# 2MBI200XAA065-50

**IGBT Modules**

## Power Module (X series)
## 650V / 200A / 2-in-1 package



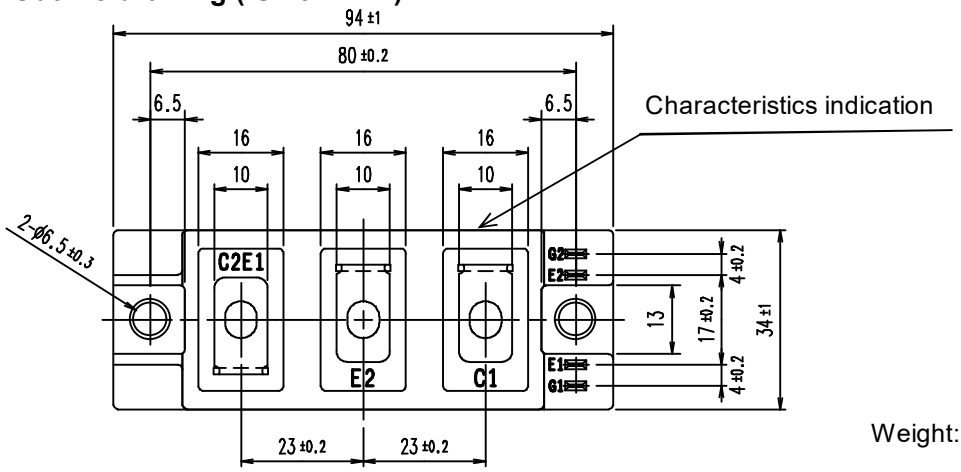
### ■ Features

Low $V_{CE(sat)}$
High speed switching
Low Inductance Module structure

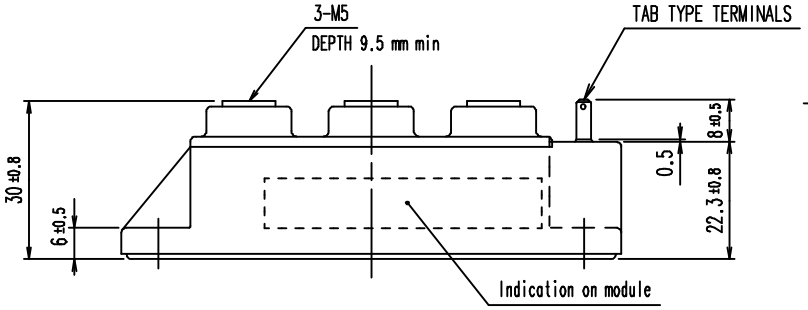
### ■ Applications

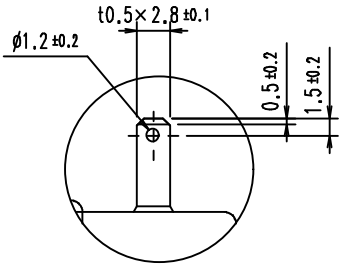
Inverter for Motor Drives, AC and DC Servo Drives
Uniterruptible Power Supply Systems,
Industrial machines,such as Welding machines

### ■ Outline drawing ( Unit : mm )



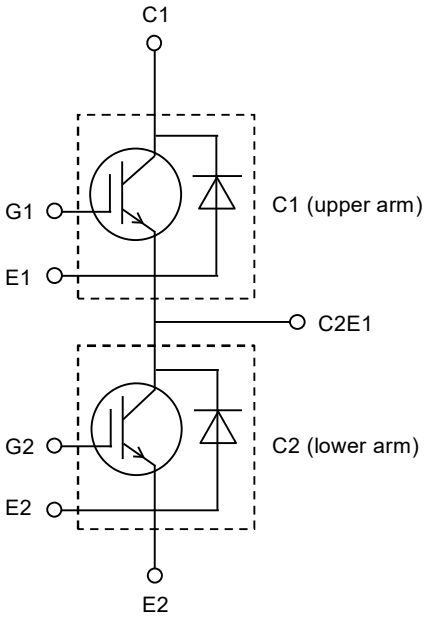

Weight: 180 g(typ.)




DETAIL TAB TYPE TERMINALS

### ■ Equivalent circuit






FM5F9204a
2023/10

# 2MBI200XAA065-50



## ■ 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 | $V_{CES}$ | | | 650 | V |
| | Gate-Emitter voltage,Collector-Emitter short-circuited | $V_{GES}$ | | | ±20 | V |
| | Collector current | $I_C$ | Continuous | $T_c$=100°C | 200 | A |
| | Repetitive peak collector current | $I_{CRM}$ | 1ms | | 400 | |
| | Forward current | $I_F$ | | | 200 | |
| | Repetitive peak forward current | $I_{FRM}$ | 1ms | | 400 | |
| | Total power dissipation | $P_{tot}$ | 1 device | | 625 | W |
| | Virtual junction temperature | $T_{vj}$ | | | 175 | °C |
| | Operating virtual junction temperature | $T_{vjop}$ | | | 175 | |
| Case temperature | | $T_c$ | | | 125 | |
| Storage temperature | | $T_{stg}$ | | | -40 ~ 125 | |
| Isolation voltage | Between terminals and copper base (*1) | $V_{isol}$ | AC: 1min. | | 4000 | Vrms |
| Mounting torque of screws to heatsink | | $M_s$ | M5 | | 3.0 ~ 5.0 | N·m |
| Mounting torque of screws to terminals | | $M_t$ | M5 | | 2.5 ~ 5.0 | |

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

## ■ 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,Gate-Emitter short-circuited | $I_{CES}$ | $V_{GE}$ = 0V<br>$V_{CE}$ = 650V | | - | - | 50 | μA |
| | Gate leakage current,Collector-Emitter short-circuited | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | - | - | 100 | nA |
| | Gate-Emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$ = 20V<br>$I_C$ = 200mA | | 6.0 | 6.5 | 7.0 | V |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE}$ = 15V<br>$I_C$= 200A | $T_{vj}$=25°C | - | 1.45 | 1.90 | V |
| | | $V_{CE(sat)}$ (chip) | | $T_{vj}$=25°C | - | 1.30 | 1.75 | |
| | | | | $T_{vj}$=125°C | - | 1.45 | - | |
| | | | | $T_{vj}$=150°C | - | 1.50 | - | |
| | | | | $T_{vj}$=175°C | - | 1.55 | - | |
| | Internal gate resistance | $r_g$ | - | | - | 3.00 | - | Ω |
| | Input capacitance | $C_{ies}$ | $V_{CE}$=10V, $V_{GE}$=0V, $f$=1MHz | | - | 23 | - | nF |
| | Output capacitance | $C_{oes}$ | | | - | 0.9 | - | |
| | Reverse transfer capacitance | $C_{res}$ | | | - | 0.31 | - | |
| | Gate charge | $Q_G$ | $V_{CC}$ = 300V, $I_C$ = 200A<br>$V_{GE}$ = -15 → +15V | | - | 1.6 | - | μC |
| | Forward voltage | $V_F$ (terminal) | $V_{GE}$ = 0V<br>$I_F$= 200A | $T_{vj}$=25°C | - | 1.70 | 2.15 | V |
| | | $V_F$ (chip) | | $T_{vj}$=25°C | - | 1.55 | 2.00 | |
| | | | | $T_{vj}$=125°C | - | 1.50 | - | |
| | | | | $T_{vj}$=150°C | - | 1.50 | - | |
| | | | | $T_{vj}$=175°C | - | 1.45 | - | |
| | Turn-on delay time(*1) | $t_{d(on)}$ | $V_{CC}$ = 300V<br>$I_C$, $I_F$ = 200A<br>$V_{GE}$ = +15/ -15V<br>$R_G$ = +6.8/-15Ω<br>$L_S$ = 30 nH | $T_{vj}$=25°C | - | 0.31 | - | μs |
| | | | | $T_{vj}$=125°C | - | 0.33 | - | |
| | | | | $T_{vj}$=150°C | - | 0.34 | - | |
| | | | | $T_{vj}$=175°C | - | 0.34 | - | |
| | Rise time(*1) | $t_r$ | | $T_{vj}$=25°C | - | 0.10 | - | |
| | | | | $T_{vj}$=125°C | - | 0.12 | - | |
| | | | | $T_{vj}$=150°C | - | 0.12 | - | |
| | | | | $T_{vj}$=175°C | - | 0.12 | - | |
| | Turn-off delay time(*1) | $t_{d(off)}$ | | $T_{vj}$=25°C | - | 0.56 | - | |
| | | | | $T_{vj}$=125°C | - | 0.59 | - | |
| | | | | $T_{vj}$=150°C | - | 0.60 | - | |
| | | | | $T_{vj}$=175°C | - | 0.61 | - | |
| | Fall time(*1) | $t_f$ | | $T_{vj}$=25°C | - | 0.10 | - | |
| | | | | $T_{vj}$=125°C | - | 0.15 | - | |
| | | | | $T_{vj}$=150°C | - | 0.16 | - | |
| | | | | $T_{vj}$=175°C | - | 0.16 | - | |
| | Reverse recovery time | $t_{rr}$ | | $T_{vj}$=25°C | - | 0.16 | - | |
| | | | | $T_{vj}$=125°C | - | 0.26 | - | |
| | | | | $T_{vj}$=150°C | - | 0.29 | - | |
| | | | | $T_{vj}$=175°C | - | 0.34 | - | |

(*1) Turn-on time ($t_{on}$) = $t_{d(on)}$+ $t_r$ , 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 | $E_{on}$ | $V_{CC}$ = 300V<br>$I_C$, $I_F$ = 200A<br>$V_{GE}$ = +15/ -15V<br>$R_G$ = +6.8/-15Ω<br>$L_S$ = 30 nH | $T_{vj}$=25°C | - | 4.5 | - | mJ |
| | | | | $T_{vj}$=125°C | - | 7.4 | - | |
| | | | | $T_{vj}$=150°C | - | 8.2 | - | |
| | | | | $T_{vj}$=175°C | - | 9.4 | - | |
| | Turn-off energy | $E_{off}$ | | $T_{vj}$=25°C | - | 6.1 | - | |
| | | | | $T_{vj}$=125°C | - | 8.2 | - | |
| | | | | $T_{vj}$=150°C | - | 8.8 | - | |
| | | | | $T_{vj}$=175°C | - | 8.9 | - | |
| | Reverse recovery energy | $E_{rr}$ | | $T_{vj}$=25°C | - | 0.7 | - | |
| | | | | $T_{vj}$=125°C | - | 1.2 | - | |
| | | | | $T_{vj}$=150°C | - | 1.4 | - | |
| | | | | $T_{vj}$=175°C | - | 1.7 | - | |

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

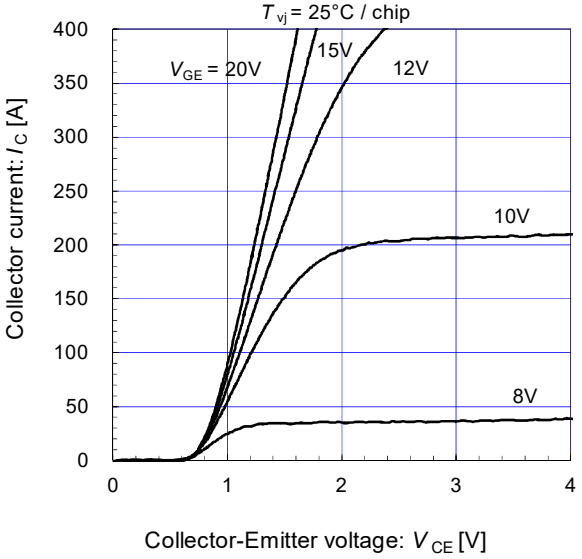
| | Symbols | Conditions | Characteristics min. | Characteristics typ. | Characteristics max. | ns |
|---|---|---|---|---|---|---|
| Thermal resistance junction to case (1device) | $R_{th(j-c)}$ | IGBT | - | - | 0.238 | K/W |
| | | FWD | - | - | 0.457 | |
| Thermal resistance case to heatsink (1IGBT + 1FWD) (*1) | $R_{th(c-s)}$ | with 1 W/(m·K) thermal grease | - | 0.050 | - | |

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

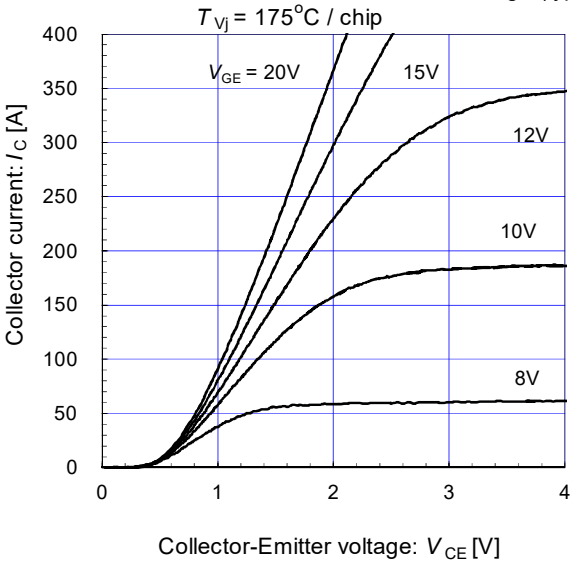
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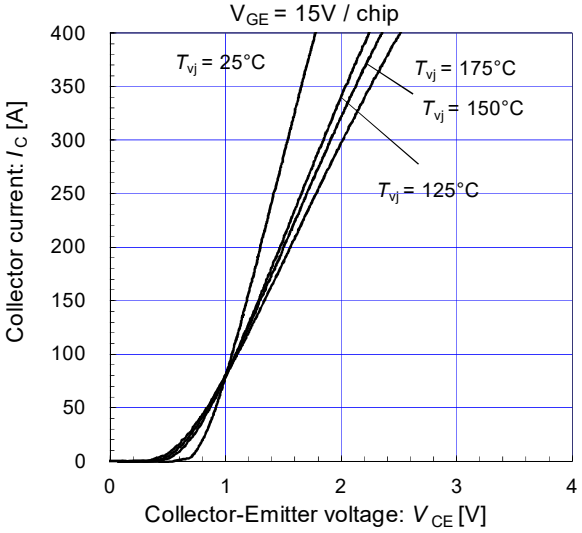
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$ = 25°C / chip



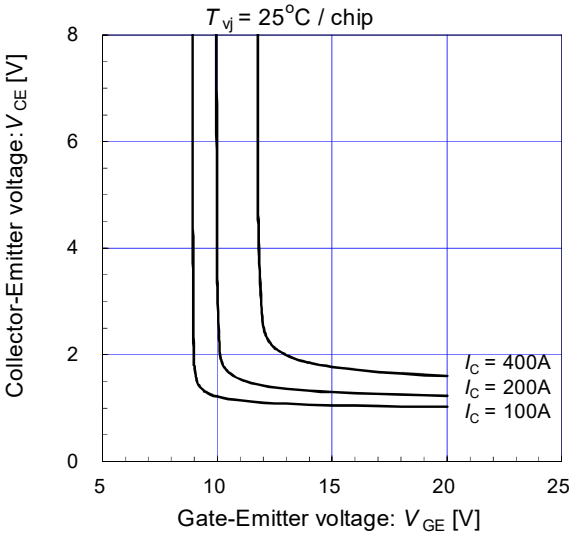

[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
$T_{Vj}$ = 175°C / chip



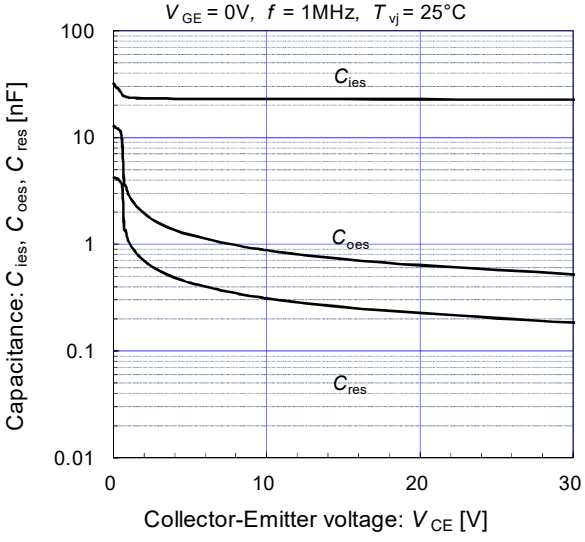

[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
$V_{GE}$ = 15V / chip



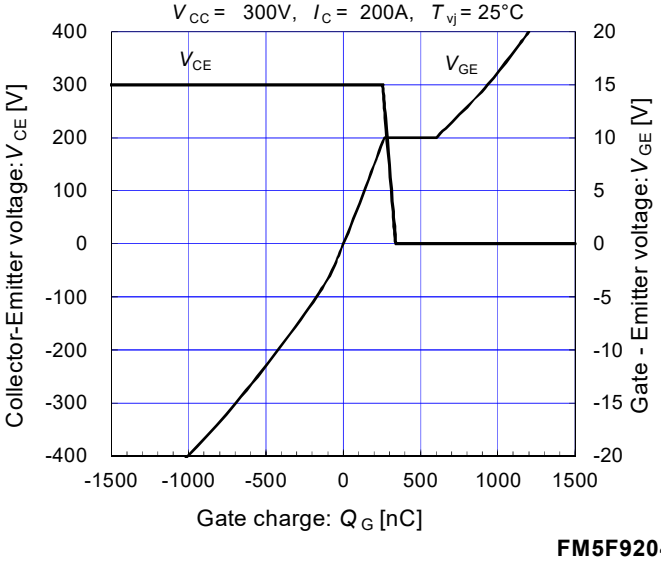

[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
$T_{vj}$ = 25°C / chip




[Inverter]
Capacitance vs. Collector-Emitter voltage (typ.)
$V_{GE}$ = 0V, $f$ = 1MHz, $T_{vj}$ = 25°C



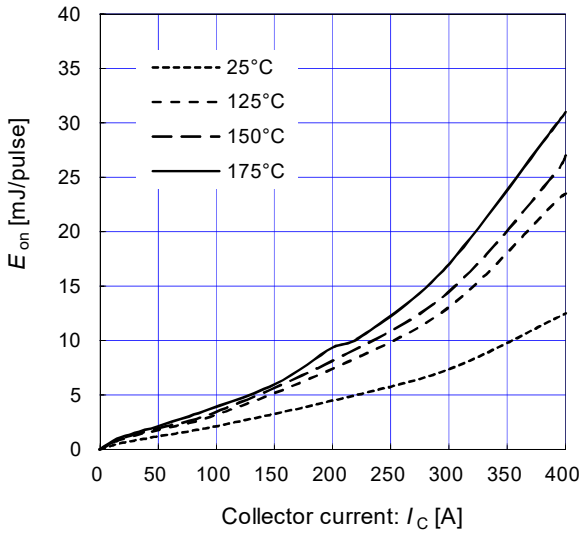

[Inverter]
Dynamic gate charge (typ.)
$V_{CC}$ = 300V, $I_C$ = 200A, $T_{vj}$ = 25°C



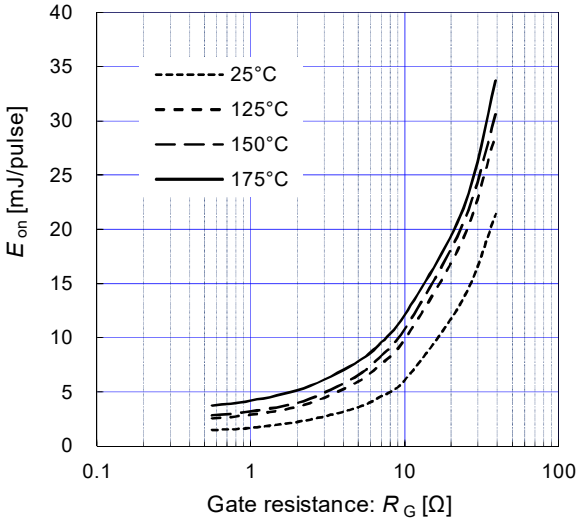
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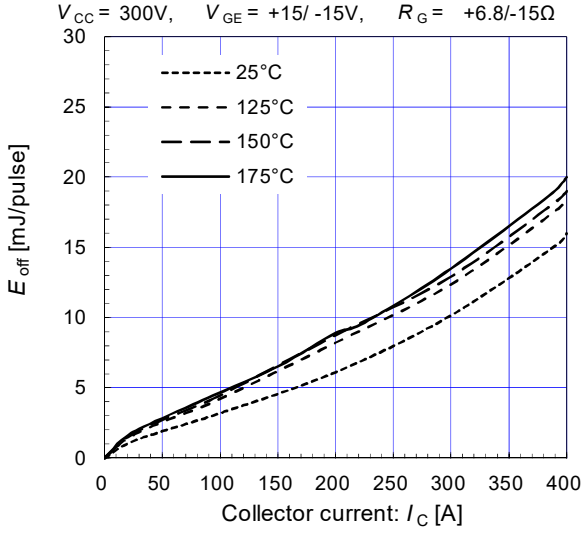
[Inverter]
$E_{on}$ vs. Collector current (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $R_G$ = +6.8/-15Ω



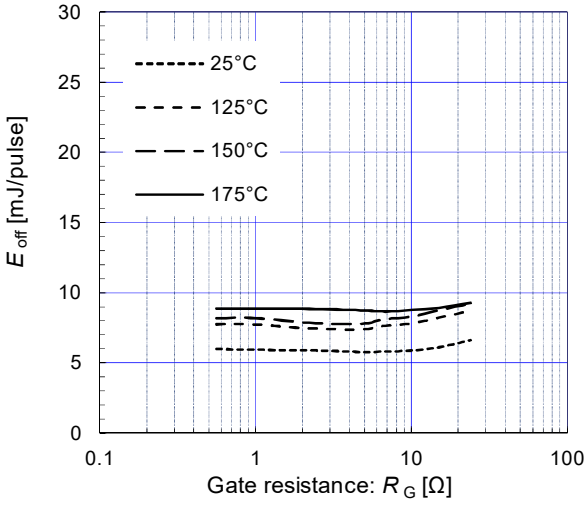

[Inverter]
$E_{on}$ vs. Gate resistance (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $I_C$ = 200A



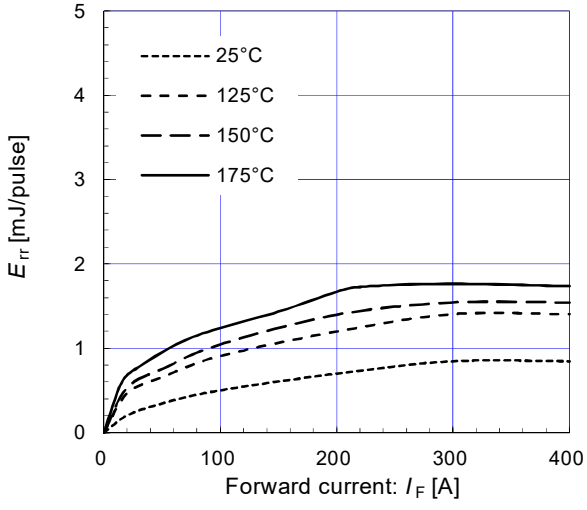

[Inverter]
$E_{off}$ vs. Collector current (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $R_G$ = +6.8/-15Ω



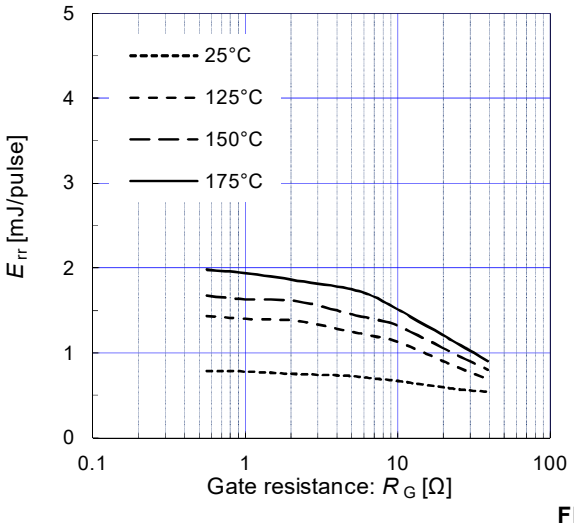

[Inverter]
$E_{off}$ vs. Gate resistance (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $I_F$ = 200A




[Inverter]
$E_{rr}$ vs. Forward current (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $R_G$ = +6.8/-15Ω



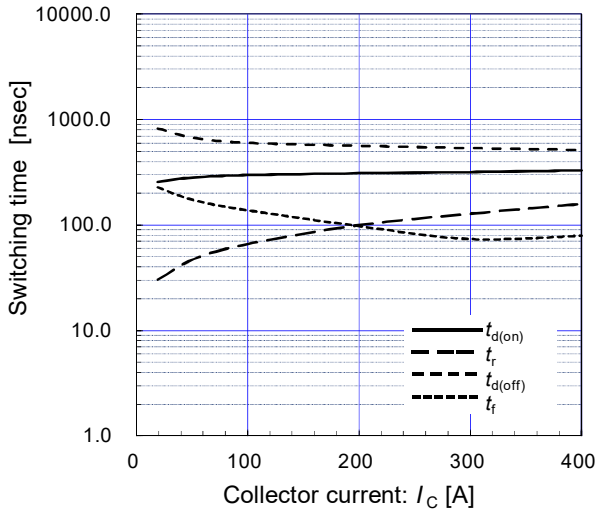

[Inverter]
$E_{rr}$ vs. Gate resistance (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $I_F$ = 200A



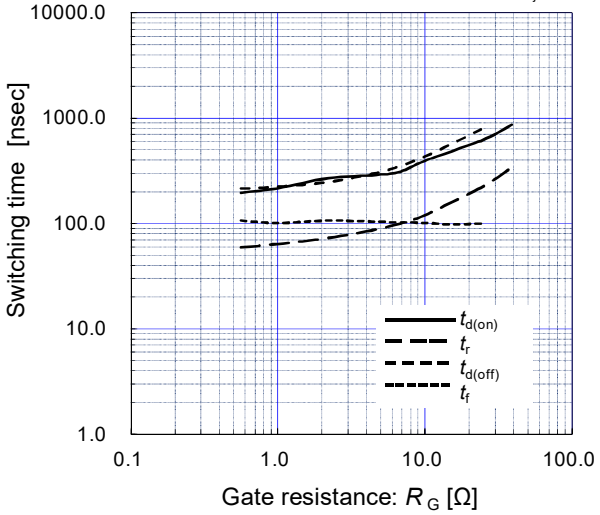
# 2MBI200XAA065-50



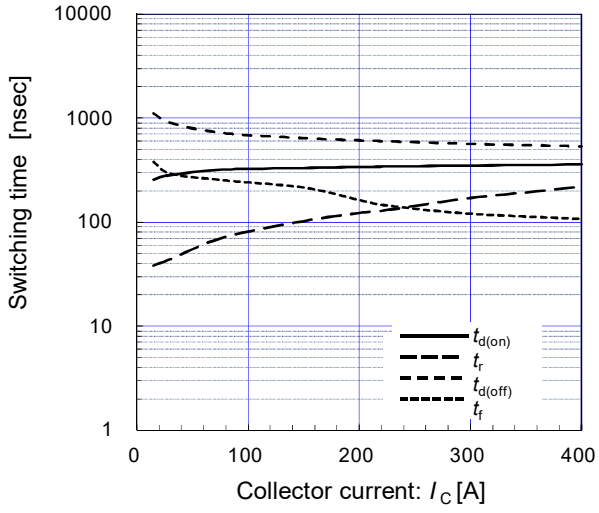
[Inverter]
Switching time vs. Collector current (typ.)
$V_{CC}$ = 300V, $R_G$ = +6.8/-15Ω, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 25°C



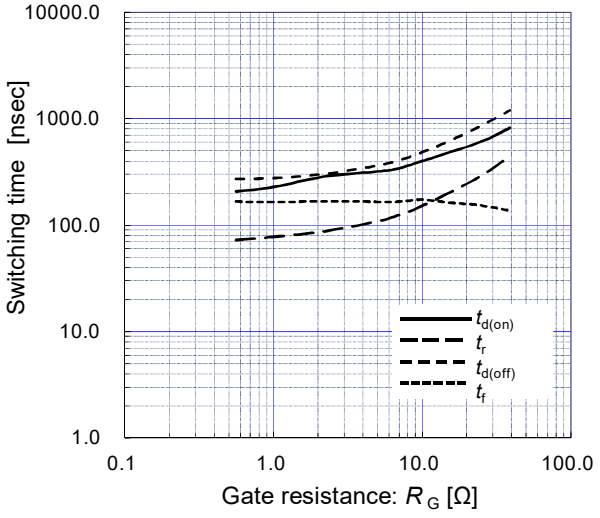

[Inverter]
Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 300V, $I_C$ = 200A, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 25°C



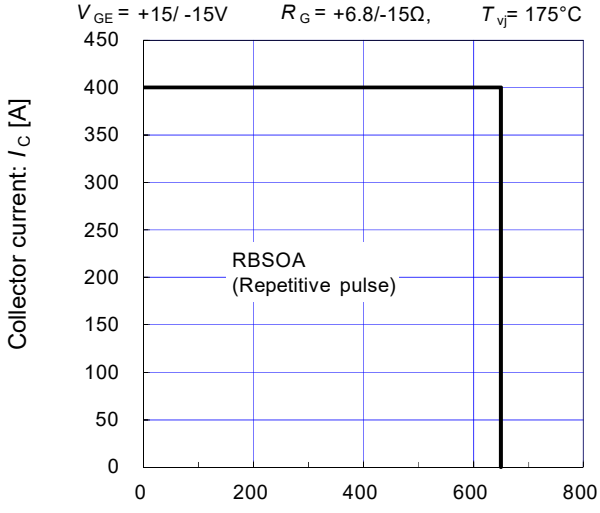

[Inverter]
Switching time vs. Collector current (typ.)
$V_{CC}$ = 300V, $R_G$ = +6.8/-15Ω, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 175°C




[Inverter]
Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 300V, $I_C$ = 200A, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 175°C



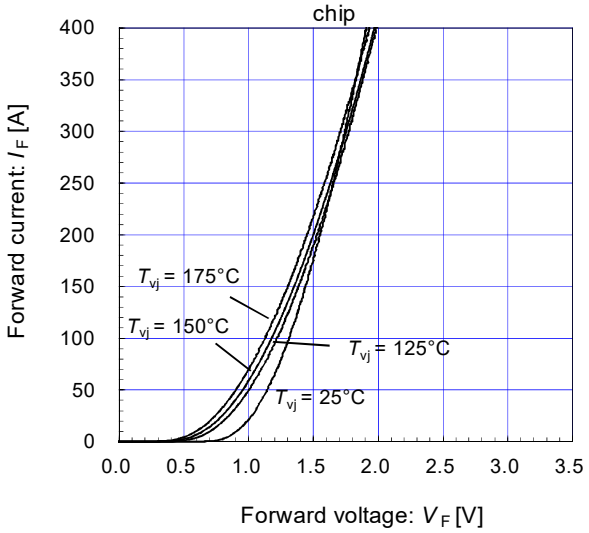

[Inverter]
Reverse bias safe operating area (max.)
$V_{GE}$ = +15/ -15V $R_G$ = +6.8/-15Ω, $T_{vj}$ = 175°C



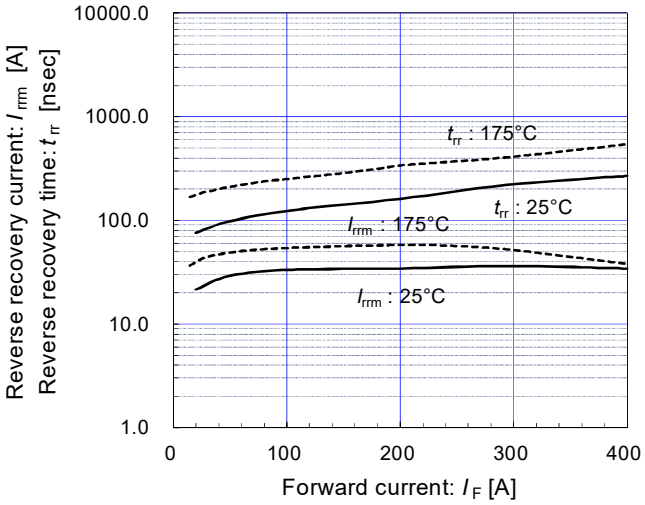
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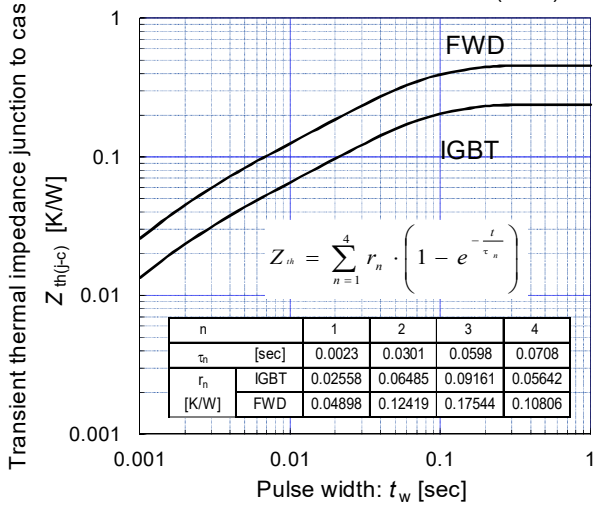
[Inverter]
Forward current vs. Forward voltage (typ.)
chip




[Inverter]
Reverse recovery characteristics (typ.)
$V_{CC}$ = 300V, $V_{GE}$ = +15/ -15V, $R_G$ = +6.8/-15Ω




[Inverter]
Transient thermal resistance(max.)




| n | | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $\tau_n$ | [sec] | 0.0023 | 0.0301 | 0.0598 | 0.0708 |
| $r_n$ [K/W] | IGBT | 0.02558 | 0.06485 | 0.09161 | 0.05642 |
| | FWD | 0.04898 | 0.12419 | 0.17544 | 0.10806 |

# Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 10/2023. The contents are subject to change without notice for specification changes or other reasons. When using a product listed in this Catalog, be sure to obtain the latest specifications.

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・Machine tools ・Audiovisual equipment ・Electrical home appliances ・Personal equipment ・Industrial robots etc.

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富士電機 Innovating Energy Technology

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IGBT Modules

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| 中国 | www.fujielectric.com/products/semiconductor/cn/ |
| Europe | www.fujielectric-europe.com/products/semiconductors/ |
| North America | www.americas.fujielectric.com/products/semiconductors/ |

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