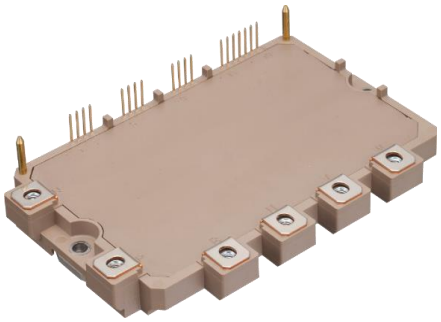
# 6MBP150XDN065-50

IGBT Modules

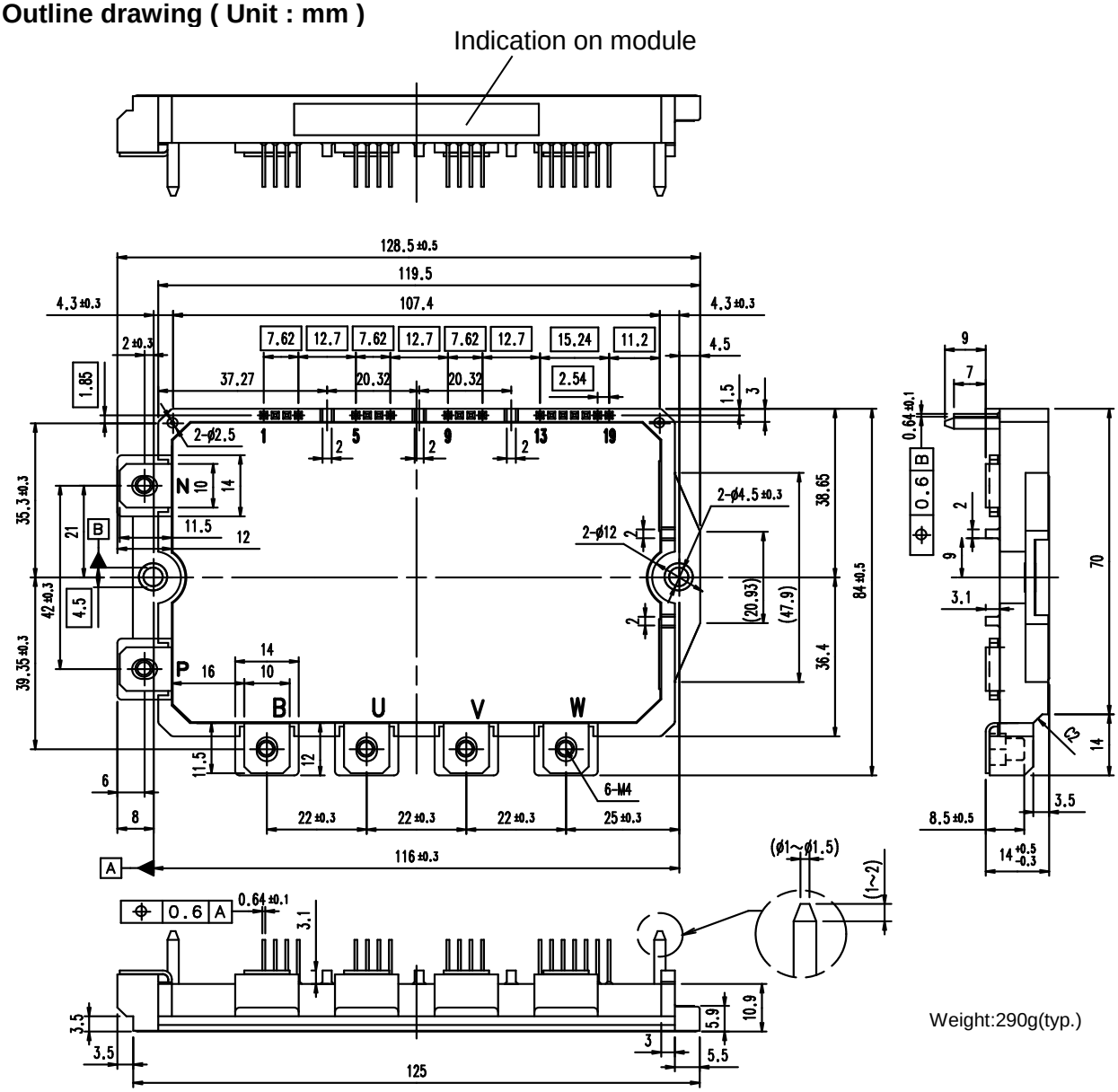
## IGBT Module (X series)



### ■ Features

- Temperature protection provided by directly detecting the junction temperature of the IGBTs
- Low power loss and soft switching
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of a big decrease in number of parts in built-in control circuit

### ■ Outline drawing ( Unit : mm )




Weight:290g(typ.)



FM6M2025
2022/05

# 6MBP150XDN065-50



## ■ Absolute maximum ratings

$T_C$=25°C, $T_{vj}$=25°C, $V_{CC}$=15V unless otherwise specified

| Items | | Symbol | Conditions | Min. | Max. | Units |
|---|---|---|---|---|---|---|
| Collector-Emitter voltage | | $V_{CES}$ | *1 | - | 650 | V |
| Short circuit voltage | | $V_{SC}$ | *2 | 200 | 400 | V |
| Inverter | Collector current | $I_C$ | DC | - | 150 | A |
| | | $I_{CP}$ | 1ms | - | 300 | A |
| | | $-I_C$ | Duty=100% *3 | - | 150 | A |
| | Total power dissipation | $P_{tot}$ | IGBT 1 device *4 | - | 681 | W |
| Brake | Repetitive peak reverse voltage | $V_{RRM}$ | Diode part | - | - | V |
| | Collector current | $I_C$ | DC | - | - | A |
| | | $I_{CP}$ | 1ms | - | - | A |
| | Forward current of diode | $I_F$ | | - | - | A |
| | Total power dissipation | $P_{tot}$ | IGBT 1 device *4 | - | - | W |
| Supply voltage of pre-driver | | $V_{CC}$ | *5 | -0.5 | 20 | V |
| Input signal voltage | | $V_{in}$ | *6 | -0.5 | $V_{CC}$+0.5 | V |
| Alarm signal voltage | | $V_{ALM}$ | *7 | -0.5 | $V_{CC}$ | V |
| Alarm signal current | | $I_{ALM}$ | *8 | - | 20 | mA |
| $T_{vj}$ warning signal voltage | | $V_{WNG}$ | *9 | -0.5 | $V_{CC}$ | V |
| $T_{vj}$ warning signal current | | $I_{WNG}$ | *10 | - | 20 | mA |
| Virtual junction temperature | | $T_{vj}$ | | - | 175 | °C |
| Operating virtual junction temperature | | $T_{vjop}$ | | - | 150 | °C |
| Operating case temperature | | $T_c$ | | -20 | 125 | °C |
| Storage temperature | | $T_{stg}$ | | -40 | 125 | °C |
| Solder temperature | | $T_{sol}$ | *11 | - | 260 | °C |
| Isolating voltage | | $V_{isol}$ | *12 | - | AC2500 | Vrms |
| Mounting torque of screws to heat sink | | $M_s$ | Mounting(M4) | - | 1.7 | Nm |
| Mounting torque of screws to terminals | | $M_t$ | Main terminals(M4) | - | 1.7 | Nm |

Notes
*1: $V_{CES}$ shall be applied to the input voltage between terminal P-(U,V, W) and (U,V, W)-N.
*2: In the case of the load inductance to be over 1μH.
*3: Duty=150°C/$R_{th(j-c)D}$/($I_F$×$V_F$ Max.)×100
*4: $P_{tot}$=150°C/$R_{th(j-c)Q}$
*5: $V_{CC}$ shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9,14 and 13.
*6: $V_{in}$ shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9,16~18 and 13.
*7: $V_{ALM}$ shall be applied to the voltage between terminal No.2 and 1 , 6 and 5 , 10 and 9 , 19 and 13.
*8: $I_{ALM}$ shall be applied to the input current to terminal No. 2,6,10 and 19.
*9: $V_{WNG}$ shall be applied to the voltage between terminal No.15 and 13.
*10: $I_{WNG}$ shall be applied to the input current to terminal No.15.
*11: Immersion time 10±1sec. 1 time.
*12: Terminal to base, 50/60Hz sine wave 1 min. All terminals should be connected together during the test.

## ■ Electrical characteristics

### ● Main circuit

$T_{vj}$=25°C, $V_{CC}$=15V unless otherwise specified

| Item | | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|---|
| Inverter | Collector current at off signal input | $I_{CES}$ | $V_{CE}$ = 650V | | - | - | 1.0 | mA |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ = 150A | Terminal | - | - | 1.80 | V |
| | | | | Chip | - | 1.15 | - | V |
| | Forward voltage of FWD | $V_F$ | $I_F$ = 150A | Terminal | - | - | 2.25 | V |
| | | | | Chip | - | 1.50 | - | V |
| Brake | Collector current at off signal input | $I_{CES}$ | $V_{CE}$ = -V | | - | - | - | mA |
| | Reverse current | $I_{RRM}$ | $V_R$ = -V | | - | - | - | mA |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $I_C$ = -A | Terminal | - | - | - | V |
| | | | | Chip | - | - | - | V |
| | Forward voltage of FWD | $V_F$ | $I_F$ = -A | Terminal | - | - | - | V |
| | | | | Chip | - | - | - | V |
| Switching time *13 | | $t_{on}$ | $I_C$ = 150A, $V_{DC}$ = 300V, $T_{vj}$ = 150°C | | 0.5 | - | - | μs |
| | | $t_{d(on)}$ | | | 0.5 | - | - | μs |
| | | $t_{off}$ | | | - | - | 2.0 | μs |
| | | $t_{d(off)}$ | | | - | - | 1.7 | μs |
| | | $t_{rr}$ | $I_F$ = 150A, $V_{DC}$ = 300V, $T_{vj}$ = 150°C | | - | - | 0.5 | μs |

*13: Turn on time ($t_{on}$) = $t_{d(on)}$ + $t_r$ , Turn off time ($t_{off}$) = $t_{d(off)}$ + $t_f$

### ● Control circuit

$T_{vj}$=25°C, $V_{CC}$=15V unless otherwise specified

| Item | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Supply current of P-side pre-driver (per one unit) | $I_{ccp}$ | Switching frequency ($f_{SW}$) = 0～15kHz, $T_C$ = -20～125°C | | - | - | 19 | mA |
| Supply current of N-side pre-driver | $I_{ccn}$ | | | - | - | 50 | mA |
| Input signal threshold voltage | $V_{inth(on)}$ | $V_{in}$-GND | ON | 1.2 | 1.4 | 1.6 | V |
| | $V_{inth(off)}$ | | OFF | 1.5 | 1.7 | 1.9 | V |

### ● Protection circuit

$T_{vj}$=25°C, $V_{CC}$=15V unless otherwise specified

| Item | | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|---|
| Over current protection level | Inverter | $I_{OC}$ | $T_{vj}$=150°C | | 225 | - | - | A |
| | Brake | | | | - | - | - | A |
| Over current protection delay time | | $t_{dOC}$ | $T_{vj}$=150°C | | - | 4.0 | - | μs |
| Short circuit protection delay time | | $t_{dSC}$ | $T_{vj}$=150°C | | - | 1.0 | - | μs |
| IGBT chips over heating protection temperature level | | $T_{jOH}$ | Surface of IGBT chips | | 175 | - | - | °C |
| Over heating protection hysteresis | | $T_{jH}$ | | | - | 20 | - | °C |
| IGBT chips warning temperature leve | | $T_{jW}$ | Surface of IGBT chips(Y) | | 150 | - | - | °C |
| Warning hysteresis | | $T_{jWH}$ | | | - | 10 | - | °C |
| Under voltage protection level | | $V_{UV}$ | | | 11.0 | - | 12.5 | V |
| Under voltage protection hysteresis | | $V_H$ | | | 0.2 | 0.5 | - | V |
| Alarm signal hold time | | $t_{ALM(OC)}$ | ALM-GND, $T_C$=-20～125°C | $V_{cc}$≧10V | 1.0 | 2.0 | 2.4 | ms |
| | | $t_{ALM(UV)}$ | | | 3.5 | 4.0 | 4.5 | ms |
| | | $t_{ALM(TjOH)}$ | | | 7.0 | 8.0 | 9.0 | ms |
| Warning signal hold time | | $t_{WNG}$ | WNG-GND, $T_C$=-20～125°C | | $T_{jw}$ operating ～ cancellation | | | ms |
| Alarm signal voltage | | $V_{ALMH}$ | ALM-GND, without protection | | 14.5 | - | 15.0 | V |
| Warning signal voltage | | $V_{WNGH}$ | WNG-GND, without warning | | 14.5 | - | 15.0 | V |
| Resistance for current limit | | $R_{ALM}$ | | | 960 | - | 1570 | Ω |
| | | $R_{WNG}$ | | | 960 | - | 1570 | Ω |

# 6MBP150XDN065-50



## ■ Thermal resistance characteristics ($T_c$ = 25℃)

| Item | | | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Thermal resistance junction to case *14 | Inverter | IGBT | $R_{th(j-c)Q}$ | - | - | 0.22 | K/W |
| | | FWD | $R_{th(j-c)D}$ | | | 0.28 | K/W |
| | Brake | IGBT | $R_{th(j-c)Q}$ | - | - | - | K/W |
| | | FWD | $R_{th(j-c)D}$ | - | - | - | K/W |
| Thermal resistance case to heat sink *15 | | | $R_{th(c-s)}$ | - | 0.05 | - | K/W |

*14: For 1 device , the measurement point of the case is just under the chip.
*15: This is the value which is defined mounting on the additional heat sink with 1 W/(m·K) thermal grease.

## ■ Noise immunity ($V_{DC}$=300V, $V_{CC}$=15V)

| Item | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Common mode rectangular noise | Pulse width 1μs,polarity ±,10min.<br>Judge：no over-current, no miss operating | ±2.0 | - | - | kV |

## ■ Recommended operating conditions

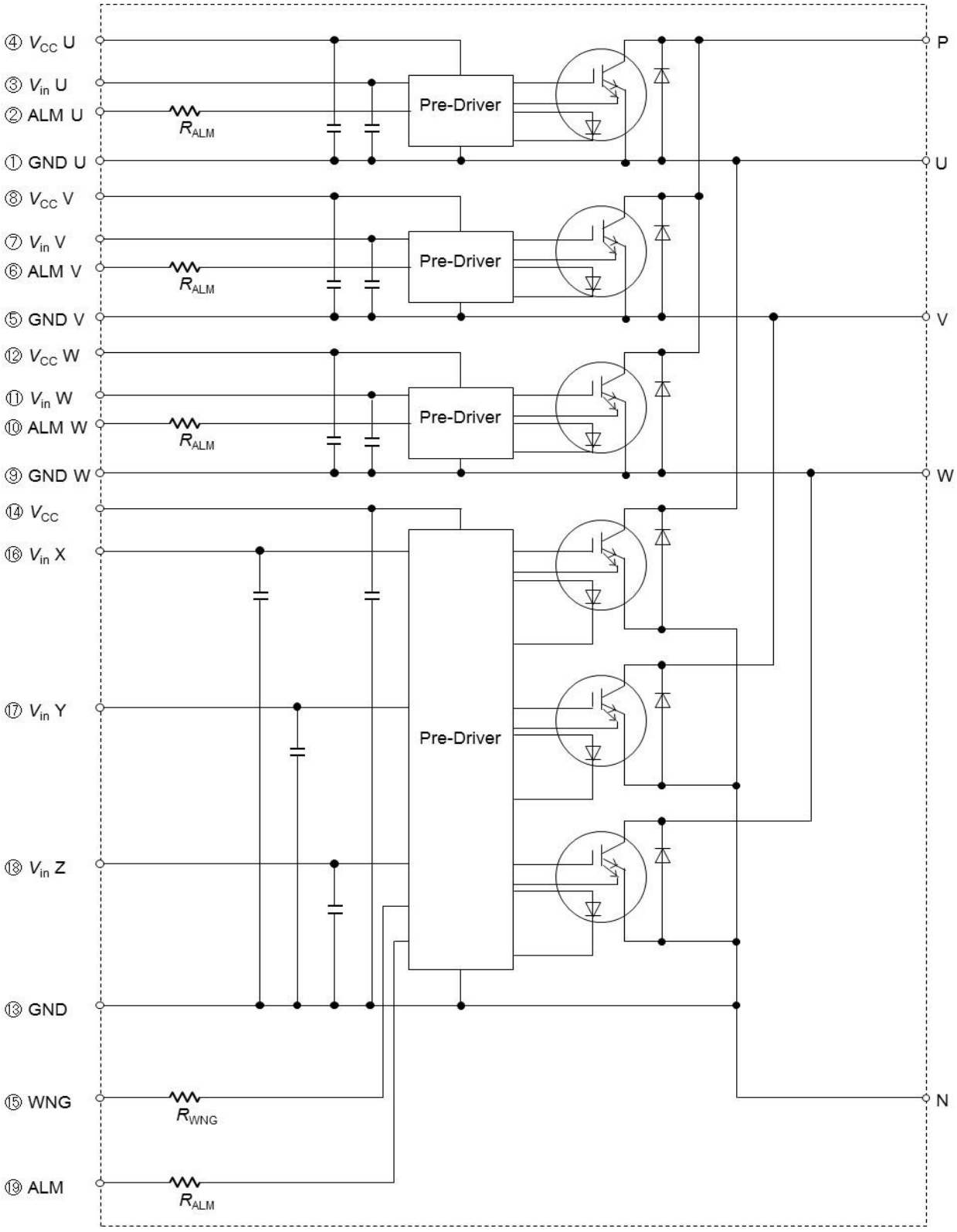
| Item | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| DC bus voltage | $V_{DC}$ | - | - | 400 | V |
| Power supply voltage of pre-driver | $V_{CC}$ | 13.5 | 15.0 | 16.5 | V |
| Switching frequency of IPM | $f_{SW}$ | - | - | 20.0 | kHz |
| Arm shoot through blocking time for IPM's input signal *16 | $t_{dead}$ | 1.5 | - | - | μs |
| Screw torque (M4) | - | 1.3 | - | 1.7 | Nm |

*16: $t_{dead} = t_{off} - t_{d(on)}$

# 6MBP150XDN065-50



## ■ Block diagram

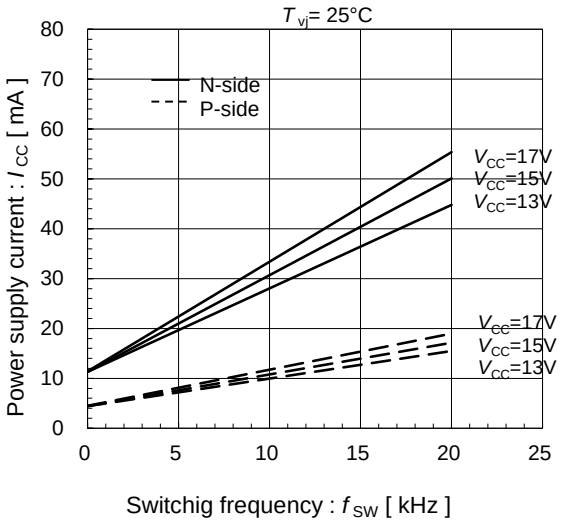



Pre-drivers include following functions
1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

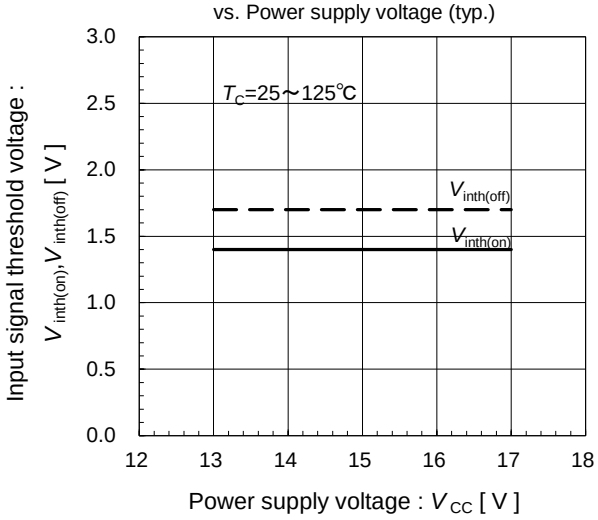
## ■ Characteristics (representative)

### ● Control circuit

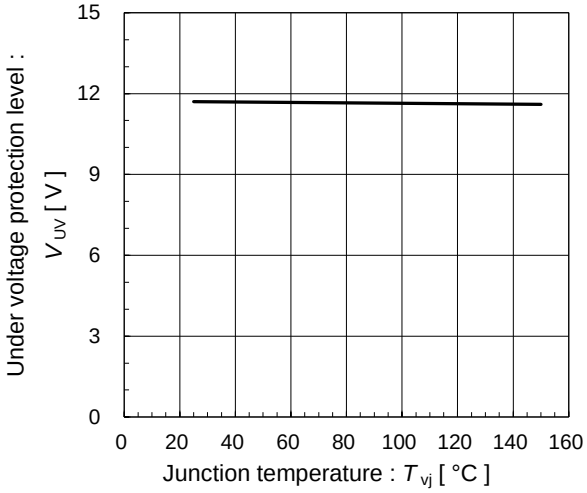
Power supply current vs. Switching frequency (typ.)



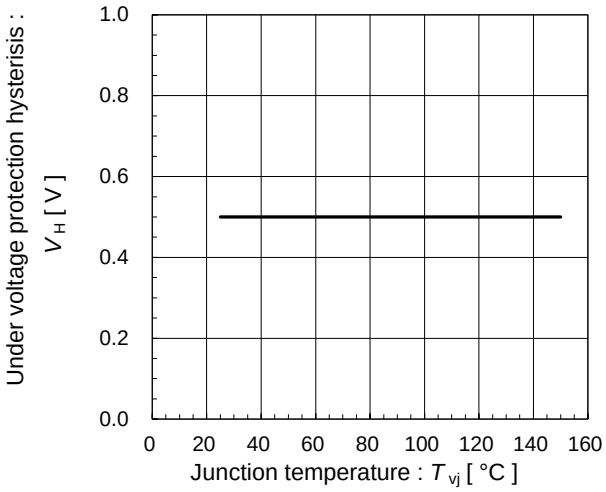

Input signal threshold voltage vs. Power supply voltage (typ.)



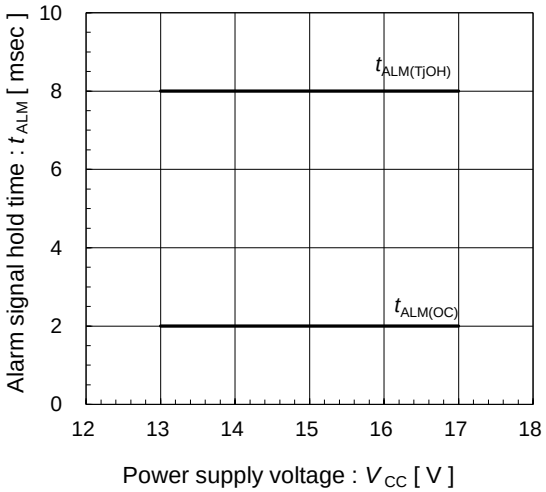

Under voltage protection level vs. Junction temperature (typ.)



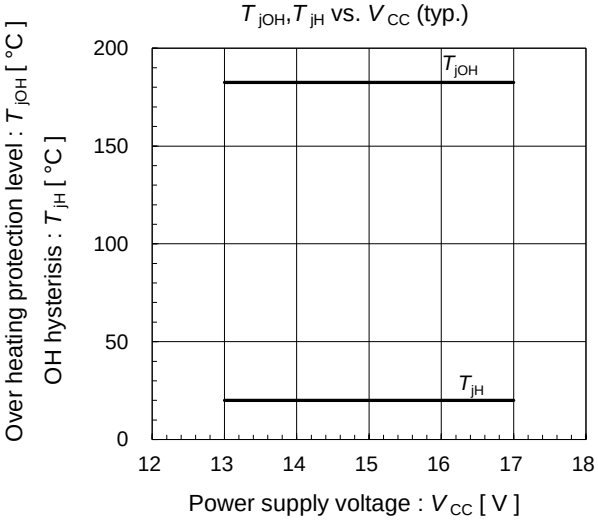

Under voltage protection hysterisis vs. Junction temperature (typ.)




Alarm signal hold time vs. Power supply voltage (typ.)

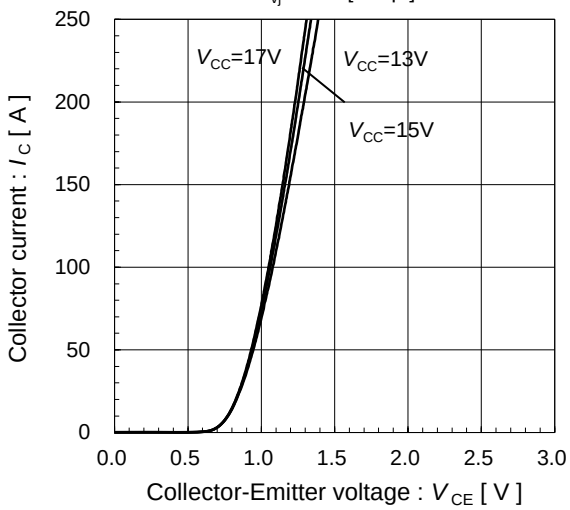



Over heating characteristics $T_{jOH}$,$T_{jH}$ vs. $V_{CC}$ (typ.)

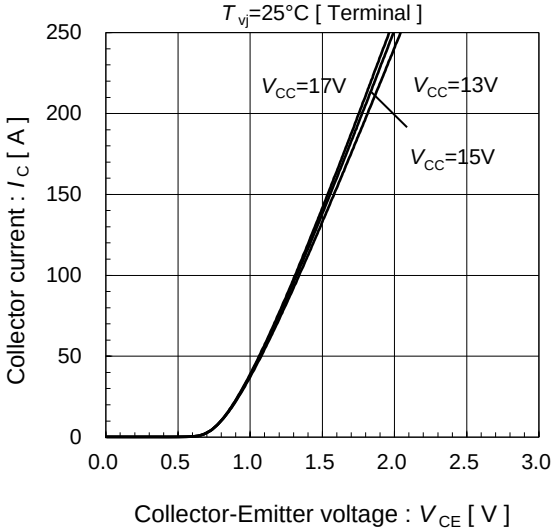


## ● Inverter

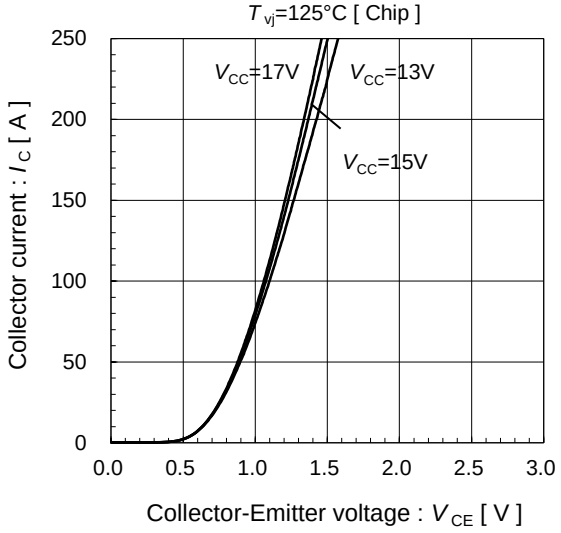
Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$=25°C [ Chip ]



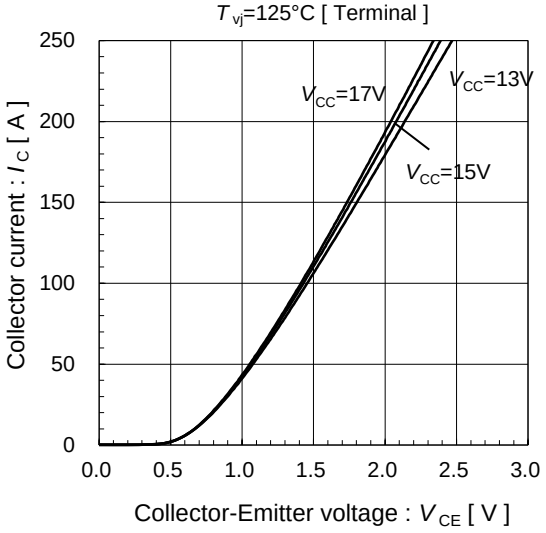

Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$=25°C [ Terminal ]



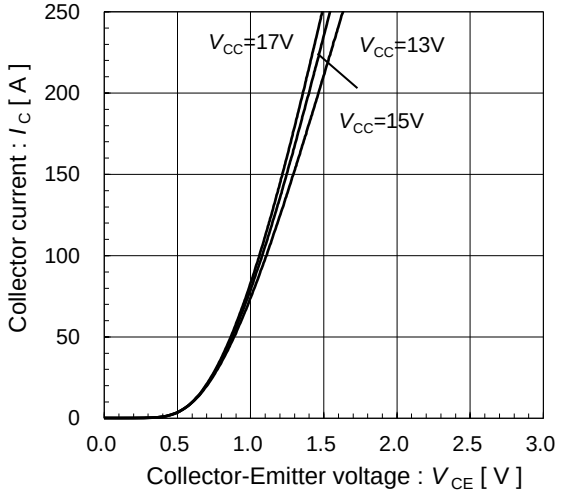

Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$=125°C [ Chip ]



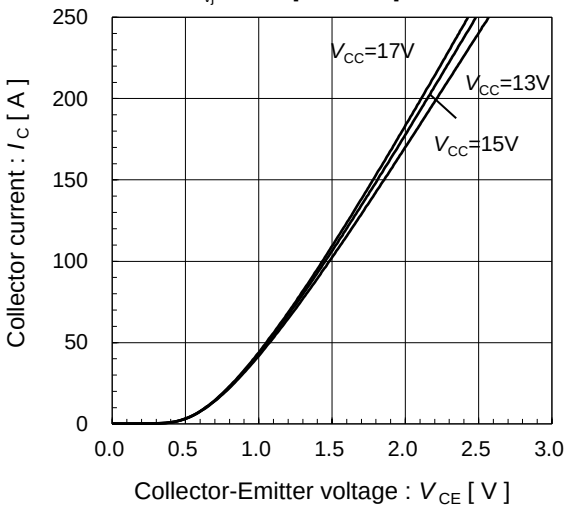

Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$=125°C [ Terminal ]



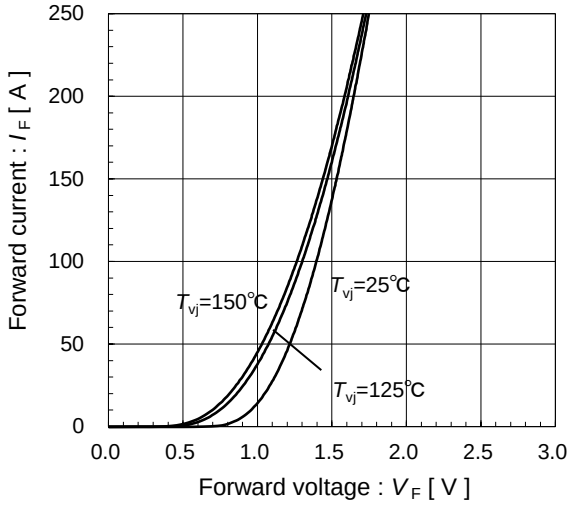

Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$=150°C [ Chip ]



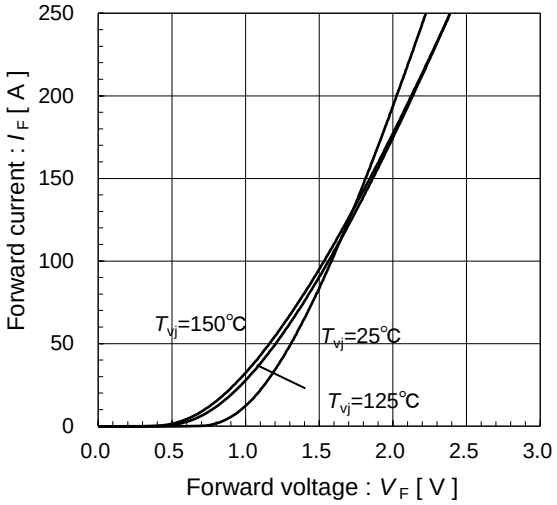

Collector current vs. Collector-Emitter voltage (typ.)
$T_{vj}$=150°C [ Terminal ]



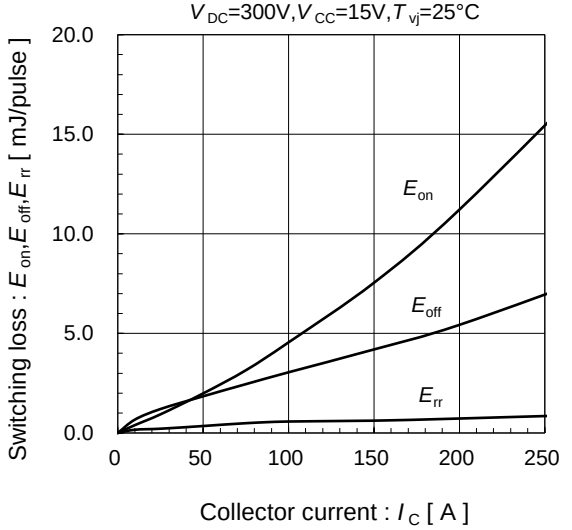
Forward current vs. Forward voltage (typ.)
[ Chip ]



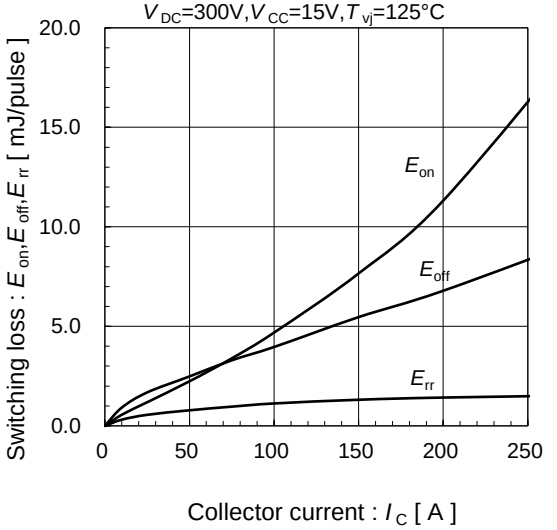

Forward current vs. Forward voltage (typ.)
[ Terminal ]



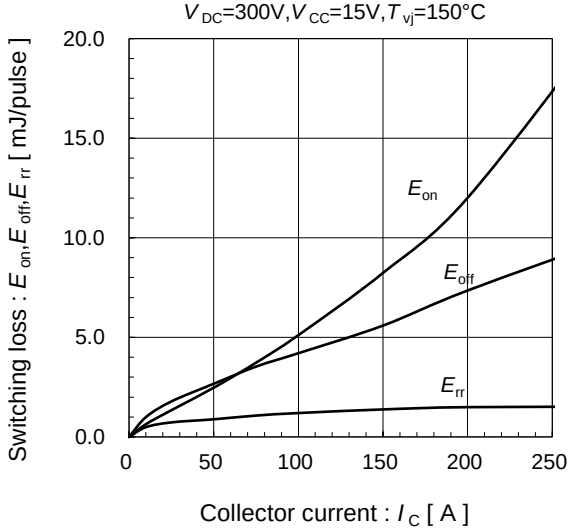

Switching loss vs. collector current (typ.)
$V_{DC}$=300V,$V_{CC}$=15V,$T_{vj}$=25°C




Switching loss vs. collector current (typ.)
$V_{DC}$=300V,$V_{CC}$=15V,$T_{vj}$=125°C



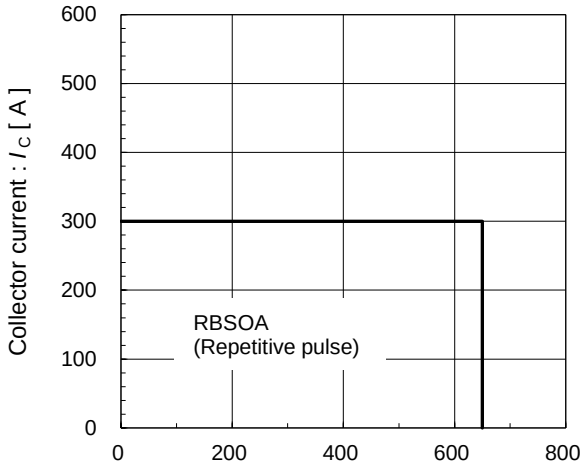

Switching loss vs. collector current (typ.)
$V_{DC}$=300V,$V_{CC}$=15V,$T_{vj}$=150°C



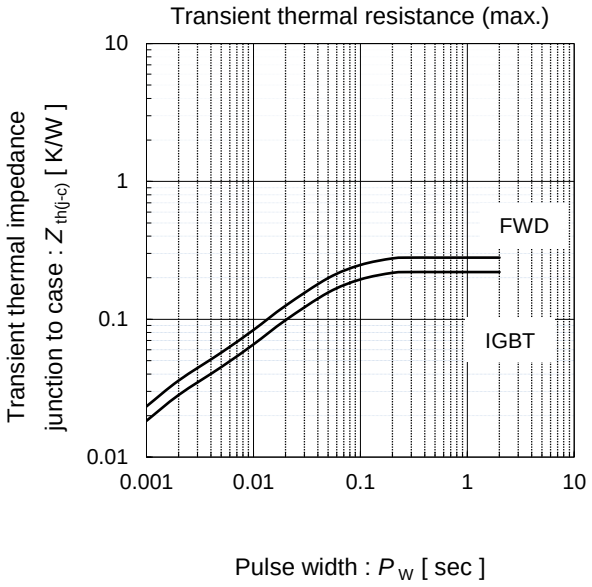
# 6MBP150XDN065-50



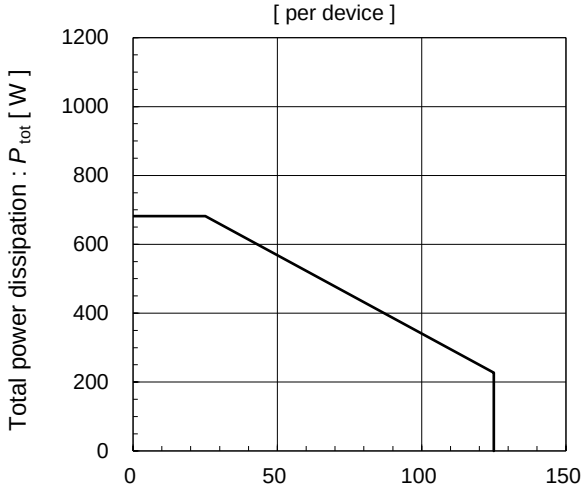
Reversed biased safe operating area (max.)
$V_{CC}$=15V, $T_{vj}$=150°C



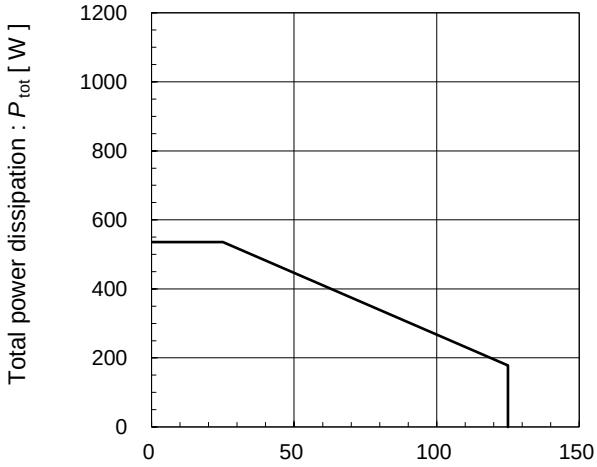

Transient thermal resistance (max.)




Power derating for IGBT (max.)
[ per device ]



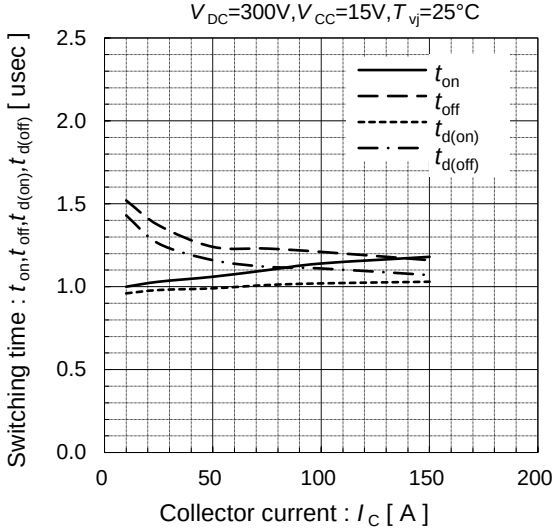

Power derating for FWD (max.)
[ per device ]



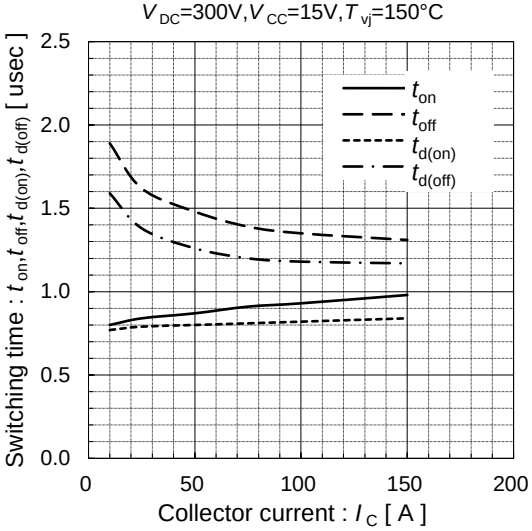
# 6MBP150XDN065-50



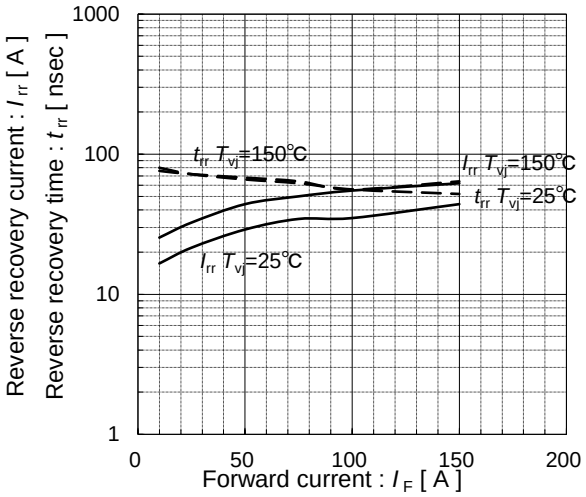
Switching time vs. Collector current (typ.)
$V_{DC}$=300V, $V_{CC}$=15V, $T_{vj}$=25°C



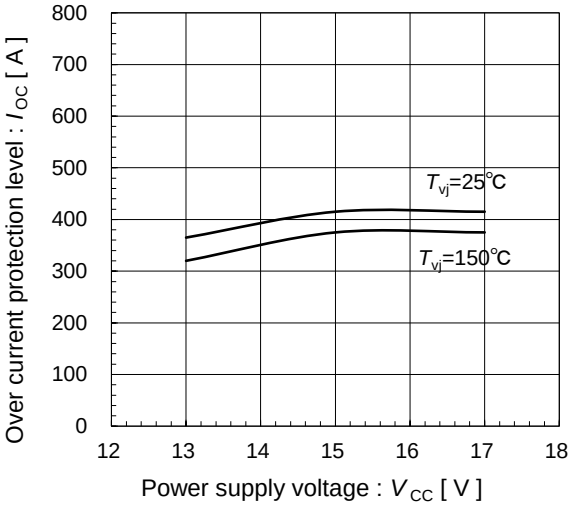

Switching time vs. Collector current (typ.)
$V_{DC}$=300V, $V_{CC}$=15V, $T_{vj}$=150°C




Reverse recovery characteristics (typ.)
$V_{DC}$=300V, $V_{CC}$=15V




Over current protection vs. Power supply voltage (typ.)
$V_{DC}$=300V



# Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 5/2022 . 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.

5. If you need to use a product in this Catalog for equipment requiring higher reliability than normal, such as for the equipment listed below, it is imperative to contact Fuji Electric Co., Ltd. to obtain prior approval. When using these products for such equipment, take adequate measures such as a backup system to prevent the equipment from malfunctioning even if a Fuji's product incorporated in the equipment becomes faulty.
・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).
・Space equipment ・Aeronautic equipment ・Nuclear control equipment ・Submarine repeater equipment

7. 

8. If you have any question about any portion in this Catalog, ask Fuji Electric Co., Ltd. or its sales agents before using the product. Neither Fuji Electric Co., Ltd. nor its agents shall be liable for any injury caused by any use of the products not in accordance with instructions set forth herein.

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# Technical Information

IGBT Modules

- Please refer to URLs below for futher information about products, application manuals and design support.
- 关于本规格书中没有记载的产品信息，应用手册，技术信息等，请参考以下链接。
- 本データシートに記載されていない製品情報，アプリケーションマニュアル，デザインサポートは以下のURLをご参照下さい。

## FUJI ELECTRIC Power Semiconductor WEB site

| | |
|---|---|
| 日本 | www.fujielectric.co.jp/products/semiconductor/ |
| Global | www.fujielectric.com/products/semiconductor/ |
| 中国 | www.fujielectric.com.cn/products/semiconductor/ |
| Europe | www.fujielectric-europe.com/en/power_semiconductor/ |
| North America | www.americas.fujielectric.com/products/semiconductors/ |

## Information

### 日本

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|---|---|
| 1 半導体総合カタログ | www.fujielectric.co.jp/products/semiconductor/catalog/ |
| 2 製品情報 | www.fujielectric.co.jp/products/semiconductor/model/ |
| 3 アプリケーションマニュアル | www.fujielectric.co.jp/products/semiconductor/model/igbt/application/ |
| 4 デザインサポート | www.fujielectric.co.jp/products/semiconductor/model/igbt/technical/ |
| 5 マウンティングインストラクション | www.fujielectric.co.jp/products/semiconductor/model/igbt/mounting/ |
| 6 IGBT 損失シミュレーションソフト | www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation/ |
| 7 富士電機技報 | www.fujielectric.co.jp/products/semiconductor/journal/ |
| 8 製品のお問い合わせ | www.fujielectric.co.jp/products/semiconductor/contact/ |
| 9 改廃のお知らせ | www.fujielectric.co.jp/products/semiconductor/discontinued/ |

### Global

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|---|---|
| 1 Semiconductors General Catalog | www.fujielectric.com/products/semiconductor/catalog/ |
| 2 Product Information | www.fujielectric.com/products/semiconductor/model/ |
| 3 Application Manuals | www.fujielectric.com/products/semiconductor/model/igbt/application/ |
| 4 Design Support | www.fujielectric.com/products/semiconductor/model/igbt/technical/ |
| 5 Mounting Instructions | www.fujielectric.com/products/semiconductor/model/igbt/mounting/ |
| 6 IGBT Loss Simulation Software | www.fujielectric.com/products/semiconductor/model/igbt/simulation/ |
| 7 Fuji Electric Journal | www.fujielectric.com/products/semiconductor/journal/ |
| 8 Contact | www.fujielectric.com/contact/ |
| 9 Revised and discontinued product information | www.fujielectric.com/products/semiconductor/discontinued/ |

### 中国

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|---|---|
| 1 半导体综合目录 | www.fujielectric.com.cn/products/semiconductor/catalog/ |
| 2 产品信息 | www.fujielectric.com.cn/products/semiconductor/model/ |
| 3 应用手册 | www.fujielectric.com.cn/products/semiconductor/model/igbt/application/ |
| 4 技术信息 | www.fujielectric.com.cn/products/semiconductor/model/igbt/technical/ |
| 5 安装说明书 | www.fujielectric.com.cn/products/semiconductor/model/igbt/mounting/ |
| 6 IGBT 损耗模拟软件 | www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation/ |
| 7 富士电机技报 | www.fujielectric.com.cn/products/semiconductor/journal/ |
| 8 产品咨询 | www.fujielectric.com/contact/ |
| 9 产品更改和停产信息 | www.fujielectric.com.cn/products/semiconductor/discontinued/ |