Fuji Electric
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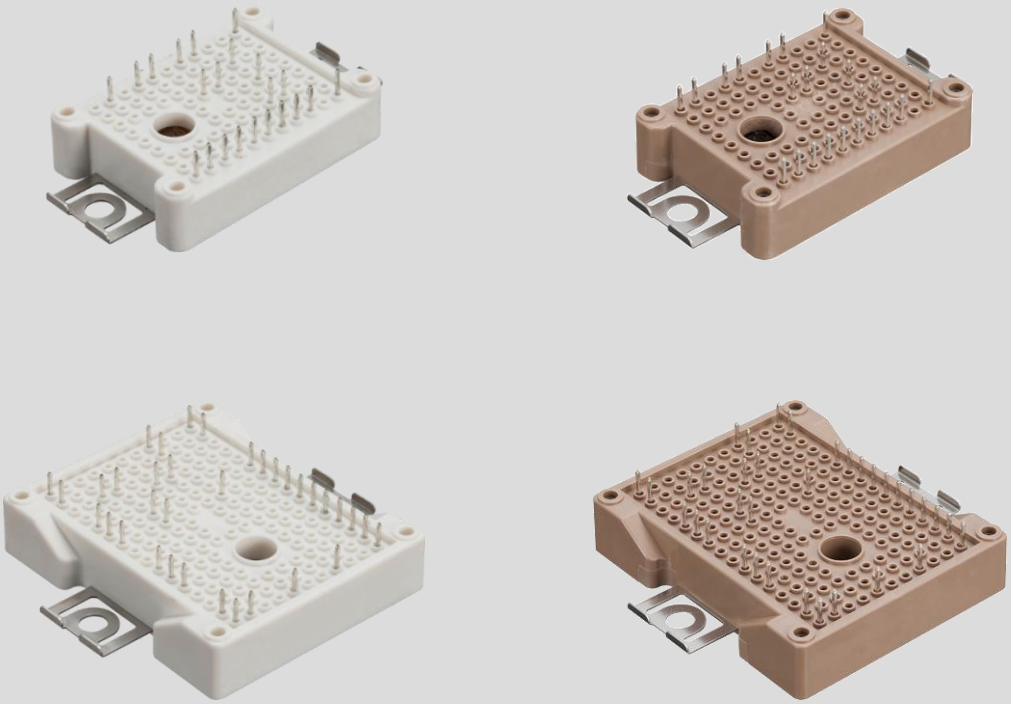

Fuji Industrial IGBT Module
Small Package Solder Pin Type
(M728, M729, M732, M733)

Mounting Instruction

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Fuji Electric Co., Ltd.

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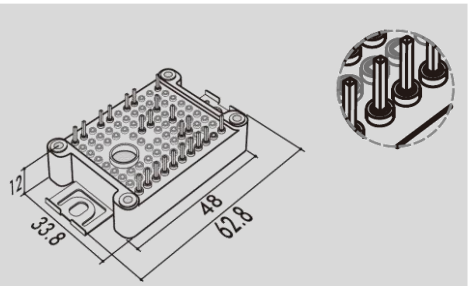
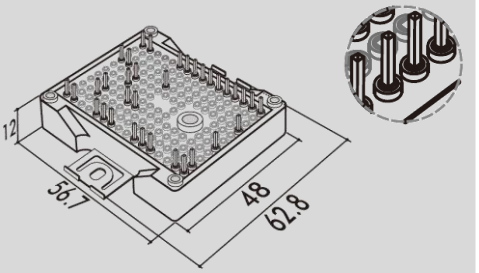
1. Scope of application

This document describes how to safely mount and use solder pin type of Small Package products for the following part numbers shown in Table 1.

Solder pin type : Products that solders the module terminals to printed circuit board

Table 1 Scope of application of this mounting instruction

Applicable model			Package outlines
Package name	Series	Part number(Examples)	
M728	V-series	7MBRxxVKC060-5x 7MBRxxVKC120-5x	
M732	X-series	7MBRxxXKC065-5x 7MBRxxXKC120-5x	
M729	V-series	7MBRxxVKD060-5x 7MBRxxVKD120-5x	
M733	X-series	7MBRxxXKD065-5x 7MBRxxXKD120-5x 7MBRxxXRKD120-5x	

The C and D of the part numbers VKC (XKC) and VKD (XKD, XRKD) indicate the solder pin type.

When handling the product, in addition to the contents described in this document, please check the Warning and Caution in the product specification too.

2. Mounting the module to printed circuit board

2-1. Requirements for printed circuit board

Fig.1 shows an example of a printed circuit board (PCB). This is a PCB for verification purpose, not an actual PCB for application.

Please use a PCB with thickness of less than 2mm.

As shown in Fig.1(1), the PCB requires 2 holes for mounting the module to the heat sink. If the module is mounted to the heat sink before the soldering process, these two holes are not required.

As shown in Fig.1(2), the PCB requires 4 holes for M2.5 screws to mount the PCB to the module. The diameter of these 4 holes should have sufficient margin for mounting.

Also, as shown in Fig.1(3), the module terminal insertion through-hole on the PCB should be wider than 1.2 mm in diameter to facilitate terminal insertion.

Requirements for the PCB material:

Double-sided PCB in accordance with IEC 60249-2-4 or IEC 60249-2-5.

Multilayer PCB in accordance with IEC 60249-2-11 or IEC 60249-2-12.

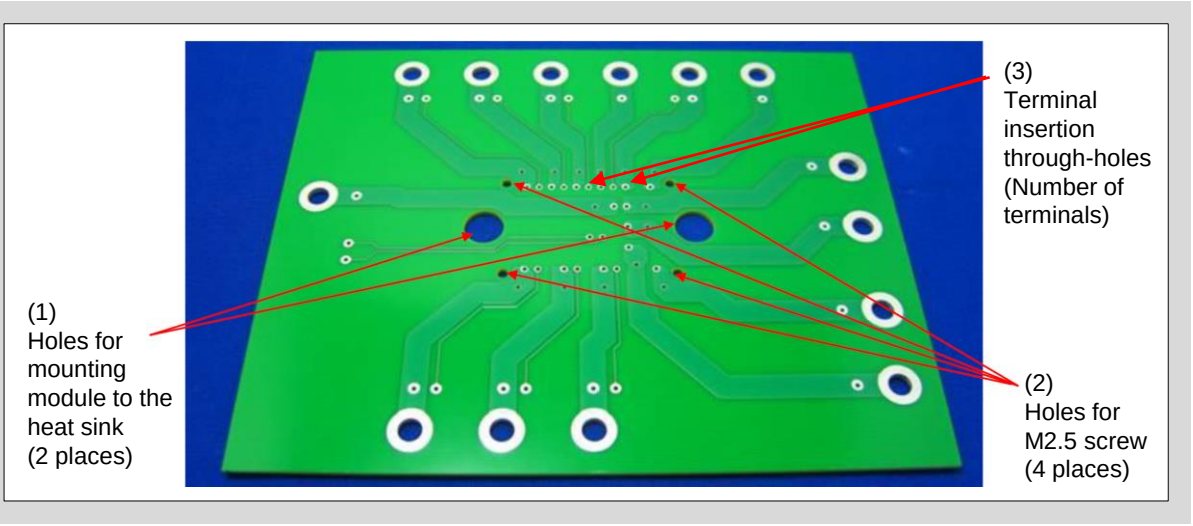
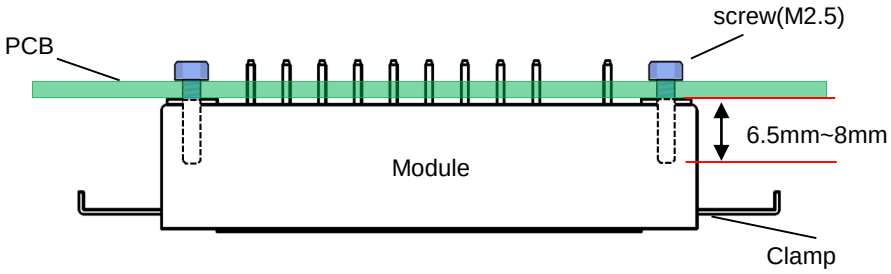


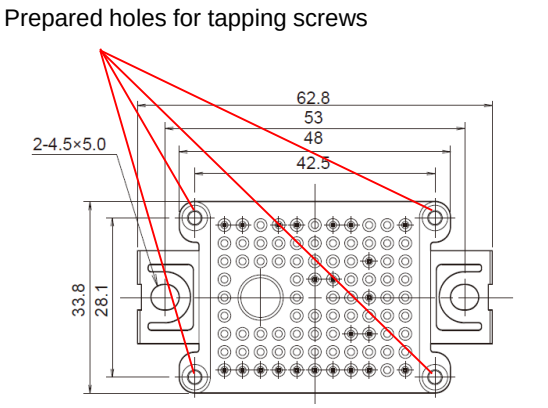
Fig.1 An example of a printed circuit board

2-2. Fixing a printed circuit board to the module

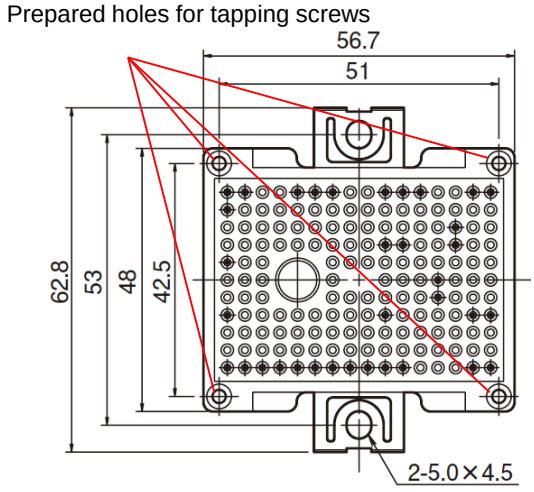
To ensure the solder joints reliability, it is possible to fix a PCB to the module by screws after the soldering process. Fig.2(a) shows an example of the fixing process.
Use M2.5 self-tapping screws (JIS type 2 tapping screws).
The effective length of the screw, excluding the thickness of the PCB, should be 6.5-8.0 mm.
The screwdriver speed must be less than 300rpm. The recommended screw driver torque is 0.4Nm±10%.



(a) Fixing a printed circuit board to the module with screws



(b) Prepared holes for tapping screws (M728,M732)



(c) Prepared holes for tapping screws (M729,M733)

Fig.2 Fixing a printed circuit board to the module

3. Mounting to heat sink

3-1. Surface conditions of heat sink

Design the heat sink so that the following surface conditions are satisfied. If the roughness and flatness do not satisfy the conditions, it may cause an increase in contact thermal resistance, or insulation failure due to package cracking.

1. The surface roughness(R_z) of the heat sink should be 10μm or less.
2. The surface flatness of the heat sink should be 50μm or less in absolute value per 100mm, taking the straight line connecting the center points of the two screw mounting holes as reference. Here, "+" (plus) is defined when the heat sink has a convex shape, and "-" (minus) is defined when the heat sink has a concave shape. If both shapes exist, the sum of the absolute values of the maximum and minimum values should be 50μm or less.

* The flatness must satisfy the above value within the entire module mounting area including the two screw clamps.

Fig.3 shows the definition of surface roughness and flatness of the heat sink.

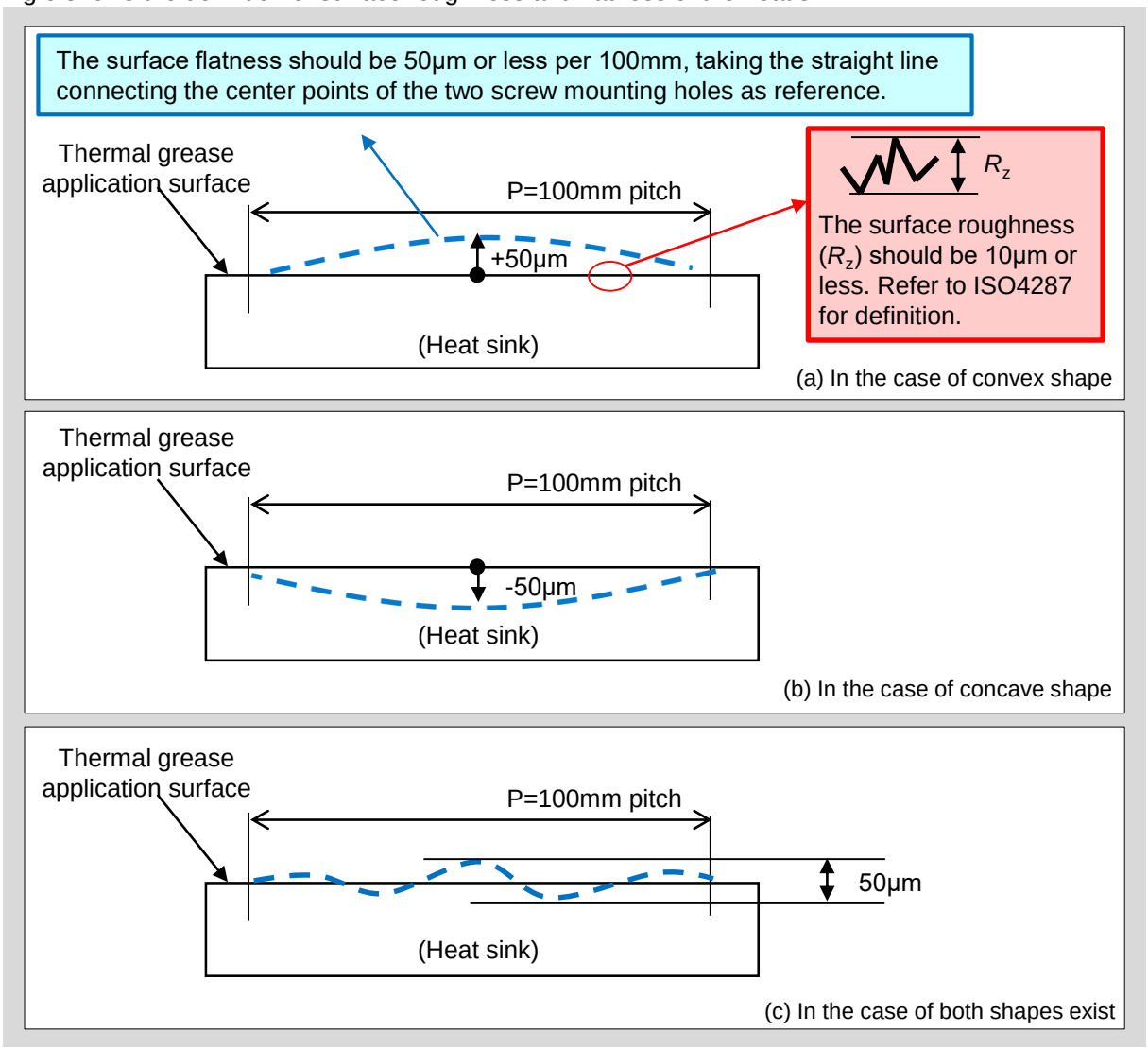


Fig.3 Heat sink surface flatness and roughness

3-2. Application of thermal grease

Thermal grease must be applied between the product mounting surface and the heat sink to ensure heat dissipation from the product to the heat sink.

If the properties, amount, and application method of the thermal grease are not appropriate, it may result in poor heat dissipation and lead to thermal failure. Make sure that the thermal grease is spread over the entire base plate of the product. Also, please check the heat dissipation status of the module by yourself. You can check the spread of thermal grease by removing the module after mounting.

Table 2 shows the recommended thermal grease properties and thickness. Assuming that the thickness is uniform, the required amount (weight) of thermal grease can be calculated from the following formula.

Thermal grease weight (g) = Thermal grease thickness (μm) x Mounting surface area of module (cm^2) x Density of thermal grease (g/cm^3)

We recommend using the stencil method to control the appropriate thermal grease thickness (Fig.4). The recommended stencil mask drawing is shown in page 13.

In addition, depending on the type or application method of thermal grease, deterioration or dry out of thermal grease may occur during high temperature operation or temperature cycle, which may shorten the product lifetime. Pay attention to the selection and application method of the thermal grease.

Table 2 Recommended properties of thermal grease

	Unit	Recommended value
Penetration (typ.)	-	>= 340
Thermal conductivity	W/m･K	>= 1
Thermal grease thickness	μm	>= 80

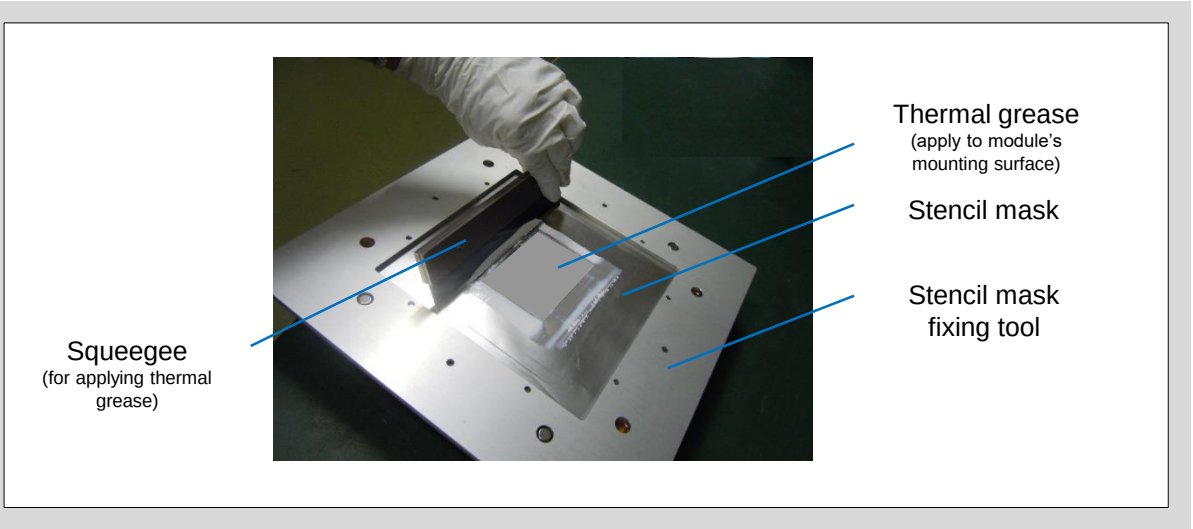
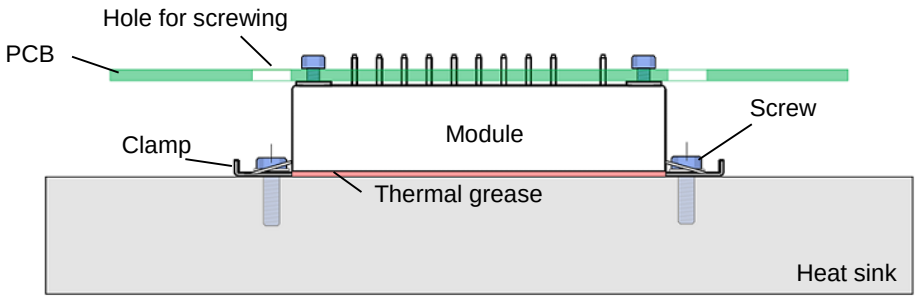


Fig.4 Thermal grease application

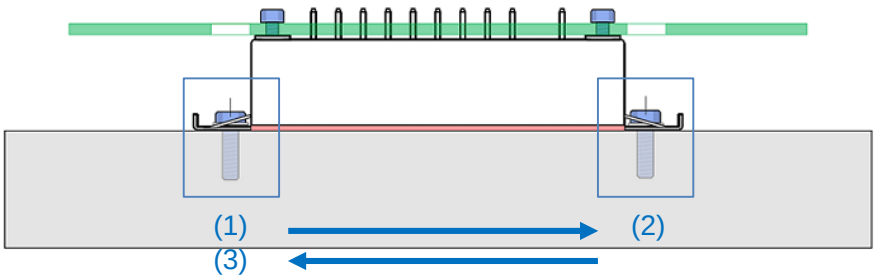
3-3. Mounting the module to heat sink

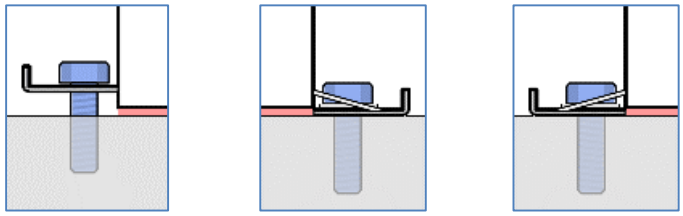
Fig.5(a) shows an example of mounting process by screwing.

If the mounting process is applied after the soldering process, the PCB must have two holes for screwing. Use M4 screws. For the washer, JIS B1256 O.D. φ9mm is recommended. Select a screw material that will not be damaged by the maximum tightening torque specified in the specifications. During the mounting process, to prevent the module from tilting, the procedure shown in Fig.5(b) is recommended.



(a) Screwing the module to heat sink





(1) Temporary tightening (2) Final tightening (3) Final tightening

	Tightening torque	Tightening sequence
Temporary tightening	Temporarily tighten the screws until the clamp does not tilt.	(1)
Final tightening	1.3 – 1.7Nm	(2) → (3)

(b) Screw tightening torque and screw tightening sequence

Fig.5 Mounting the module to heat sink

After the module has been set on the thermal grease, it is possible to remove the module from the heat sink before the module is screwed to the heat sink.

After the screwing, it is not recommended to remove the module from the heat sink because deformation of the module structure may cause the module to fail.

In the case of removing the module from the heat sink, please use the methods shown in Fig.6. Be careful in the removal process to avoid module destruction or failure. It is recommended to check the isolation of the module after the removal process.

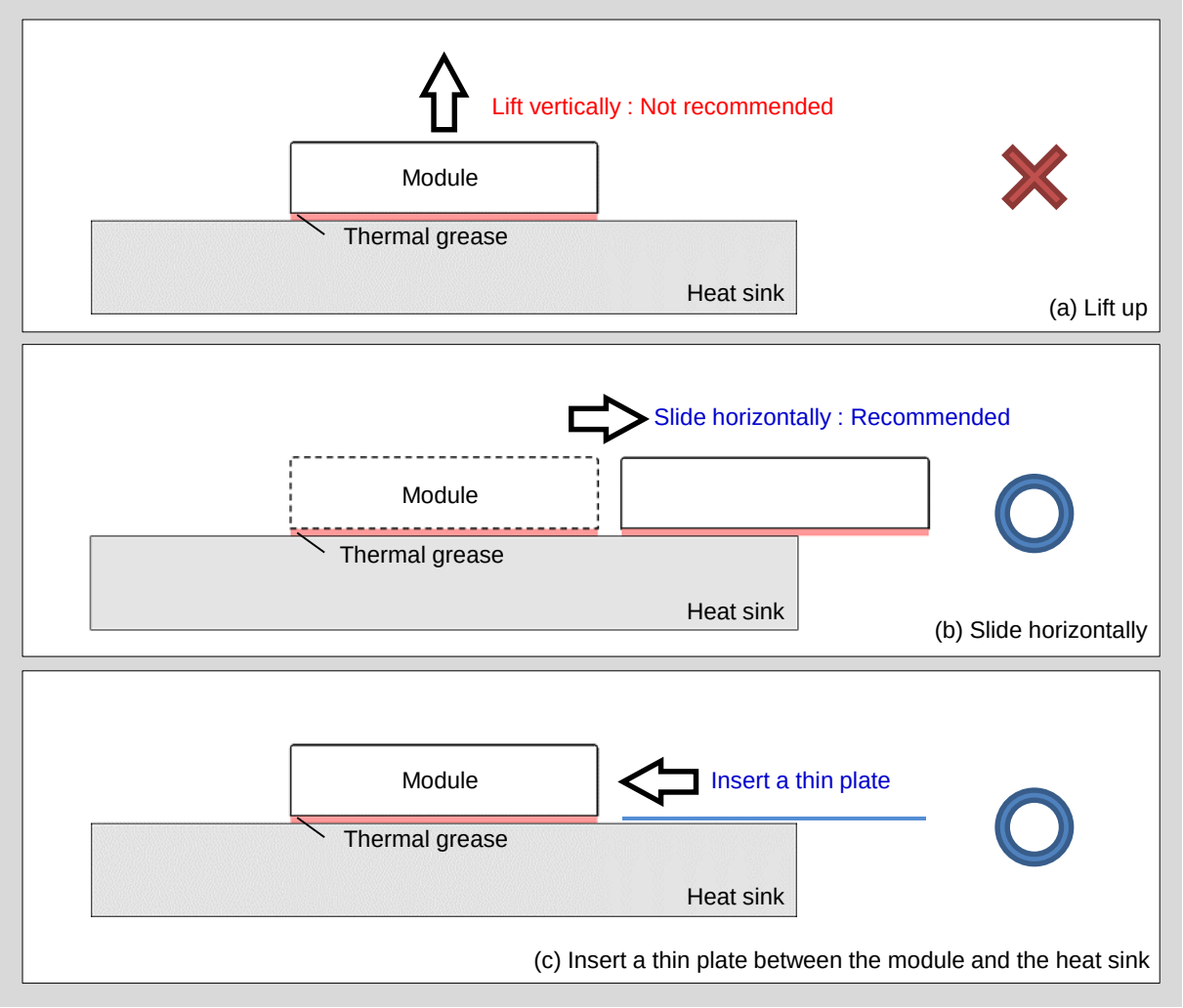


Fig.6 An example of removal process after screwing

3-4. Fixing the printed circuit board to heat sink

To ensure solder joints reliability against vibration, fix the PCB to the heat sink with spacers and screws. Fig.7 shows an example of the fixing process.

The spacer placement is restricted to avoid excess stress to the solder joints. In the case of the fixing process is after soldering, the distance between the module outer edge and the spacer center line must be more than 5cm.

In the case of the fixing process is before soldering, distance less than 5cm is allowed.

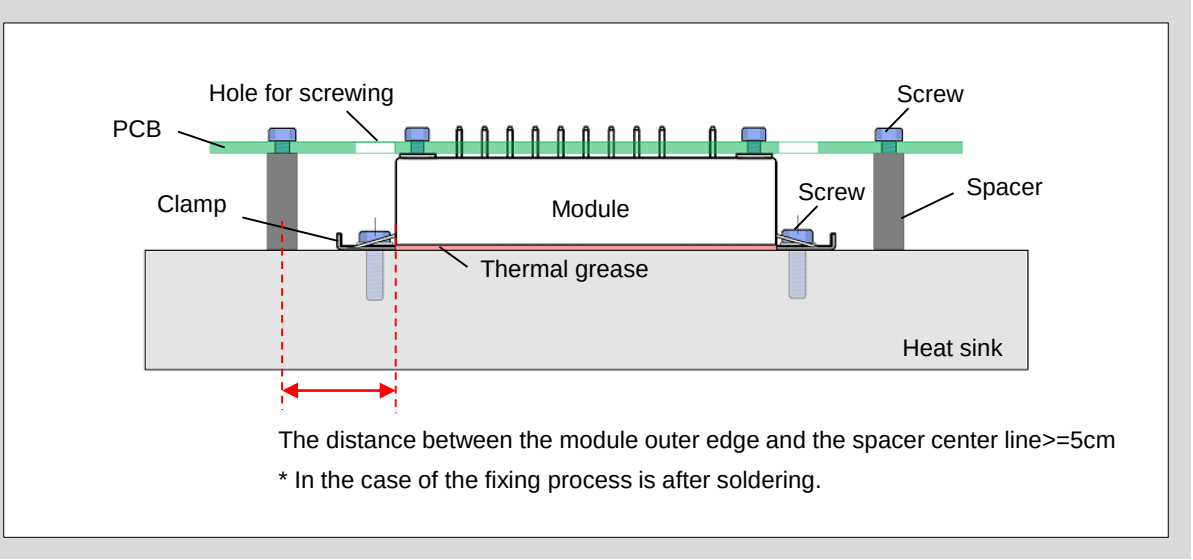
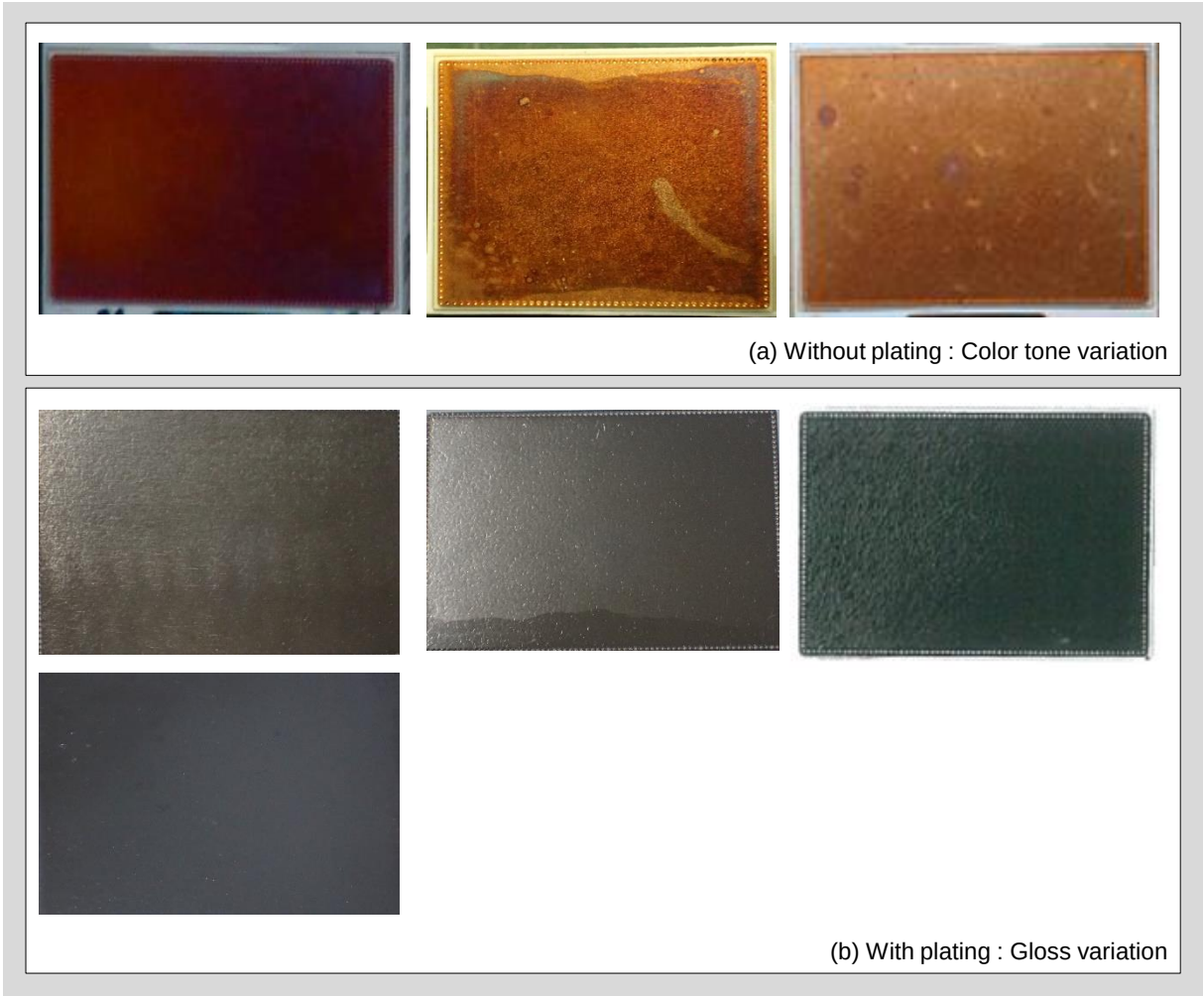


Fig.7 Fixing the printed circuit board to heat sink

4. Color tone of mounting surface

Discoloration and/or color tone variation on the mounting surface may occur, but does not affect the thermal characteristics.

Fig.8 shows examples of discoloration and color tone variation.



(a) Without plating : Color tone variation

(b) With plating : Gloss variation

Fig.8 Examples of discoloration and color tone variation on the mounting surfaces which do not affect the thermal characteristics

5. Warning

(1) If the printed circuit board is not suitable, the terminals temperature may exceed the storage temperature. Use the terminals within the range of storage temperature.

(2) In the case of soldering the product at an excessive temperature, the package may be deteriorated. Please handle with care during the soldering process.

(3) If longer screws than the allowable length described in this specification are used, the product may be damaged, causing ground faults and poor insulation. In that case, Fuji Electric Co., Ltd. is not responsible for the matter.

(4) In any environment containing acids, alkalis, organic substances, corrosive gases (hydrogen sulfide, sulfurous acid gas, etc.) and corrosive liquids (cutting fluid, etc.), this product may oxidize or corrode, resulting in poor contact, disconnection, short circuit, ground fault, etc. In such cases, avoid using this product as it may cause malfunctions. In the unlikely event that a short circuit or ground fault occurs, there is secondary risk of smoke, fire, or explosion, etc. If this product is used under conditions containing these corrosive substances, Fuji Electric Co., Ltd. is not responsible regardless of the conditions (temperature, humidity, concentration, etc.).

(5) This product is not designed for use in a dusty environment. When used in an environment where dust is generated, heat dissipation may deteriorate due to clogging of the heat sink, and short circuits or ground faults may occur due to leaks between terminals or creeping discharge. (even if the dust is insulating materials such as fiber, leakage may occur due to moisture absorption.)

This manual does not describe all applications and mounting conditions. Therefore, it is necessary to evaluate under actual usage conditions and confirm the mechanical characteristics, electrical characteristics, thermal characteristics, lifetime, etc.

The order in which CONTENTS is described in this manual does not indicate the order in which the products should be mounted. Please consider and decide the installation process.

The applications described in this manual are illustrative of typical applications using Fuji Electric's semiconductor products. This manual do not warrant or grant licenses for the enforcement of industrial property rights or other rights.

6. Storage and transportation notes

6.1 Storage

(1) Please manage the storage location so that the temperature is 5 to 35°C and the humidity is 45 to 75%. If more than a year has passed since the product was manufactured under these storage conditions, confirm that the terminal solderability is not deteriorated before mounting.
(2) Avoid exposure to corrosive gases and dust.
(3) Rapid temperature changes may cause condensation on the module surface. Therefore, store modules in a place with minimal temperature changes.
(4) During storage, it is important that nothing be placed on top of the modules, since this may cause excessive external force on the case.
(5) Store modules with unprocessed terminals. Corrosion may form causing processed connections to have high contact resistance or potential solder defects in later processing.
(6) Use only antistatic containers for storing IGBT modules in order to prevent ESD damage.

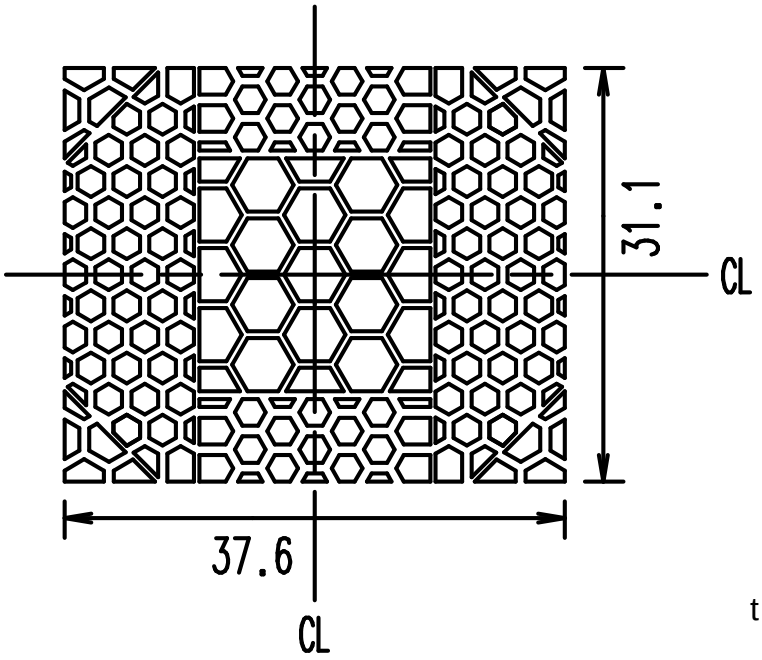
6.2 Transportation

(1) Do not drop or cause impact to the modules which could otherwise cause mechanical stress.
(2) When transporting several modules in the same box or container, provide sufficient ESD padding between the modules to protect the terminals and to keep the modules from shifting.

7. Stencil mask drawing

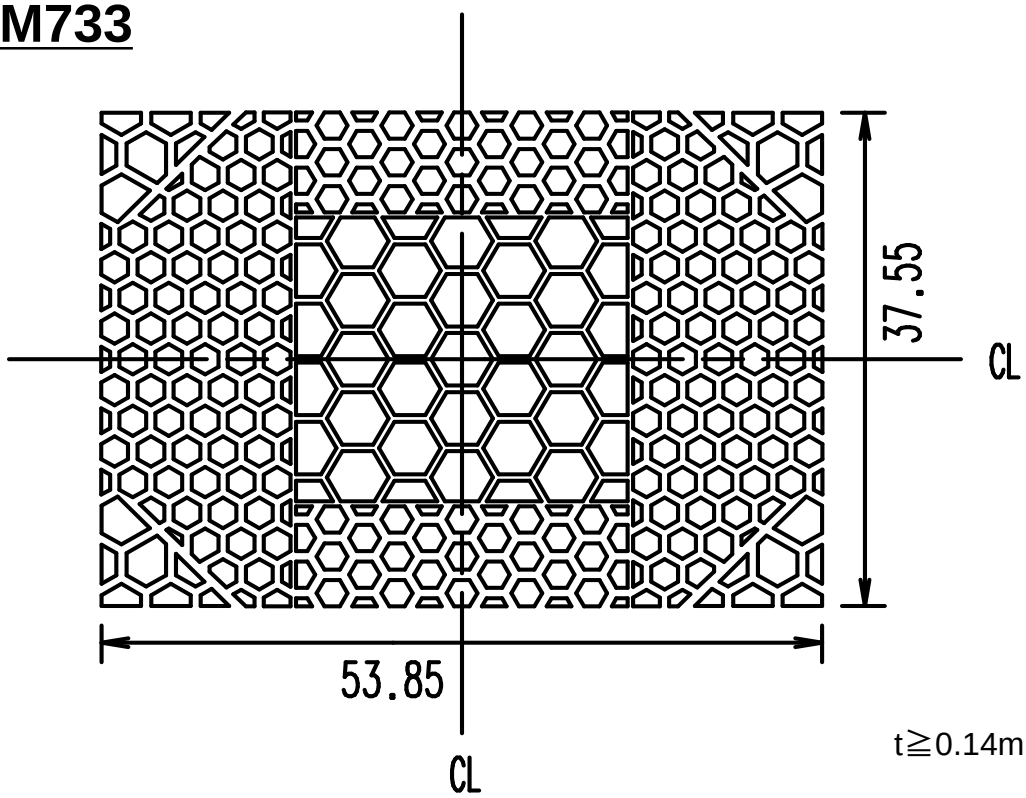
Stencil mask drawing for thermal grease application (recommended)
If you would like to obtain the following data, please contact our sales department.

M728,M732



t≧0.14mm

M729,M733



t≧0.14mm

Warning:

The contents in this manual (product specifications, characteristics, data, materials, structure, etc.) are as of March 2022. The contents are subject to change without prior notice due to changes in product specifications or for other reasons. When using a product described in this manual, please obtain the product's latest specification and check the data.