
- ・Fan motor inverter for room air conditioner
- ・Compressor motor inverter for heat pump applications, etc.

If you need to use a semiconductor product in this application note for equipment requiring higher reliability than normal, such as listed below, be sure to contact Fuji Electric Co., Ltd. to obtain prior approval. When using these products, take adequate safety measures such as a backup system to prevent the equipment from malfunctioning when a Fuji Electric's product incorporated in the equipment becomes faulty.

- ・Transportation equipment (mounted on vehicles and ships)
- ・Trunk communications equipment
- ・Traffic-signal control equipment
- ・Gas leakage detectors with an auto-shutoff function
- ・Disaster prevention / security equipment
- ・Safety devices, etc.

Do not use a product in this application note for equipment requiring extremely high reliability such as:

- ・Space equipment ・Airborne equipment ・Atomic control equipment
- ・Submarine repeater equipment ・Medical equipment

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1. Soldering to PCB

- The product's temperature during soldering might exceed the maximum storage temperature. To prevent damage to the product and to ensure reliability, please use the following soldering temperature.

Table 6.1 Soldering temperature and duration

Methods	Soldering Temp. & Time
Dip soldering	$260\pm5^{o}C$, $10\pm1sec$

- A stopper is provided on the terminal to prevent the immersion depth of the terminal from coming too close to the product body. Use this stopper to secure the required distance from the printed circuit board and prevent the product body from being immersed in the solder bath during flow soldering.
- It is not recommended to reuse the product after it is removed from the printed circuit board because there is a possibility that the removed product was subjected to thermal or mechanical damage during the removal process.

2. Mounting to Heat Sink

- When mounting the product to a heat sink, please refer to the following recommended fastening order. Uneven fastening due to excessive torque might lead to destruction or degradation of the chip.
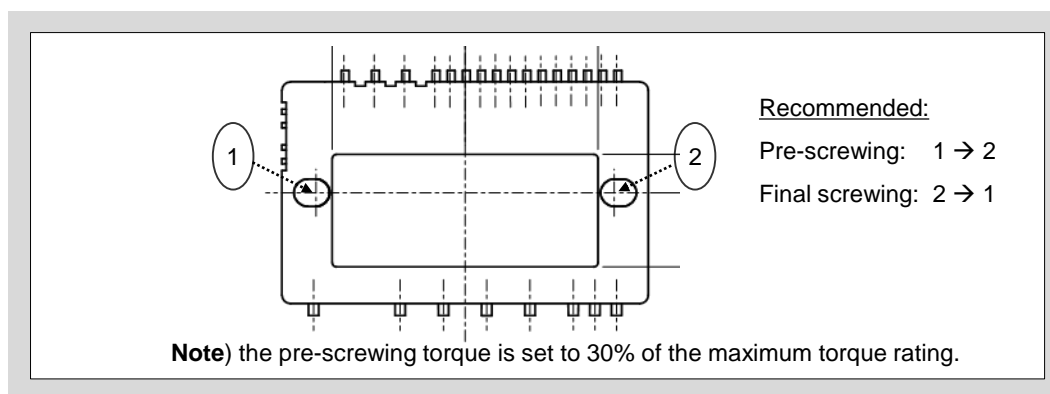

Recommended:
Pre-screwing: 1 → 2
Final screwing: 2 → 1

Note) the pre-screwing torque is set to 30% of the maximum torque rating.

Fig.6-1 Recommended screw fastening procedure

- Fig.6-2 shows the measurement position of heat sink flatness.
- The heat sink flatness should be 0μm/100mm to +100μm/100mm, and the surface roughness (Rz) should be less than 10μm.
- If the heat sink surface is concave, a gap occurs between the heat sink and the product, leading to deterioration of cooling efficiency.
- If the flatness is +100μm/100 mm or more, the aluminum base of the product is deformed and cracks could occur in the internal isolating substrates.
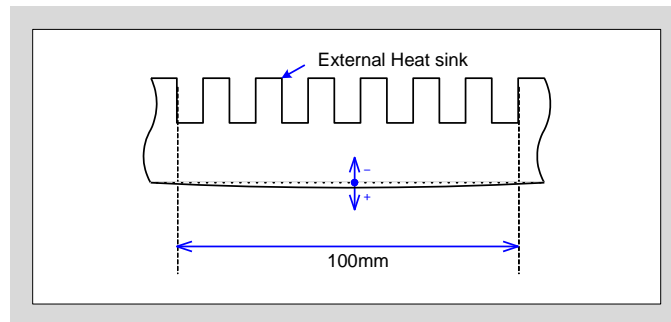
Fig.6-2 The measurement point of heat sink flatness

In order to achieve good heat dissipation, thermal grease with high thermal conductivity should be applied evenly to the contact surface between the product and the heat sink. The stencil mask method (Fig. 6-3) is recommended to control the appropriate thermal grease thickness. Please refer to mounting instruction for the recommended characteristics, amount, stencil mask pattern, etc. of thermal grease.
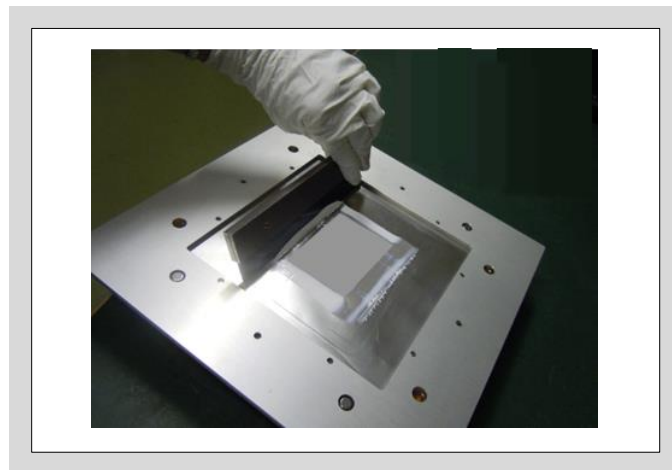

Fig. 6-3 Thermal grease application

- Please make sure that the junction temperature T_{vj} should not exceed the maximum junction temperature rating for safe operation. Heat sink should be designed to ensures that T_{vj} is always below the maximum junction temperature rating even during abnormal conditions such as overload operation as well as during rated load.
- Operating the IGBT above the maximum junction temperature rating can cause damage to the chips. The over heating (OH) protection function works when the IGBT junction temperature exceeds the maximum junction temperature rating. However, if the temperature rises too quickly, the OH protection might not work.
- Please note that the junction temperature of FWD should not exceed the maximum junction temperature rating too.
- When selecting a heat sink, please verify the chip temperature by measuring at the position shown in Fig.2-2.

For more detail about thermal design, please refer to Chapter 6 Section 2 of this note and "IGBT MODULE APPLICATION MANUAL (REH984e)"

Contents:
- Power dissipation loss calculation
- Selecting heat sinks
- Heat sink mounting precautions
- Troubleshooting