# 2MBI1000XRNE120-50

**IGBT Modules**

## Power Module (X series)
## 1200V / 1000A / 2-in-1 package

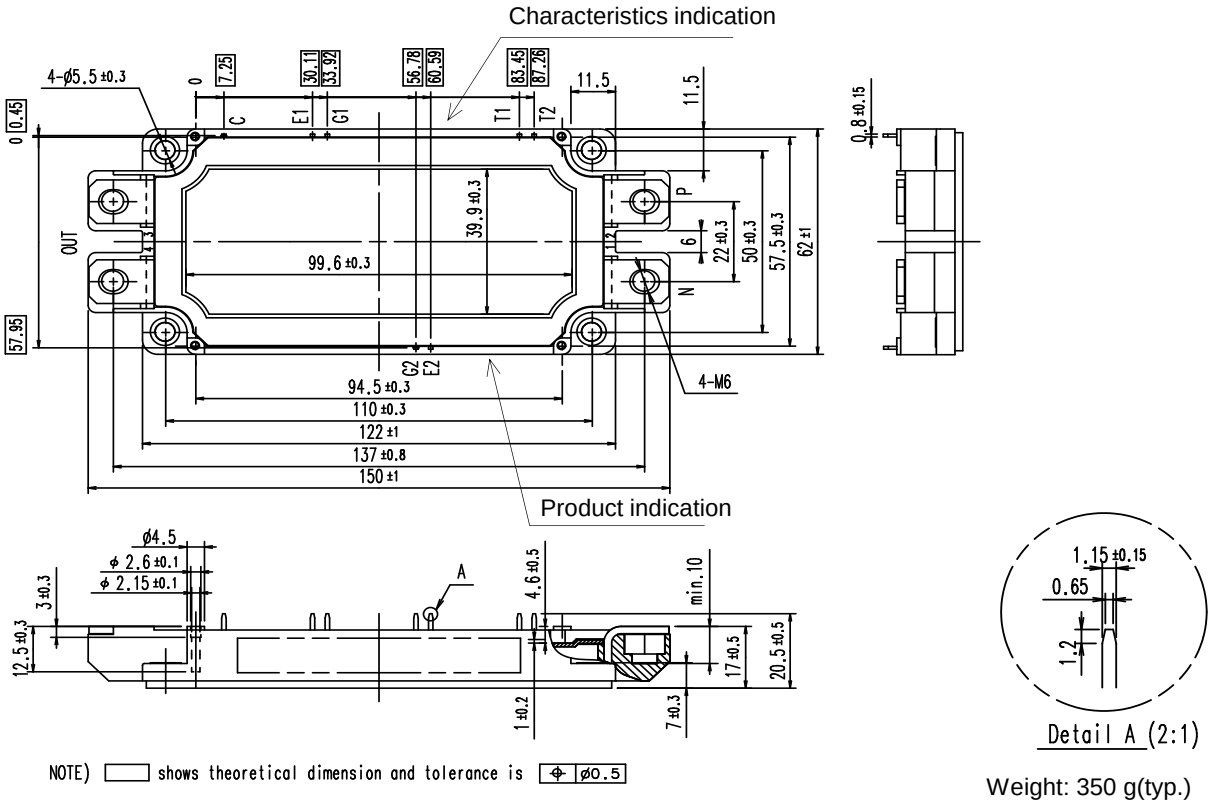
### ■ Features

Low $V_{CE(sat)}$
Low Inductance Module structure
Solder pin terminals

### ■ Applications

Inverter for Motor Drives, AC and DC Servo Drives
Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems

### ■ Outline drawing ( Unit : mm )

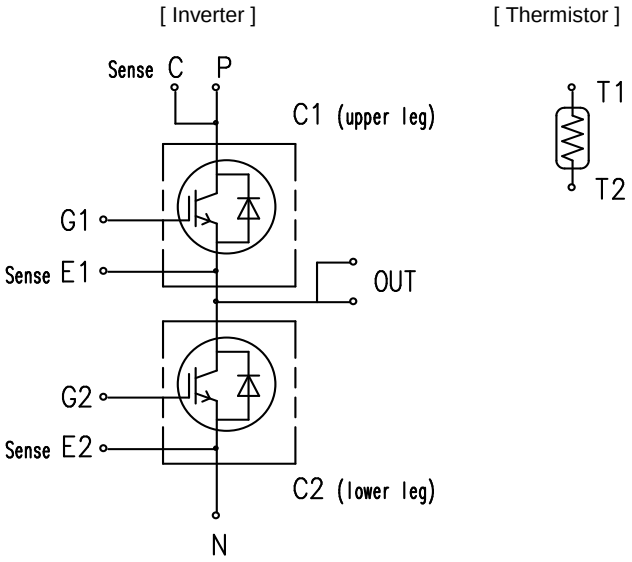






Weight: 350 g(typ.)

### ■ Equivalent Circuit



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## ■ Absolute Maximum Ratings (at $T_C$= 25°C unless otherwise specified)

| Items | | Symbols | Conditions | | Maximum Ratings | Units |
|---|---|---|---|---|---|---|
| Inverter | Collector-emitter voltage, gate-emitter short-circuited | $V_{CES}$ | | | 1200 | V |
| | Gate-emitter voltage, collector-emitter short-circuited | $V_{GES}$ | | | ±20 | V |
| | Collector current | $I_C$ | Continuous | $T_C$=100°C | 1000 | A |
| | Repetitive peak collector current | $I_{CRM}$ | 1ms | | 2000 | |
| | Reverse-conducting current | $I_{RC}$ | | | 1000 | |
| | Repetitive peak reverse-conducting current | $I_{RCRM}$ | 1ms | | 2000 | |
| | Total power dissipation | $P_{tot}$ | 1 device | | 8330 | W |
| | Virtual junction temperature | $T_{vj}$ | | | 175 | °C |
| | Operating virtual junction temperature (under switching conditions) | $T_{vjop}$ | | | 175 | |
| Case temperature | | $T_c$ | | | 150 | |
| Storage temperature | | $T_{stg}$ | | | -40 ~ 150 | |
| Isolation voltage | between terminals and copper base (*1)<br>between thermistor and others (*2) | $V_{isol}$ | AC: 1min. | | 4000 | Vrms |
| Mounting torque for screws to heatsink (*3) | | $M_s$ | M5 | | 6.0 | N·m |
| Mounting torque for terminal screws (*3) | | $M_t$ | M6 | | 6.0 | |

(*1) All terminals should be connected together during the test.

(*2) Two thermistor terminals should be connected together, other terminals should be connected together

(*3) Recommendable Value: : Mounting torque of screws to heatsink 2.5 ~ 6.0 N·m (M5)

Recommendable Value: : Mounting torque of screws to terminals 3.5 ~ 6.0 N·m (M6)

## ■ Electrical characteristics (at $T_{vj}$= 25°C unless otherwise specified)

| | Items | Symbols | Conditions | | Characteristics min. | Characteristics typ. | Characteristics max. | Units |
|---|---|---|---|---|---|---|---|---|
| Inverter | Collector-emitter cut-off current, Collector current | $I_{CES}$ | $V_{GE}$ = 0V<br>$V_{CE}$ = 1200V | | - | - | 200 | μA |
| | Gate leakage current, collector-emitter short-circuited | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | - | - | 400 | nA |
| | Gate-emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = 20V<br>$I_C$ = 1000mA | | 5.8 | 6.4 | 7.0 | V |
| | Collector-emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE}$ = 15V<br>$I_C$ = 1000A | $T_{vj}$=25°C | - | 2.75 | 3.30 | V |
| | | $V_{CE(sat)}$ (chip) | | $T_{vj}$=25°C | - | 1.55 | 2.00 | |
| | | | | $T_{vj}$=125°C | - | 1.85 | - | |
| | | | | $T_{vj}$=150°C | - | 1.95 | - | |
| | | | | $T_{vj}$=175°C | - | 2.00 | - | |
| | Internal gate resistance | $r_g$ | - | | - | 0.95 | - | Ω |
| | Input capacitance | $C_{ies}$ | $V_{CE}$=10V, $V_{GE}$=0V, f=1MHz | | - | 126 | - | nF |
| | Output capacitance | $C_{oes}$ | | | - | 5.3 | - | |
| | Reverse transfer capacitance | $C_{res}$ | | | - | 1.19 | - | |
| | Gate charge | $Q_G$ | $V_{CC}$ = 600V, $I_C$ = 1000A<br>$V_{GE}$ = -15 → +15V | | - | 7.8 | - | μC |
| | Reverse-conducting voltage | $V_{RC}$ (terminal) | $V_{GE}$ = 0V<br>$I_{RC}$= 1000A | $T_{vj}$=25°C | - | 2.80 | 3.30 | V |
| | | $V_{RC}$ (chip) | | $T_{vj}$= 25°C | - | 1.60 | 2.05 | |
| | | | | $T_{vj}$=125°C | - | 1.75 | - | |
| | | | | $T_{vj}$=150°C | - | 1.75 | - | |
| | | | | $T_{vj}$=175°C | - | 1.75 | - | |
| | Turn-on delay time (*1) | $t_{d(on)}$ | $V_{CC}$ = 600V<br>$I_C$, $I_F$ = 1000A<br>$V_{GE}$ = +15V / -15V<br>$R_G$ = 0.5Ω<br>$L_S$ = 35 nH | $T_{vj}$= 25°C | - | 0.42 | - | μs |
| | | | | $T_{vj}$=125°C | - | 0.43 | - | |
| | | | | $T_{vj}$=150°C | - | 0.43 | - | |
| | | | | $T_{vj}$=175°C | - | 0.43 | - | |
| | Rise time | $t_r$ | | $T_{vj}$= 25°C | - | 0.10 | - | |
| | | | | $T_{vj}$=125°C | - | 0.11 | - | |
| | | | | $T_{vj}$=150°C | - | 0.11 | - | |
| | | | | $T_{vj}$=175°C | - | 0.12 | - | |
| | Turn-off delay time (*2) | $t_{d(off)}$ | | $T_{vj}$= 25°C | - | 0.54 | - | |
| | | | | $T_{vj}$=125°C | - | 0.55 | - | |
| | | | | $T_{vj}$=150°C | - | 0.56 | - | |
| | | | | $T_{vj}$=175°C | - | 0.56 | - | |
| | Fall time | $t_f$ | | $T_{vj}$= 25°C | - | 0.12 | - | |
| | | | | $T_{vj}$=125°C | - | 0.15 | - | |
| | | | | $T_{vj}$=150°C | - | 0.15 | - | |
| | | | | $T_{vj}$=175°C | - | 0.16 | - | |
| | Forward recovery time | $t_{fr}$ | | $T_{vj}$= 25°C | - | 0.28 | - | |
| | | | | $T_{vj}$=125°C | - | 0.38 | - | |
| | | | | $T_{vj}$=150°C | - | 0.41 | - | |
| | | | | $T_{vj}$=175°C | - | 0.45 | - | |

(*1) Turn on time ($t_{on}$) = $t_{d(on)}$+ $t_r$

(*2) Turn off time ($t_{off}$) = $t_{d(off)}$ + $t_f$

## ■ Electrical characteristics (at $T_{vj}$= 25°C unless otherwise specified)

| Items | | Symbols | Conditions | | Characteristics min. | Characteristics typ. | Characteristics max. | Units |
|---|---|---|---|---|---|---|---|---|
| Inverter | Turn-on energy (per pulse) | $E_{on}$ | $V_{CC}$ = 600V, $I_C$, $I_F$ = 1000A, $V_{GE}$ = +15V / -15V, $R_G$ = 0.5Ω, $L_S$ = 35 nH | $T_{vj}$= 25°C | - | 75.7 | - | mJ |
| | | | | $T_{vj}$=125°C | - | 98.9 | - | |
| | | | | $T_{vj}$=150°C | - | 103.5 | - | |
| | | | | $T_{vj}$=175°C | - | 110.5 | - | |
| | Turn-off energy (per pulse) | $E_{off}$ | | $T_{vj}$= 25°C | - | 106.6 | - | |
| | | | | $T_{vj}$=125°C | - | 117.6 | - | |
| | | | | $T_{vj}$=150°C | - | 125.3 | - | |
| | | | | $T_{vj}$=175°C | - | 134.1 | - | |
| | Forward recovery energy (per pulse) | $E_{fr}$ | | $T_{vj}$= 25°C | - | 93.5 | - | |
| | | | | $T_{vj}$=125°C | - | 124.7 | - | |
| | | | | $T_{vj}$=150°C | - | 137.7 | - | |
| | | | | $T_{vj}$=175°C | - | 139.0 | - | |
| Thermistor | Resistance | $R$ | $T$ = 25°C | | - | 5000 | - | Ω |
| | | | $T$ = 100°C | | 465 | 495 | 520 | |
| | B value | $B$ | $T$ = 25/ 50°C | | 3305 | 3375 | 3450 | K |

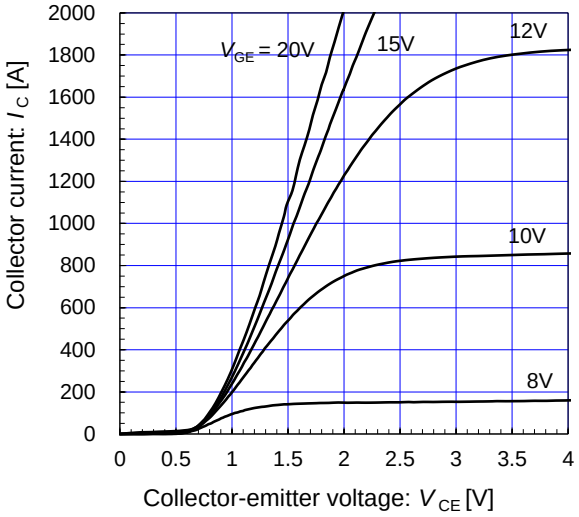
NOTICE:
The external gate resistance ($R_G$) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum $R_G$ depends on circuit configuration and/or environment. We recommend that the $R_G$ has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

## ■Thermal resistance characteristics

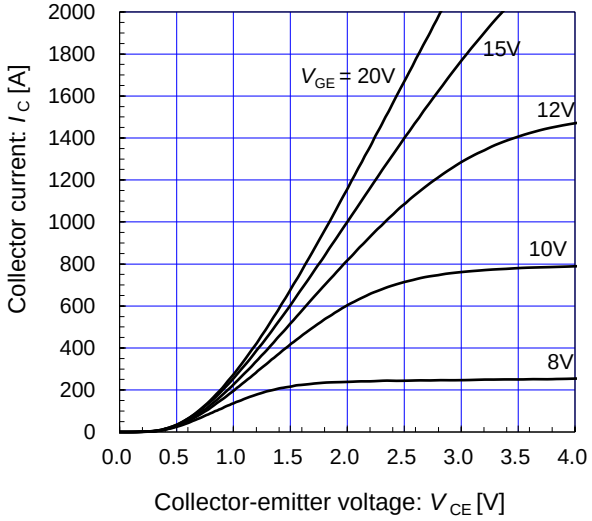
| Items | Symbols | Conditions | Characteristics min. | Characteristics typ. | Characteristics max. | Units |
|---|---|---|---|---|---|---|
| Thermal resistance junction to case(1 device) | $R_{th(j-c)}$ | Inverter IGBT | - | - | 0.018 | K/W |
| Thermal resistance case to heatsink(1 IGBT+1 FWD)(*1) | $R_{th(c-s)}$ | with 1 W/(m·K) thermal grease | - | 0.0125 | - | |

(*1) This is the value which is defined mounting on the additional hestsink with thermal grease.

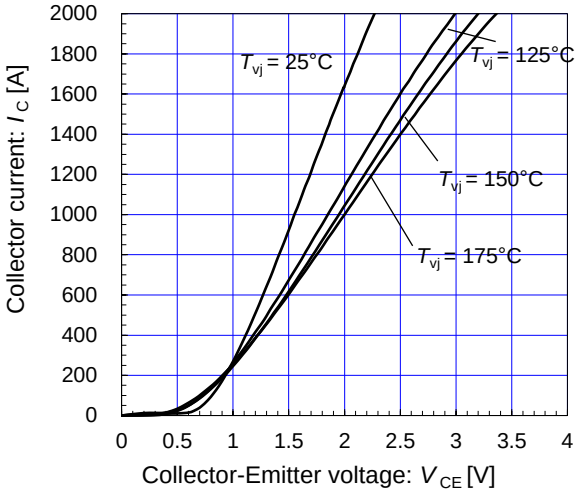
[Inverter]
Collector current vs. Collector-emitter voltage
$T_{vj}$ = 25°C / chip



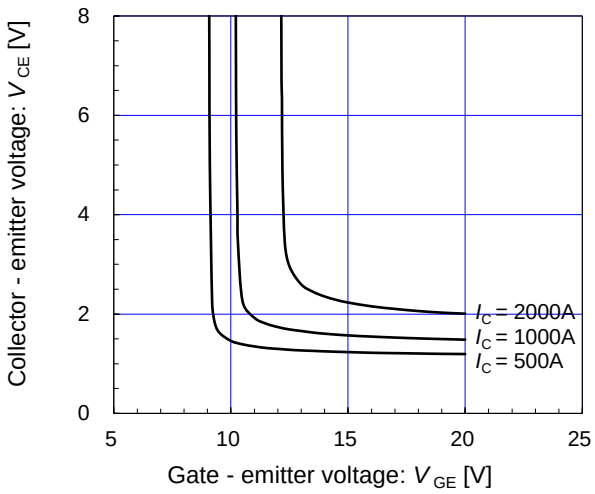

[Inverter]
Collector current vs. Collector-emitter voltage (typ.)
$T_{vj}$ = 175°C / chip



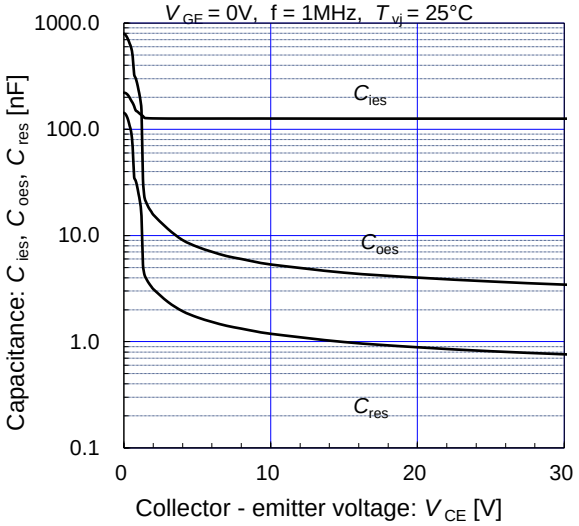

[Inverter]
Collector current vs. Collector-emitter voltage
$V_{GE}$ = 15V / chip



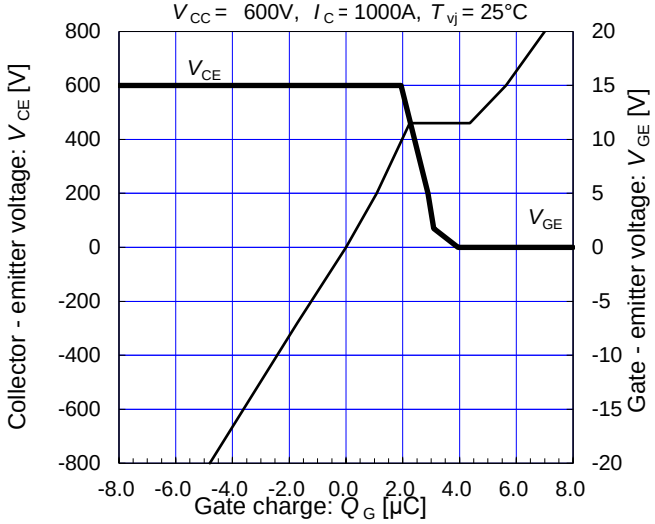

[Inverter]
Collector-emitter voltage vs. Gate-emitter voltage
$T_{vj}$ = 25°C / chip




[Inverter]
Capacitance vs. Collector-emitter Voltage
$V_{GE}$ = 0V, f = 1MHz, $T_{vj}$ = 25°C




[Inverter]
Dynamic Gate charge (typ.)
$V_{CC}$ = 600V, $I_C$ = 1000A, $T_{vj}$ = 25°C



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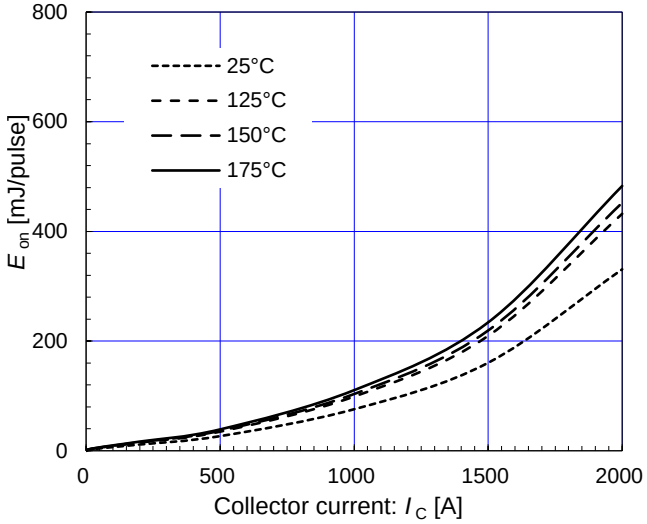
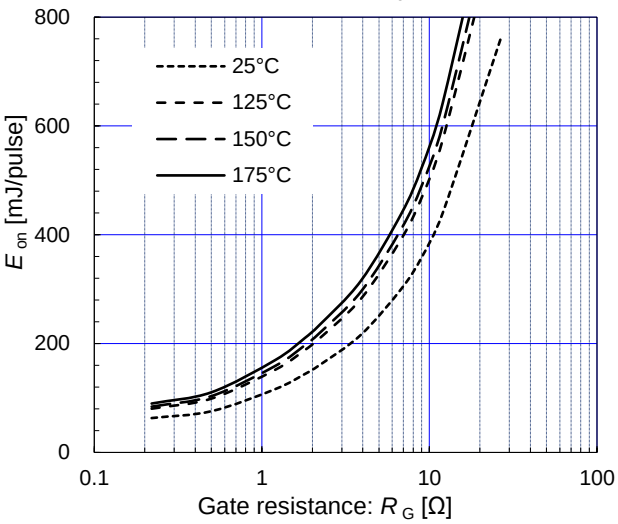
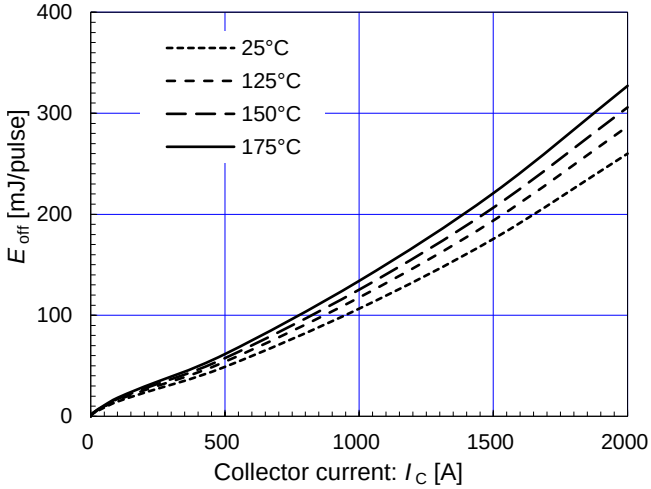
[Inverter]
$E_{on}$ vs. Collector current (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $R_G$ = 0.5Ω



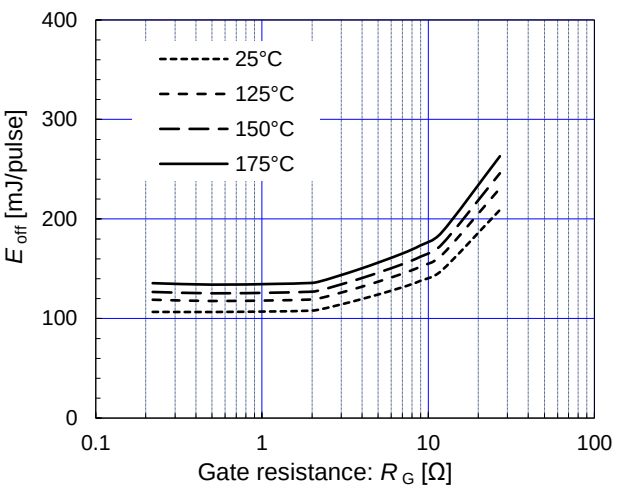

[Inverter]
$E_{on}$ vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $I_C$ = 1000A



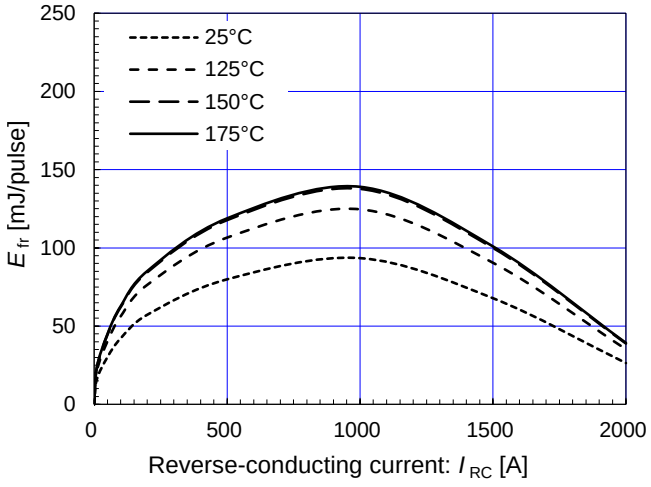

[Inverter]
$E_{off}$ vs. Collector current (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $R_G$ = 0.5Ω



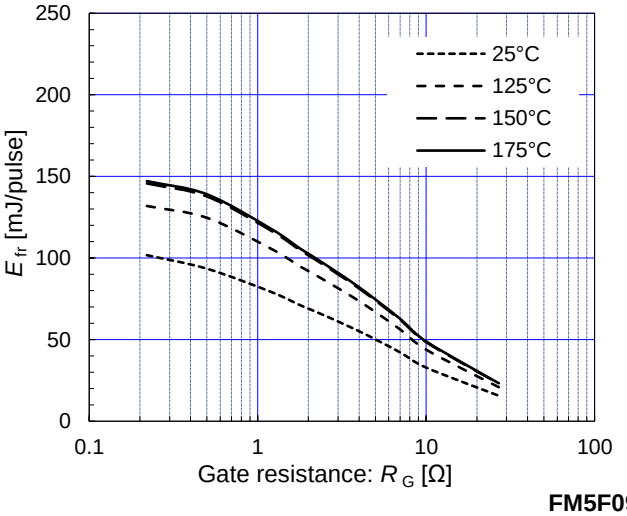

[Inverter]
$E_{off}$ vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $I_C$ = 1000A




[Inverter]
$E_{fr}$ *vs.* Reverse-conducting current (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $R_G$ = 0.5Ω



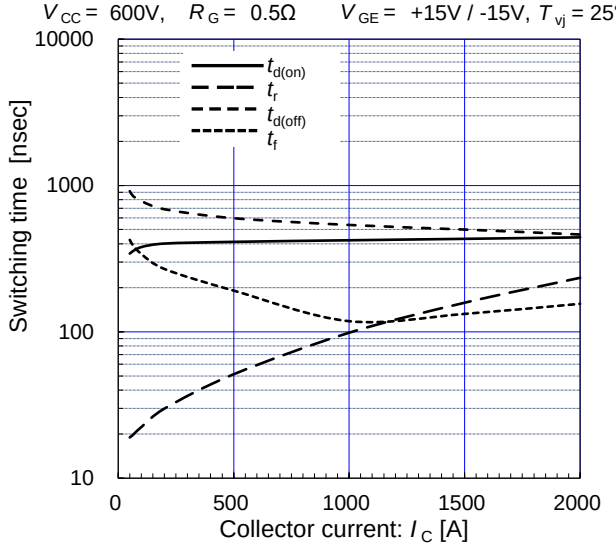

[Inverter]
$E_{fr}$ vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $I_F$ = 1000A



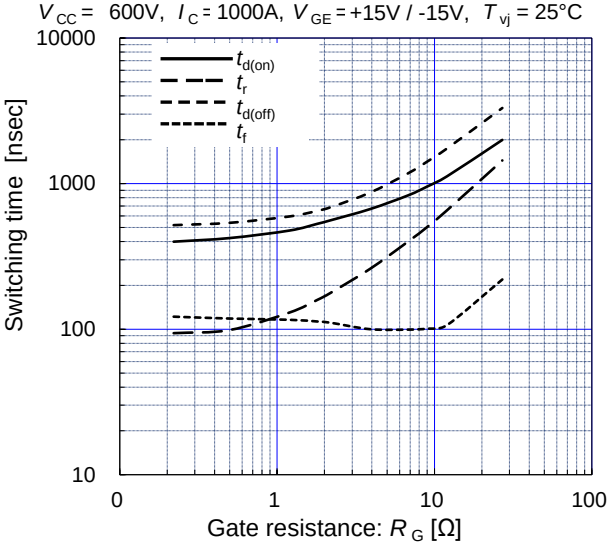
# 2MBI1000XRNE120-50



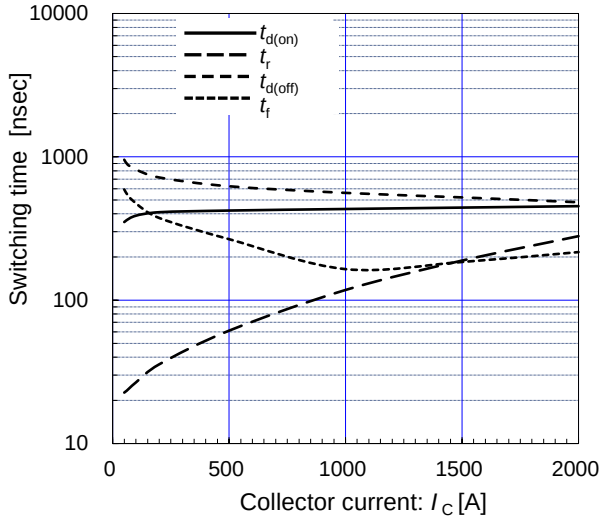
[Inverter]
Switching time vs. Collector current (typ.)
$V_{CC}$ = 600V, $R_G$ = 0.5Ω $V_{GE}$ = +15V / -15V, $T_{vj}$ = 25°C



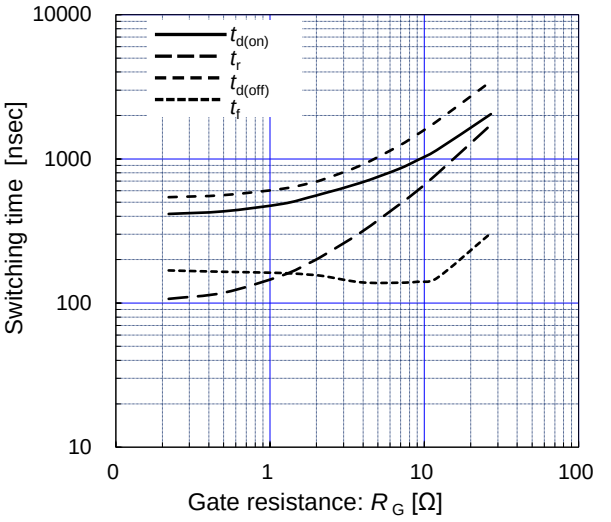

[Inverter]
Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $I_C$ = 1000A, $V_{GE}$ = +15V / -15V, $T_{vj}$ = 25°C



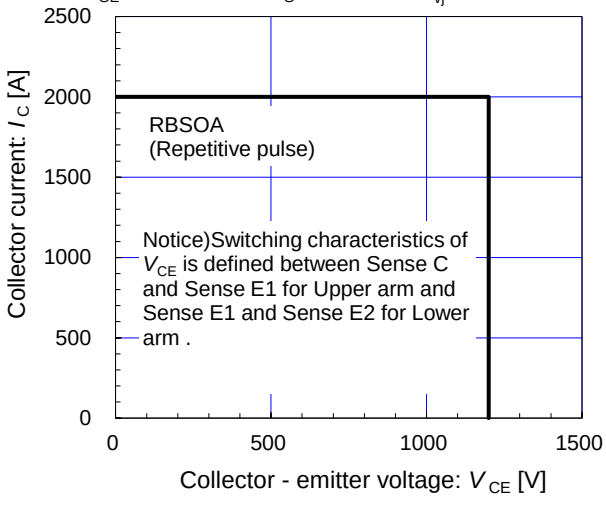

[Inverter]
Switching time vs. Collector current (typ.)
$V_{CC}$ = 600V, $R_G$ = 0.5Ω $V_{GE}$ = +15V / -15V, $T_{vj}$ = 175°C




[Inverter]
Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $I_C$ = 1000A, $V_{GE}$ = +15V / -15V, $T_{vj}$ = 175°C



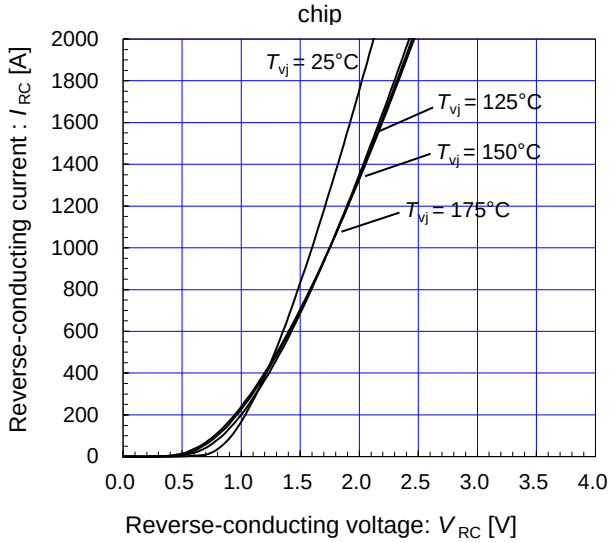

[Inverter]
Reverse bias safe operating area (max.)
$V_{GE}$ = +15V / -15V $R_G$ = 0.5Ω $T_{vj}$ = 175°C



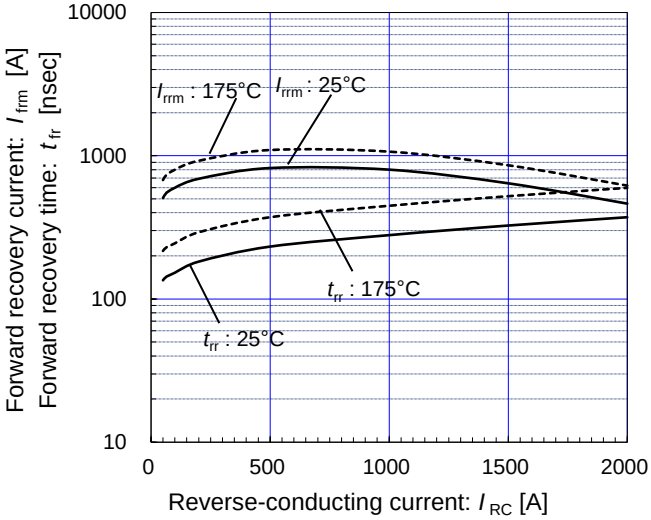
# 2MBI1000XRNE120-50

**IGBT Modules**

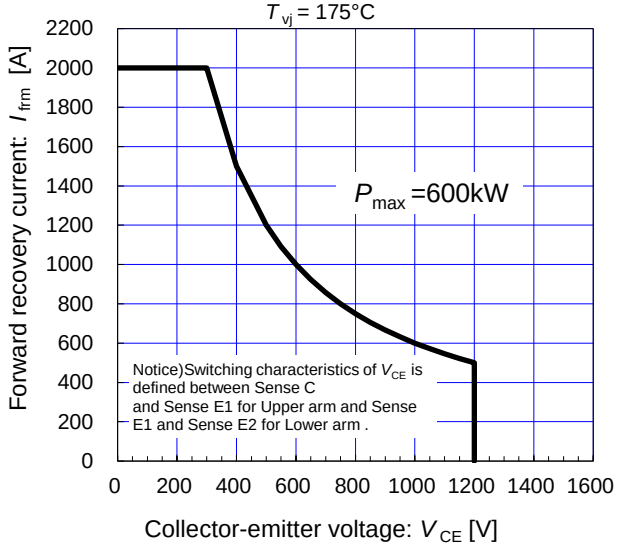
[Inverter]
Reverse-conducting current vs. Reverse-conducting voltage (typ.)
chip



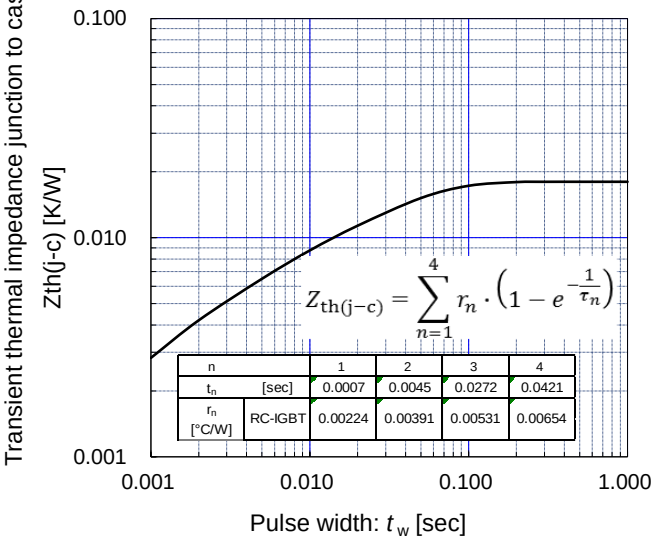

[Inverter]
Forward recovery characteristics (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15V / -15V, $R_G$ = 0.5Ω




[Inverter]
FWD safe operation area (max.)
$T_{vj}$ = 175°C

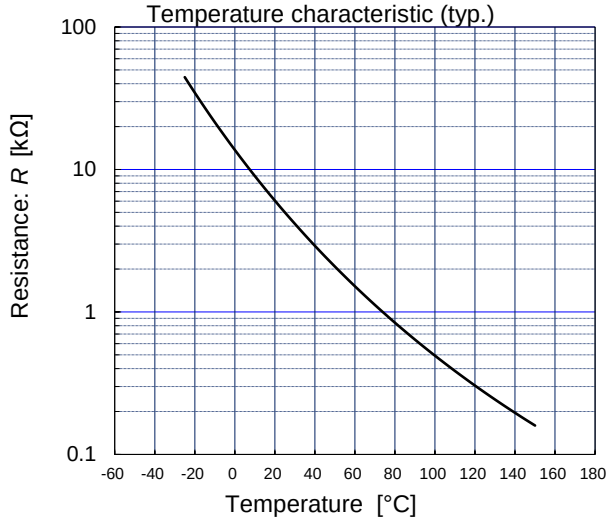



[Inverter]
Transient thermal impedance (max.)




| n | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $t_n$ | [sec] | 0.0007 | 0.0045 | 0.0272 | 0.0421 |
| $r_n$ [°C/W] | RC-IGBT | 0.00224 | 0.00391 | 0.00531 | 0.00654 |

[Thermistor]
Temperature characteristic (typ.)



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# Warnings

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・Computers ・OA equipment ・Communications equipment (terminal devices) ・Measurement equipment
・Machine tools ・Audiovisual equipment ・Electrical home appliances ・Personal equipment ・Industrial robots etc.

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・Transportation equipment (mounted on cars and ships) ・Trunk communications equipment
・Traffic-signal control equipment ・Gas leakage detectors with an auto-shut-off feature
・Emergency equipment for responding to disasters and anti-burglary devices ・Safety devices ・Medical equipment

6. Do not use products in this Catalog for the equipment requiring strict reliability such as the following and equivalents to strategic equipment (without limitation).
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7. 

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