Mounting Instruction for M254 Package (so called “NewDual pin”) revision c

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Contents

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

This mounting instruction is available only for type name(s) of 2MBI XXX VN- XXX -5X (X is number of 0~9)

Revision records

Date	Classification	Ind.	Drawn	Check	Approval	Content
30-Aug-‘10	Enactment	-	T.Harada	-R.Maruyama	S.Okita	
05-Sep.-‘11	Revised	a	T.Harada	-R.Maruyama	S.Okita	Add Bus bar connection
06-Sept.-‘11	Revised	b	T.Harada	-R.Maruyama	S.Okita	Change format
27-Mar-‘12	Revised	c	T.Harada	-R.Maruyama	S.Okita	Revise mounting procedure and PCB mounting procedure.

1 Mounting IGBT modules_

This section presents how to mount M254 package, so called “DualXT(Pin)”.

1.1 Mounting on heatsink

The thermal resistance between IGBT module baseplate and heatsink depends on module location, thermal properties of heatsink and cooling methods. In general, each system has different heatsink properties such as thermal conductivity and cooling fan, this section focuses on module location on heatsink. 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 heat sink 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

1.2 Heat sink surface finishing (module mounting area)

The mounting surface of the heatsink should be finished to the roughness of 10μm or less. A warp based on a length of 100mm should be 50μm or less. If the surface of the heat sink does not have enough flatness, the modules may have unexpected increase in the contact thermal resistance (Rth(c-f)). If the heatsink flatness does not match the above requirements, the high stress in the DCB on the modules may result high voltage insulation failure.

1.3 Thermal grease pasting

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

Table 1 Recommended properties of thermal grease

Items	Recommendation
Penetration (typ.)	>= 338
Thermal conductivity	>= 0.92 W/m.K
Thermal grease thickness	100μm +/- 30μm

*1 The thermal desistance between the heatsink and the module depends on the thermal grease properties and thickness. We strongly recommend customer to check contact interface after mounted to confirm if the interface has good thermal grease spreading. Also we recommend checking the thermal interface conditions after thermal cycling if the thermal grease has low viscosity.

*2 Stencil mask pattern electric data and recommended method are also available on request.

1.4 Mounting procedure

Mounting procedures onto heatsink 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) or (4)-(3)-(2)-(1) in Fig.1. (c)

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

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

Fig.1 Mounting holes 1-4 in M254 modules

1.5 PCB mounting procedure

PCB mounting processes are described.

(a) Minimum and maximum torque for mounting M2.6 self tapping screws indicated P1 to P4 in Fig.1:
Minimum: 0.4Nm
Maximum: 0.5Nm

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

(c) Final torque must be within specified force of 0.4 to 0.5Nm with sequence P1-P2-P3-P4 or P4-P3-P2-P1 in Fig.1. (c)

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 is necessary.

2 Connecting main terminals

2.1 Bus bar connection

- Screw M6
- Screw length Bus bar thickness + (7 to 9mm)
- Screw torgue Minimum 3.5Nm / Maximum 4.5Nm
- Maximum terminal temperature $100^{o}C$

<Important notes>

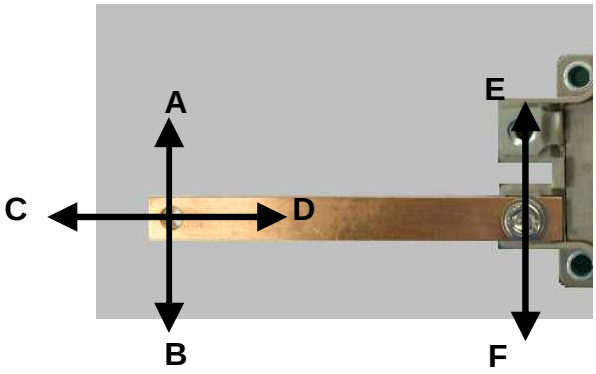
Special care should be taken when mounting bus bar to IGBT main terminals so that the terminals do not have excess forces. The principle of a lever sometimes makes the moment of force much bigger than expected especially when installing to long bus bar. In addition, the terminals may have seriously damages 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 force vectors from bus bar

Maximum vectors and definitions are described in the table below.

Vector	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

*) Strength in the table is the mechanical capability for the short period in mounting process.



(a) Horizontal direction

(a) Vertical direction

Fig.2 Vector descriptions from bus bar

2.3 Clearance and creepage distance

In order to establish good isolation voltage, it is recommended for the IGBT application to have both clearance and creepage distance for the main terminal design as defined (a) and (b) in Fig.3 should be longer than minimum value of :

Clearance distance	9.5mm
Creepage distance	14.0mm

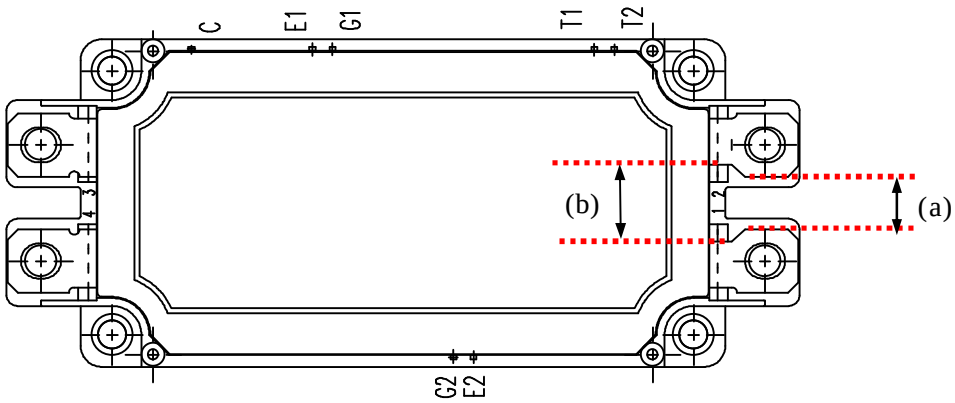
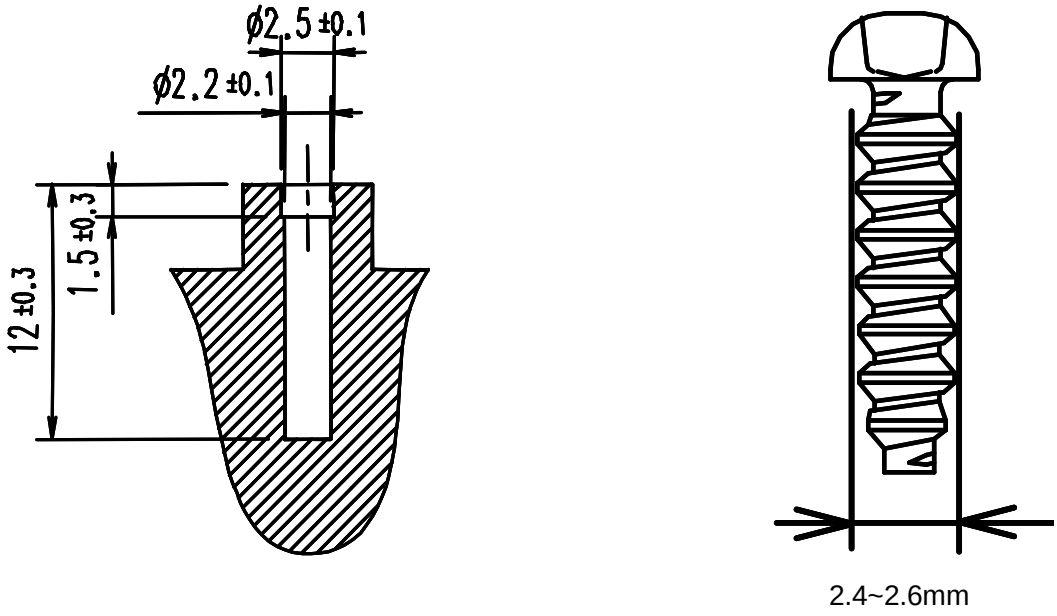


Fig. 3 Clearance and creepage distance for IGBT main terminals

3 Suggestions when mounting onto PCB

3.1 Recommended screws

As mounting holes for PCBs have step holes with diameter of 2.2mm and 2.5mm, screws with diameter of 2.4 to 2.6mm are recommended. Figures below shows recommended screw types and length. Self-tapping screws are recommended. In Japan, M2.6 screws are recommended.



(a) Holes for PCB (b) recommended screw

Fig.4 PCB screw holes and recommended screw cross section

3.2 Screw length

5.0mm to 8.0mm 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.5 and 6, 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.

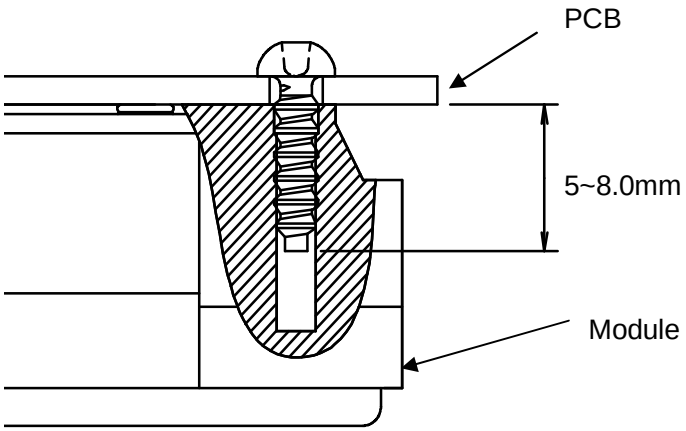


Fig.5 Hole cross sectional image of screw

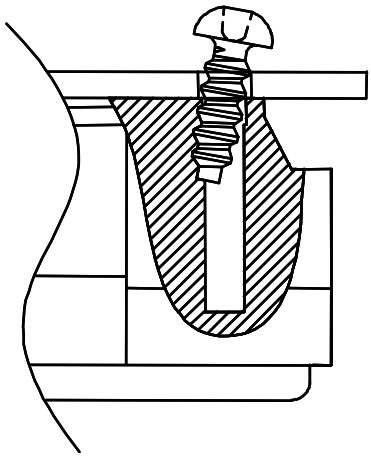


Fig.6 Bad example of screw tightened with angular position

3.3 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.

3.4 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.7. Screw types and process advanced confirmation is desirable.

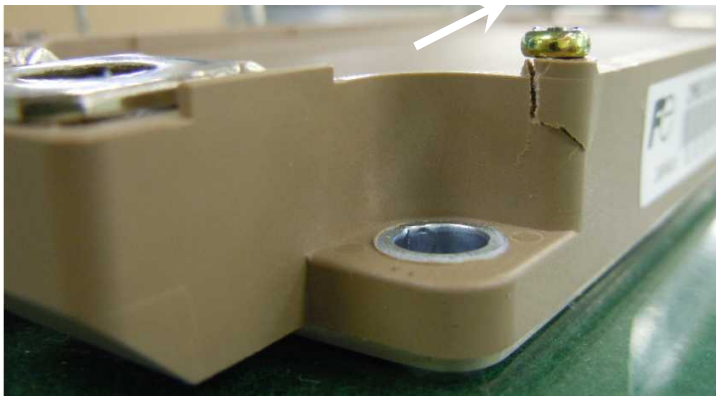


Fig.7 Mechanical damage example of IGBT module