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# SPECIFICATION

|             |   |               |
|-------------|---|---------------|
| Device Name | : | IGBT Module   |
| Type Name   | : | 2MBI400TB-060 |
| Spec. No.   | : | MS5F 5293     |

Fuji Electric Co., Ltd.  
Matsumoto Factory

|         | DATE         | NAME        | APPROVED   | Fuji Electric Co.,Ltd. |           |        |   |
|---------|--------------|-------------|------------|------------------------|-----------|--------|---|
| DRAWN   | Oct- 22 -'02 | Y.Kobayashi | T.Fujihira | DWG.NO.                | MS5F 5293 | 1 / 14 | a |
| CHECKED | Oct- 23 -'02 | T.Miyasaka  |            |                        |           |        | b |
|         |              | K.Yamada    |            |                        |           |        | c |

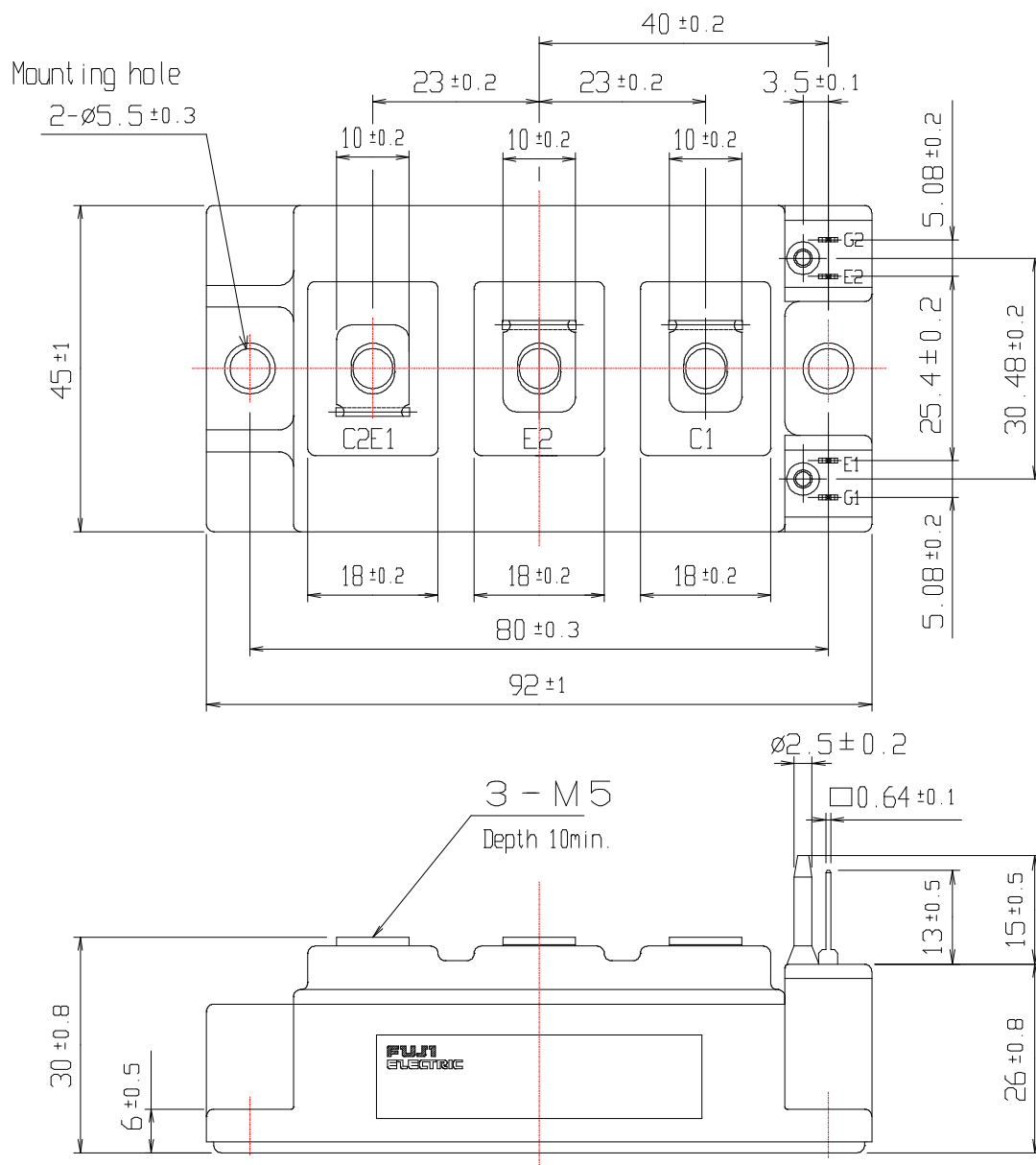
# Revised Records

| Date        | Classification | Ind. | Content                                                      | Applied date | Drawn       | Checked                | Approved   |
|-------------|----------------|------|--------------------------------------------------------------|--------------|-------------|------------------------|------------|
| Oct.-23-'02 | enactment      | —    | —                                                            | Issued date  | —           | T.Miyasaka<br>K.Yamada | T.Fujihira |
| Nov.-29-'02 | Revision       | a    | Revised Reliability test condition (P7/14)                   |              | Y.Kobayashi | T.Miyasaka<br>K.Yamada | T.Fujihira |
| Jan.-31-'03 | Revision       | b    | Revised characteristics curve up to 800A (P11/14, 12/14)     |              | Y.Kobayashi | T.Miyasaka<br>K.Yamada | T.Fujihira |
| Apr.-07-'04 | Revision       | c    | Revised ton,tr,toff,tf (P4/14)<br>Revised Rth curve (P12/14) |              | Y.Kobayashi | T.Miyasaka<br>K.Yamada | Y.Seki     |
|             |                |      |                                                              |              |             |                        |            |
|             |                |      |                                                              |              |             |                        |            |
|             |                |      |                                                              |              |             |                        |            |
|             |                |      |                                                              |              |             |                        |            |
|             |                |      |                                                              |              |             |                        |            |
|             |                |      |                                                              |              |             |                        |            |
|             |                |      |                                                              |              |             |                        |            |

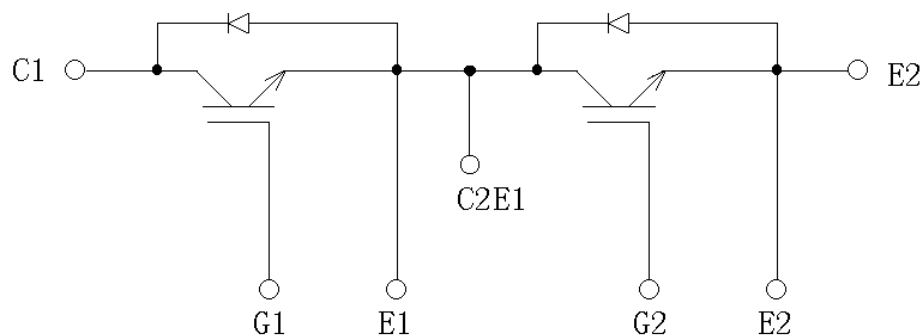
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# 2MBI400TB-060

## 1. Outline Drawing ( Unit : mm )



## 2. Equivalent circuit



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H04-004-03

### 3. Absolute Maximum Ratings ( at Tc= 25°C unless otherwise specified )

| Items                            | Symbols                  | Conditions | Maximum Ratings | Units |
|----------------------------------|--------------------------|------------|-----------------|-------|
| Collector-Emitter voltage        | VCES                     | Ic=1mA     | 600             | V     |
| Gate-Emitter voltage             | VGES                     |            | ±20             | V     |
| Collector current                | Ic                       | Duty=100 % | 400             | A     |
|                                  | Ic pulse                 | 1ms        | 800             |       |
|                                  | IF                       | Duty=56 %  | 400             |       |
|                                  | IF pulse                 | 1ms        | 800             |       |
| Collector Power Dissipation      | Pc                       | 1 device   | 1270            | W     |
| Junction temperature             | Tj                       |            | 150             | °C    |
| Storage temperature              | Tstg                     |            | -40~ +125       | °C    |
| Isolation voltage <sup>(*)</sup> | Viso                     | AC : 1min. | 2500            | V     |
| Screw Torque                     | Mounting <sup>(*)</sup>  |            | 3.5             | N.m   |
|                                  | Terminals <sup>(*)</sup> |            | 3.5             |       |

(\*) All terminals should be connected together when isolation test will be done.

(\*)2 Recommendable Value : Mounting 2.5~3.5 N.m (M5)

Terminal 2.5~3.5Nm (M5)

### 4. Electrical characteristics ( at Tj= 25°C unless otherwise specified)

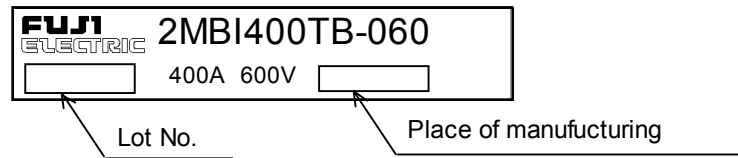
| Items                                                                        | Symbols  | Conditions               | Characteristics |        |      | Units |
|------------------------------------------------------------------------------|----------|--------------------------|-----------------|--------|------|-------|
|                                                                              |          |                          | min.            | typ.   | Max. |       |
| Zero gate voltage Collector current                                          | ICES     | VGE = 0 V, VCE = 600 V   | -               | -      | 2.0  | mA    |
| Gate-Emitter leakage current                                                 | IGES     | VCE = 0 V, VGE = ±20 V   | -               | -      | 400  | nA    |
| Gate-Emitter threshold voltage                                               | VGE(th)  | VCE = 20 V, Ic = 400 mA  | 6.2             | 6.7    | 7.7  | V     |
| Collector-Emitter saturation voltage                                         | VCE(sat) | VGE = 15 V<br>Ic = 400 A | -               | 1.9    | -    | V     |
|                                                                              |          | Chip<br>Terminal         | -               | 2.2    | 2.5  |       |
| Input capacitance                                                            | Cies     | VGE = 0 V                | -               | 30000  | -    | pF    |
| Output capacitance                                                           | Coes     | VCE = 10 V               | -               | 5200   | -    |       |
| Reverse transfer capacitance                                                 | Cres     | f = 1 MHz                | -               | 4500   | -    |       |
| Turn-on time                                                                 | ton      | Vcc = 300 V              | -               | ° 0.4  | 1.2  | μs    |
|                                                                              | tr       | Ic = 400 A               | -               | ° 0.2  | 0.6  |       |
|                                                                              | tr(i)    | VGE = ±15 V              | -               | 0.1    | -    |       |
| Turn-off time                                                                | toff     | RG = 6.8 Ω               | -               | ° 0.55 | 1.2  |       |
|                                                                              | tf       |                          | -               | ° 0.05 | 0.45 |       |
| Forward on voltage                                                           | VF       | IF = 400 A               | -               | 1.75   | -    | V     |
|                                                                              |          | Chip<br>Terminal         | -               | 1.9    | 2.5  |       |
| Reverse recovery time                                                        | trr      | IF = 400 A               | -               | -      | 0.3  | μs    |
| Allowable avalanche energy during short circuit cutting off (Non-repetitive) | PAV      | Ic > 800A, Tj = 125°C    | 200             | -      | -    | mJ    |

### 5. Thermal resistance characteristics

| Items                         | Symbols  | Conditions              | Characteristics |       |       | Units |
|-------------------------------|----------|-------------------------|-----------------|-------|-------|-------|
|                               |          |                         | min.            | typ.  | Max.  |       |
| Thermal resistance (1 device) | Rth(j-c) | IGBT                    | -               | -     | 0.098 | °C/W  |
|                               |          | FWD                     | -               | -     | 0.19  |       |
| Contact Thermal resistance    | Rth(c-f) | With thermal compound * | -               | 0.025 | -     |       |

\* This is the value which is defined mounting on the additional cooling fin with thermal compound.

6. Indication on module



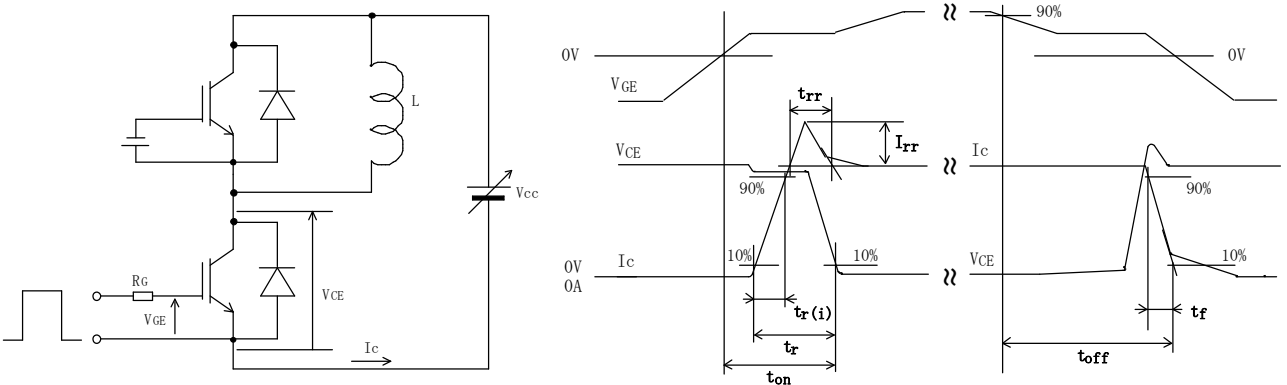
7. Applicable category

This specification is applied to IGBT Module named 2MBI400TB-060

8. Storage and transportation notes

- The module should be stored at a standard temperature of 5 to 35C and humidity of 45 to 75% .
- Store modules in a place with few temperature changes in order to avoid condensation on the module surface.
- Avoid exposure to corrosive gases and dust.
- Avoid excessive external force on the module.
- Store modules with unprocessed terminals.
- Do not drop or otherwise shock the modules when tranporting.

9. Definitions of switching time



### 13. Reliability test results

#### Reliability Test Items

| Test categories   | Test items                      | Test methods and conditions                                                                                                                                                                                                                                                                        | Reference norms<br>EIAJ<br>ED-4701 | Number of sample | Acceptance number |
|-------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------|-------------------|
| Mechanical Tests  | 1 Terminal Strength (Pull test) | Pull force : <sup>a</sup> 40N<br>Test time : 10±1 sec.                                                                                                                                                                                                                                             | A - 111<br>Method 1                | 5                | (1 : 0)           |
|                   | 2 Mounting Strength             | Screw torque : 2.5 ~ 3.5 N·m (M5)<br>Test time : 10±1 sec.                                                                                                                                                                                                                                         | A - 112<br>Method 2                | 5                | (1 : 0)           |
|                   | 3 Vibration                     | Range of frequency : 10 ~ 500Hz<br>Sweeping time : 15 min.<br>Acceleration : <sup>a</sup> 10G<br>Sweeping direction : Each X,Y,Z axis<br>Test time : 6 hr. (2hr./direction)                                                                                                                        | A - 121                            | 5                | (1 : 0)           |
|                   | 4 Shock                         | Maximum acceleration : 1000G<br>Pulse width : 0.5msec.<br>Direction : Each X,Y,Z axis<br>Test time : 3 times/direction                                                                                                                                                                             | A - 122                            | 5                | (1 : 0)           |
| Environment Tests | 1 High Temperature Storage      | Storage temp. : 125±5 °C<br>Test duration : 1000hr.                                                                                                                                                                                                                                                | B - 111                            | 5                | (1 : 0)           |
|                   | 2 Low Temperature Storage       | Storage temp. : -40±5 °C<br>Test duration : 1000hr.                                                                                                                                                                                                                                                | B - 112                            | 5                | (1 : 0)           |
|                   | 3 Temperature Humidity Storage  | Storage temp. : 85±3 °C<br>Relative humidity : 85±5%<br>Test duration : 1000hr.                                                                                                                                                                                                                    | B - 121                            | 5                | (1 : 0)           |
|                   | 4 Unsaturated Pressure Cooker   | Test temp. : 121 °C<br>Atmospheric pressure : 2.03×10 <sup>5</sup> Pa (Reference value)<br>Test duration : 20hr.                                                                                                                                                                                   | B - 123                            | 5                | (1 : 0)           |
|                   | 5 Temperature Cycle             | Test temp. : $\begin{cases} \text{Low temp. } -40^{+3}_{-5} \text{ °C} \\ \text{High temp. } 125^{+5}_{-5} \text{ °C} \\ \text{RT } 5 \sim 35 \text{ °C} \end{cases}$<br>Dwell time : High ~ RT ~ Low ~ RT<br>1hr. 0.5hr. 1hr. 0.5hr.<br>Number of cycles : 100 cycles                             | B - 131                            | 5                | (1 : 0)           |
|                   | 6 Thermal Shock                 | Test temp. : $\begin{cases} \text{High temp. } 100^{+0}_{-5} \text{ °C} \\ \text{Low temp. } 0^{+5}_{-0} \text{ °C} \end{cases}$<br>Used liquid : Water with ice and <sup>a</sup> boiling water<br>Dipping time : 5 min. par each temp.<br>Transfer time : 10 sec.<br>Number of cycles : 10 cycles | B - 141                            | 5                | (1 : 0)           |

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