Mounting Instruction for M254 Package

(V-series DualXT Module)

This document provides information how to mount IGBT modules of M254 package, so called DualXT (Pin-type).

This mounting instruction is available only for type name of 2MBIxxxVN-xxx-5x
(x is number of 0~9)

1 Mounting IGBT modules

✓ This document describes how to mount DualXT solder pin-type module (M254 package).

1.1 Mounting on heat sink

The thermal resistance between IGBT module baseplate and heat sink depends on module location on the heat sink, thermal properties, such as thermal conductivity, of heat sink, and cooling methods. This section, the module location on heat sink is focused and described. Following items should be taken into account in the IGBT module mounting process since thermal resistance will be varied according to the position of the mounted modules:

- ✓ IGBT module(s) should have thermally optimized layout on heat sink according to the mechanical-thermal design so that the modules have good heat spread to minimize the thermal resistance.
- ✓ In case of several IGBT modules to be mounted on the same heat sink, the distance between IGBT modules should be optimized based on the mechanical-thermal design and the estimated total power dissipation of each module in order to avoid the thermal coupling effect between neighbor modules.

1.2 Heat sink surface finishing (module mounting area)

The flatness of the heat sink between the mounting holes should be less than 50μm per 100mm. The surface roughness should be less than 10μm. If the surface of the heat sink does not have enough flatness, the module may have unexpected increase of the contact thermal resistance ($R_{th(c-f)}$) between the module and the heat sink. Also, if the heat sink flatness doesn't meet the above requirements, a high mechanical stress may be applied to the DCB on the module and it may cause insulation failure.

1.3 Thermal grease pasting

Thermal grease between heat sink and module baseplate is absolutely necessary to reduce the contact thermal resistance. Screen-printing, rollers or spatulas are typical method of thermal grease pasting, however, using a stencil mask is recommended when the target grease thickness is less than 100μm.

Table 1 Recommended properties of thermal grease

Items	Recommendation
Penetration (typ.)	≥ 338
Thermal conductivity	≥ 0.92 W/mK
Thermal grease thickness	100μm ±30μm

*1) The thermal resistance between the heat sink and the module depends on the thermal grease properties and thickness. Fuji Electric strongly recommends customers to confirm contact interface after mounting whether the terminal grease spreading is good enough or not. Also Fuji Electric recommends confirmation of the thermal interface status after thermal cycling if the thermal grease has low viscosity.

*2) Electrical document of the recommended stencil mask pattern and recommended method are also available on request.

1.4 Mounting procedure

Mounting procedures onto heat sink are described in below.

(a) The minimum and maximum screw torque for mounting screws (M5) indicated as (1) – (4) in Fig.1 are:

Minimum: 2.5Nm

Maximum: 3.5Nm

(b) Pre-fastening is recommended with 1/3 of the final torque with sequence of (1)–(2)–(3)–(4) or (4)-(3)-(2)-(1) in Fig.1.

(c) Final torque must be within specified force of 2.5 to 3.5 Nm with sequence of (1)–(2)–(3)–(4) or (4)-(3)-(2)-(1) in Fig.1.

(d) To keep the creepage and clearance distance, the total height include screw and washer must not exceed 6.0mm.

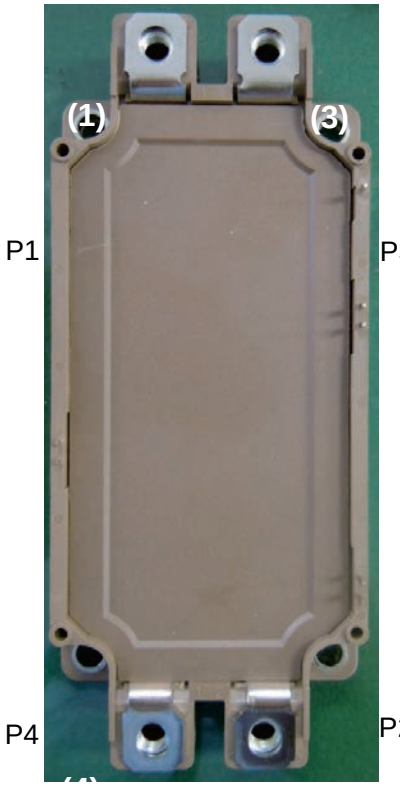


Fig.1 Mounting holes of M254 package

1.5 PCB mounting procedure

The PCB mounting procedure is described in below.

(a) The minimum and maximum torque for screwing (P1) – (P4) indicated in Fig. 1 with M2.6 self-tapping screw are:

Minimum: 0.4Nm

Maximum: 0.5Nm

(b) Pre-fastening is recommended with 1/3 of the final torque with sequence of (P1)–(P2)–(P3)–(P4) or (P4)-(P3)-(P2)-(P1) in Fig.1.

(c) Final torque must be within specified torque of 0.4 to 0.5Nm with sequence (P1)–(P2)–(P3)–(P4) or (P4)-(P3)-(P2)-(P1) in Fig.1. The maximum screw rotation speed is 300 rpm.

1.6 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 Connecting main terminals

2.1 Bus bar connection

- Screw size for main terminals: M6
- Screw length: Bus bar thickness + (7 to 9mm)
- Screw torque: Minimum 3.5Nm / Maximum 4.5Nm
- Maximum terminal temperature 125°C

<Important notes>

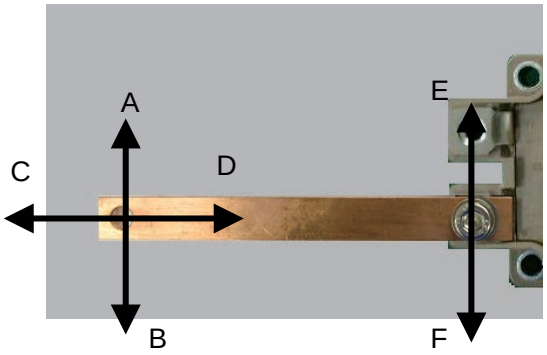
Special care should be taken when mounting bus bar to IGBT main terminals so that the terminals do not have excess forces. The principle of a lever sometimes makes the moment of force much bigger than expected especially when installing to long bus bar. In addition, the terminals may have seriously damages when the module is fixed with miss alignment in position between the module terminal and bus bar holes. Well alignment to the module terminals and bus bar holes are recommended to reduce mechanical stress.

2.2 Maximum allowable strength and directions for bus bars

Mechanical allowable mechanical strength and directions when connecting bus bars to the main and auxiliary terminals are describes in the table below.

Direction	Strength*
A	5 Nm
B	3 Nm
C	500 N
D	500 N
E	200 N
F	200 N
G	5 Nm
H	5 Nm
I	500 N
J	1000 N

*) The strength in the table is the mechanical capability for the short period during the mounting process.



(a) Horizontal direction

(b) Vertical direction

Fig.2 Vector descriptions from bus bar

2.3 Clearance and creepage distance

In order to keep enough isolation voltage, it is recommended that the terminals should keep both clearance and creepage distance as defined (a) and (b) in Fig.3. The minimum value of the clearance and

creepage distance are:

✓ Clearance distance 9.5mm

✓ Creepage distance 14.0mm

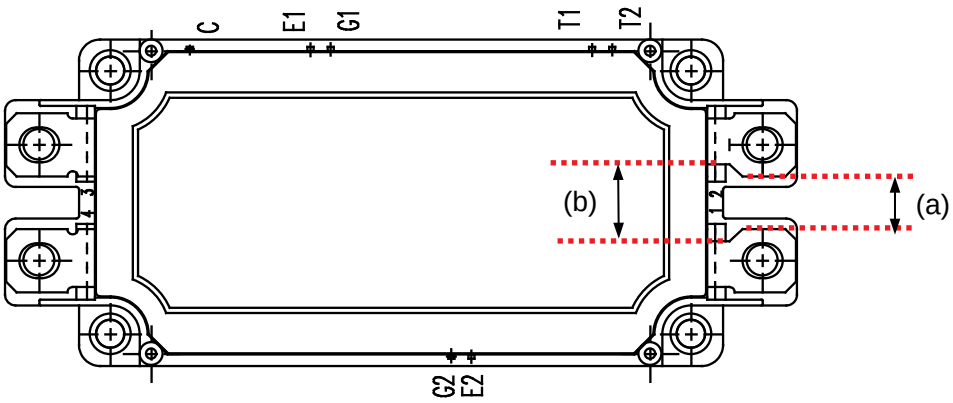
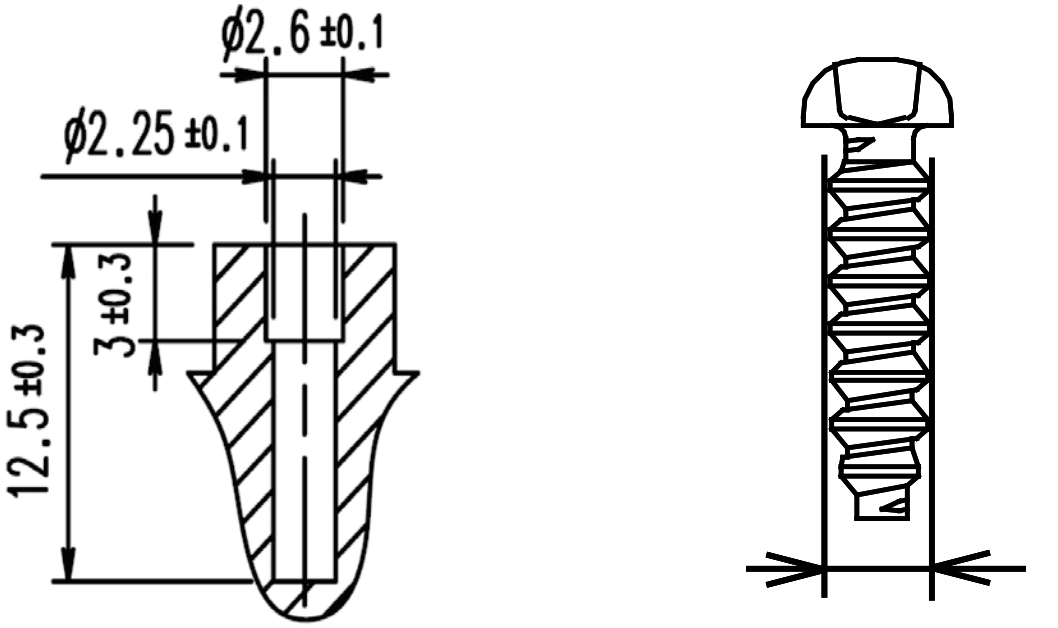


Fig. 3 Clearance and creepage distance for IGBT main terminals

3 PCB mounting procedure

3.1 Recommended screws

The recommended screw diameter is 2.4mm to 2.6mm (M2.6) because the diameter of the mounting holes for PCB is 2.2mm and 2.5mm. Fig.4 shows the recommended screw types and length. Self-tapping screws are recommended.



(a) Holes for PCB

(b) recommended screw

Fig.4 PCB screw holes and recommended screw cross section

3.2 Screw length

7.0mm to 10.0mm length screws are recommended for mounting PCBs onto the module.

Recommended screw torque is 0.4~0.5Nm, the screws should be placed straight along the hole as shown in Fig.5. If screws are tightened with angles as shown Fig.6, the module or PCB might be damaged in worst case.

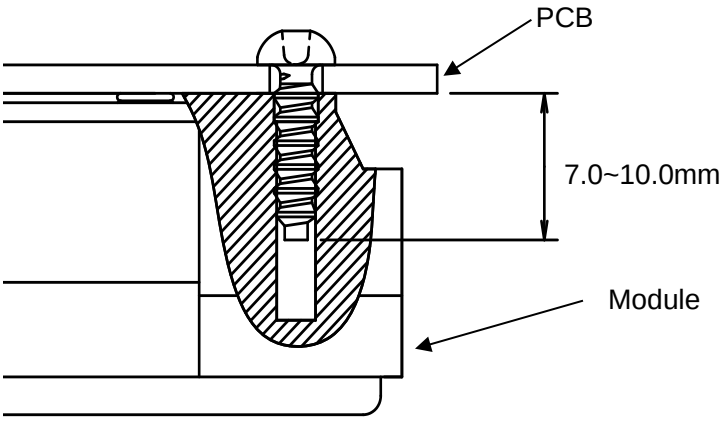


Fig.5 Hole cross sectional image of screw

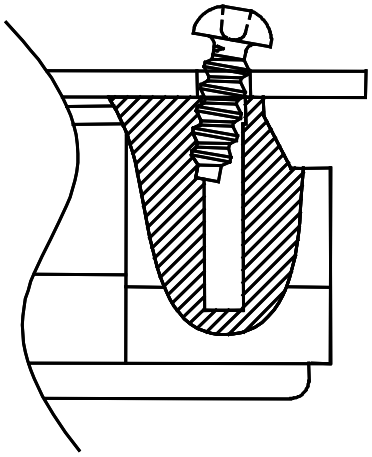


Fig.6 Bad example of screw tightened with angular position

3.3 Screwing for mounting PCB

Manual screwing is recommended for PCB mounting. If other tools such as electric drivers or other automated machines are used, please confirm the parameter configuration such as screwing torque of the tools before the mounting process in order to avoid the mechanical damage by the automatic screw process.

3.4 Example of mechanical damage with wrong screw and/or process

If unrecommended screws and/or methods are used in IGBT/PCB installation process, it may have a risk of mechanical damage as shown in Fig.7. Please confirm the screw types and mounting process in advance.

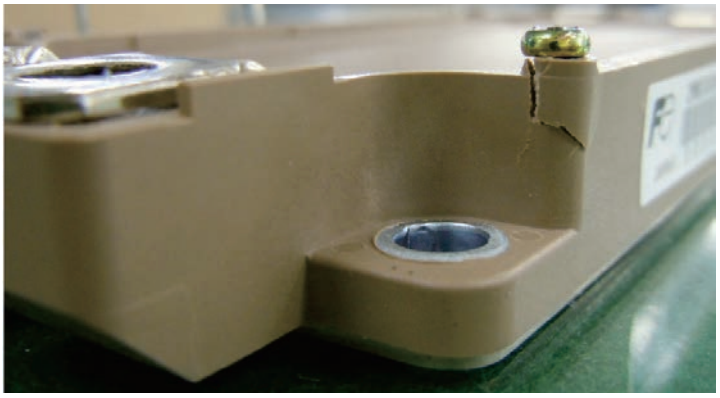


Fig.7 Example of damaged module by wrong screw

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