

# 2MBI600VJ-120-50

IGBT Modules

## IGBT MODULE (V series) 1200V / 600A / 2 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 |
|-------------------------------------------------------------|---------------------------------------|--------------|-----------------|-------|
| Inverter                                                    | Collector-Emitter voltage             | $V_{CES}$    | 1200            | V     |
|                                                             | Gate-Emitter voltage                  | $V_{GES}$    | $\pm 20$        | V     |
|                                                             | Collector current                     | $I_c$        | Continuous      | A     |
|                                                             |                                       | $I_c$ pulse  | 1ms             |       |
|                                                             |                                       | $-I_c$       |                 |       |
|                                                             |                                       | $-I_c$ pulse | 1ms             |       |
|                                                             | Collector power dissipation           | $P_c$        | 1 device        | W     |
| Junction temperature                                        |                                       | $T_j$        | 175             | °C    |
| Operating junction temperature (under switching conditions) |                                       | $T_{jop}$    | 150             |       |
| Case temperature                                            |                                       | $T_c$        | 125             |       |
| Storage temperature                                         |                                       | $T_{stg}$    | -40 to +125     |       |
| Isolation voltage                                           | between terminal and copper base (*1) | $V_{iso}$    | 2500            | VAC   |
|                                                             | between thermistor and others (*2)    |              |                 |       |
| Screw torque                                                | Mounting (*3)                         | -            | 3.5             | N m   |
|                                                             | Terminals (*4)                        |              | 4.5             |       |
|                                                             | PC-Board (*5)                         |              | 0.6             |       |

Note \*1: All terminals should be connected together during the test.

Note \*2: Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

Note \*3: Recommendable value : 2.5-3.5 Nm (M5) Note \*4: Recommendable value : 3.5-4.5 Nm (M6)

Note \*5: Recommendable value : 0.4-0.6 Nm (M2.5)

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

| Items                 |                                      |  |          | Symbols                     | Conditions                               | Characteristics      |      |      | Units |          |
|-----------------------|--------------------------------------|--|----------|-----------------------------|------------------------------------------|----------------------|------|------|-------|----------|
|                       |                                      |  |          |                             |                                          | min.                 | typ. | max. |       |          |
| Inverter              | Zero gate voltage collector current  |  |          | $I_{CES}$                   | $V_{GE} = 0V, V_{CE} = 1200V$            |                      | -    | -    | 3.0   | mA       |
|                       | Gate-Emitter leakage current         |  |          | $I_{GES}$                   | $V_{CE} = 0V, V_{GE} = \pm 20V$          |                      | -    | -    | 600   | nA       |
|                       | Gate-Emitter threshold voltage       |  |          | $V_{GE(th)}$                | $V_{CE} = 20V, I_C = 600mA$              |                      | 6.0  | 6.5  | 7.0   | V        |
|                       | Collector-Emitter saturation voltage |  |          | $V_{CE(sat)}$<br>(terminal) | $V_{GE} = 15V$<br>$I_C = 600A$           | $T_J = 25^{\circ}C$  | -    | 2.45 | 2.90  | V        |
|                       |                                      |  |          |                             |                                          | $T_J = 125^{\circ}C$ | -    | 2.80 | -     |          |
|                       |                                      |  |          | $V_{CE(sat)}$<br>(chip)     |                                          | $T_J = 150^{\circ}C$ | -    | 2.85 | -     |          |
|                       |                                      |  |          |                             |                                          | $T_J = 25^{\circ}C$  | -    | 1.85 | 2.30  |          |
|                       |                                      |  |          |                             |                                          | $T_J = 125^{\circ}C$ | -    | 2.20 | -     |          |
|                       |                                      |  |          |                             |                                          | $T_J = 150^{\circ}C$ | -    | 2.25 | -     |          |
|                       | Input capacitance                    |  |          | $C_{ies}$                   | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$    |                      | -    | 48   | -     | nF       |
|                       | Turn-on time                         |  |          | $t_{on}$                    | $V_{CC} = 600V$<br>$I_C = 600A$          | -                    | 550  | 1200 | nsec  |          |
|                       |                                      |  |          | $t_r$                       |                                          | -                    | 180  | 600  |       |          |
|                       |                                      |  |          | $t_r(i)$                    |                                          | -                    | 120  | -    |       |          |
|                       | Turn-off time                        |  |          | $t_{off}$                   | $V_{GE} = \pm 15V$<br>$R_G = 0.62\Omega$ | -                    | 1050 | 2000 | nsec  |          |
|                       |                                      |  |          | $t_f$                       |                                          | -                    | 110  | 350  |       |          |
|                       | Forward on voltage                   |  |          | $V_F$<br>(terminal)         | $V_{GE} = 0V$<br>$I_F = 600A$            | $T_J = 25^{\circ}C$  | -    | 2.30 | 2.75  | V        |
|                       |                                      |  |          |                             |                                          | $T_J = 125^{\circ}C$ | -    | 2.45 | -     |          |
|                       |                                      |  |          |                             |                                          | $T_J = 150^{\circ}C$ | -    | 2.40 | -     |          |
|                       |                                      |  |          | $V_F$<br>(chip)             |                                          | $T_J = 25^{\circ}C$  | -    | 1.70 | 2.15  |          |
| $T_J = 125^{\circ}C$  |                                      |  |          |                             |                                          | -                    | 1.85 | -    |       |          |
| $T_J = 150^{\circ}C$  |                                      |  |          |                             |                                          | -                    | 1.80 | -    |       |          |
| Reverse recovery time |                                      |  | $t_{rr}$ | $I_F = 600A$                |                                          | -                    | 200  | 600  | nsec  |          |
| Thermistor            | Resistance                           |  |          | $R$                         | $T = 25^{\circ}C$                        |                      | -    | 5000 | -     | $\Omega$ |
|                       |                                      |  |          |                             | $T = 100^{\circ}C$                       |                      | 465  | 495  | 520   |          |
|                       | B value                              |  |          | $B$                         | $T = 25/50^{\circ}C$                     |                      | 3305 | 3375 | 3450  | K        |

#### ● Thermal resistance characteristics

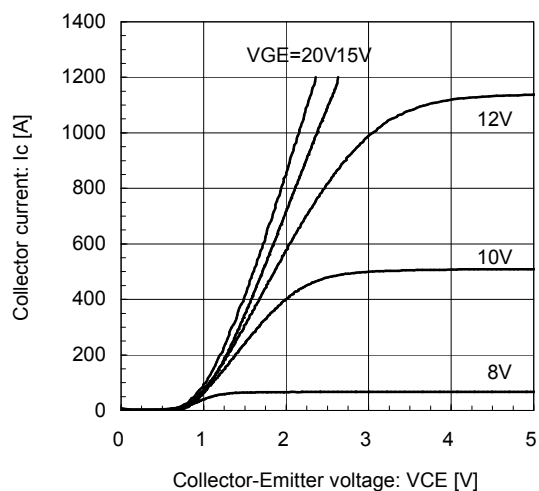
| Items                                     | Symbols       | Conditions            | Characteristics |        |      | Units |
|-------------------------------------------|---------------|-----------------------|-----------------|--------|------|-------|
|                                           |               |                       | min.            | typ.   | max. |       |
| Thermal resistance (1device)              | $R_{th(j-c)}$ | Inverter IGBT         | -               | -      | 0.04 | °C/W  |
|                                           |               | Inverter FWD          | -               | -      | 0.06 |       |
| Contact thermal resistance (1device) (*6) | $R_{th(c-f)}$ | with Thermal Compound | -               | 0.0167 | -    |       |

Note \*6: This is the value which is defined mounting on the additional cooling fin with thermal compound.

## ■ Characteristics (Representative)

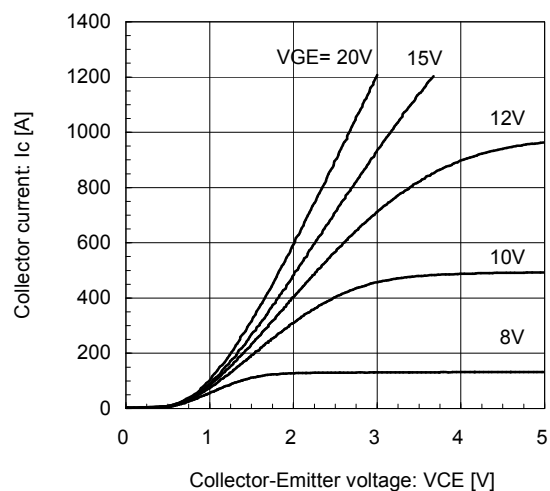
[INVERTER]

Collector current vs. Collector-Emitter voltage (typ.)  
T<sub>j</sub> = 25°C / chip



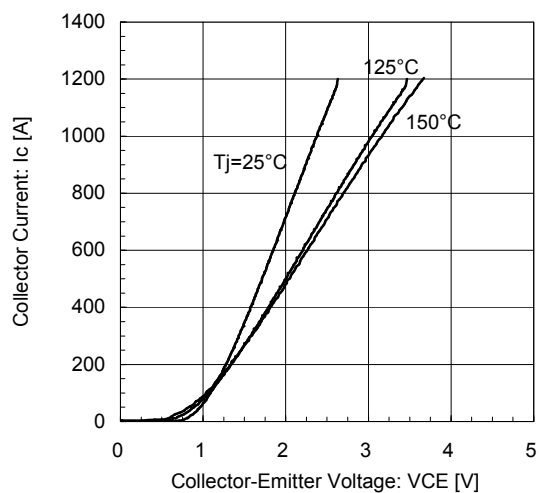
[INVERTER]

Collector current vs. Collector-Emitter voltage (typ.)  
T<sub>j</sub> = 150°C / chip



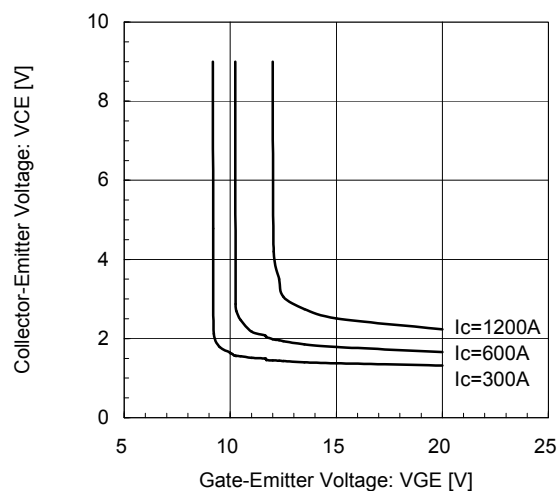
[INVERTER]

Collector current vs. Collector-Emitter voltage (typ.)  
V<sub>GE</sub> = 15V / chip



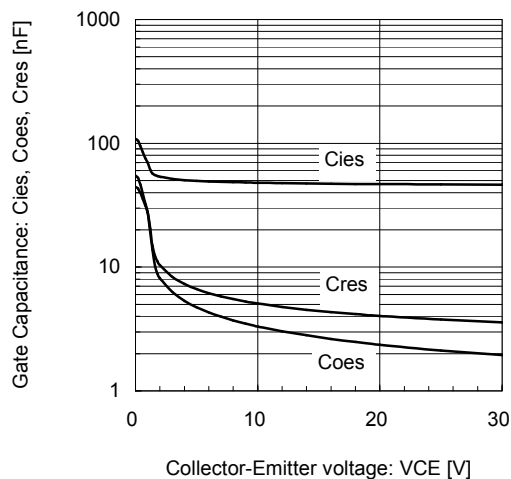
[INVERTER]

Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)  
T<sub>j</sub> = 25°C / chip



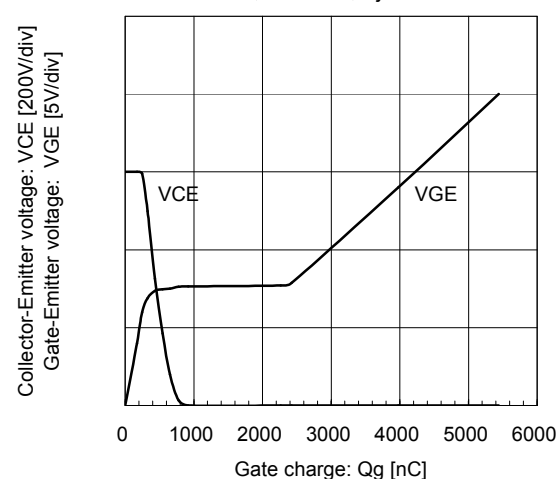
[INVERTER]

Gate Capacitance vs. Collector-Emitter Voltage (typ.)  
V<sub>GE</sub> = 0V, f = 1MHz, T<sub>j</sub> = 25°C



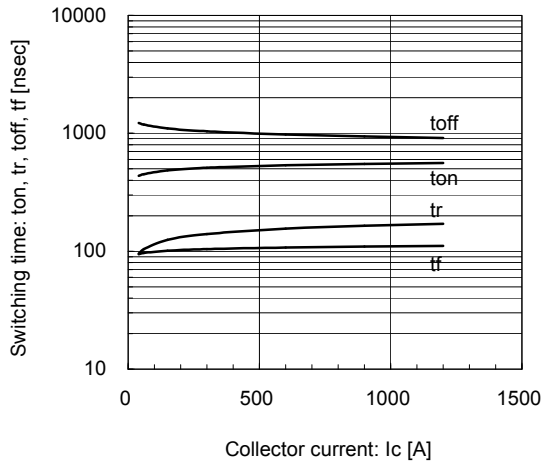
[INVERTER]

Dynamic Gate Charge (typ.)  
V<sub>CC</sub> = 600V, I<sub>c</sub> = 600A, T<sub>j</sub> = 25°C



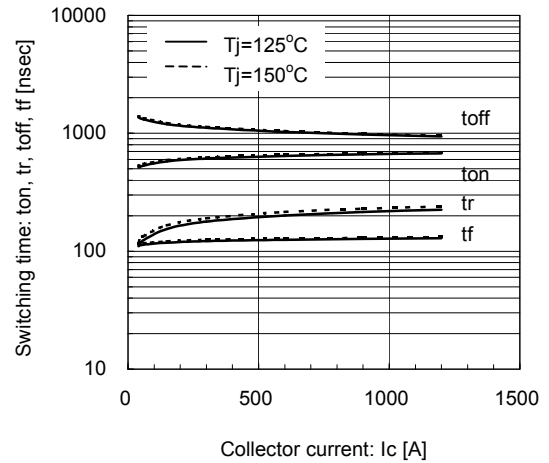
## [INVERTER]

Switching time vs. Collector current (typ.)  
 $V_{cc}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_g=0.62\Omega$ ,  $T_j=25^\circ C$



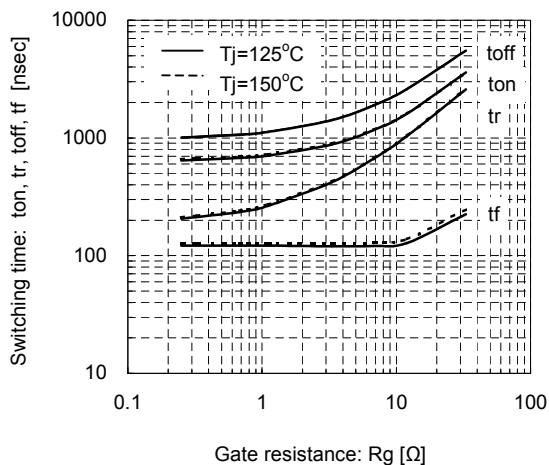
## [INVERTER]

Switching time vs. Collector current (typ.)  
 $V_{cc}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_g=0.62\Omega$ ,  $T_j=125^\circ C, 150^\circ C$



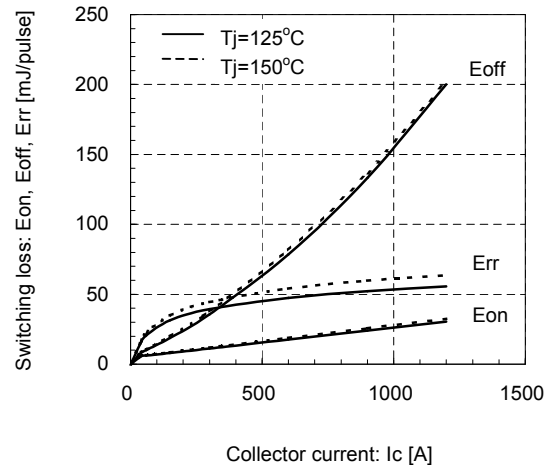
## [INVERTER]

Switching time vs. Gate resistance (typ.)  
 $V_{cc}=600V$ ,  $I_c=600A$ ,  $V_{GE}=\pm 15V$ ,  $T_j=125^\circ C, 150^\circ C$



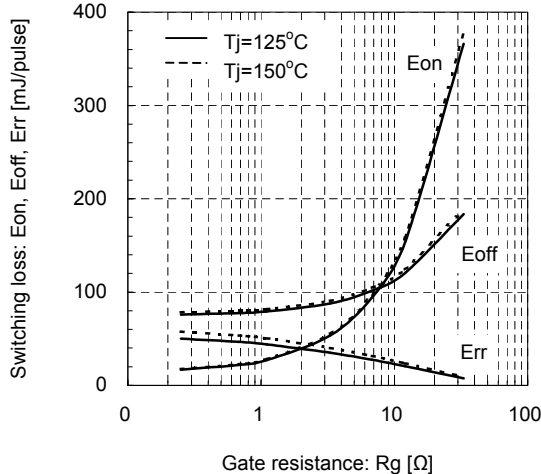
## [INVERTER]

Switching loss vs. Collector current (typ.)  
 $V_{cc}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_g=0.62\Omega$ ,  $T_j=125^\circ C, 150^\circ C$



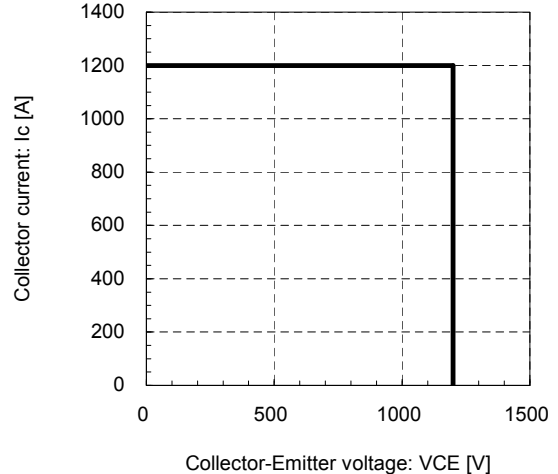
## [INVERTER]

Switching loss vs. Gate resistance (typ.)  
 $V_{cc}=600V$ ,  $I_c=600A$ ,  $V_{GE}=\pm 15V$ ,  $T_j=125^\circ C, 150^\circ C$

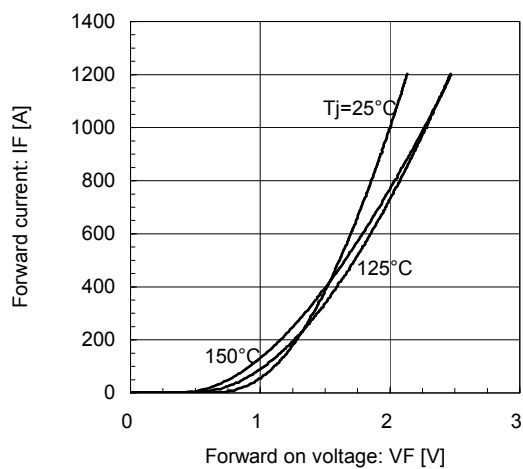


## [INVERTER]

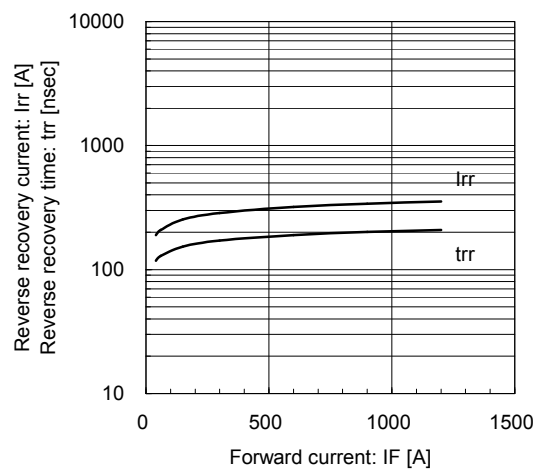
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V$ ,  $-V_{GE}=15V$ ,  $R_g=0.62\Omega$ ,  $T_j=150^\circ C$



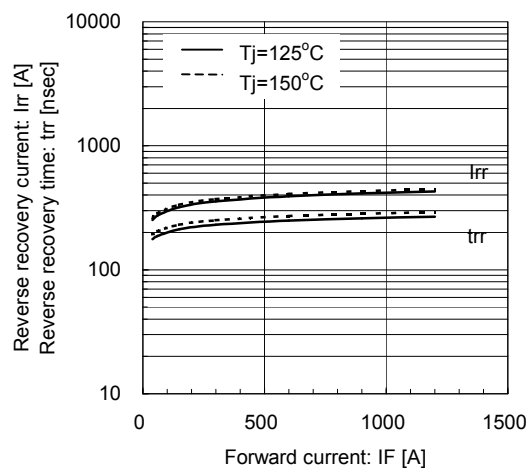
## [INVERTER]

Forward Current vs. Forward Voltage (typ.)  
chip

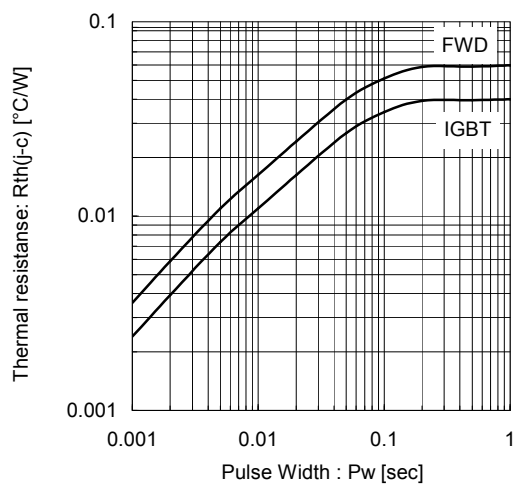
## [INVERTER]

Reverse Recovery Characteristics (typ.)  
Vcc=600V, VGE=±15V, Rg=0.62Ω, Tj=25°C

## [INVERTER]

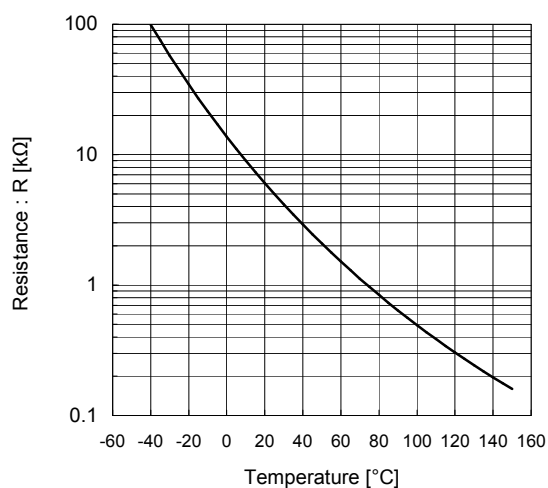
Reverse Recovery Characteristics (typ.)  
Vcc=600V, VGE=±15V, Rg=0.62Ω, Tj=125°C, 150°C

Transient Thermal Resistance (max.)

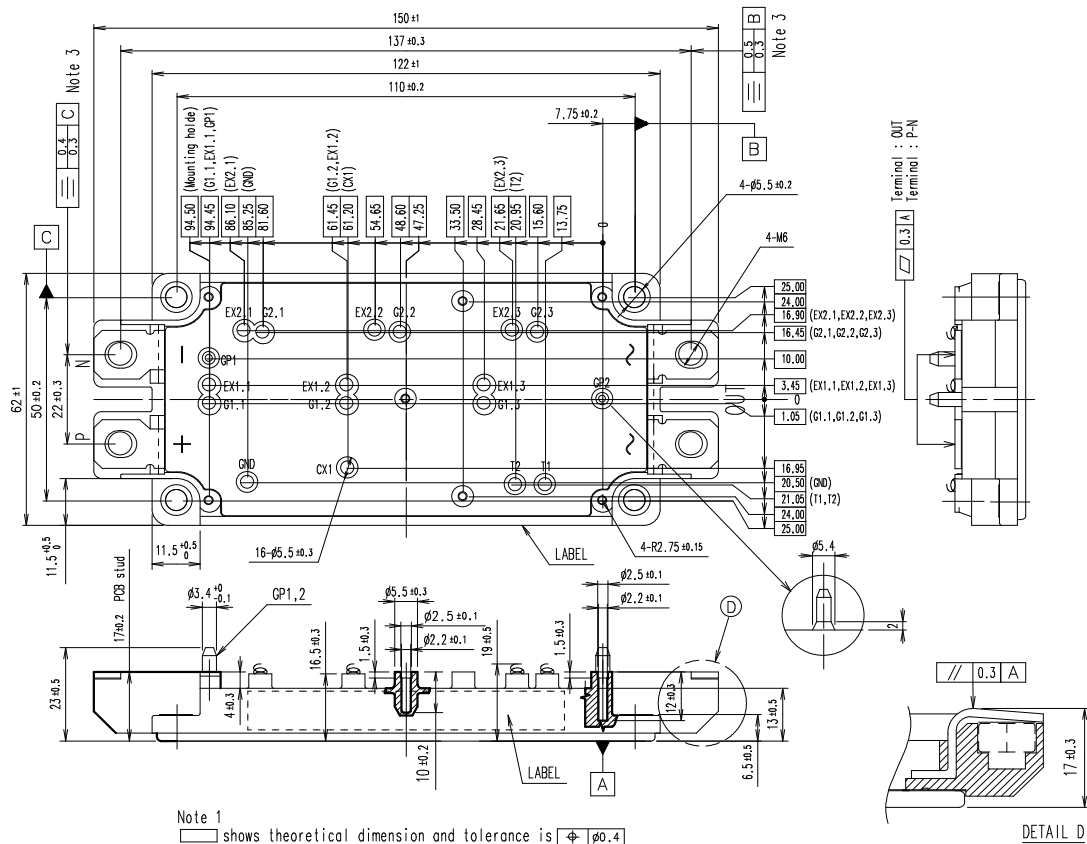


## [THERMISTOR]

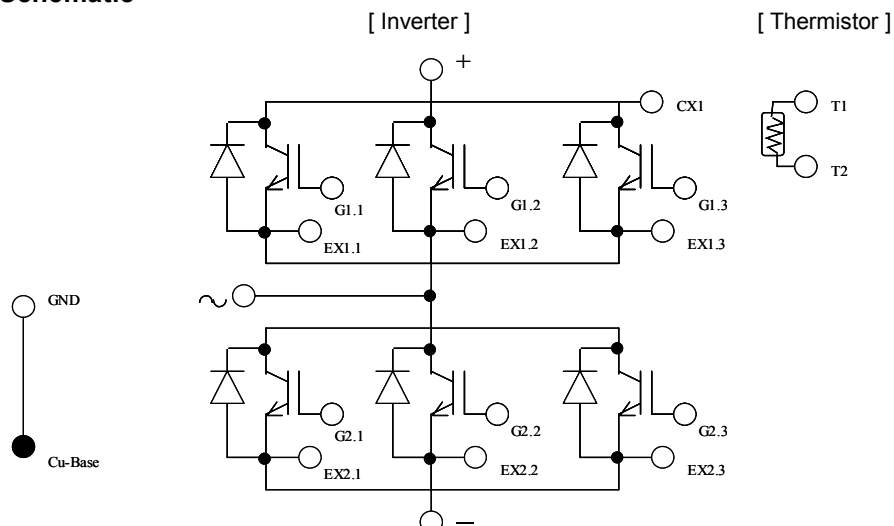
Temperature characteristic (typ.)



## Outline Drawings, mm



## Equivalent Circuit Schematic



**WARNING**

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|                 |                         |                                               |                          |
|-----------------|-------------------------|-----------------------------------------------|--------------------------|
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|                                                                             |                                                       |
|-----------------------------------------------------------------------------|-------------------------------------------------------|
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|                                |                        |                             |
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| • Submarine repeater equipment |                        |                             |
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