

# 1MBI3600VD-170E

**IGBT Modules**

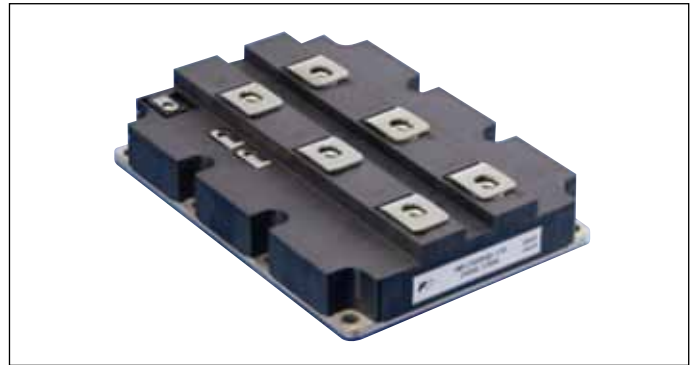
## IGBT MODULE (V series) 1700V / 3600A / 1 in one package

### ■ Features

- High speed switching
- Voltage drive
- Low Inductance module structure

### ■ Applications

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Industrial machines, such as Welding machines



### ■ Maximum Ratings and Characteristics

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

| Items   | Symbols   | Conditions | Maximum ratings | Units |   |
|---|---|------------|-----------------|-------|---|
| Collector-Emitter voltage                                   | $V_{CES}$                                       |            | 1700            | V     |   |
| Gate-Emitter voltage  | $V_{GES}$                                       |            | ±20             | V     |   |
| Collector current   | $I_c$   | Continuous | Tc=25°C         | 4800  | A |
|   |   |            | Tc=100°C        | 3600  |   |
|   | $I_{cp}$  | 1ms        | 7200            |       |   |
|   | $-I_c$  |            | 3600            |       |   |
|   | $-I_c$ pulse                                    | 1ms        | 7200            |       |   |
| Collector power dissipation                                 | $P_c$   | 1 device   | 22380           | W     |   |
| Junction temperature  | $T_j$   |            | 175             | °C    |   |
| Operating junction temperature (under switching conditions) | $T_{jop}$                                       |            | 150             |       |   |
| Storage temperature   | $T_{stg}$                                       |            | -40 ~ +150      |       |   |
| Isolation voltage   | Between terminal and copper base (*1) $V_{iso}$ | AC : 1min. | 4000            | VAC   |   |
| Screw torque (*2)   | Mounting  | M6         | 5.75            | Nm    |   |
|   | Main Terminals                                  | M8         | 10              |       |   |
|   | Sense Terminals                                 | M4         | 2.5             |       |   |

Note \*1: All terminals should be connected together when isolation test will be done.

Note \*2: Recommendable Value :

Mounting 4.25~5.75 Nm (M6) , Main Terminals 8~10 Nm (M8) , Sense Terminals 1.7~2.5 Nm (M4)

● Electrical characteristics (at Tj= 25°C unless otherwise specified)

| Items                                | Symbols                          | Conditions  | Characteristics     |       |      | Units      |   |
|--------------------------------------|----------------------------------|---|---------------------|-------|------|------------|---|
|                                      |                                  |   | min.                | typ.  | max. |            |   |
| Zero gate voltage collector current  | $I_{CES}$                        | $V_{GE} = 0V, V_{CE} = 1700V$   | -                   | -     | 1.0  | mA         |   |
| Gate-Emitter leakage current         | $I_{GES}$                        | $V_{CE} = 0V, V_{GE} = \pm 20V$   | -                   | -     | 4800 | nA         |   |
| Gate-Emitter threshold voltage       | $V_{GE(th)}$                     | $V_{CE} = 20V, I_c = 3600mA$  | 6.0                 | 6.5   | 7.0  | V          |   |
| Collector-Emitter saturation voltage | $V_{CE(sat)}$<br>(main terminal) | $V_{GE} = 15V$<br>$I_c = 3600A$   | $T_j = 25^\circ C$  | -     | 2.32 | 2.61       | V |
|                                      |                                  |   | $T_j = 125^\circ C$ | -     | 2.72 | -          |   |
|                                      |                                  |   | $T_j = 150^\circ C$ | -     | 2.77 | -          |   |
|                                      | $V_{CE(sat)}$<br>(chip)          |   | $T_j = 25^\circ C$  | -     | 2.00 | 2.25       |   |
|                                      |                                  |   | $T_j = 125^\circ C$ | -     | 2.40 | -          |   |
|                                      |                                  |   | $T_j = 150^\circ C$ | -     | 2.45 | -          |   |
| Internal gate resistance             | Int Rg                           |   | -                   | 0.63  | -    | $\Omega$   |   |
| Input capacitance                    | $C_{ies}$                        | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$   | -                   | 326   | -    | nF         |   |
| Turn-on                              | $t_{on}$                         | $V_{CC} = 900V, I_c = 3600A$<br>$L_m = 46nH, V_{GE} = \pm 15V, T_j = 125^\circ C$ | -                   | 2.27  | -    | $\mu s$    |   |
|                                      | $t_r$                            |   | -                   | 0.75  | -    |            |   |
| Turn-off                             | $t_{off}$                        | $R_{gon} = 0.5 \Omega$<br>$R_{goff} = 0.5 \Omega$                                 | -                   | 2.67  | -    |            |   |
|                                      | $t_f$                            |   | -                   | 0.31  | -    |            |   |
| Forward on voltage                   | $V_F$<br>(main terminal)         | $V_{GE} = 0V$<br>$I_F = 3600A$  | $T_j = 25^\circ C$  | -     | 2.12 | 2.52       | V |
|                                      |                                  |   | $T_j = 125^\circ C$ | -     | 2.32 | -          |   |
|                                      |                                  |   | $T_j = 150^\circ C$ | -     | 2.30 | -          |   |
|                                      | $V_F$<br>(chip)                  |   | $T_j = 25^\circ C$  | -     | 1.80 | 2.15       |   |
|                                      |                                  |   | $T_j = 125^\circ C$ | -     | 2.00 | -          |   |
|                                      |                                  |   | $T_j = 150^\circ C$ | -     | 1.98 | -          |   |
| Reverse recovery                     | $t_{rr}$                         | $I_F = 3600A, T_j = 125^\circ C$  | -                   | 0.61  | -    | $\mu s$    |   |
| Lead resistance, terminal-chip       | R lead                           |   | -                   | 0.089 | -    | m $\Omega$ |   |

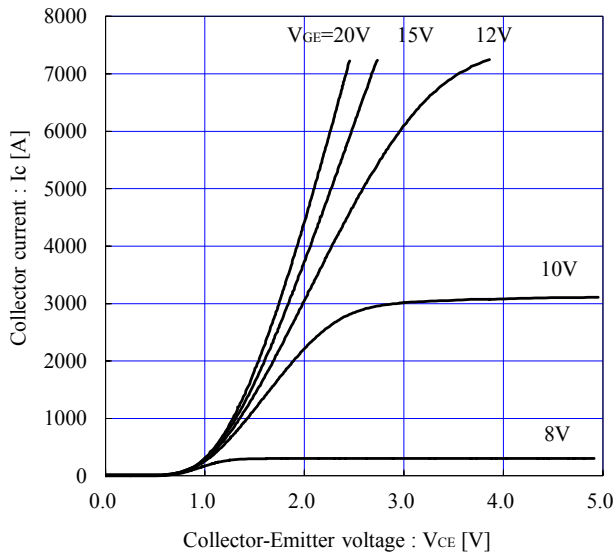
● Thermal resistance characteristics

| Items                           | Symbols       | Conditions            | Characteristics |       |        | Units        |
|---------------------------------|---------------|-----------------------|-----------------|-------|--------|--------------|
|                                 |               |                       | min.            | typ.  | max.   |              |
| Thermal resistance              | $R_{th(j-c)}$ | IGBT                  | -               | -     | 0.0067 | $^\circ C/W$ |
|                                 |               | FWD                   | -               | -     | 0.011  |              |
| Contact thermal resistance (*3) | $R_{th(c-f)}$ | with Thermal Compound | -               | 0.004 | -      |              |

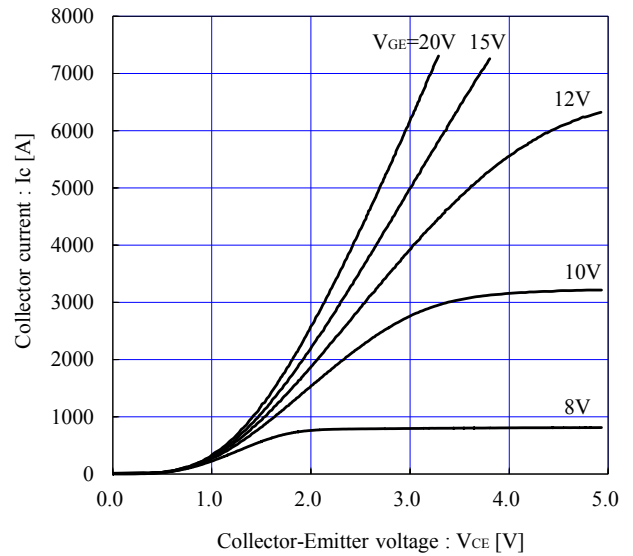
Note \*3: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

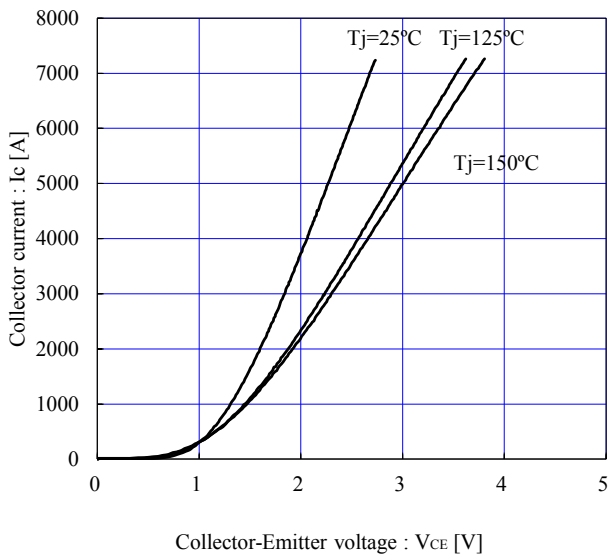
Collector current vs. Collector-Emittter voltage (typ.)  
Tj=25°C,chip



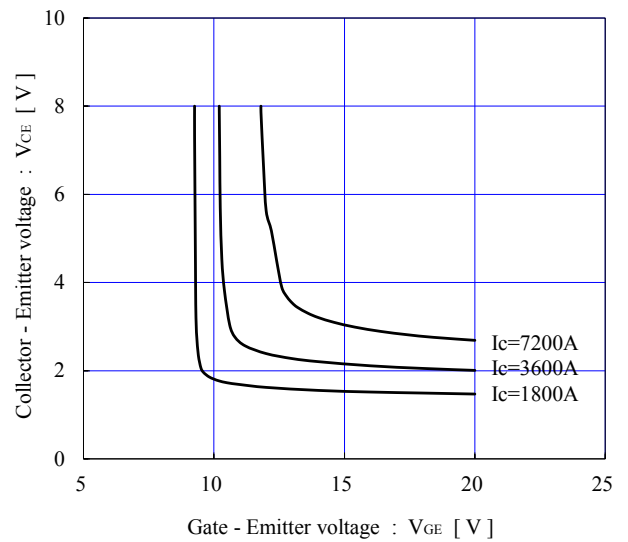
Collector current vs. Collector-Emittter voltage (typ.)  
Tj= 150°C, chip



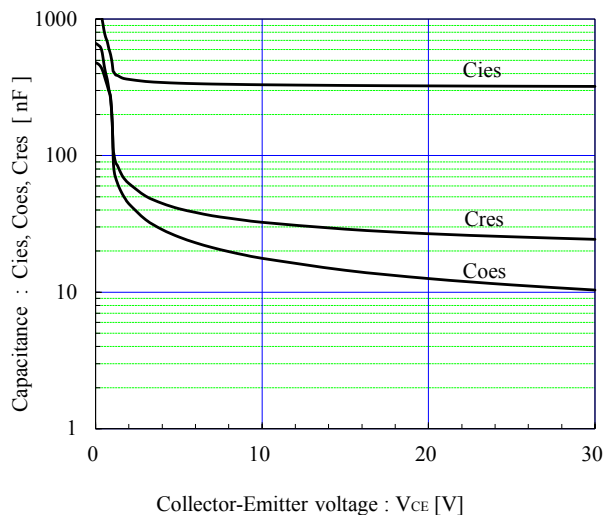
Collector current vs. Collector-Emittter voltage (typ.)  
Vge=+15V,chip



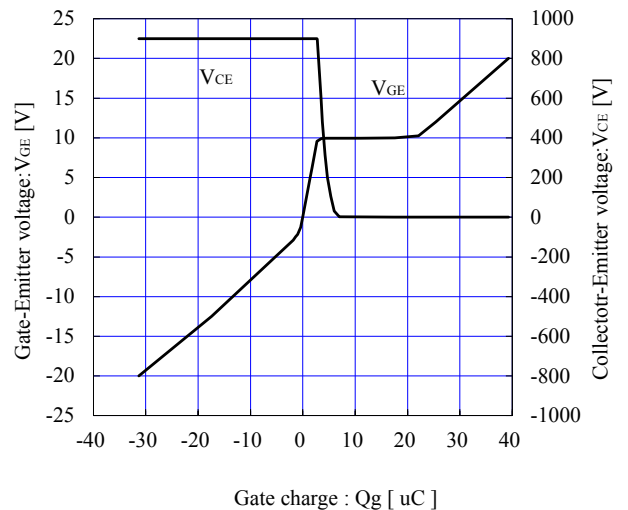
Collector-Emittter voltage vs. Gate-Emittter voltage (typ.)  
Tj=25°C,chip



Capacitance vs. Collector-Emittter voltage (typ.)  
Vge=0V, f= 1MHz, Tj= 25°C

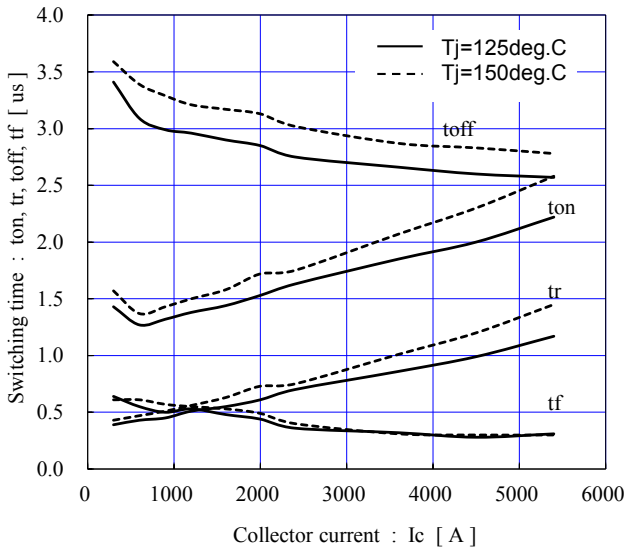


Dynamic Gate charge (typ.)  
Tj= 25°C



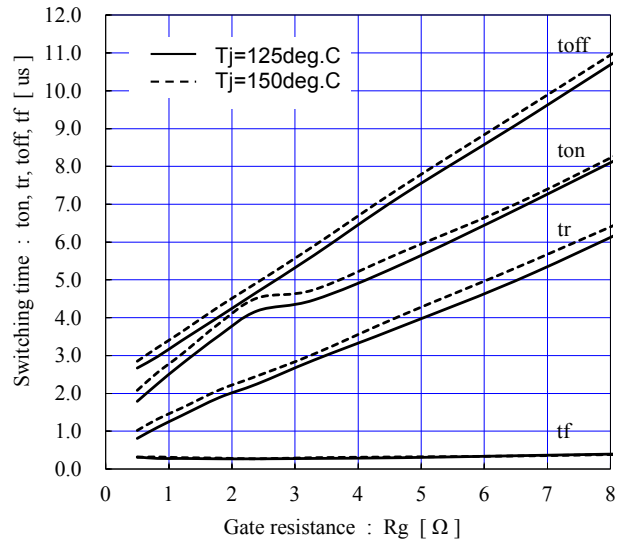
Switching time vs. Collector current (typ.)

$V_{cc}=900V, V_{GE}=\pm 15V, R_{gon}=0.5\Omega, R_{goff}=0.5\Omega$



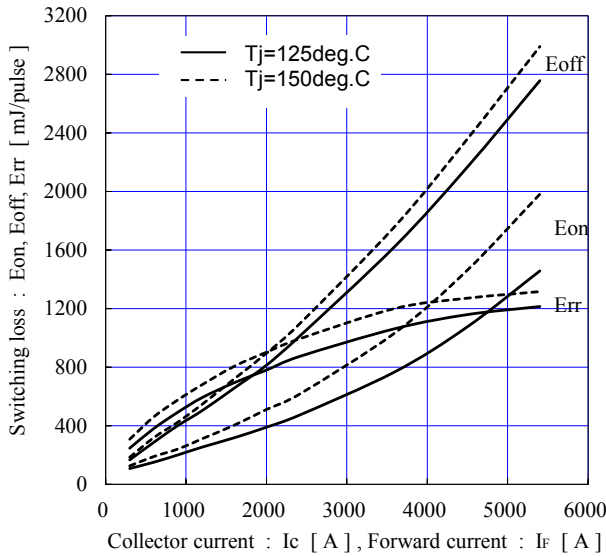
Switching time vs. Gate resistance (typ.)

$V_{cc}=900V, I_c=3600A, V_{GE}=\pm 15V$



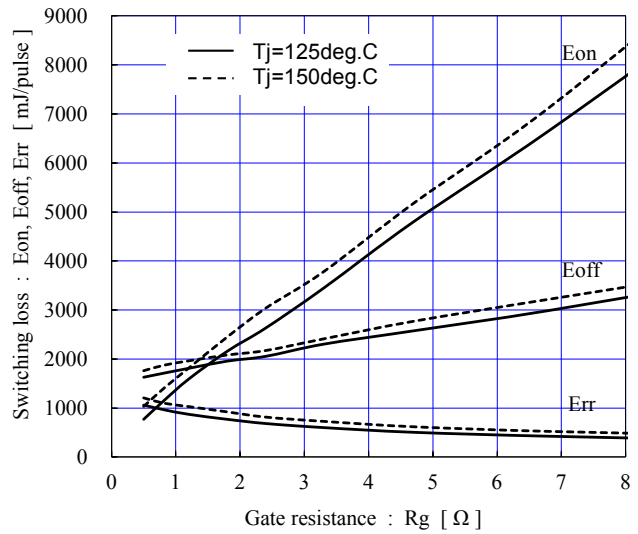
Switching loss vs. Collector current (typ.)

$V_{cc}=900V, V_{GE}=\pm 15V, R_{gon}=0.5\Omega, R_{goff}=0.5\Omega$



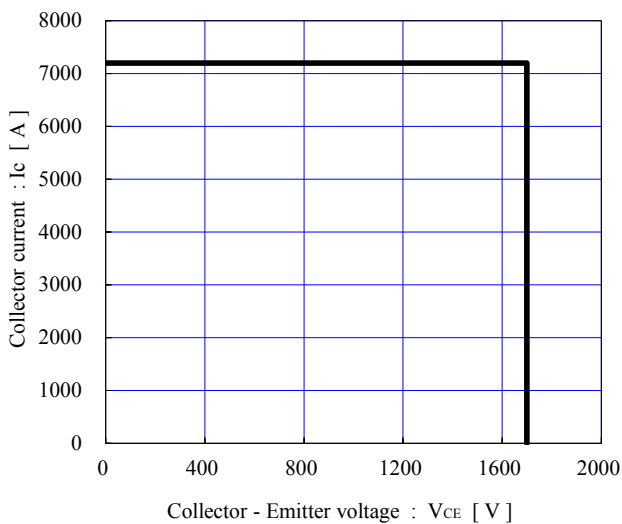
Switching loss vs. Gate resistance (typ.)

$V_{cc}=900V, I_c=3600A, V_{GE}=\pm 15V$

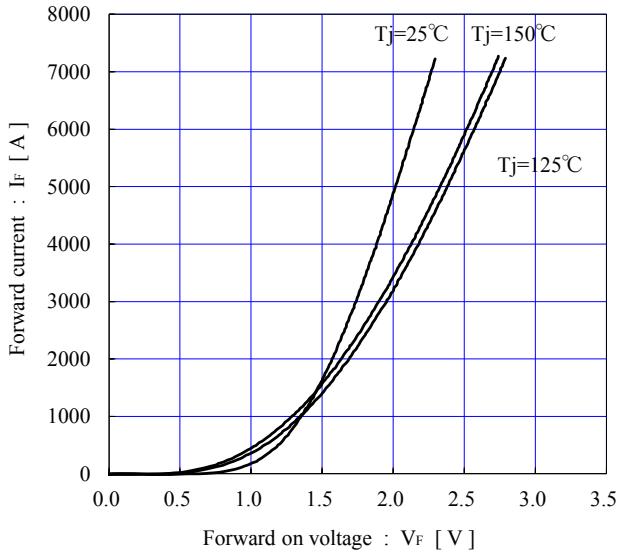


Reverse bias safe operating area (max.)

$\pm V_{GE}=15V, T_j = 150^\circ C / \text{chip}$

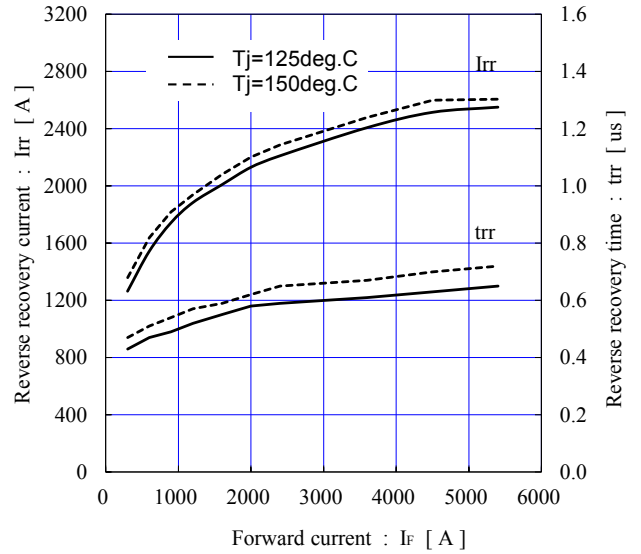


Forward current vs. Forward on voltage (typ.)  
chip



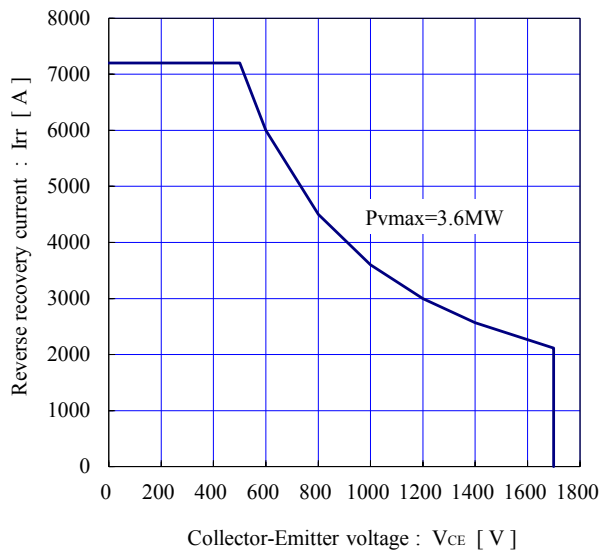
Reverse recovery characteristics (typ.)

V<sub>CC</sub>=900V, V<sub>GE</sub>=±15V, R<sub>gon</sub>=0.5Ω

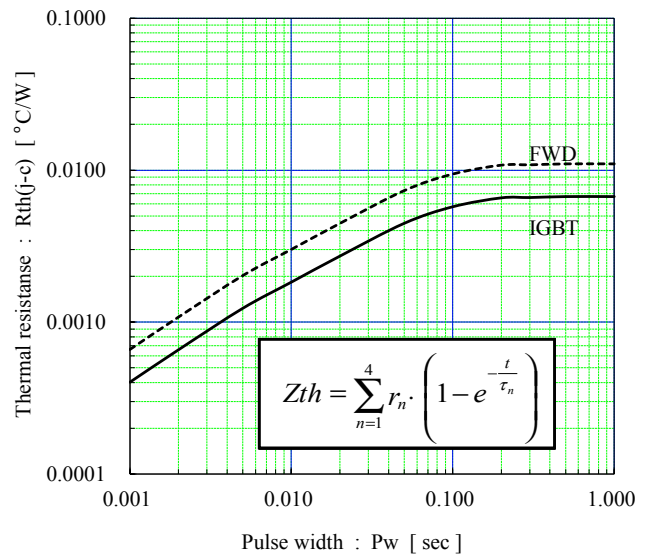


FWD safe operating area (max.)

T<sub>j</sub>=150°C / sence terminals

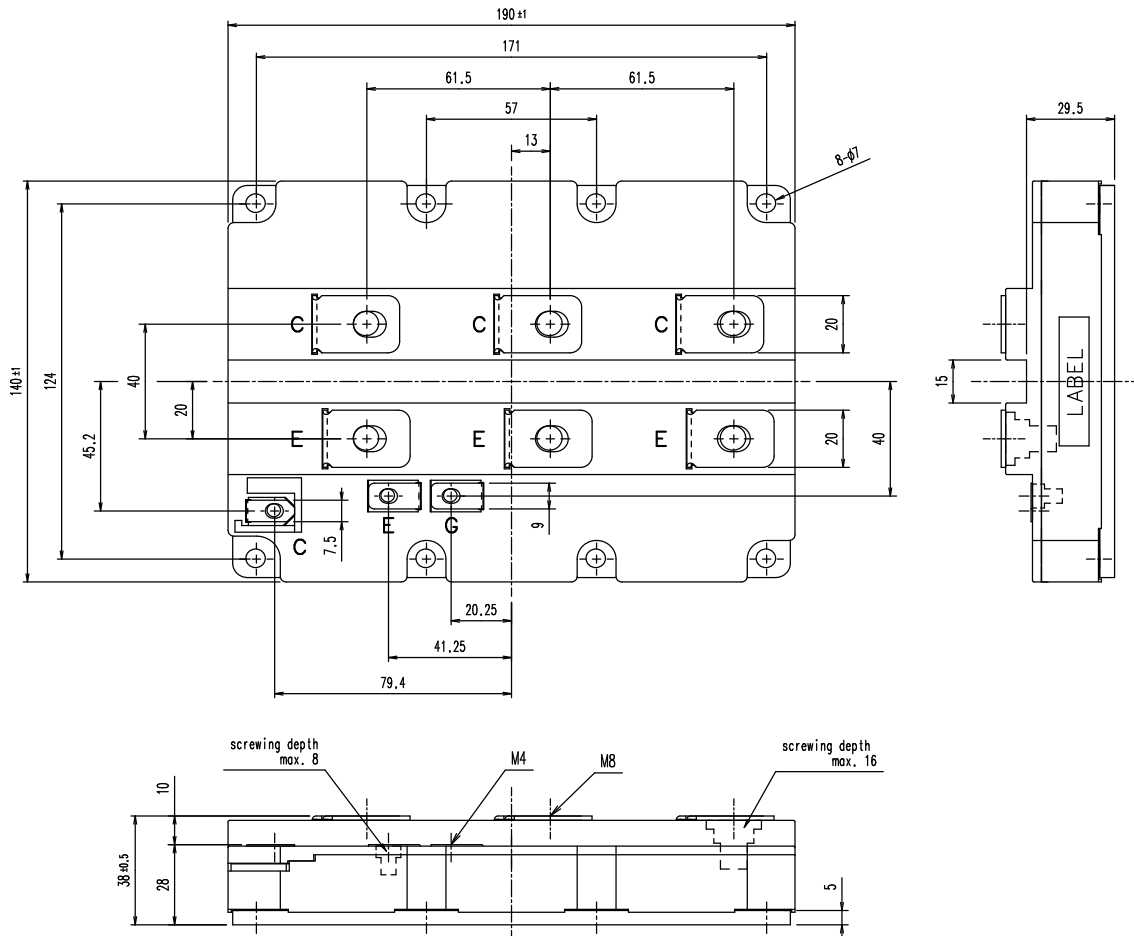


Transient thermal resistance (max.)

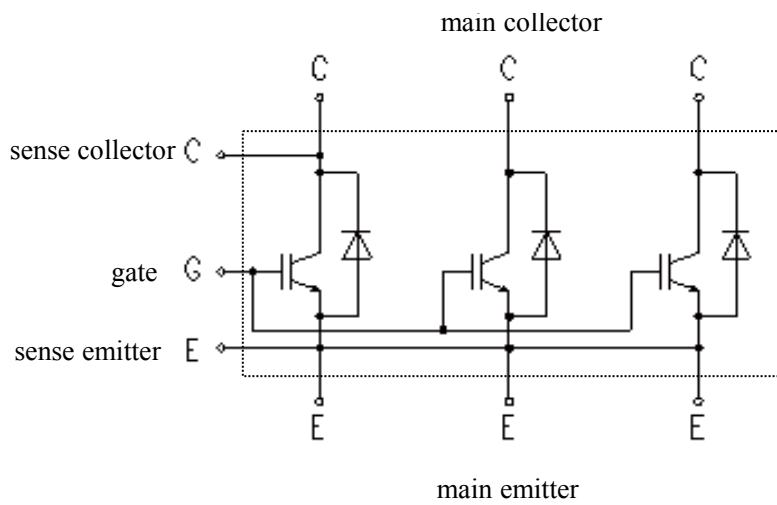


|    | IGBT    | FWD     |
|----|---------|---------|
| r1 | 0.00196 | 0.00226 |
| r2 | 0.00192 | 0.00354 |
| r3 | 0.00153 | 0.00286 |
| r4 | 0.00129 | 0.00234 |
| τ1 | 0.0127  | 0.0069  |
| τ2 | 0.0402  | 0.0477  |
| τ3 | 0.0684  | 0.0586  |
| τ4 | 0.0928  | 0.0765  |

■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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