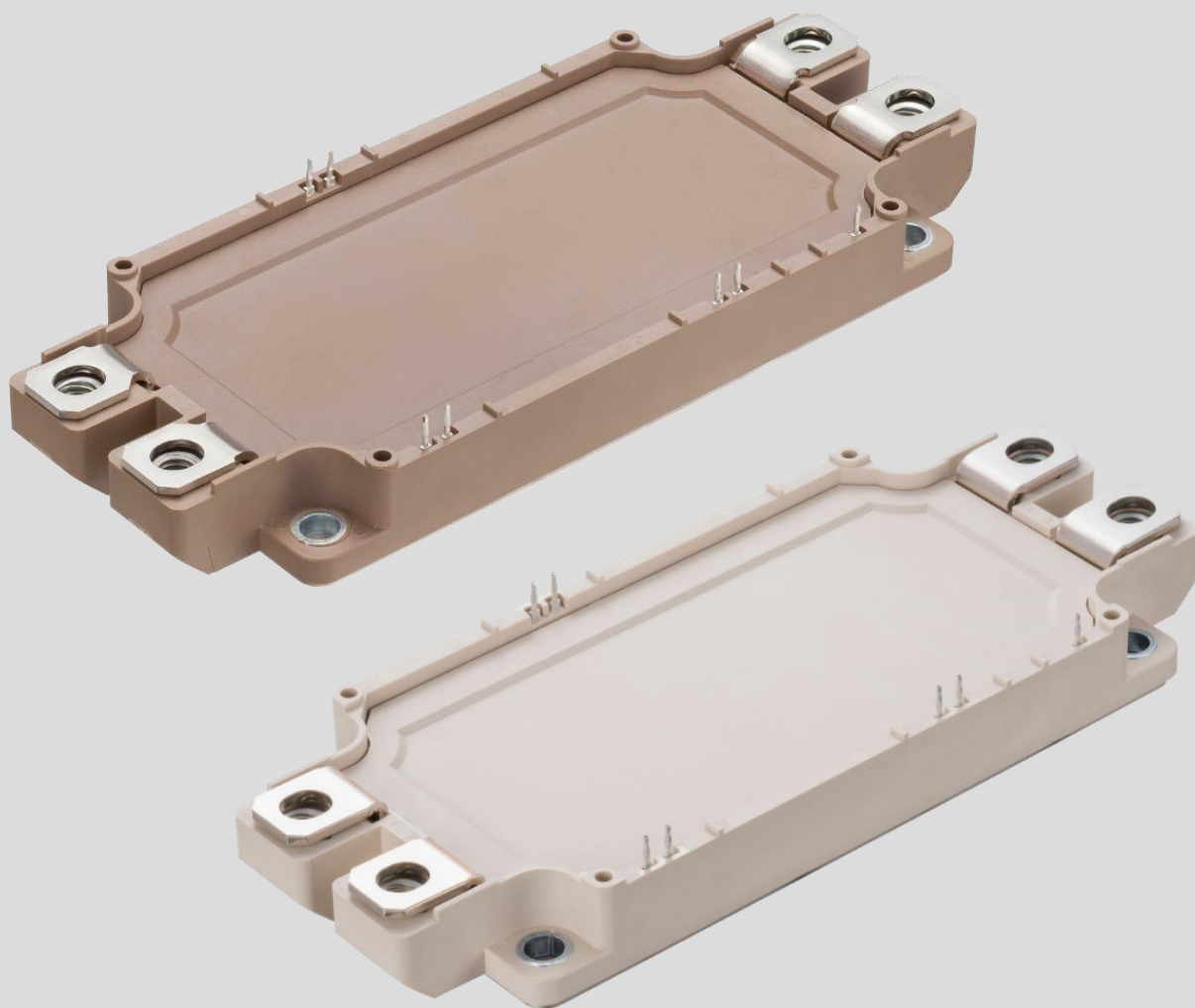




Industrial IGBT Module
Dual XT
Press Fit Type (M282, M286)

Mounting Instruction

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1. Scope of application

This document describes how to safely mount and use press fit type of Dual XT for the following part numbers.

Press fit type : Modules that can be mounted solder less to printed circuit board (PCB)

[V-series]

M282: 2MBIxxxVX-xxx-5x

[X-series]

M282: 2MBIxxxXNBxxx-5x, 2MBIxxxXNHxxx-5x,

M286: 2MBIxxxXNFxxx-5x, 2MBIxxxXRNFxxx-5x

(Example: 2MBI800XNF120-50)

Press fit terminals have the characteristic shape shown in Fig.1(a). When the press fit terminal is pressed into the PCB, the contact pressure is applied to both sides of the terminals, and they are deformed and inserted as shown in Fig.1(b). The deformation pressure makes it possible to mount the module on the PCB solderless.

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

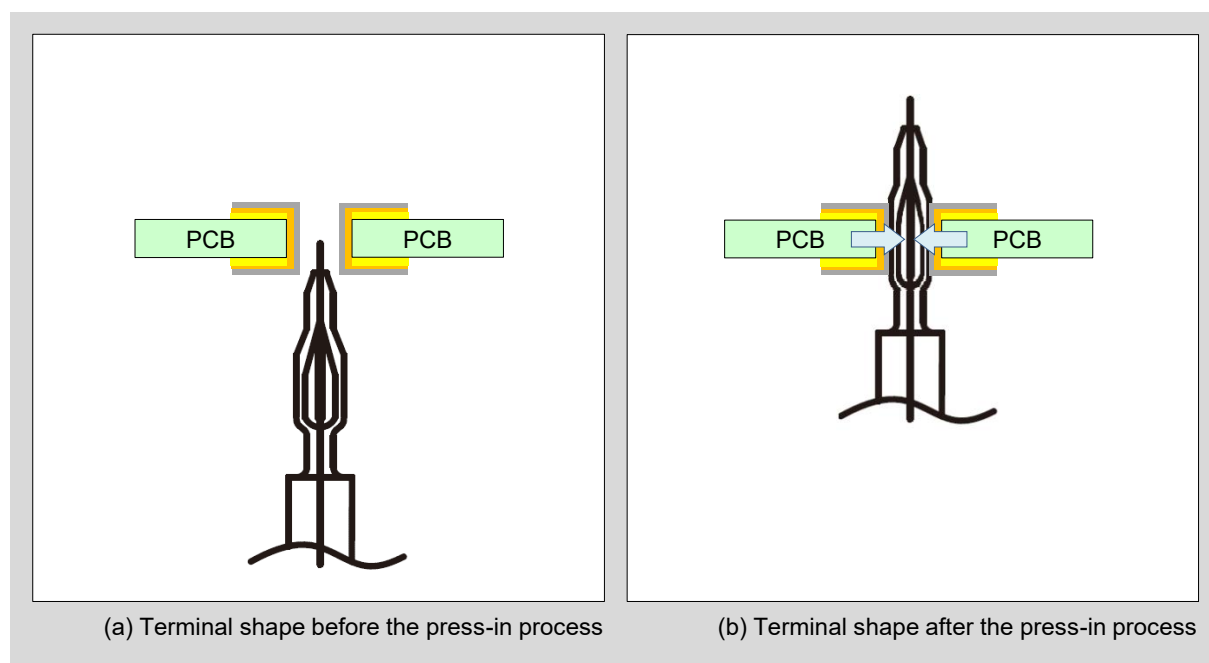


Fig.1 Terminal shape before and after the press-in process to the printed circuit board

2. Mounting the module to printed circuit board

2-1. Requirements for printed circuit board

Table 1 and Fig.2 show the recommended specifications of a PCB.

The requirement specifications in Table 1 is evaluated based on IEC60352-5. When using a PCB other than the requirement specifications, evaluation is required.

For example, the through hole diameter should be in the range of 0.95mm to 1.09mm with properly Sn/Cu plated sidewall. If the diameter is too small, problems such as damage to the terminals and PCBs may occur during the press-in process. On the other hand, if the diameter is too large, the contact may be incomplete, causing problems such as vibration and shock, resulting in reduced reliability.

Table 1 Requirements for a printed circuit board

	Min.	Typ.	Max.
Drill hole diameter	1.12mm	1.15mm	
Cu thickness in hole	25μm		50μm
Metallization in hole			15μm
Through hole diameter	0.95mm		1.09mm
Cu thickness of conductors	35μm	70μm 105μm	400μm
PCB material	FR4		

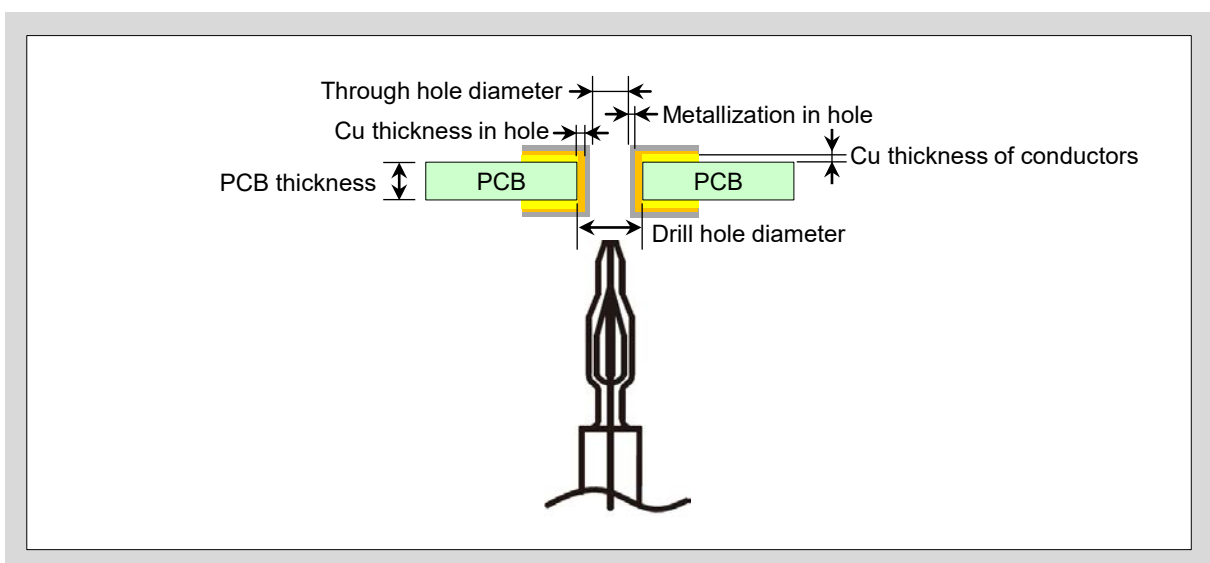


Fig.2 Description of each dimension

2-2. The press-in and push-out process of printed circuit board

This section describes the procedure of the press-in and push-out process of PCB.

Table 2,3 shows the recommended press speed and force (average per terminal) during the press-in and push-out process.

Please keep an appropriate gap so as not to affect surrounding components when press-in and push-out.

Table 2 Typical press-in speed and force

	Min.	Typ.	Max.
Press-in speed	25mm/min.		
Press-in force (Average per terminal)		140N	

Table 3 Typical push-out speed and force

	Min.	Typ.	Max.
Push-out speed	12mm/min.		
Push-out force (Average per terminal)	40N		

If the press-in force is too low, there will be issues with the contact between PCB and the module terminals. On the other hand, if the press-in force is too high, it can damage the PCB and other mounted components.

Therefore, it is recommended to use dedicated machine and tools for the press-in and push-out process. Fig.3 shows a photo of the example of press machine. It is also recommended to use the press-in and push-out tools described in the later section.

Before applying, please confirm the maximum force per module that is actually applied to avoid damage to the module and PCB.

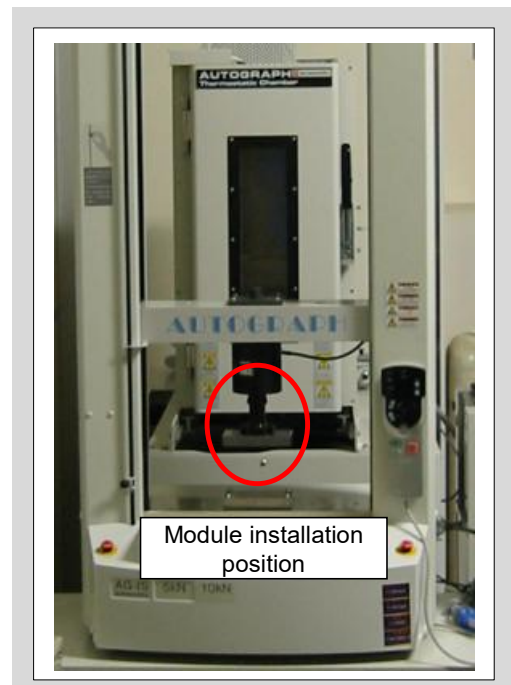


Fig.3 Example of press machine

2-2-1. Press-in / Push-out tool

Fig.4(a)(b) are: (a) example of physical dimension (drawings) of press-in tools, (b) push-out drawing examples

PCB-Guide in press-in lower tool works as mechanical stopper. Press-in lower and upper tool contact first and absorb the insertion force to protect PCB and its surface mounted devices from mechanical stress during press-in process. The height should be adjusted with the board thickness and press-in equipment.

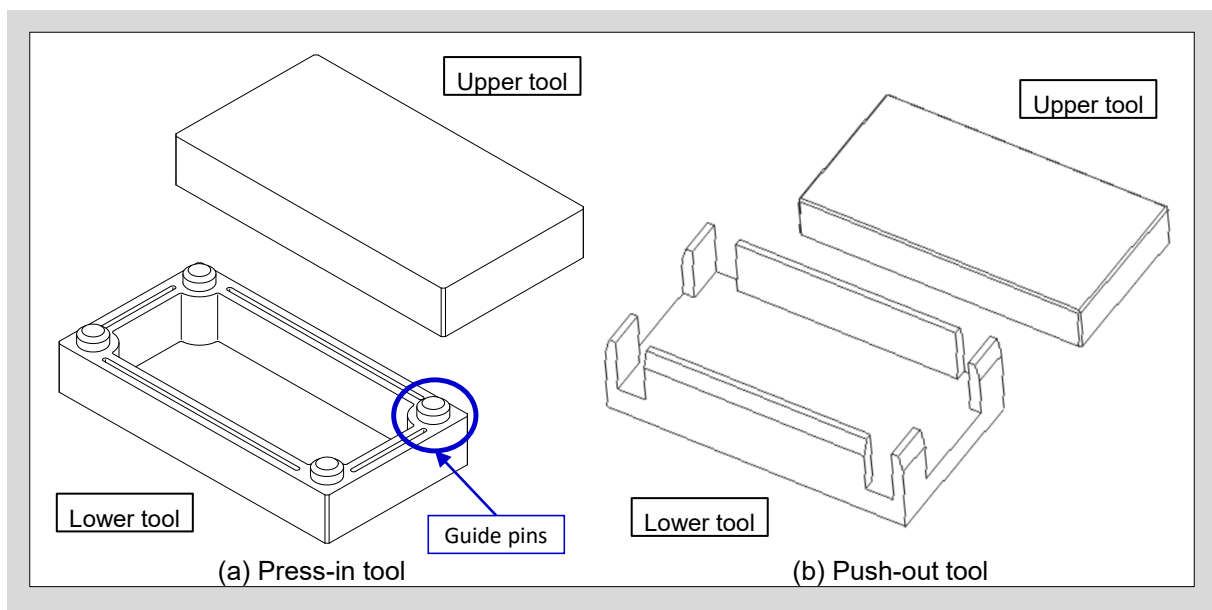


Fig.4 Recommended press-in, Push-out tool

2-2-2. Example of press-in process

Fig.6(a)-(c) show the example of press-in process.

- (a) Set the press-in upper tool and lower tool on the press machine.
- (b) Set the PCB on the lower tool and the module on the PCB.
- (c) Press the module.

Please refer to section 2-2.

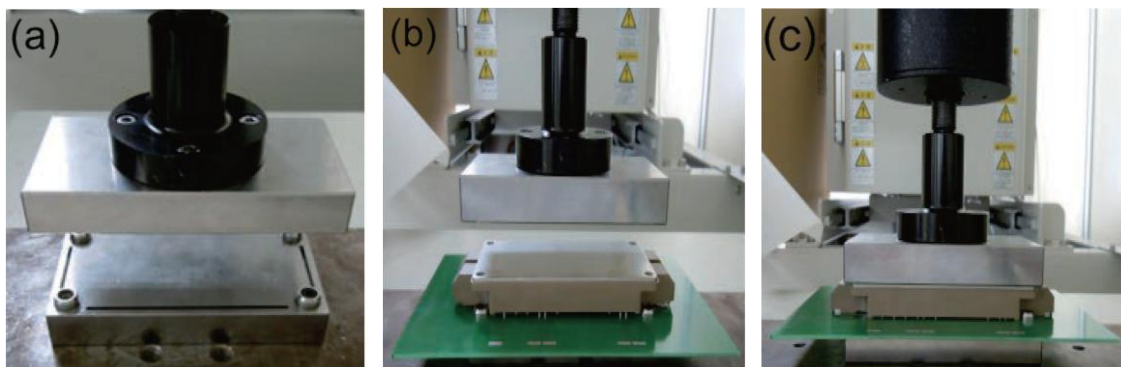


Fig.6 Example of press-in process

2-2-3. Example of push-out process

Fig.7(a)-(c) show the example of push-out process.

- (a) Set the push-out upper tool and lower tool on the press machine.
- (b) Set the PCB mounted module on the lower tool.
Press the terminals of the module with the upper tool.
- (c) The module is removed from the PCB and drops onto the lower tool.

Please refer to section 2-2.

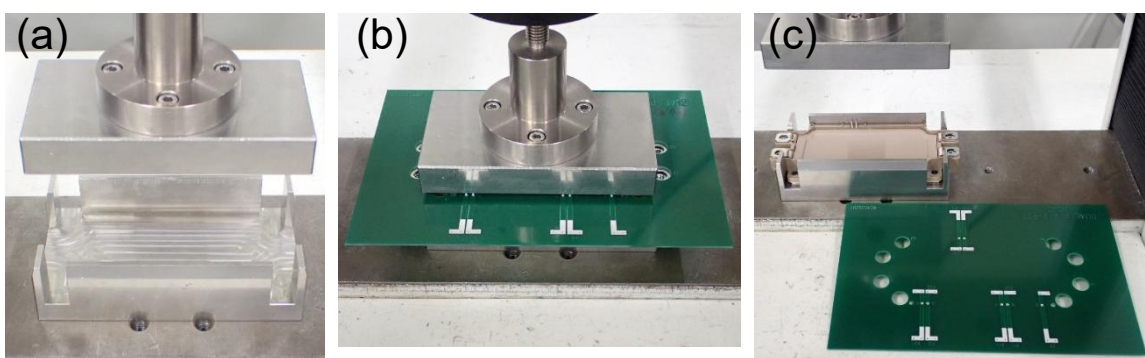


Fig.7 Example of push-out process

2-3. Soldering the module to the printed circuit board after push-out

It is possible to reuse a module after push-out. Remove the PCB carefully. However, since the press fit terminals after push-out is deformed compared with the unmounted state, please solder the contact part of the press fit terminals and PCB when remounting. The recommended conditions for soldering the module to the PCB are shown below.

Terminal temperature : $245 \pm 5^{\circ}\text{C}$

Time : $5 \pm 0.5\text{sec}$

The recommended soldering temperature is defined as “terminal temperature”. This is different from the preset temperature of the soldering equipment. Please set the temperature of the soldering equipment according to the heat capacity of your PCB. Also, make sure that the resin temperature below the module terminal during soldering does not exceed 260°C .

Table 4 Recommended screw specifications and tightening torque

Package	Screw	Tightening torque
M282	B0 tapping screw $\text{M}2.6 \times \text{L}10$	$0.53 \pm 5\% \text{ N}\cdot\text{m}$
M286		$0.43 \pm 5\% \text{ N}\cdot\text{m}$

<Important notes>

Manual screwing is recommended to avoid damage to the module. When using an electric screwdriver, optimize the parameters such as tool selection and tightening conditions. Check that the module is not damaged after tightening. Also, the rotation speed should not exceed 300 rpm when screwing.

Do not tighten the screws in an tilted state as shown in Fig.10(a). It may result in mechanical damage as shown in Fig.10(b).

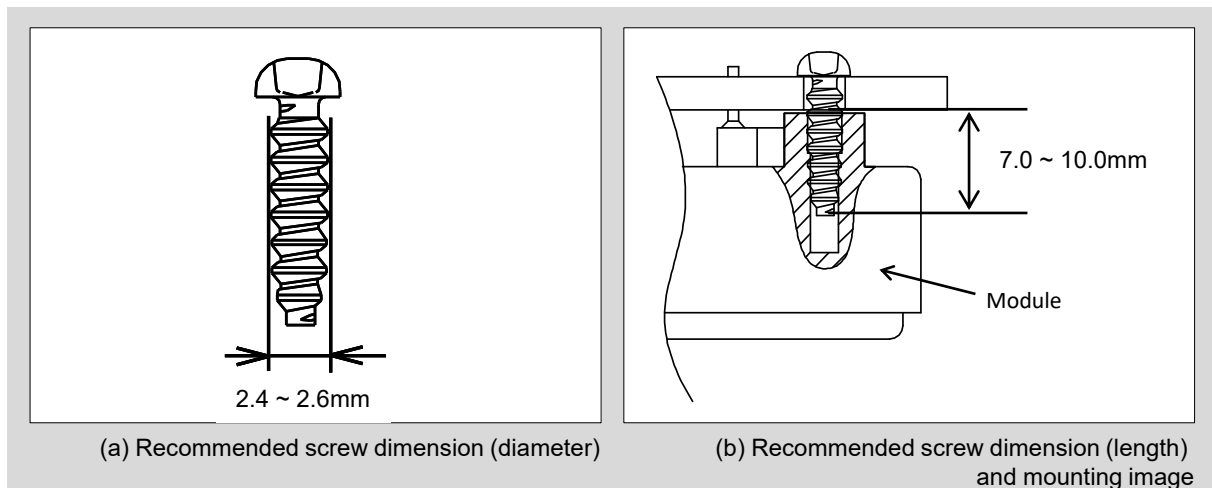


Fig.9 Recommended screw dimensions and mounting image

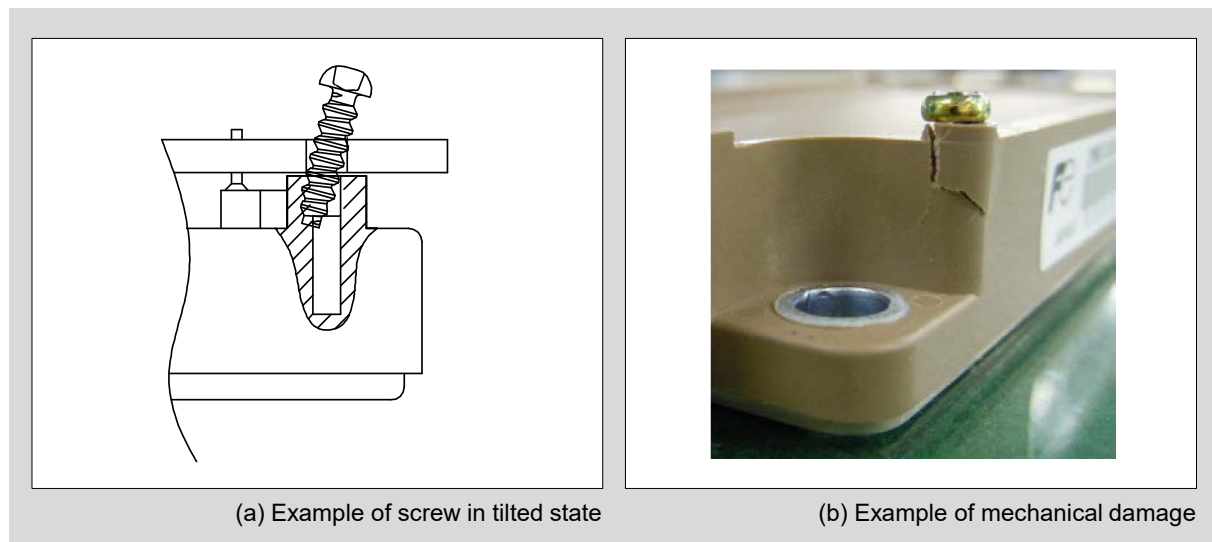


Fig.10 Incorrect example of screw tightening and possibly damage

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 $10\mu\text{m}$ or less.
2. The surface flatness of the heat sink should be $50\mu\text{m}$ 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 $50\mu\text{m}$ or less.

Fig.11 shows the definition of surface roughness and flatness of the heat sink.

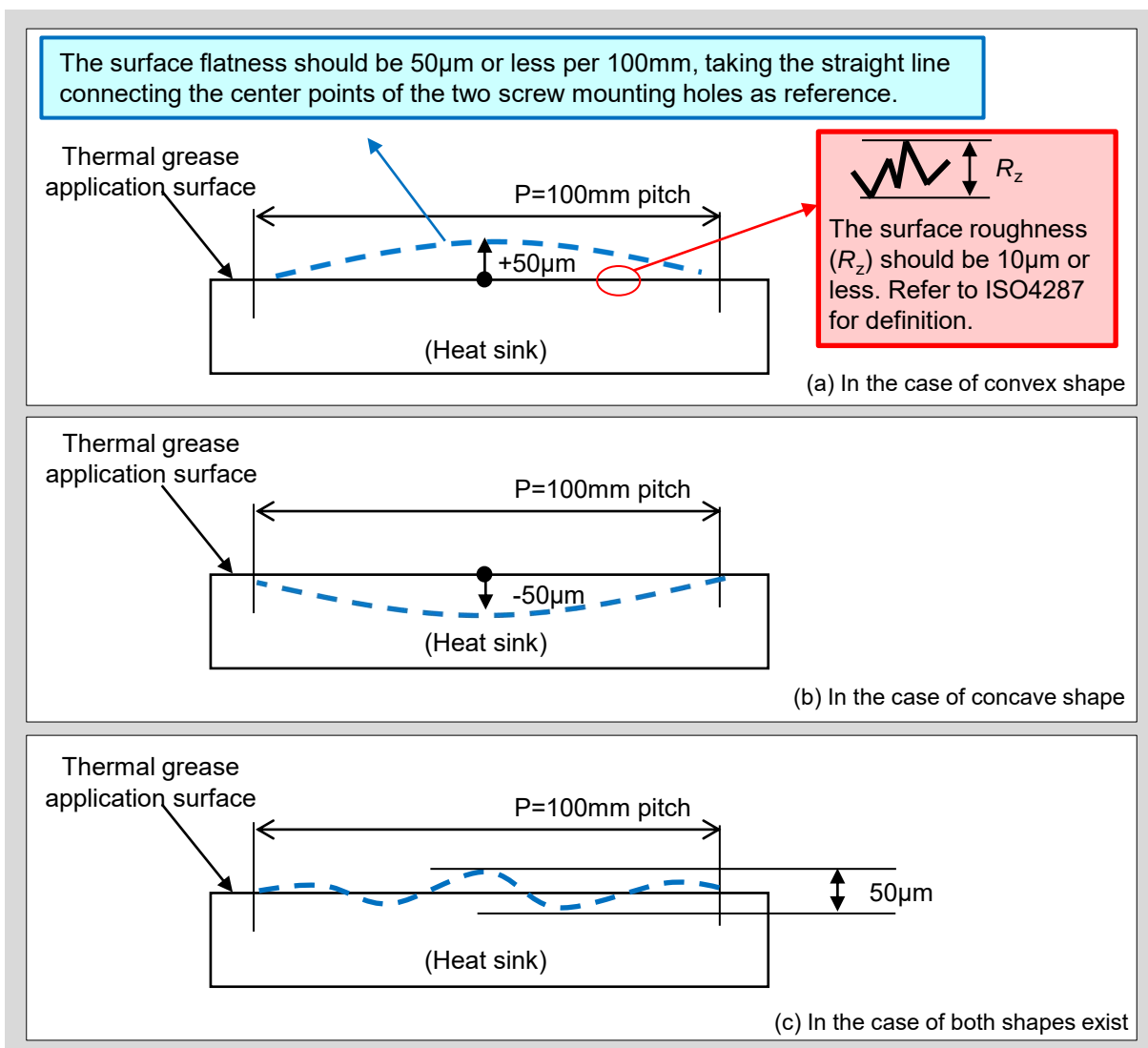


Fig.11 Heat sink surface flatness and roughness

3-2. Application of thermal grease

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

Improper thermal grease characteristics, application amount, and application method can lead to thermal breakdown due to deterioration of heat dissipation caused by thermal grease not spreading sufficiently throughout the module, or to a reduction in module life due to degradation or depletion of thermal grease during high temperature operation or temperature cycling. Pay attention to the selection and application method of the thermal grease.

Assuming that the thickness is uniform, the required amount (weight) of thermal grease can be calculated from the following formula.

$$\text{Thermal grease weight (g) } \times 10^4 = \text{Thermal grease thickness } (\mu\text{m}) \times \text{Base plate area of module (cm}^2\text{)} \times \text{Density of thermal grease (g/cm}^3\text{)}$$

The stencil method of application is recommended to control proper thickness (Fig.12). The recommended stencil mask pattern (Table 5) can be provided upon request.

The spreading of thermal grease can be checked by removing the module after mounting. Make sure that the thermal grease is well spread over the entire module mounting surface.

When applying thermal grease, should check not only the spread of the thermal grease over the entire surface of the module, but also the heat dissipation of the module.

Fuji Electric confirmed that the spreading which is not a problem in actual use using ELECTROLUBE's HTC thermal grease with our recommended stencil masks and heat sinks of the shape described in our specifications. Table 6 shows typical characteristics of HTC thermal grease.

Additionally, the use of phase change thermal interface material and thermal sheet may cause excessive stress on the module as described below.

- Phase change thermal interface material :

When the grease solidifies, its hardness increases significantly compared to normal thermal grease. If there is a step between the fastening points due to the grease, the module may be subjected to excessive stress at the step when fastening the module. To reduce module stress during fastening, consider measures such as increasing the fastening torque in stages, fastening while heating and softening the grease. After the grease softens and spreads, the tightening torque may decrease. Consider measures such as retightening within the specified torque range or using spring washers.

- Thermal sheet :

If there is a step between the fastening points due to the sheet, the module may be subjected to excessive stress at the step when fastening the module. Please consider placing the sheet over the entire backside of the module, including around the heat sink fastening screw holes.

The above explanation shows the basic concept of thermal interface material (TIM), but when using it, customer is responsible for making the decision to apply it with sufficient application verification.

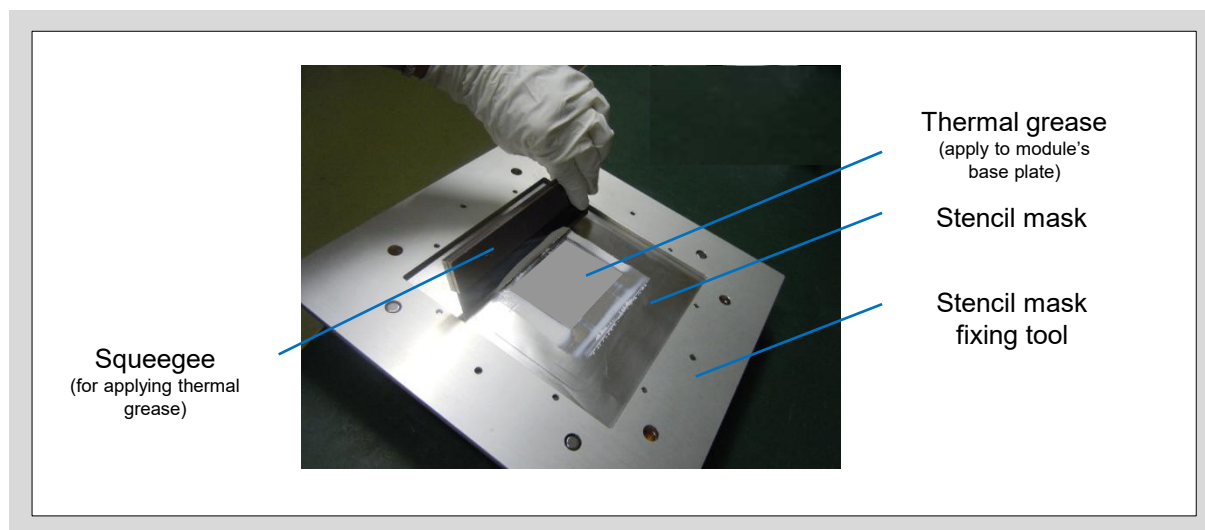


Fig.12 Example of thermal grease application

Table 5 Recommended stencil mask pattern and part number

Stencil mask pattern	Part number
Type A	2MBIxxxVX-xxx-5x 2MBIxxxXNBxxx-5x, 2MBIxxxXNHxxx-5x 2MBIxxxXNFxxx-5x
Type B	2MBIxxxxXRNFxxx-5x

Table 6 Typical characteristics of HTC thermal grease and recommended thickness

	Unit	Value
Viscosity (23deg.C, 1RPM)	Pa·s	202 ~ 205 *
Thermal conductivity	W/m·K	0.9 *
Average thickness after spreading	μm	100 +/- 30

* Excerpt from HTC Technical Data Sheet

4. Main terminal connection

4-1. Bus bar connection

This section describes the conditions and precautions when connecting the module to bus bar.

1. Screw size: M6
2. Screw length: Bus bar thickness + (7 ~ 9mm)
3. Tightening torque: V-series: 3.5 ~ 4.5N·m, X-series: 3.5 ~ 6.0N·m

<Important notes>

Do not apply excessive force to the module main terminals when connecting to bus bar. The force applied to the end of the bus bar is much greater than at the main terminal because the moment of force is proportional to the bus bar length. Also, do not tighten the screws if the main terminal and the bus bar is misaligned. This may cause damage to the terminals as mechanical stress is continuously applied to the terminals.

4-2. Maximum allowable mechanical force when connecting to bus bar

The maximum allowable mechanical force when connecting the bus bar is shown in Fig.14. Do not exceed this value even for a moment.

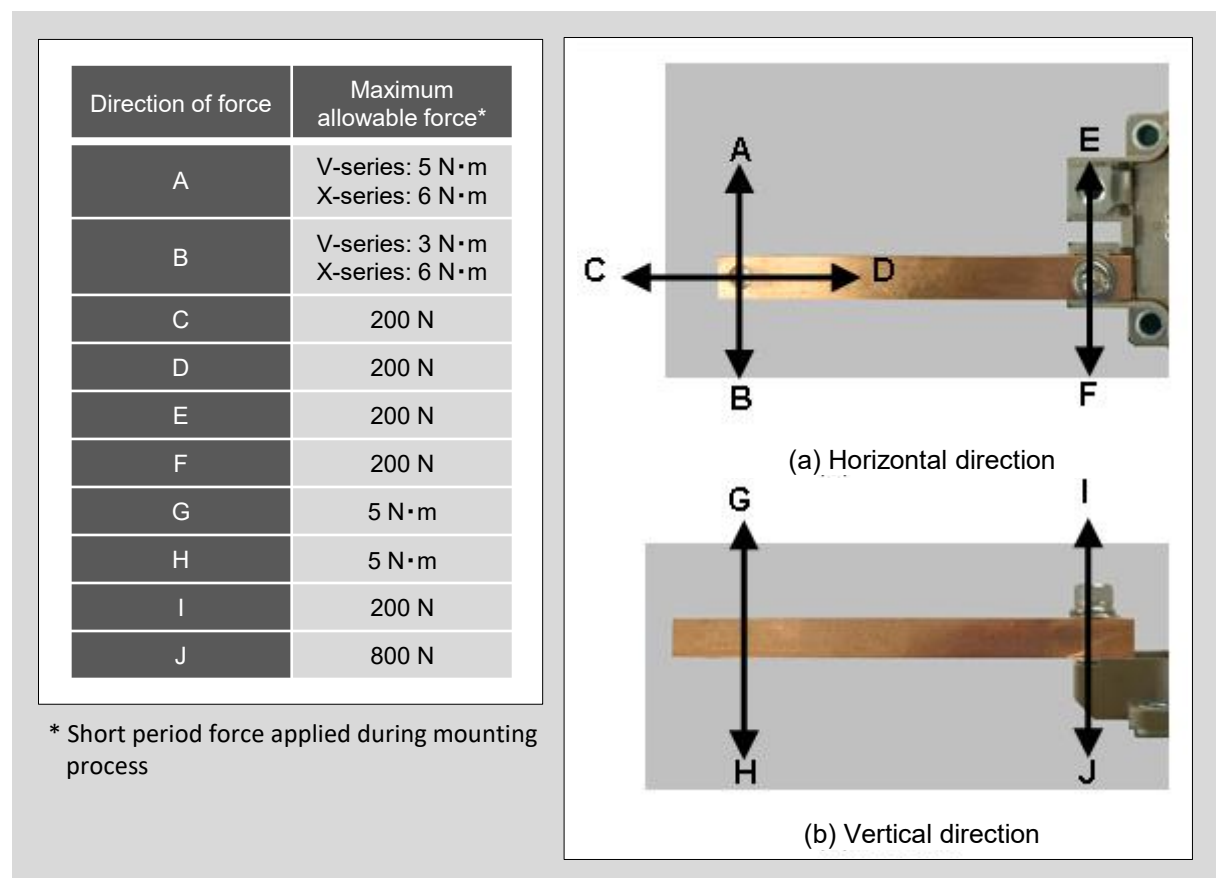


Fig.14 Maximum allowable force for each direction

5. Insulation distance

5-1. Insulation distance (M282)

This section describes the insulation distances of the modules.(creepage, clearance distances)

Creepage and clearance distances are shown in the Fig.15 and Table7.

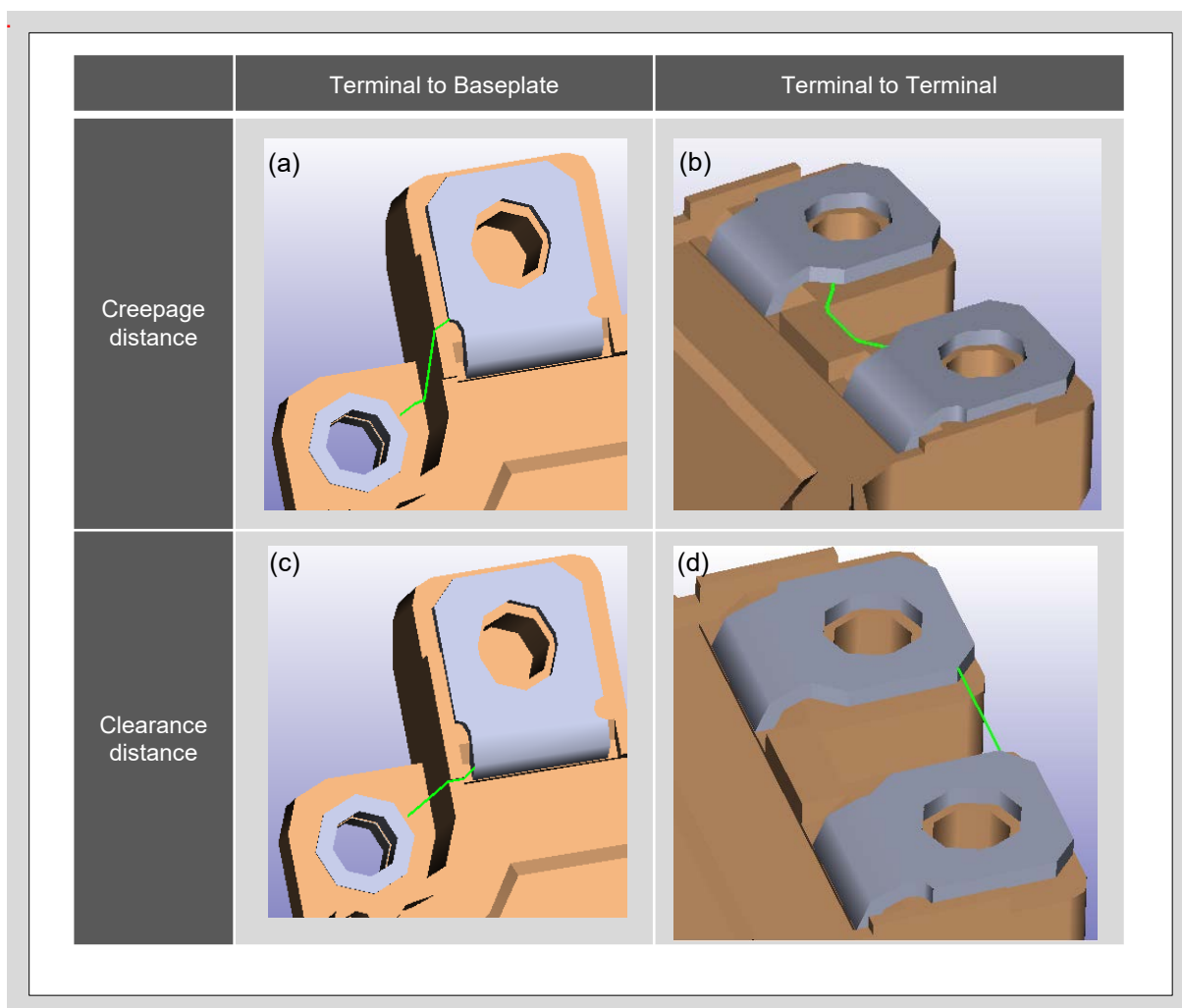


Fig.15 Creepage and clearance distance

Table 7 The Creepage and clearance distance for M282

	Conditions	Symbol	Unit	Value	Fig.15
Creepage Distance (※1)	Terminal to Baseplate	d_s	mm	≥ 14.7	(a)
	Terminal to Terminal			≥ 11.8	(b)
Clearance distance	Terminal to Baseplate	d_a	mm	≥ 12.5	(c)
	Terminal to Terminal			≥ 9.6	(d)

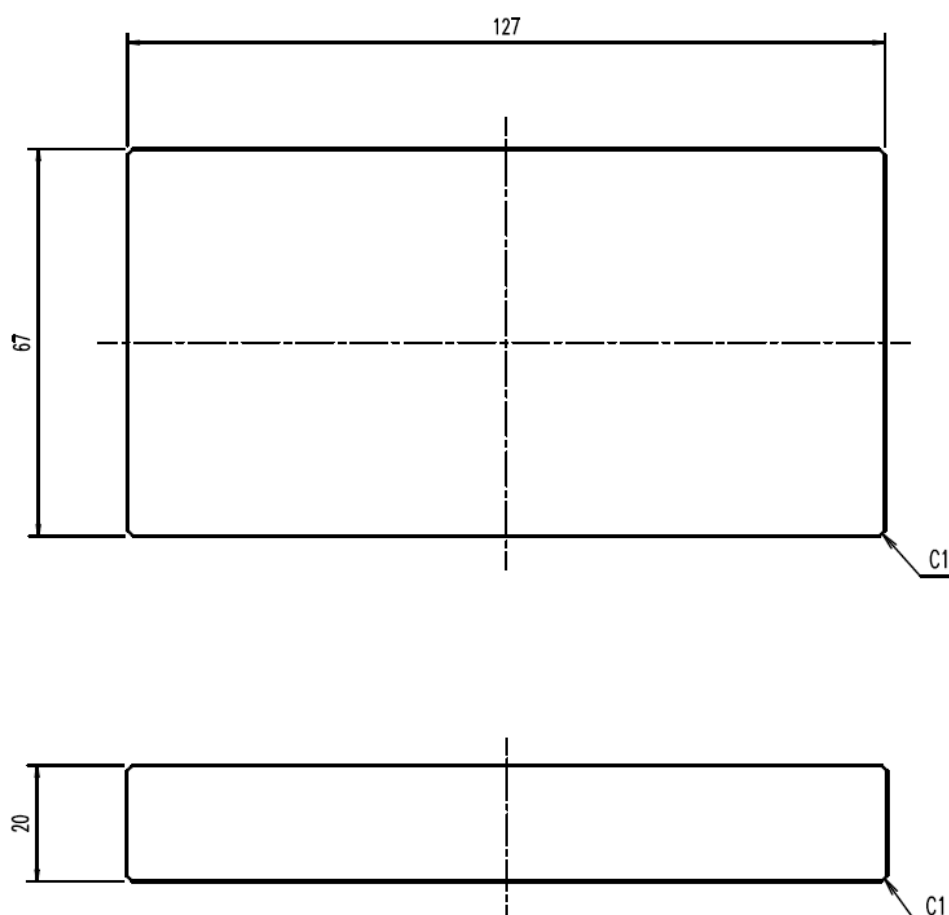
※1: PD2, IEC 60664-1 ed 3.0

Appendix 1 : Press-in / push-out tool drawing

Appendix 1-1. For M282 and M286

(a) Press-in upper tool

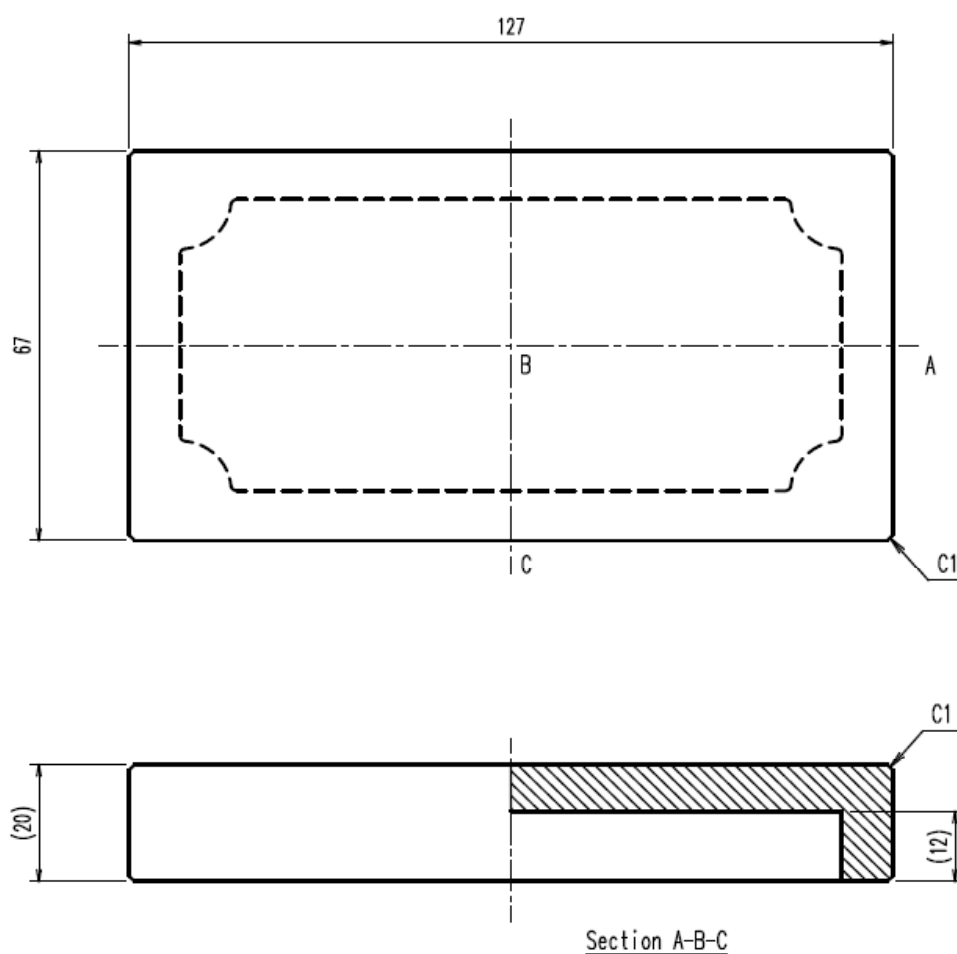
Unit : mm
Material : SUS



Appendix 1-1. For M282 and M286

(c) Push-out upper tool

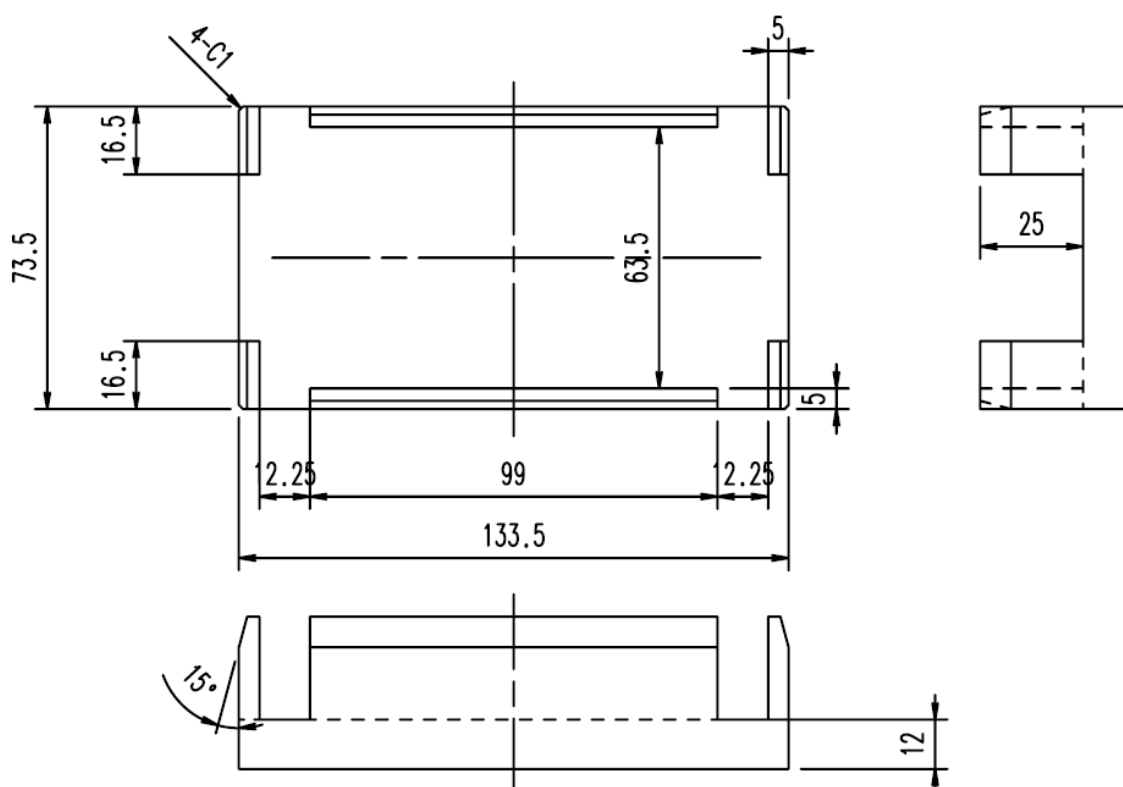
Unit : mm
Material : SUS



Appendix 1-1. For M282 and M286

(d) Push-out lower tool

Unit : mm
Material : SUS



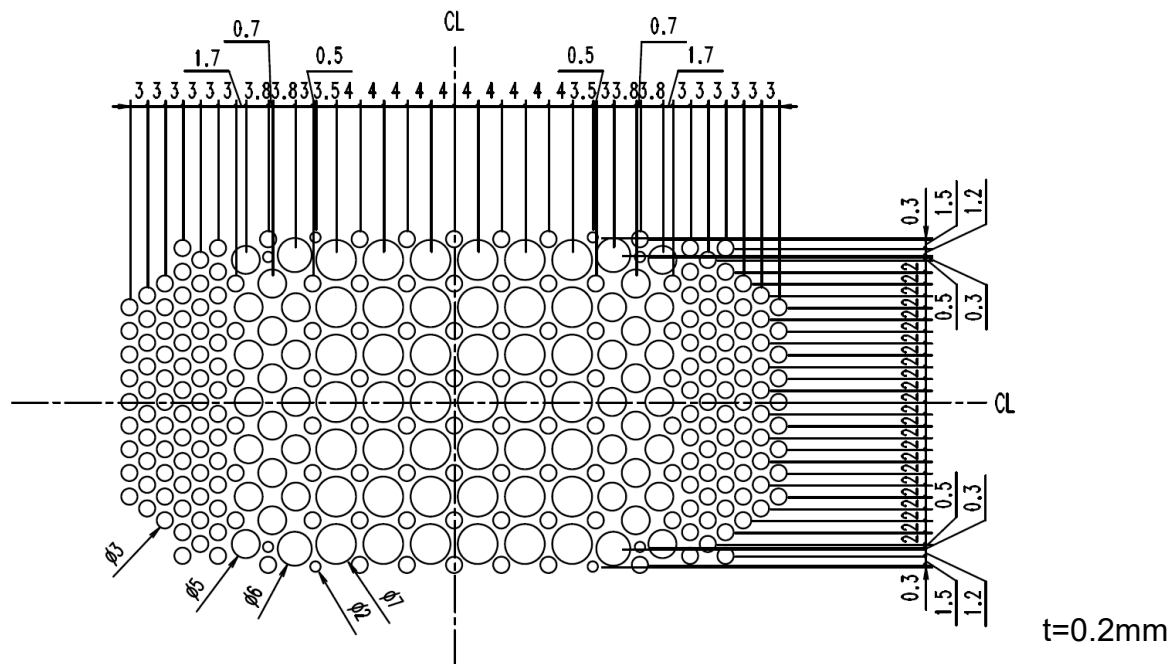
Appendix 2 : Stencil mask drawing

Stencil mask drawing for thermal grease application (recommended)

If you would like to obtain the following data, please contact our sales department.

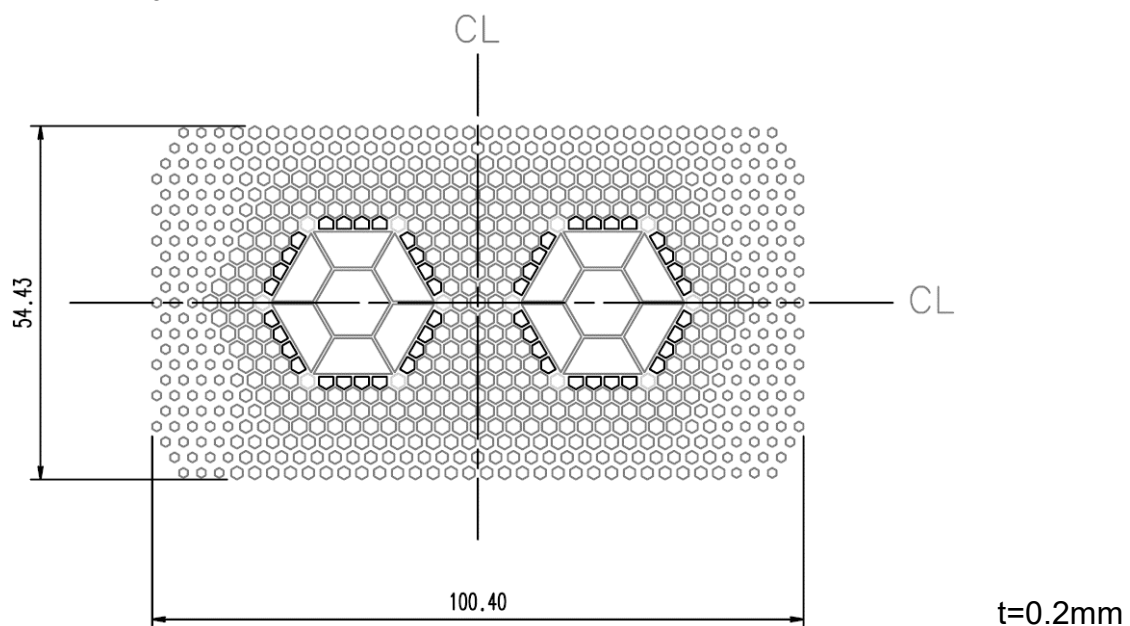
Type A

2MBIxxxVX-xxx-5x, 2MBIxxxXNBxxx-5x, 2MBIxxxXNHxxx-5x, 2MBIxxxXNFxxx-5x



Type B

2MBIxxxxXRNfxxx-5x



Warning

The contents in this manual (product specifications, characteristics, data, materials, structure, etc.) are as of Sep. 2025. 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.

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.

When using a product described in this manual, please obtain the product's latest specification and check the data.