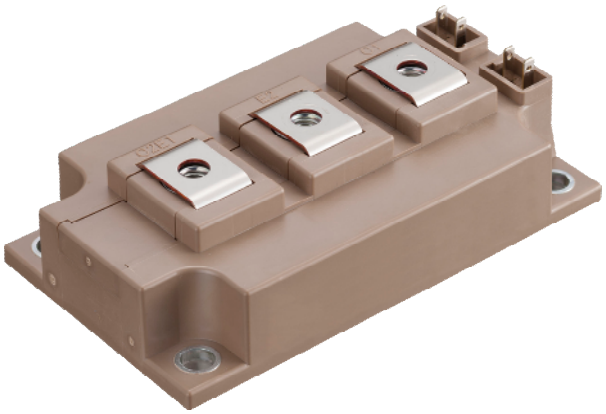
# 2MBI300XHA120-50

**IGBT Modules**

## Power Module (X series)
## 1200V / 300A / 2-in-1 package



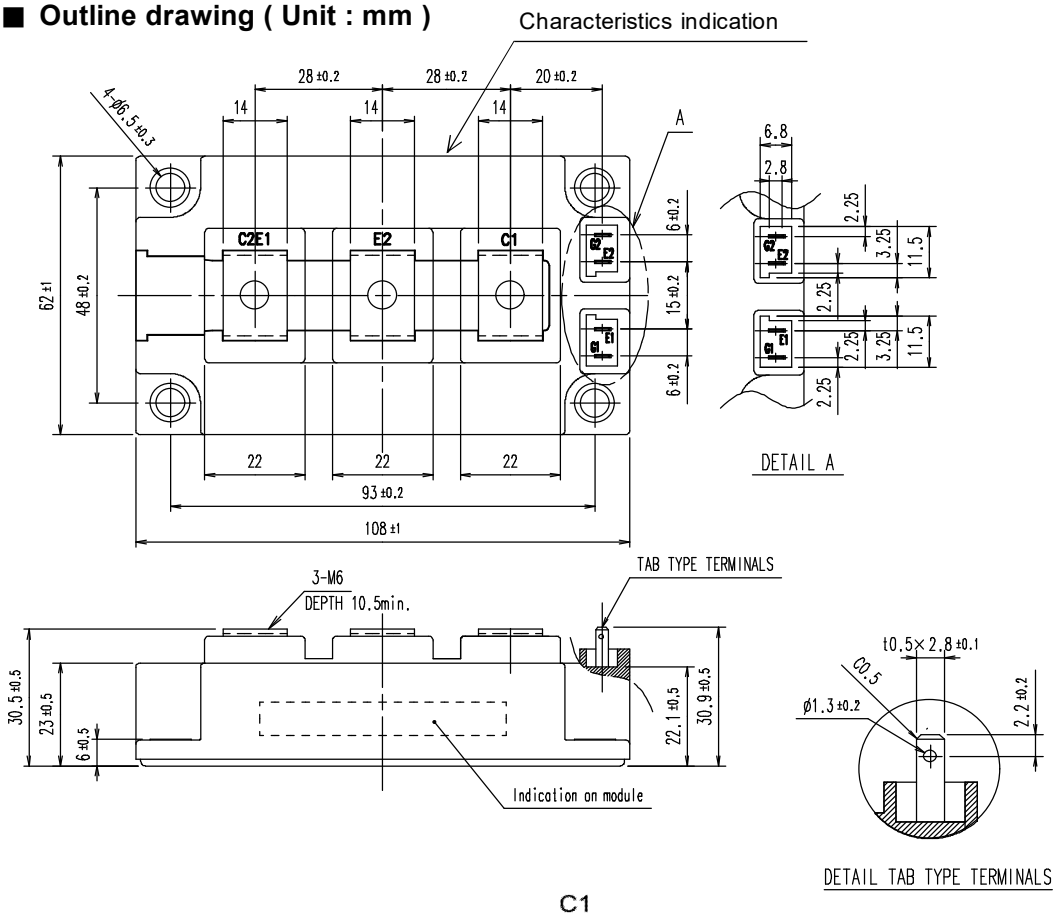
### ■ Features

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

### ■ Applications

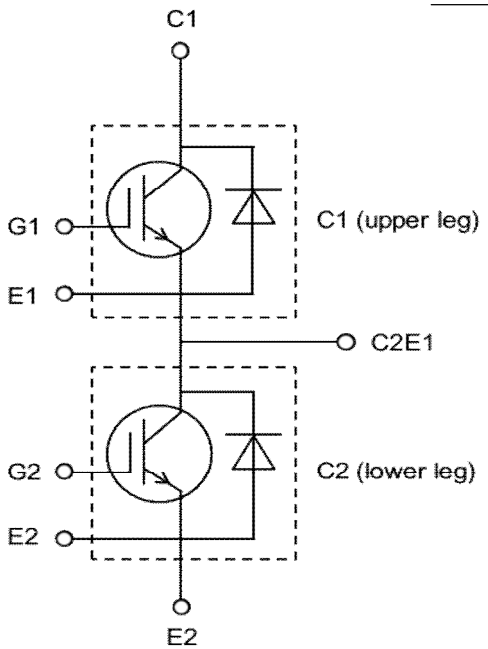
Inverter for Motor Drives, AC and DC Servo Drives
Uniterruptible Power Supply Systems,
Industrial machines,such as Welding machines

### ■ Outline drawing ( Unit : mm )




Weight: 370 g(typ.)

### ■ Equivalent circuit






FM5F9128b
2024/01

# 2MBI300XHA120-50



## ■ Absolute maximum ratings (at $T_C$= 25°C unless otherwise specified)

| Items | | Symbols | Conditions | | Maximum ratings | Units |
|---|---|---|---|---|---|---|
| Inverter | Collector-Emitter voltage | $V_{CES}$ | | | 1200 | V |
| | Gate-Emitter voltage | $V_{GES}$ | | | ±20 | V |
| | Collector current | $I_C$ | Continuous | $T_c$=100°C | 300 | A |
| | | $I_{CRM}$ | 1ms | | 600 | |
| | Forward current | $I_F$ | | | 300 | |
| | | $I_{FRM}$ | 1ms | | 600 | |
| | Collector power dissipation | $P_{tot}$ | 1 device | | 1425 | W |
| | Junction temperature | $T_{vj}$ | | | 175 | °C |
| | Operating virtual junction temperature (under switching conditions) | $T_{vjop}$ | | | 175 | |
| Case temperature | | $T_c$ | | | 125 | |
| Storage temperature | | $T_{stg}$ | | | -40 ~ 125 | |
| Isolation voltage | between terminal and copper base (*1) | $V_{isol}$ | AC: 1min. | | 4000 | Vrms |
| Mounting torque of screws to heat sink | | $M_s$ | M5 or M6 | | 3.0 ~ 6.0 | N·m |
| Mounting torque of screws to terminals | | $M_t$ | M6 | | 2.5 ~ 5.0 | |

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

# 2MBI300XHA120-50



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

| | Items | Symbols | Conditions | | Characteristics min. | Characteristics typ. | Characteristics max. | Units |
|---|---|---|---|---|---|---|---|---|
| Inverter | Zero gate voltage collector current | $I_{CES}$ | $V_{GE}$= 0V<br>$V_{CE}$= 1200V | | - | - | 200 | μA |
| | Gate-Emitter leakage current | $I_{GES}$ | $V_{CE}$=0V, $V_{GE}$=±20V | | - | - | 400 | nA |
| | Gate-Emitter threshold voltage | $V_{GE(th)}$ | $V_{CE}$= 20V<br>$I_C$= 300mA | | 6.0 | 6.5 | 7.0 | V |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (terminal) | $V_{GE}$ = 15V<br>$I_C$= 300A | $T_{vj}$=25°C | - | 1.55 | 2.00 | V |
| | | $V_{CE(sat)}$ (chip) | | $T_{vj}$=25°C | - | 1.45 | 1.90 | |
| | | | | $T_{vj}$=125°C | - | 1.80 | - | |
| | | | | $T_{vj}$=150°C | - | 1.90 | - | |
| | | | | $T_{vj}$=175°C | - | 1.95 | - | |
| | Internal gate resistance | $r_g$ | - | | - | 3.75 | - | Ω |
| | Capacitance | $C_{ies}$ | $V_{CE}$=10V, $V_{GE}$=0V, f=1MHz | | - | 32 | - | nF |
| | | $C_{oes}$ | | | - | 1.1 | - | |
| | | $C_{res}$ | | | - | 0.29 | - | |
| | Gate charge | $Q_G$ | $V_{CC}$= 600V, $I_C$= 300A<br>$V_{GE}$= -15 → +15V | | - | 2050 | - | nC |
| | Forward voltage | $V_F$ (terminal) | $V_{GE}$ = 0V<br>$I_F$= 300A | $T_{vj}$=25°C | - | 1.70 | 2.15 | V |
| | | $V_F$ (chip) | | $T_{vj}$= 25°C | - | 1.60 | 2.05 | |
| | | | | $T_{vj}$=125°C | - | 1.65 | - | |
| | | | | $T_{vj}$=150°C | - | 1.60 | - | |
| | | | | $T_{vj}$=175°C | - | 1.60 | - | |
| | Switching time (*1) | $t_{d(on)}$ | $V_{CC}$= 600V<br>$I_C$, $I_F$ = 300A<br>$V_{GE}$= +15/ -15V<br>$R_G$= 1.8 Ω<br>$L_S$= 30 nH | $T_{vj}$= 25°C | - | 395 | - | ns |
| | | | | $T_{vj}$=125°C | - | 425 | - | |
| | | | | $T_{vj}$=150°C | - | 430 | - | |
| | | | | $T_{vj}$=175°C | - | 425 | - | |
| | | $t_r$ | | $T_{vj}$= 25°C | - | 90 | - | |
| | | | | $T_{vj}$=125°C | - | 100 | - | |
| | | | | $T_{vj}$=150°C | - | 105 | - | |
| | | | | $T_{vj}$=175°C | - | 110 | - | |
| | | $t_{d(off)}$ | | $T_{vj}$= 25°C | - | 335 | - | |
| | | | | $T_{vj}$=125°C | - | 375 | - | |
| | | | | $T_{vj}$=150°C | - | 385 | - | |
| | | | | $T_{vj}$=175°C | - | 405 | - | |
| | | $t_f$ | | $T_{vj}$= 25°C | - | 150 | - | |
| | | | | $T_{vj}$=125°C | - | 205 | - | |
| | | | | $T_{vj}$=150°C | - | 220 | - | |
| | | | | $T_{vj}$=175°C | - | 255 | - | |
| | Reverse recovery time | $t_{rr}$ | | $T_{vj}$= 25°C | - | 330 | - | |
| | | | | $T_{vj}$=125°C | - | 590 | - | |
| | | | | $T_{vj}$=150°C | - | 660 | - | |
| | | | | $T_{vj}$=175°C | - | 710 | - | |

(*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 | Switching loss (per pulse) | $E_{on}$ | $V_{CC}$ = 600V<br>$I_C$, $I_F$ = 300A<br>$V_{GE}$ = +15/ -15V<br>$R_G$ = 1.8 Ω<br>$L_S$ = 30 nH | $T_{vj}$=25°C | - | 25.4 | - | mJ |
| | | | | $T_{vj}$=125°C | - | 37.8 | - | |
| | | | | $T_{vj}$=150°C | - | 40.9 | - | |
| | | | | $T_{vj}$=175°C | - | 45.6 | - | |
| | | $E_{off}$ | | $T_{vj}$=25°C | - | 18.3 | - | |
| | | | | $T_{vj}$=125°C | - | 23.6 | - | |
| | | | | $T_{vj}$=150°C | - | 25.0 | - | |
| | | | | $T_{vj}$=175°C | - | 27.0 | - | |
| | | $E_{rr}$ | | $T_{vj}$=25°C | - | 7.3 | - | |
| | | | | $T_{vj}$=125°C | - | 14.1 | - | |
| | | | | $T_{vj}$=150°C | - | 15.8 | - | |
| | | | | $T_{vj}$=175°C | - | 18.4 | - | |

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

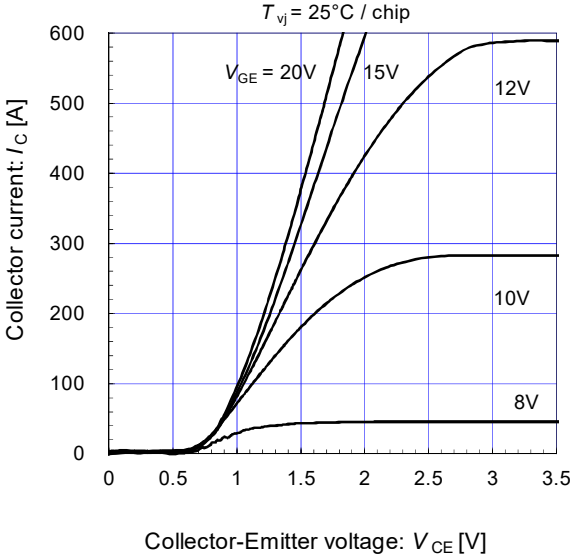
| | Symbols | Conditions | Characteristics min. | Characteristics typ. | Characteristics max. | ns |
|---|---|---|---|---|---|---|
| Thermal resistance junction to case (1device) | $R_{th(j-c)}$ | IGBT | - | - | 0.105 | K/W |
| | | FWD | - | - | 0.165 | |
| Thermal resistance case to heat sink (1IGBT + 1FWD) (*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 cooling fin with thermal compound.

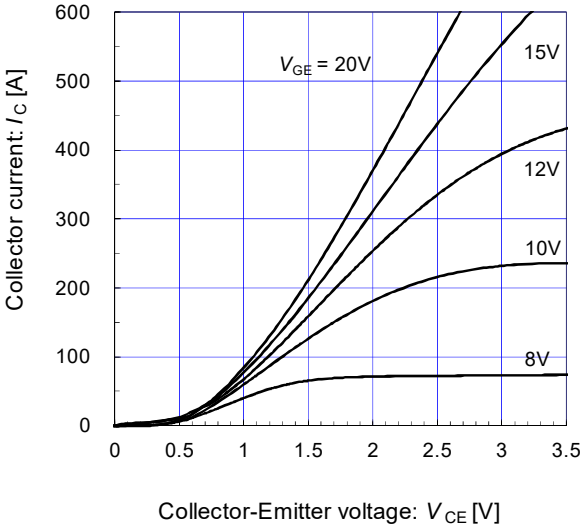
# 2MBI300XHA120-50



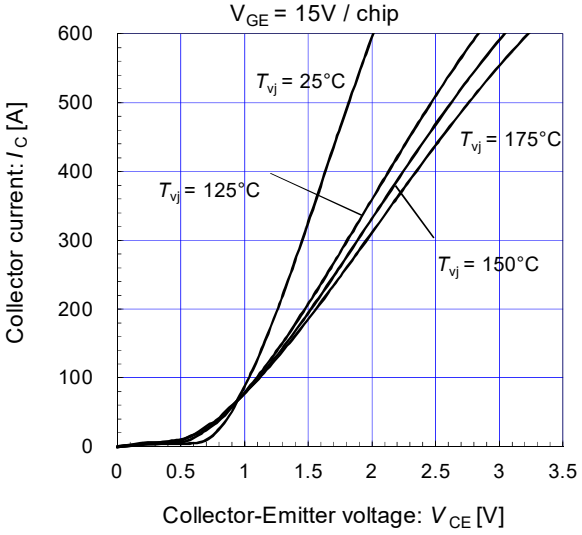
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$ = 25°C / chip



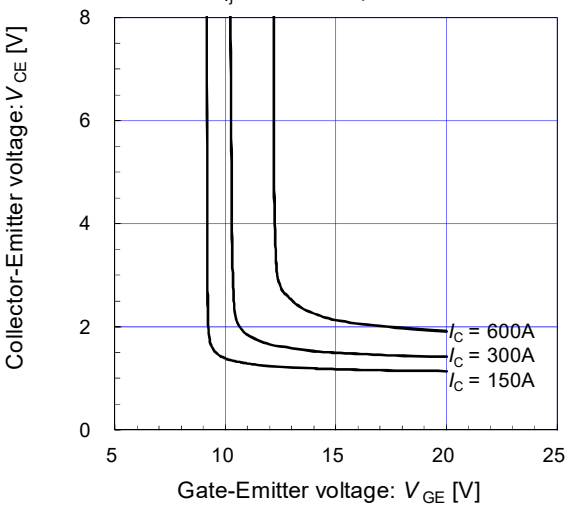

[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
$T_{Vj}$ = 175°C / chip



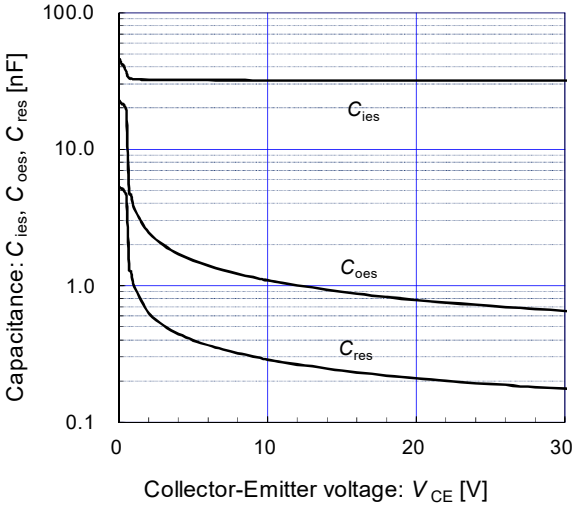

[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
$V_{GE}$ = 15V / chip



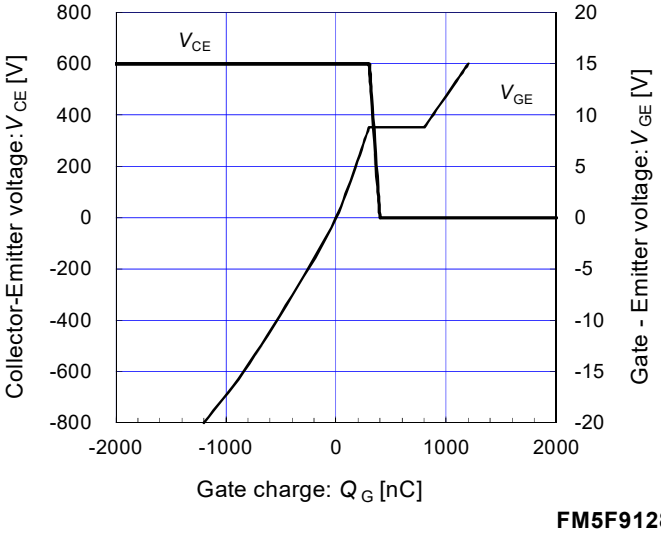

[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
$T_{vj}$ = 25°C / chip




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



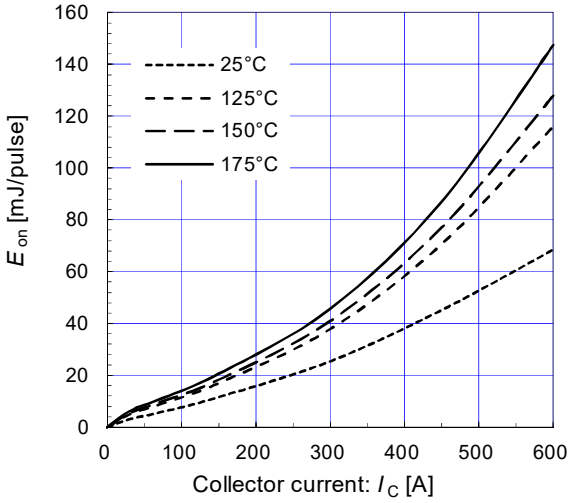

[Inverter]
Dynamic gate charge (typ.)
$V_{CC}$ = 600V, $I_C$ = 300A, $T_{vj}$ = 25°C



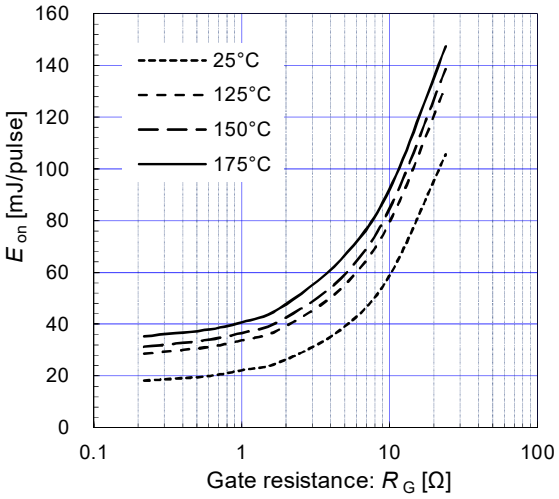
# 2MBI300XHA120-50



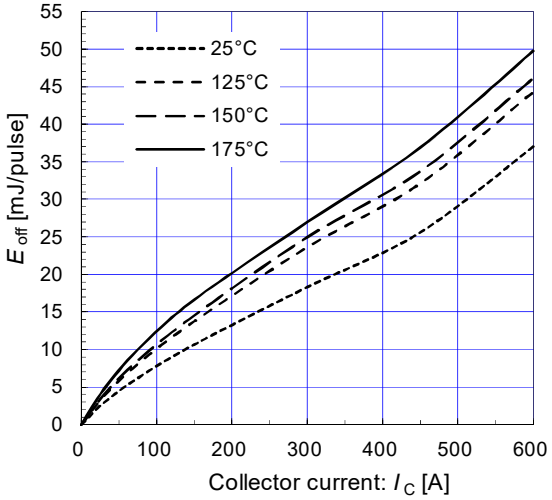
[Inverter]
$E_{on}$ vs. Collector current (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $R_G$ = 1.8 Ω



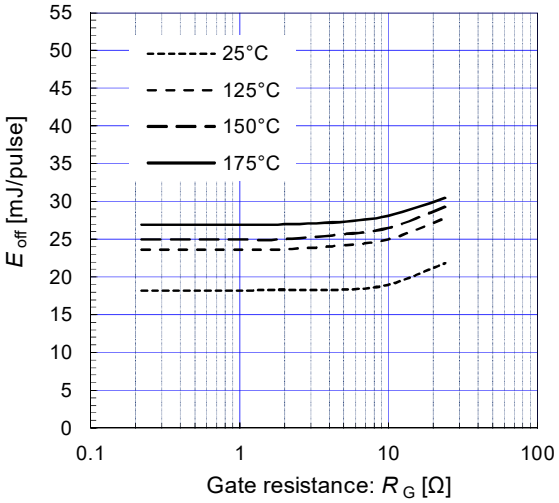

[Inverter]
$E_{on}$ vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $I_C$ = 300A



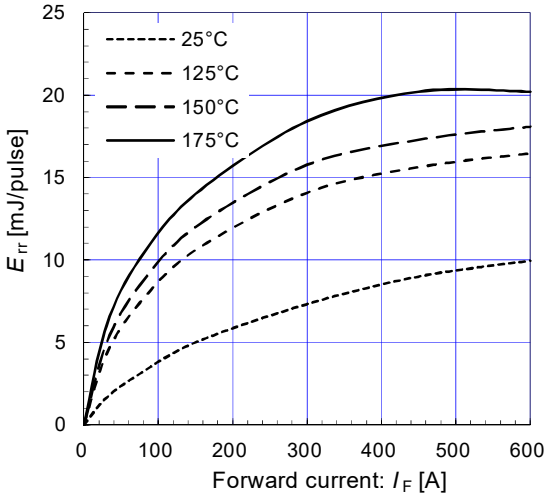

[Inverter]
$E_{off}$ vs. Collector current (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $R_G$ = 1.8 Ω



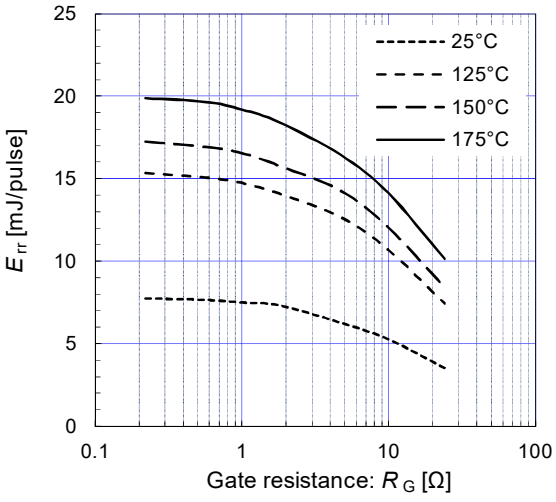

[Inverter]
$E_{off}$ vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $I_C$ = 300A



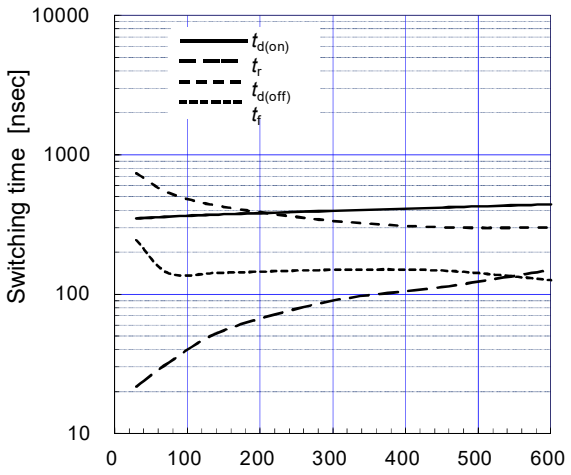

[Inverter]
$E_{rr}$ vs. Forward current (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $R_G$ = 1.8 Ω



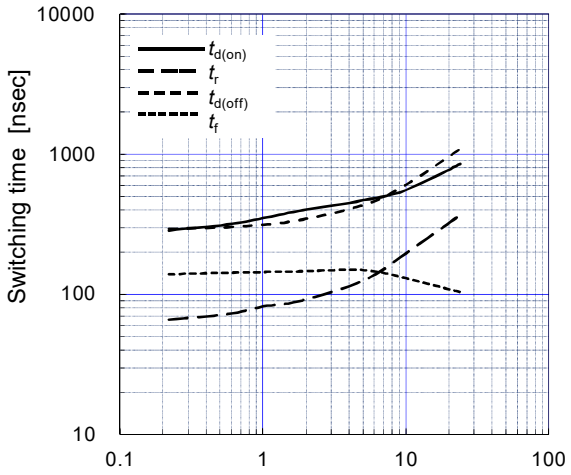

[Inverter]
$E_{rr}$ vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $I_F$ = 300A



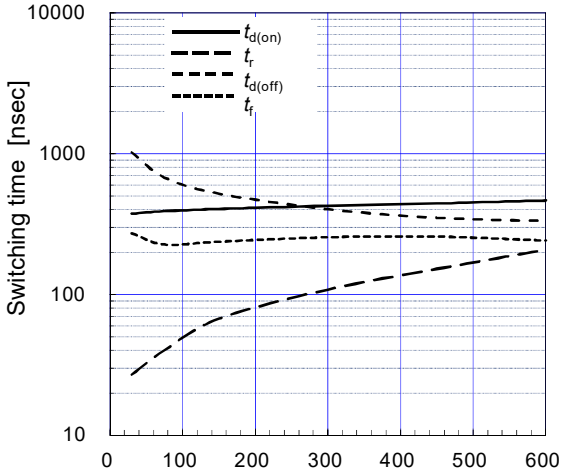
[Inverter]
Switching time vs. Collector current (typ.)
$V_{CC}$ = 600V, $R_G$ = 1.8 Ω, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 25°C



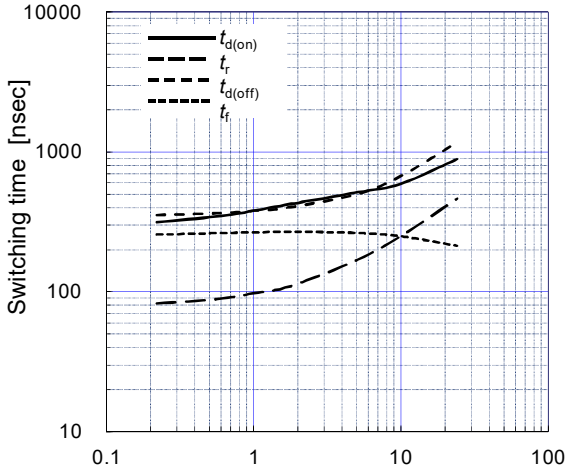

[Inverter]
Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $I_C$ = 300A, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 25°C



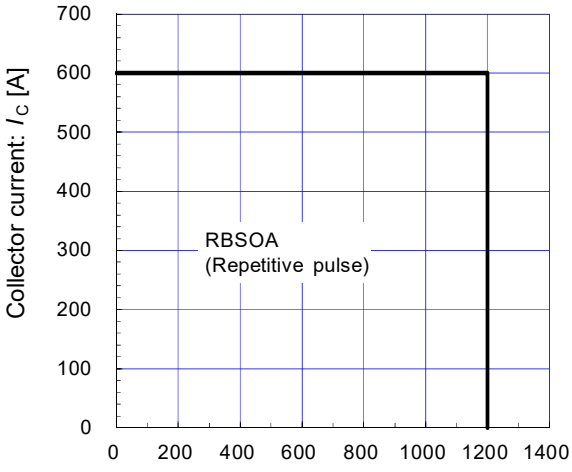

[Inverter]
Switching time vs. Collector current (typ.)
$V_{CC}$ = 600V, $R_G$ = 1.8 Ω, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 175°C




[Inverter]
Switching time vs. Gate resistance (typ.)
$V_{CC}$ = 600V, $I_C$ = 300A, $V_{GE}$ = +15/ -15V, $T_{vj}$ = 175°C



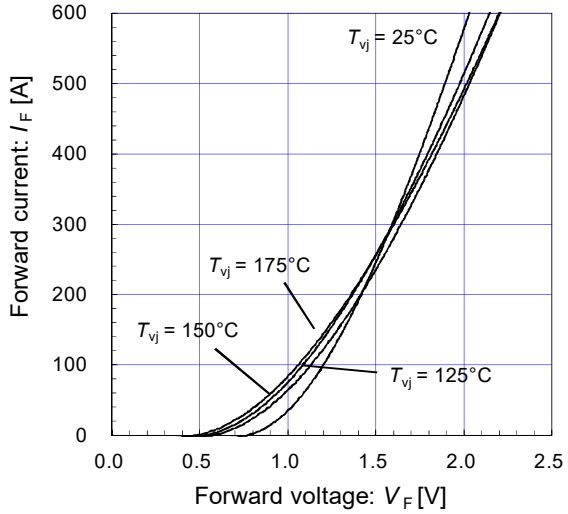

[Inverter]
Reverse bias safe operating area (max.)
$V_{GE}$ = +15/ -15V $R_G$ = 1.8 Ω, $T_{vj}$ = 175°C



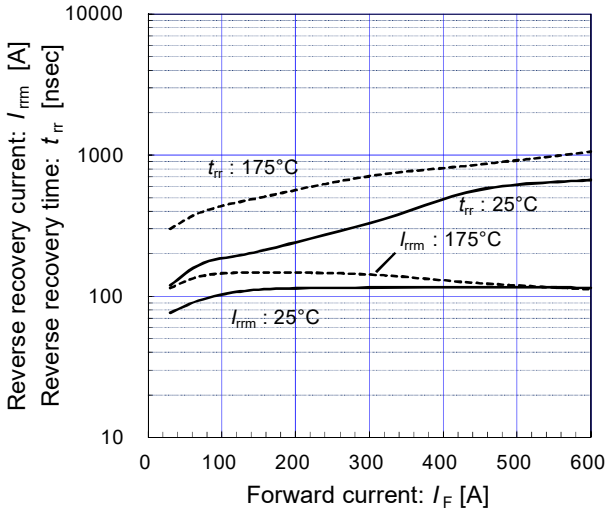
# 2MBI300XHA120-50



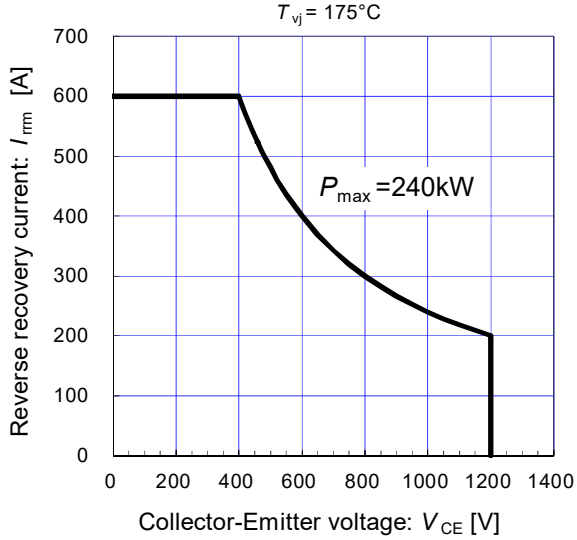
[Inverter]
Forward current vs. Forward voltage (typ.)
chip



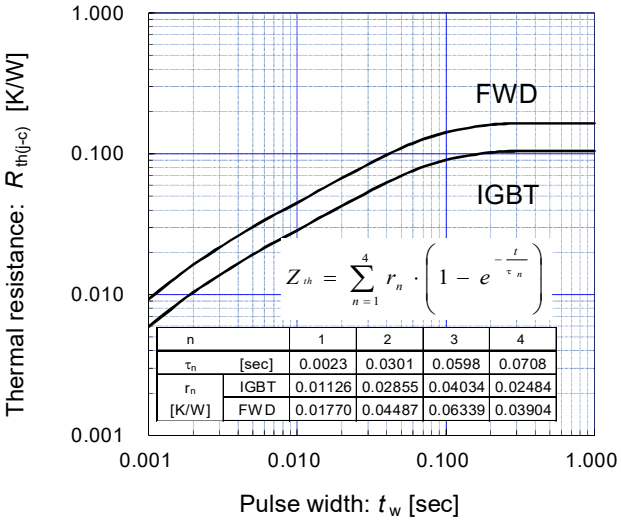

[Inverter]
Reverse recovery characteristics (typ.)
$V_{CC}$ = 600V, $V_{GE}$ = +15/ -15V, $R_G$ = 1.8 Ω




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




[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 | 0.01126 | 0.02855 | 0.04034 | 0.02484 |
| | FWD | 0.01770 | 0.04487 | 0.06339 | 0.03904 |

# Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 1/2024. 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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富士電機 Innovating Energy Technology

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IGBT Modules

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

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