

1MBI3600VD-170E

IGBT Modules

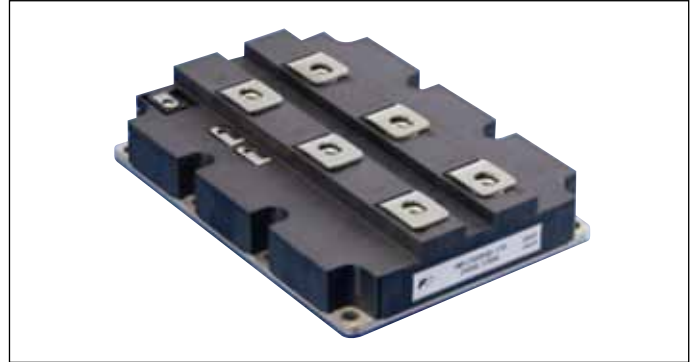
IGBT MODULE (V series) 1700V / 3600A / 1 in one package

■ 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 | $V_{CE(sat)}$ (main terminal) | $V_{GE} = 15V$ $I_c = 3600A$ | $T_j = 25^\circ C$ | - | 2.32 | 2.61 | V |
| | | | $T_j = 125^\circ C$ | - | 2.72 | - | |
| | | | $T_j = 150^\circ C$ | - | 2.77 | - | |
| | $V_{CE(sat)}$ (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 | - | Ω | |
| Input capacitance | C_{ies} | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$ | - | 326 | - | nF | |
| Turn-on | t_{on} | $V_{CC} = 900V, I_c = 3600A$ $L_m = 46nH, V_{GE} = \pm 15V, T_j = 125^\circ C$ | - | 2.27 | - | μs | |
| | t_r | | - | 0.75 | - | | |
| Turn-off | t_{off} | $R_{gon} = 0.5 \Omega$ $R_{goff} = 0.5 \Omega$ | - | 2.67 | - | | |
| | t_f | | - | 0.31 | - | | |
| Forward on voltage | V_F (main terminal) | $V_{GE} = 0V$ $I_F = 3600A$ | $T_j = 25^\circ C$ | - | 2.12 | 2.52 | V |
| | | | $T_j = 125^\circ C$ | - | 2.32 | - | |
| | | | $T_j = 150^\circ C$ | - | 2.30 | - | |
| | V_F (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 | - | μs | |
| Lead resistance, terminal-chip | R lead | | - | 0.089 | - | m Ω | |

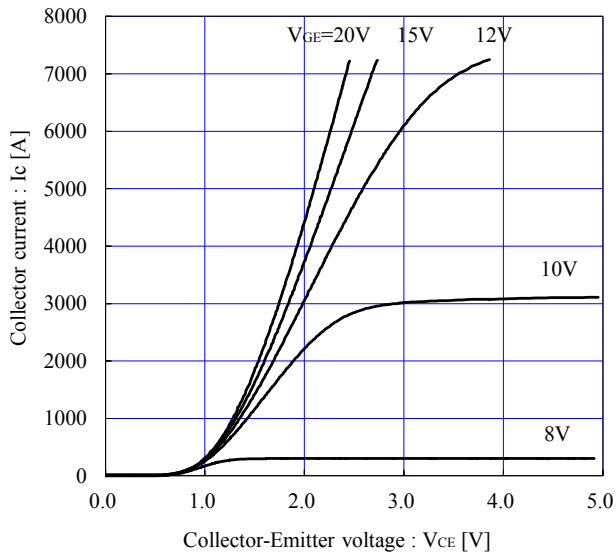
● Thermal resistance characteristics

| 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 | - | |

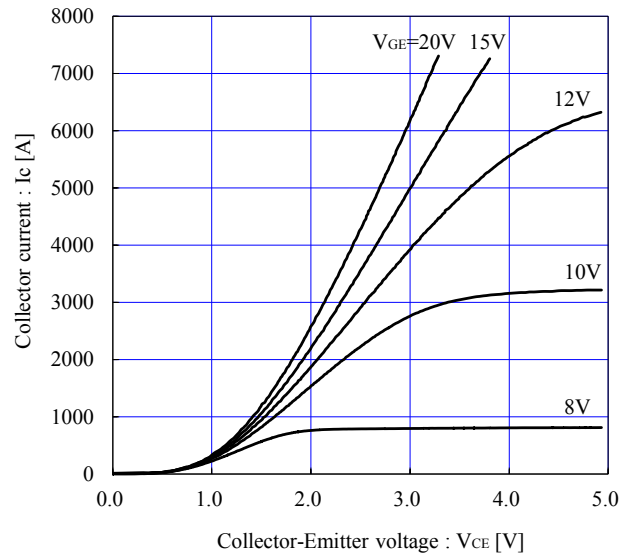
Note *3: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

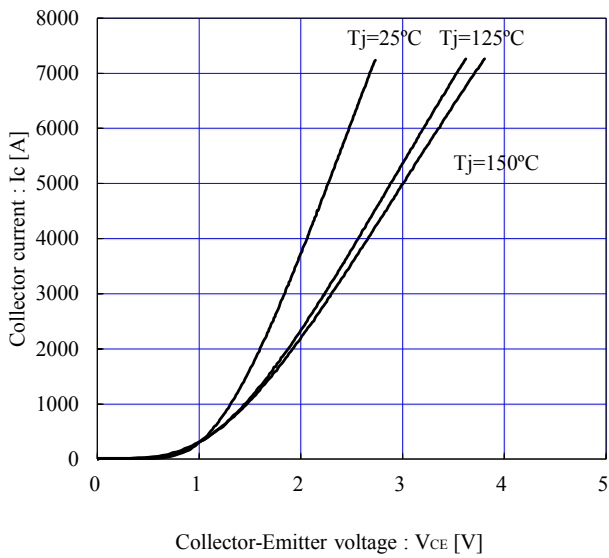
Collector current vs. Collector-Emittor voltage (typ.)
Tj=25°C, chip



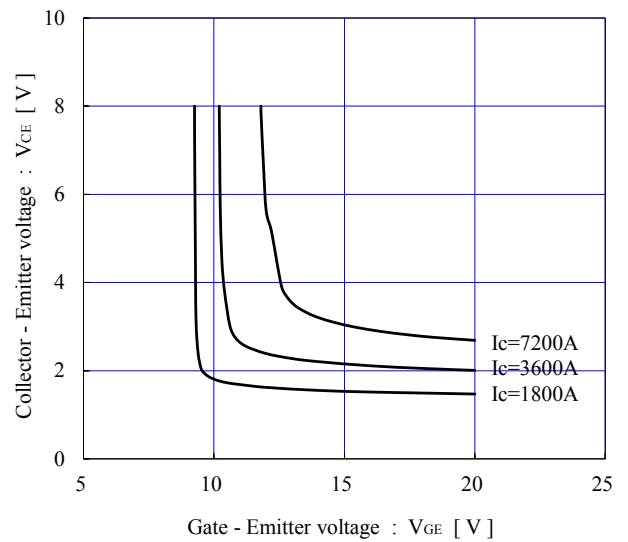
Collector current vs. Collector-Emittor voltage (typ.)
Tj= 150°C, chip



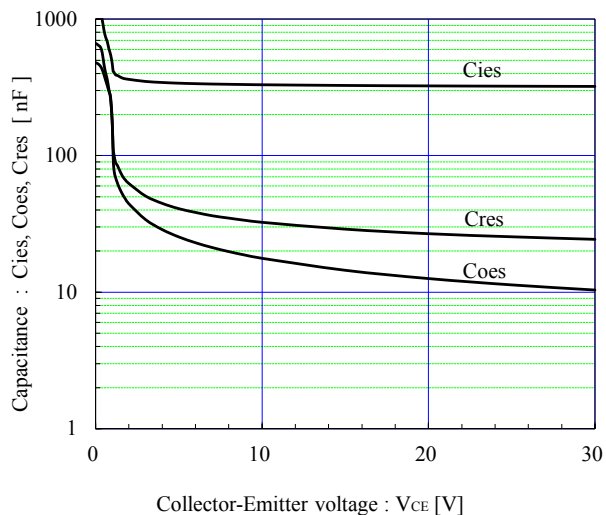
Collector current vs. Collector-Emittor voltage (typ.)
Vge=+15V, chip



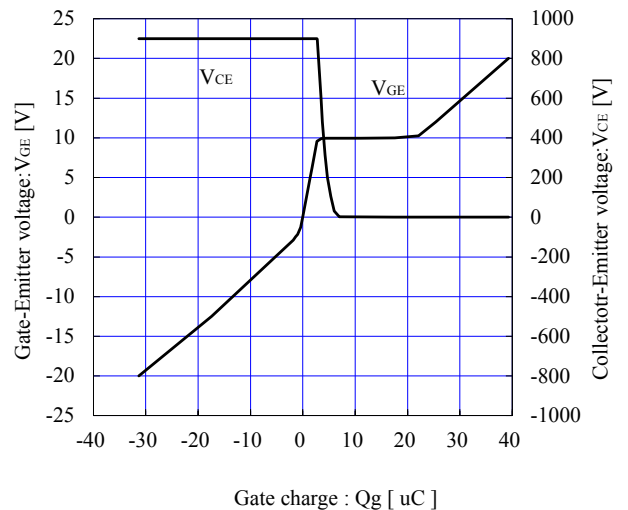
Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)
Tj=25°C, chip



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

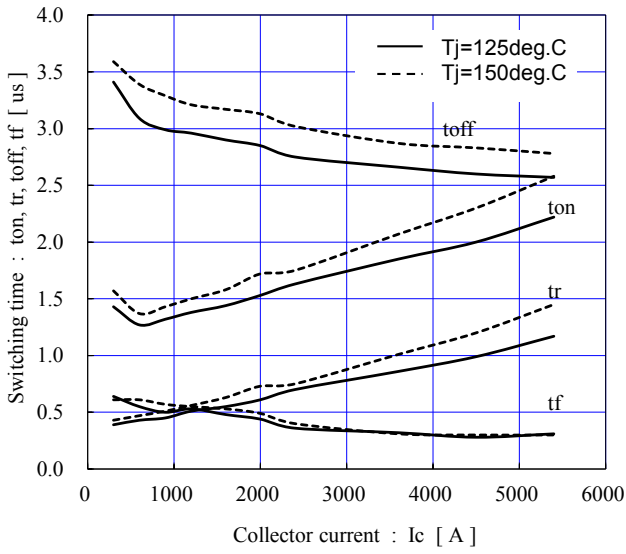


Dynamic Gate charge (typ.)
Tj= 25°C



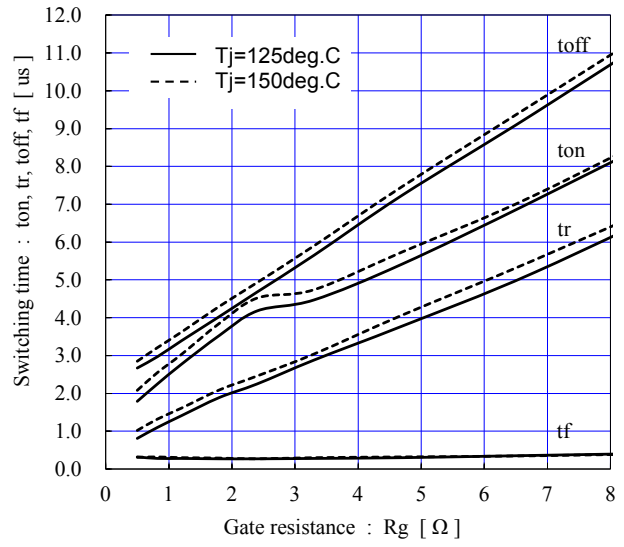
Switching time vs. Collector current (typ.)

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



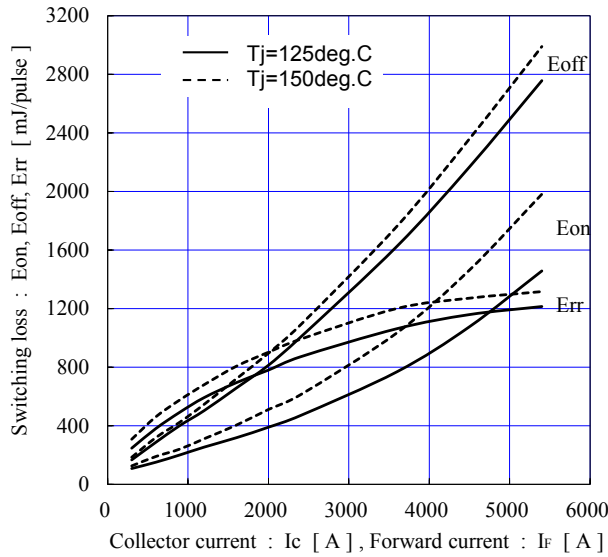
Switching time vs. Gate resistance (typ.)

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



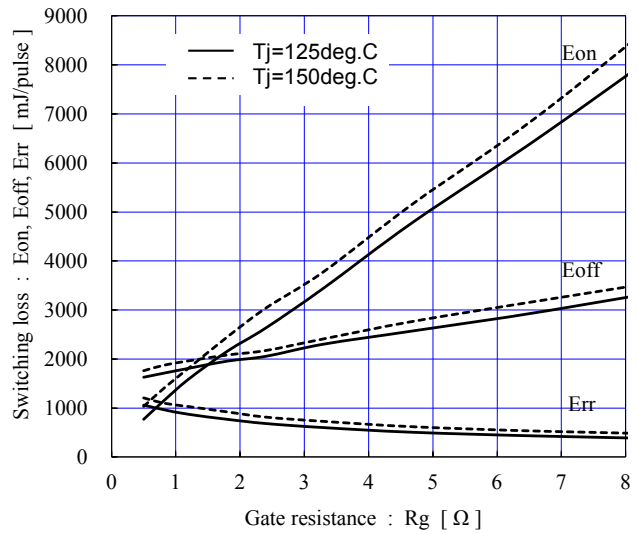
Switching loss vs. Collector current (typ.)

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



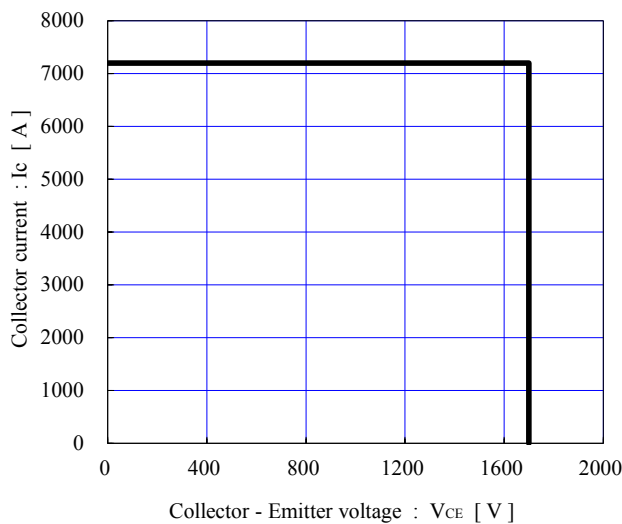
Switching loss vs. Gate resistance (typ.)

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

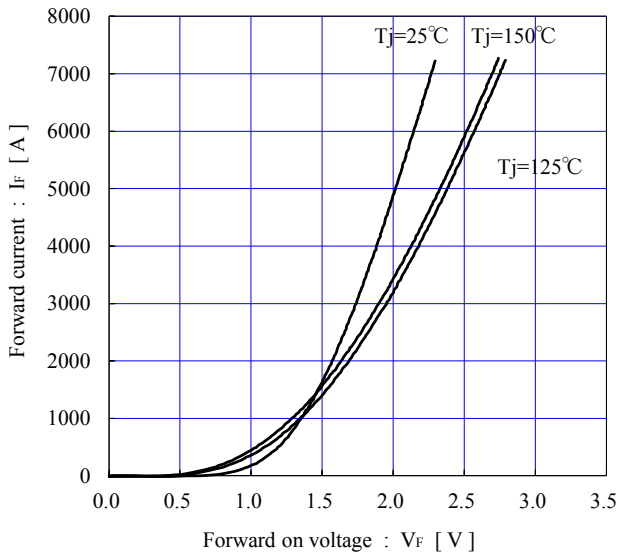


Reverse bias safe operating area (max.)

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

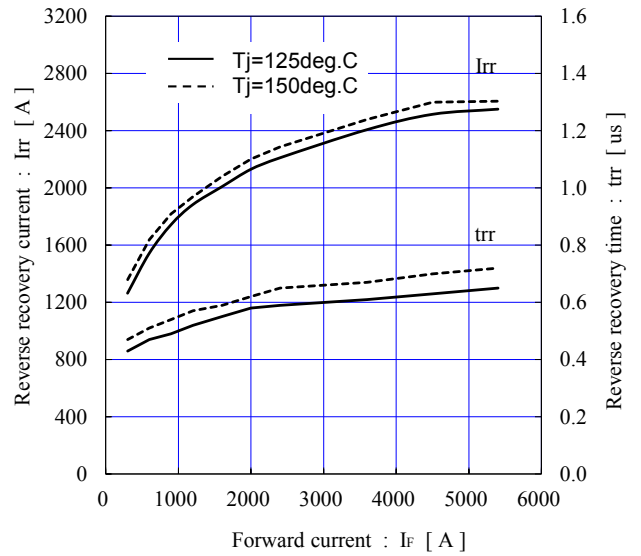


Forward current vs. Forward on voltage (typ.)
chip



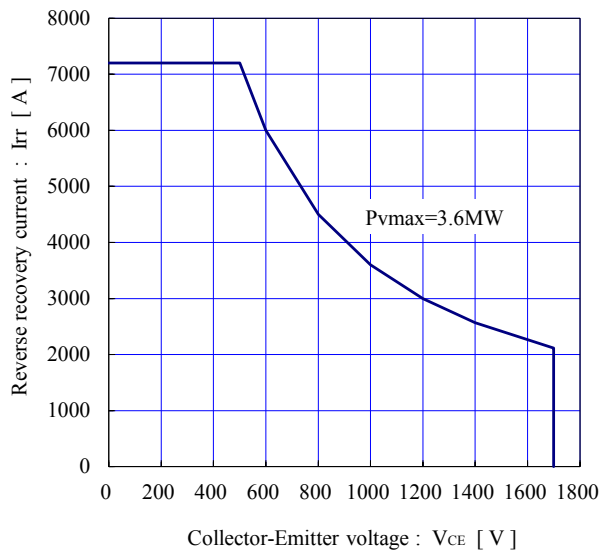
Reverse recovery characteristics (typ.)

V_{CC}=900V, V_{GE}=±15V, R_{gon}=0.5Ω

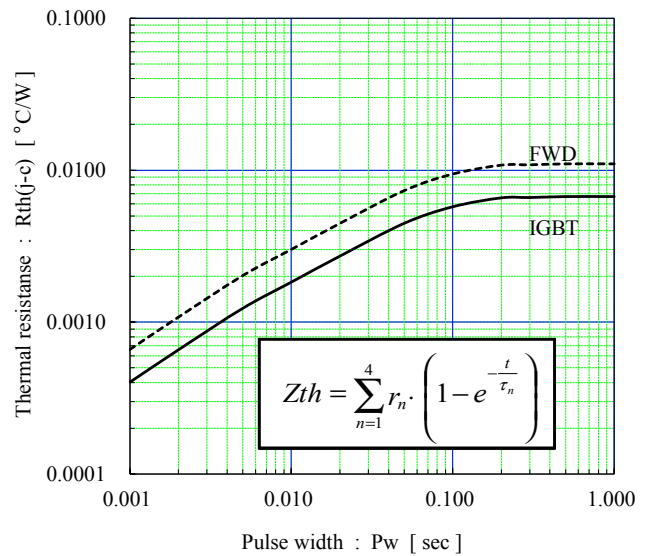


FWD safe operating area (max.)

T_j=150°C / sence terminals

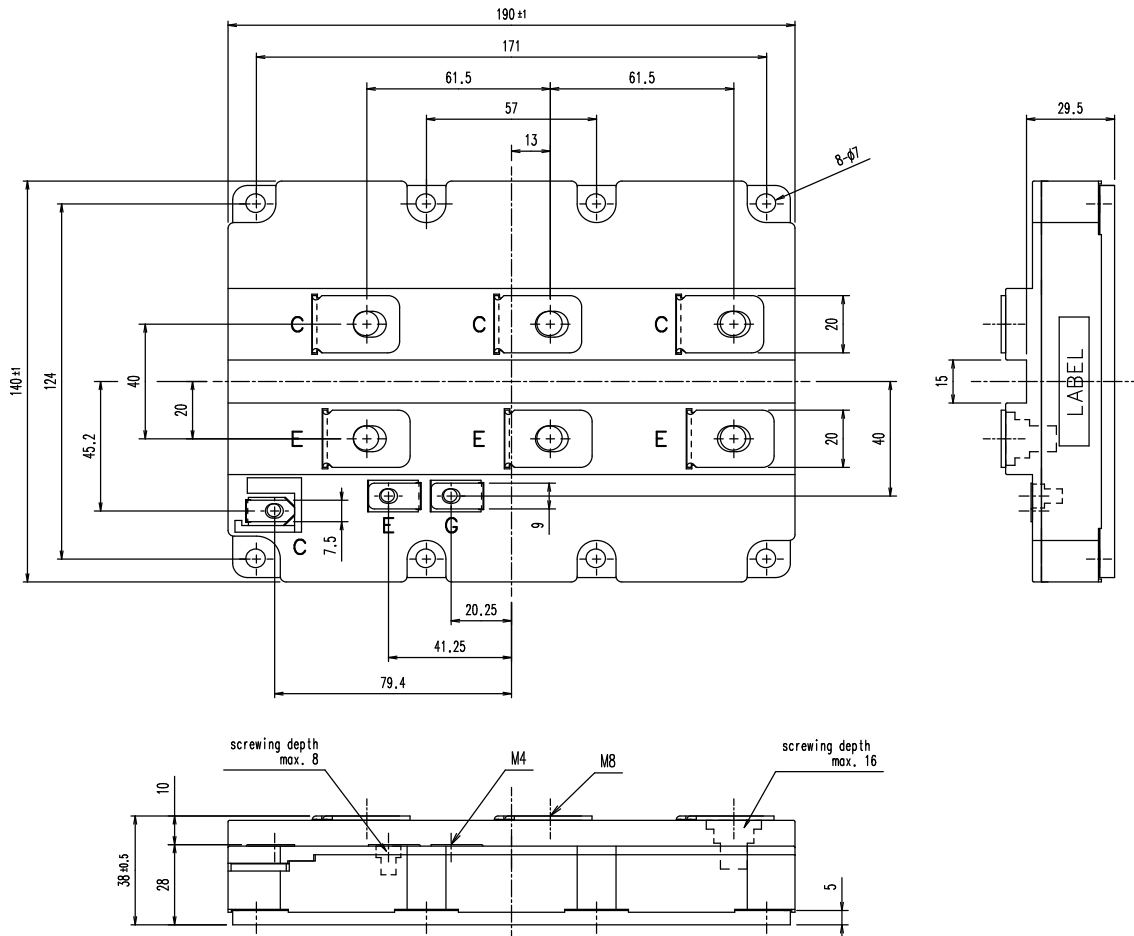


Transient thermal resistance (max.)

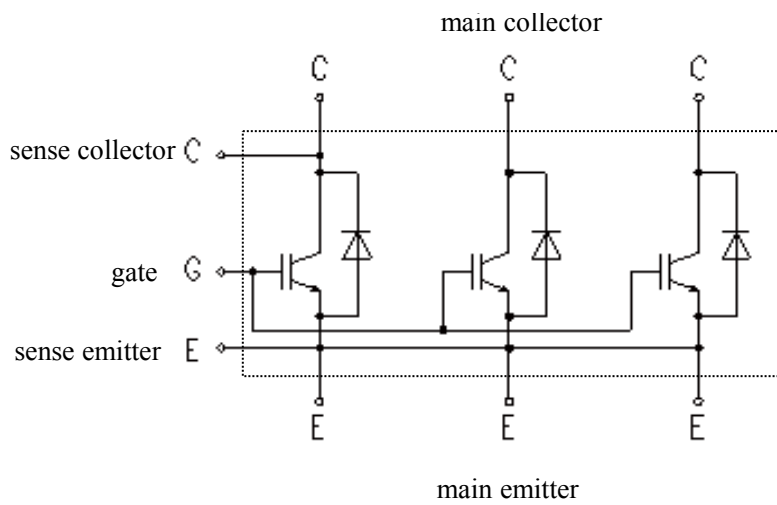


| | IGBT | FWD |
|----|---------|---------|
| r1 | 0.00196 | 0.00226 |
| r2 | 0.00192 | 0.00354 |
| r3 | 0.00153 | 0.00286 |
| r4 | 0.00129 | 0.00234 |
| τ1 | 0.0127 | 0.0069 |
| τ2 | 0.0402 | 0.0477 |
| τ3 | 0.0684 | 0.0586 |
| τ4 | 0.0928 | 0.0765 |

■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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