

Small IPM (Intelligent Power Module)

P642 Series

6MBP\*\*XT\*065-50

## Application Manual

## Cautions

This Instruction contains the product specifications, characteristics, data, materials, and structures as of April 2024. 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 relaying equipment      • Medical equipment

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If you have any question about any portion of this application note, ask Fuji Electric Co., Ltd. or its sales agencies. Neither Fuji Electric Co., Ltd. nor its agencies shall be liable for any injury or damage caused by any use of the products not in accordance with instructions set forth herein.

## Chapter 6 Mounting Guidelines and Thermal Design

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## 1. Soldering to PCB

- The product temperature during soldering might exceed the absolute maximum rating of the product. To prevent damage to the product and to ensure reliability, please do not use exceed the following soldering temperature.

Table 6-1 Soldering temperature and immersion time

Method	Soldering temperature and time
Dip soldering	260±5°C, 10±1sec

- 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 tightening sequence. Uneven tightening due to excessive torque might lead to destruction or degradation of the chip.

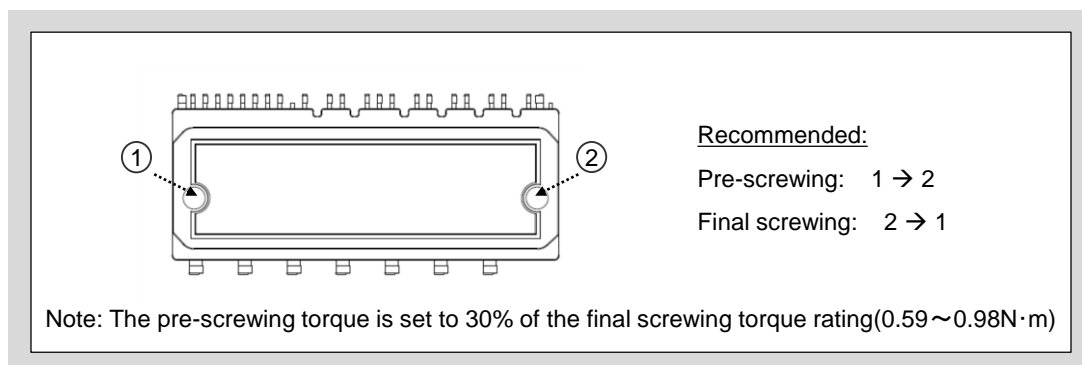


Fig. 6-1 Recommended screw tightening sequence

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

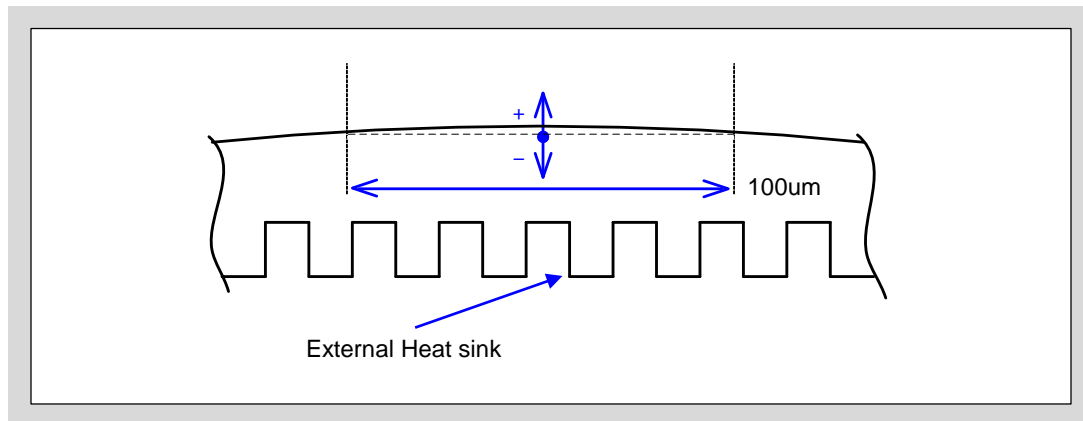


Fig. 6-2 The measurement position of heat sink flatness

It is recommended to apply thermal grease using a stencil mask to obtain the heat dissipation effect. The stencil mask is described in the mounting instructions (MT6M16534).

### 3. Heat Sink Selection

- Please design the cooling body (heat sink) so that the IGBT virtual junction temperature does not exceed the maximum virtual junction temperature  $T_{vj}$  for safe operation even during abnormal conditions such as overload.
- Operation of the IGBT at a temperature higher than the  $T_{vj}$  might cause damage to the chip. In 6MBP\*\*XTC065-50 products, all low side IGBTs will shutdown when the LVIC temperature exceeds  $T_{OH}$ . However if the temperature rises rapidly, the IGBTs might not be protected.
- Similarly, please make sure that the FWD chip temperature does not exceed the  $T_{vj}$  too.
- When selecting a cooling body (heat sink), please verify the chip temperature by measuring at the position shown in Figure 2-3.

Please refer to Chapter 6, Section 2 and the following document for more details about thermal design:  
“FUJI IGBT MODULES APPLICATION MANUAL (REH984)”

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