

Mounting instruction for Press Fit Dual XT

MT5F29194

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Revision records

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1 General Introduction

1.1 General information for Press Fit Dual XT

This application note describes the recommended PCBs specification and advises for mounting / removing process of Fuji Electric (here in after Fuji) Press Fit type Dual XT. It is called Press Fit Dual XT in this report.

This application note cannot cover every type of application and / or conditions. Therefore, Fuji Press Fit Dual XT, which is used out of these suggestions on PCB and mounting process, will not have any warranty and / or guarantee under any circumstances. We recommend you or your technical partners to confirm throughout electro-mechanical evaluation in practical applications.

The Press Fit technology provides solder less mounting onto PCB with low resistive stable contact. A Press Fit pin before insertion has opened shape as shown in Fig.1. After press-in processes, which are described in later section, the pin is closed by the contact pressure from both sides (Fig.2). During the press-in process, mechanical deformation of pin and materials of the PCB hole sidewall form cold-welding joints, it is possible to have low resistivity and stable contact with this new technology.



Fig.1 Press Fit pin

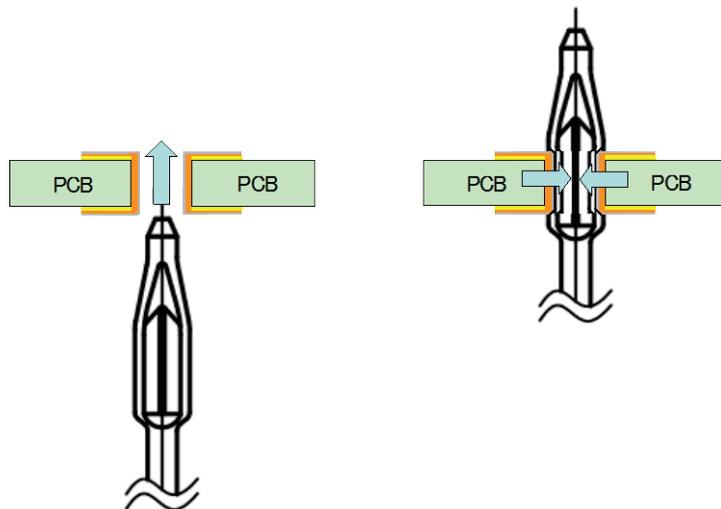


Fig.2 Closed pin shape after mounted onto the PCB

1.2 Electrostatic Discharge (ESD) protection

If excessive static electricity is applied to the control terminals, the devices can be broken. Some countermeasures against static electricity are necessary.

2 Requirements for PCBs

This chapter describes the PCB recommendation for the Press Fit Dual XT.

PCB should have been designed within criteria in the Table1. For example, end hole diameter should be a range of 0.95mm to 1.09mm with properly Sn/Cu plated sidewall as described in the figure. When it smaller, mechanical issue in the press-in process would be found, on the other hands, if it bigger, contact reliability may have concerns.

These results were experimentally obtained based from IEC60352-5. The evaluation is separately needed if PCBs which have out of these parameters.

PCB should have holes for guide pins of press-in tools with a specific position, hole diameter so that 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.

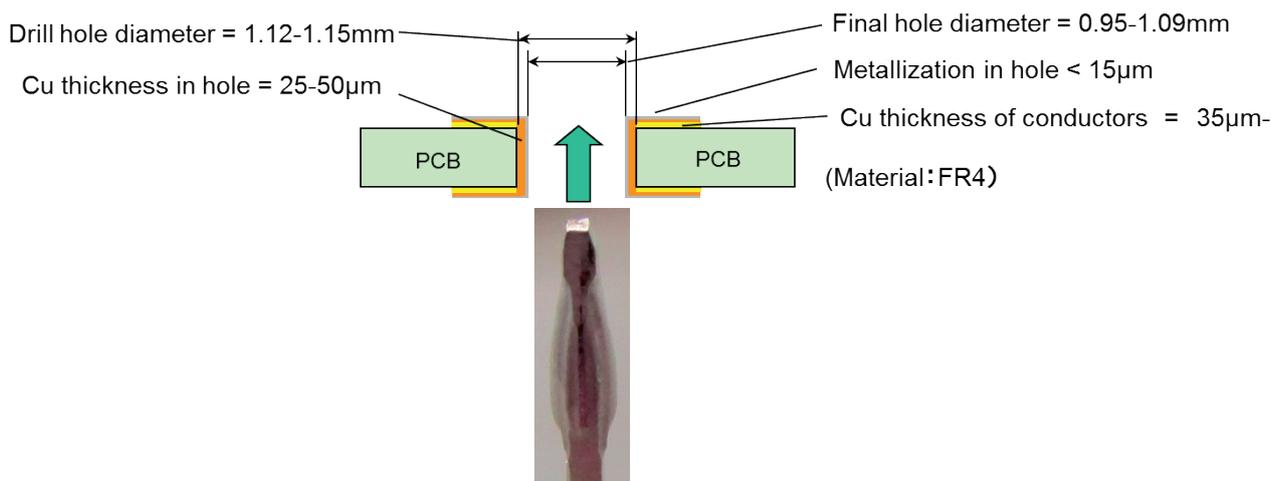


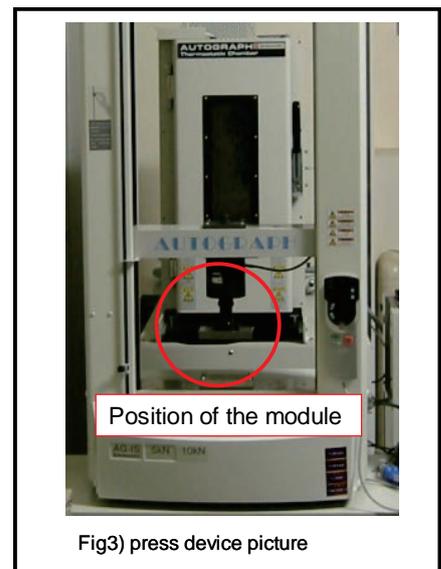
Table1.Recommended PCB specification

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

3 Mounting process and removing process

The procedure for mounting process and removing process of Press Fit module are described in this section. Press Fit module should be inserted within a specific range of mounting speed and force. If mounting force were below the limit, the module would have issue in low resistive and stable contact. On the other hand, mechanical damage on PCB and other parts mounted on the surface would be expected if too much press-in force.

When press-in, we recommend using the equipment as shown in Fig.3 to have accurate control in force control. We also recommend using specific press-in and push-out tools provided in the latter section with drawings.



Recommended press-in force and speed, push-out forces are described in the Table 2 and 3. Typical forces for each pin are also indicated in the table. Press-in speed of 25mm/min is also recommended to have good contact.

It is possible to remove a module from PCB and re-press-in to the PCBs again, however, we recommend soldering all pins for the modules that are not 1st-press-in, in order to avoid risk of mechanical damage during push-out process.

Table2. Recommended Press-in force

	Min.	Typ.	Max.
Final hole diameter	0.95mm		1.09mm
Press-in speed	25mm/min.		
Press-in force per pin		140N	

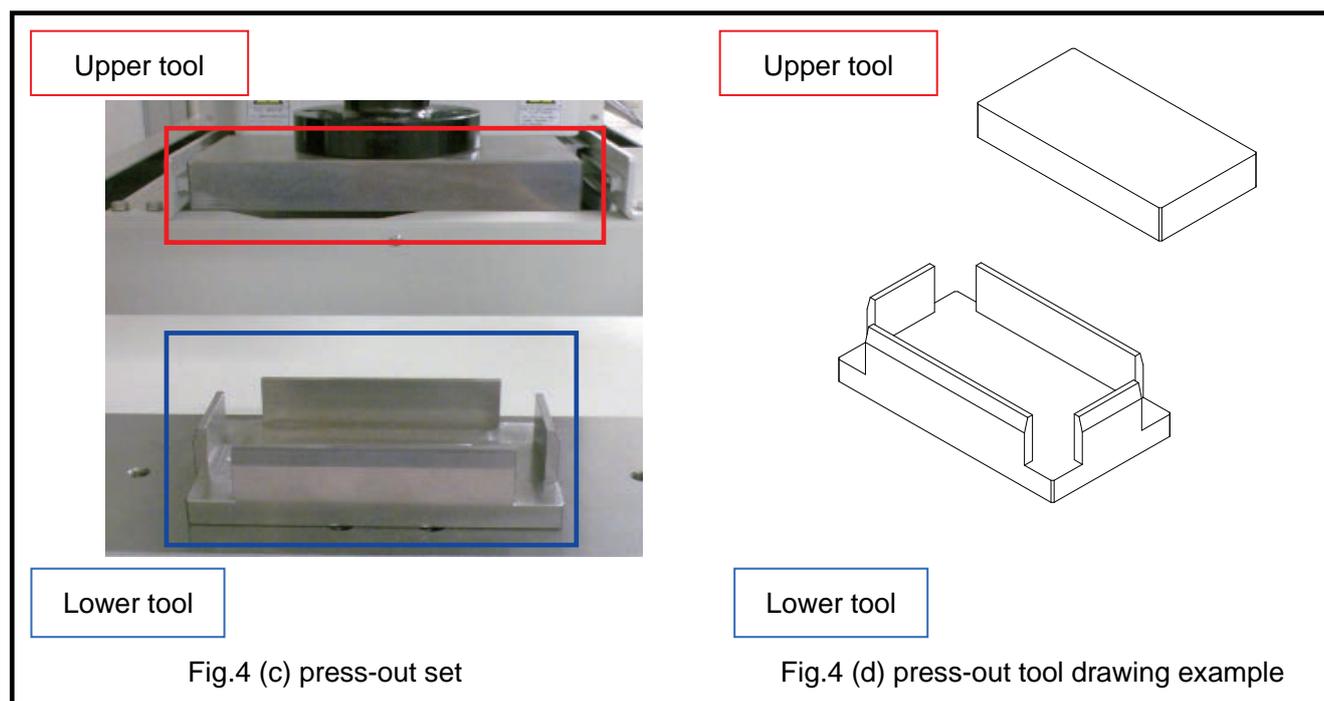
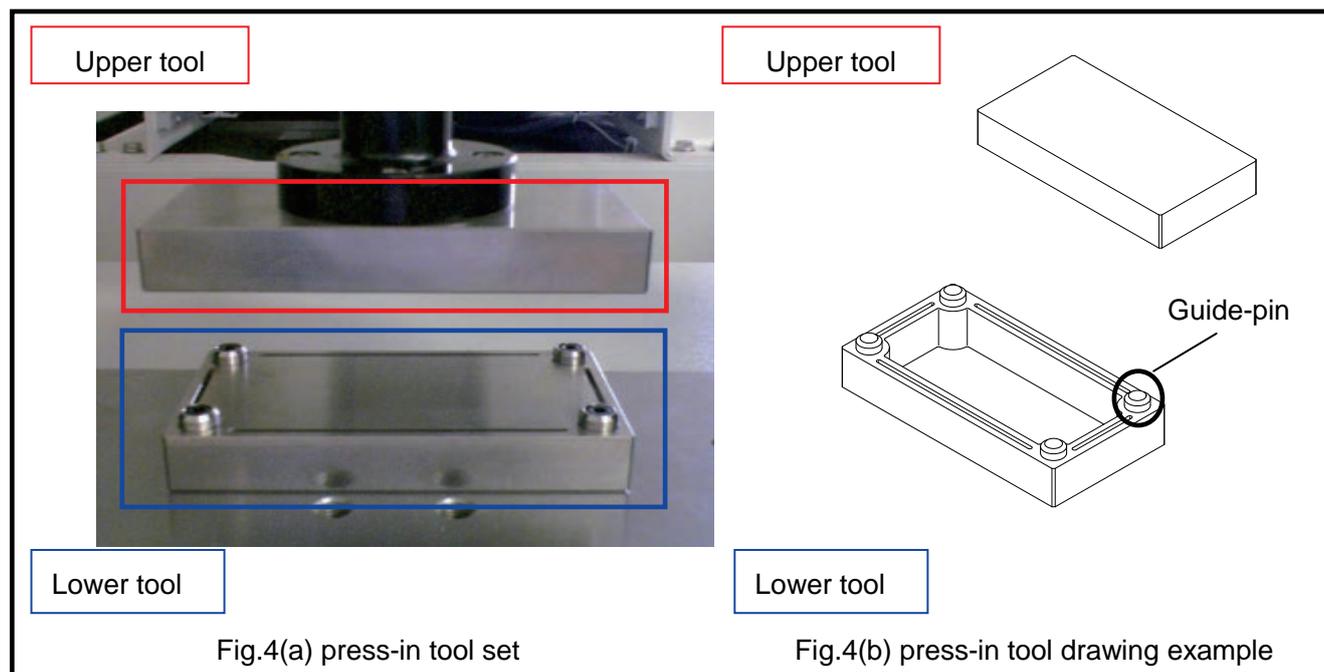
Table2. Recommended Push-out force

	Min.	Typ.	Max.
Push-out speed	12mm/min.		
Push-out force per pin	40N		

4 Example of Press-in and Push-out tools

Figures 4(a)-(d) are: (a) Photograph press-in toolset, (b) example of physical dimension (drawings) of press-in tools, (c) Push-out tools photo, (d) Push-out tool 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.



5 Example of mounting process of a module into PCB : Press-in

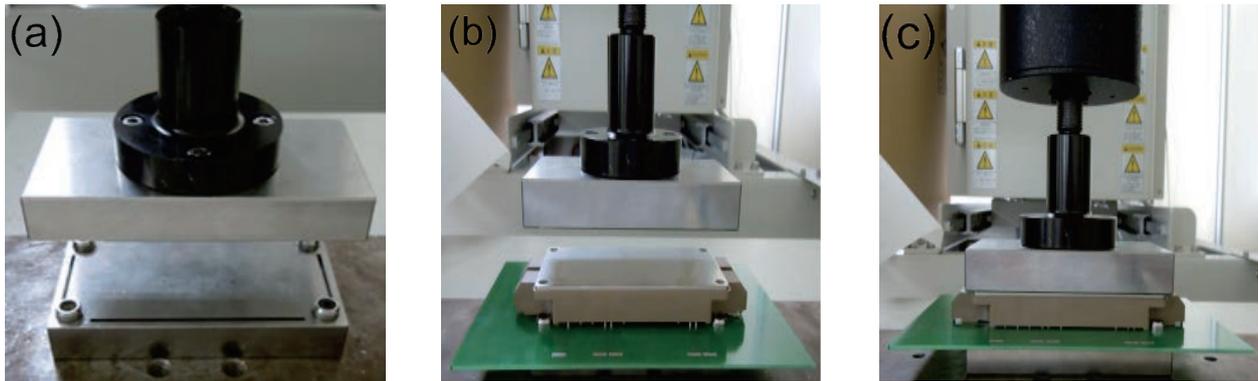


Fig.5 Example of Press-in Process

Figures 5(a)-(c) are example of mounting process of the module into the PCB:press-in process.

- (a): Set an upper tool and a lower tool on the machine.
- (b): Set a PCB on the lower tool and a module on the PCB.
- (c): Press the backside of the module by the upper tool to press-in the module to the PCB.

6 Example of removing process of module from PCB : Push-out

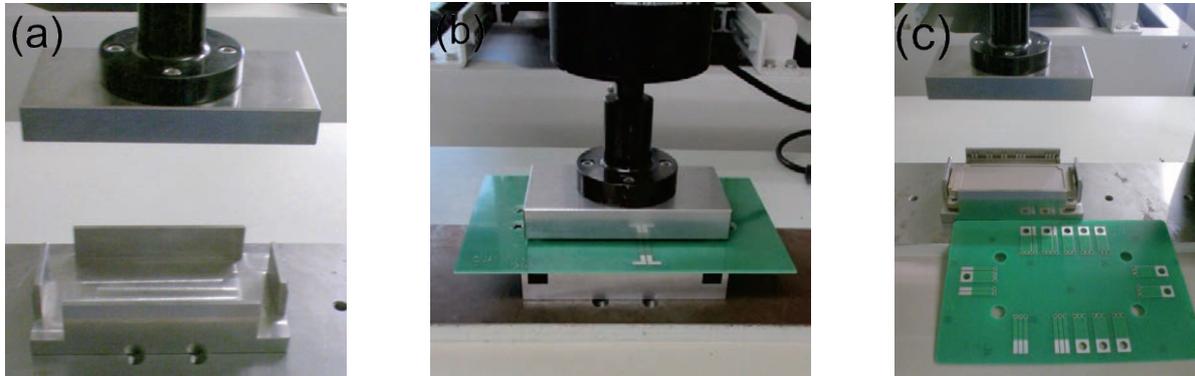


Fig.6 Example of Push-out Process

Figures 6(a)-(c) are example of push-out process.

- (a): Set an upper tool and a lower tool on the machine.
- (b): Set a module and a PCB on the lower tool and push Press FIT pins of the module by the upper tool.
- (c): The module is removed from the PCB and drops into the lower tool.

7 Fixing a PCB to the Module

7.1 Recommended screws

The diameter of mounting holes for PCBs are 2.15 - 2.35mm. It is recommended that the diameter of screw to attach PCB is 2.4-2.6mm. Recommended screw type and length are shown as follows. The recommended screw type is a self-tapping screw.

Screw type: Self-tapping screw

(In Japan, M2.6 self-tapping screw)

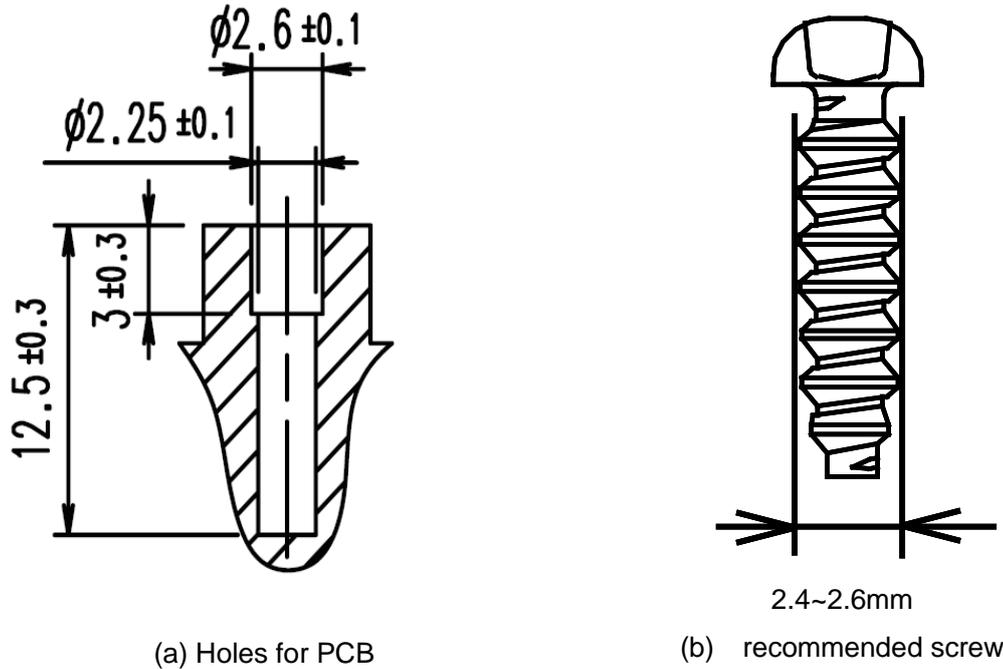


Fig.7 PCB screw holes and recommended screw cross section

7.2 Screw length

7.0mm to 10.0mm length screws are recommended to mount PCBs.

Recommended mounting torque is 0.4~0.5Nm, screws should be placed vertically. If screws are tightened with angles as shown in Figs.8 and 9, the pads on PCB and control terminals on IGBT modules may have loose electrical contact, which may have risk of module failure in worst case.

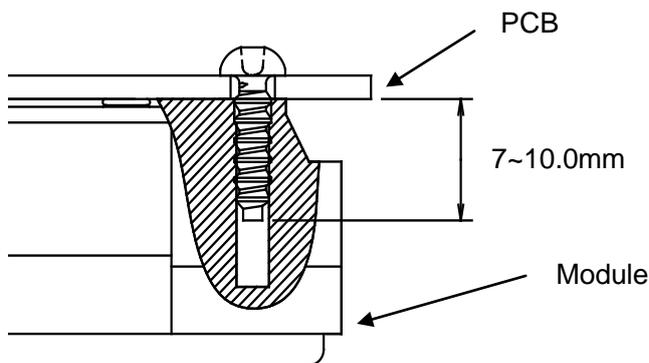


Fig.8 Hole cross sectional image of screw

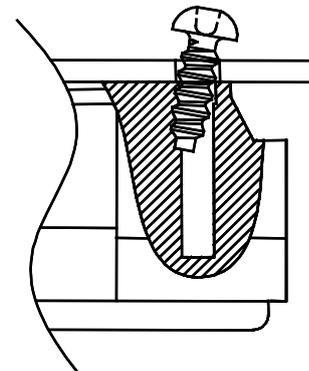


Fig.9 Bad example of screw tightened with angular position

7.3 How to mounting PCB screws

Manual tighten of PCB screw is preferable. However, if other tools such as electric drivers or other automated methods are used, parameter optimization and confirmation is recommended in practical installation process by customer so that IGBT module does not have mechanical damage by automatic screw process.

7.4 Example of mechanical damage with not recommended screw and/or process

PCB mounting is recommended by the methods above.

In case, not recommended screws and/or methods are used in IGBT installation process, it may have a risk of mechanical damage as shown in Fig.10. Screw types and process advanced confirmation is desirable.



Fig.10 Mechanical damage example of IGBT module

8 Application of Thermal Past

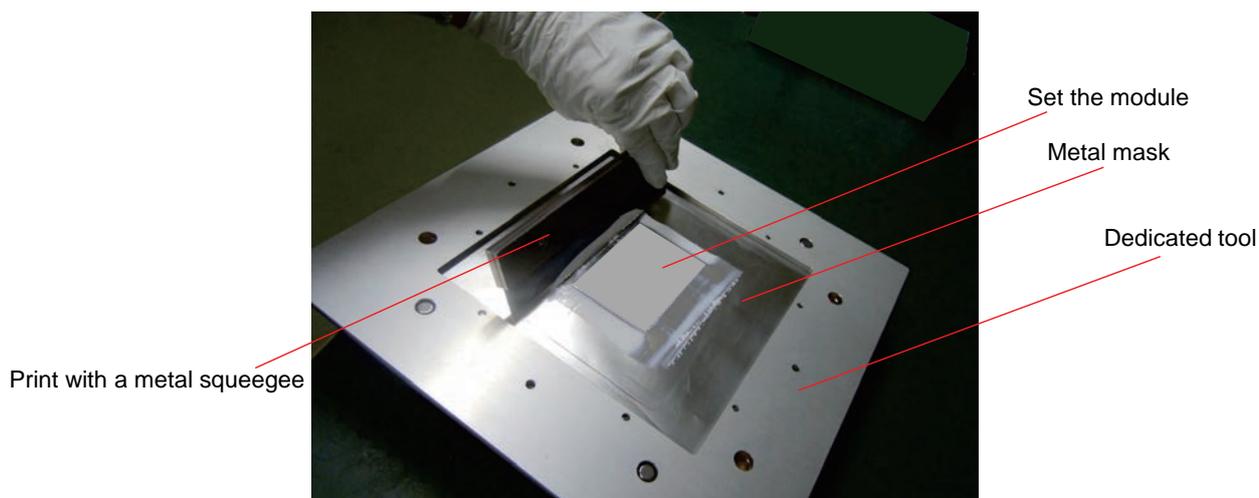


Fig. 11 Stencil printing process

Thermal paste thickness strongly affects the thermal resistivity between the module and a cooling fin. Stencil printing process is recommended to control thermal paste thickness. Fig. 11 shows an example of stencil printing process. Thermal paste thickness 80 μ m is recommended.

9 Mounting the Module to a Cooling fin

9.1 Mounting on cooling fin

The thermal resistance between IGBT module baseplate and cooling fin depends on module location, thermal properties of cooling fin and cooling methods. In general, each system has different cooling fin properties such as thermal conductivity and cooling fan, this section focuses on module location on cooling fin. Followings should be taken into account in IGBT module mounting process since thermal resistance varies according to the position of the mounted modules:

- ✓ IGBT modules should have thermally optimized layout on cooling fin according to the mechanical-thermal design so that the modules have good heat spread to minimize the thermal resistance.

- ✓ The distance between IGBT modules should be optimized based on the mechanical-thermal design and the estimated total power dissipation for each module to avoid the thermal coupling effect between modules mounted on the next

9.2 Cooling fin surface finishing (module mounting area)

The mounting surface of the cooling fin should be finished to the roughness of 10 μ m or less. A warp based on a length of 100mm should be 50 μ m or less. If the surface of the cooling fin does not have enough flatness, the modules may have unexpected increase in the contact thermal resistance ($R_{th(c-f)}$). If the cooling fin flatness does not match the above requirements, the high stress in the DCB on the modules may result high voltage insulation failure.

9.3 Mounting procedure

Mounting procedures onto cooling fin are described.

- (a) Minimum and maximum torque for mounting M5 screws indicated (1) ~ (4) in the picture on the right are:
Minimum: 2.5Nm / Maximum: 3.5Nm
- (b) Pre-torque is recommended with 1/3 of the final torque with sequence (1) - (2) - (3) - (4) in Fig.12
- (c) Final torque must be within specified force of 2.5 to 3.5 Nm with sequence (1) - (2) - (3) - (4)
- (d) To comply the creep age and clearance distance, the total height of screw and washer must not exceed 6.0mm.



Fig.12 Mounting holes (1) ~ (4) in Press Fit module

10 Storage and Transport condition

- (1) The module should be stored at a standard temperature of 5 to 35°C and humidity of 45 to 75%. Be careful to press-fit contact if the module has passed over one year from manufacturing date, under the above storage condition.
- (2) Store modules in a place with few temperature changes in order to avoid condensation on the module surface.
- (3) Avoid exposure to corrosive gases and dust.
- (4) Avoid excessive external force on the module.
- (5) Store modules with unprocessed terminals.
- (6) Do not drop or otherwise shock the modules when transporting.

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