

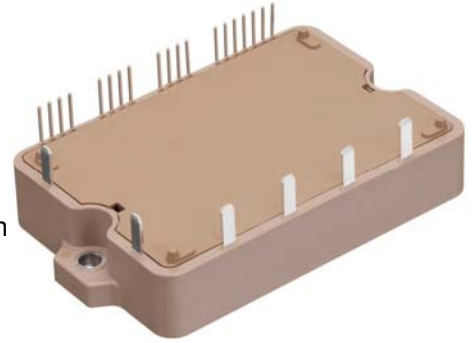
6MBP100VFN060-50

IGBT Modules

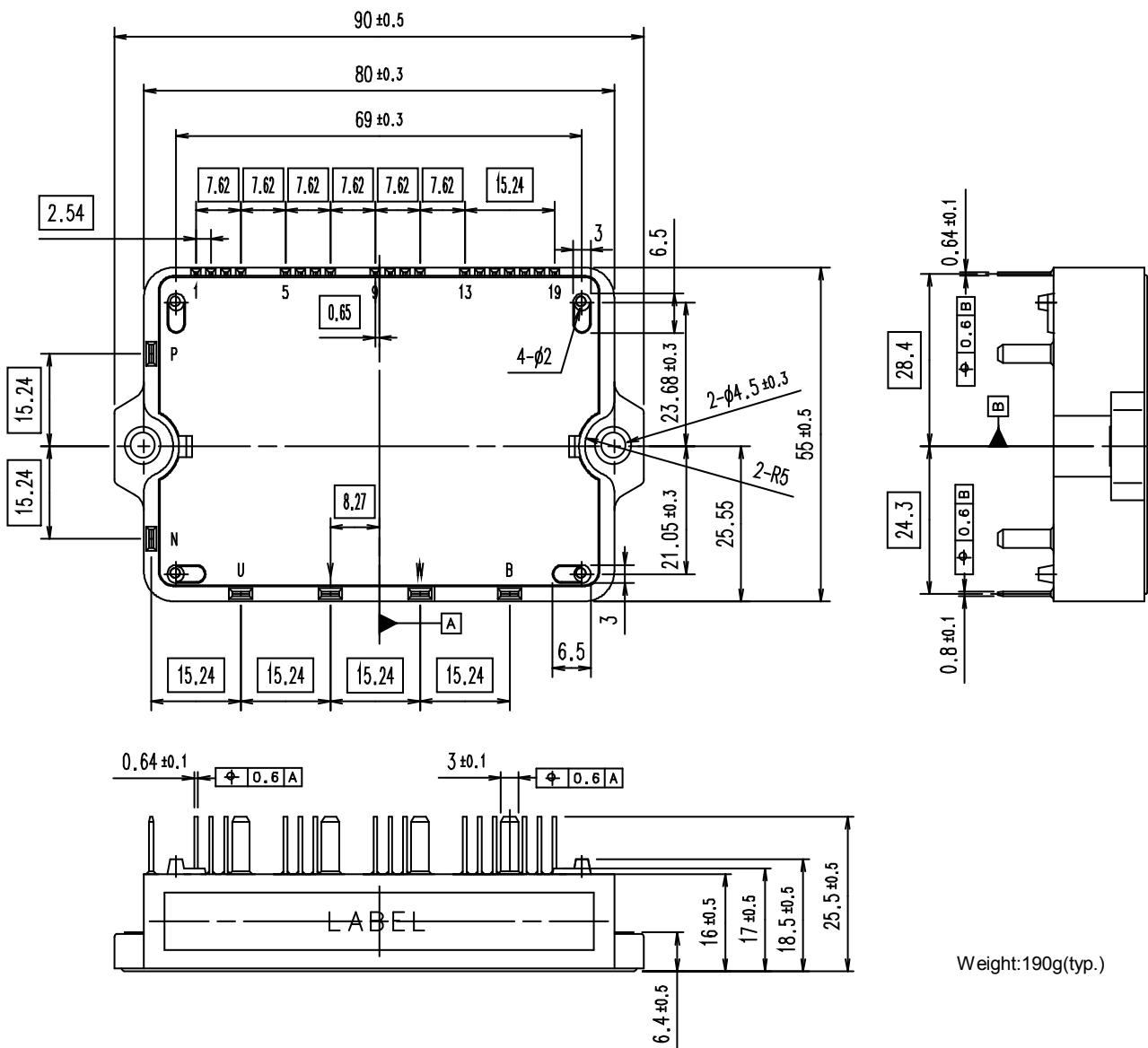
IGBT Module (V series)
600V / 100A / IPM

■ **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: 190g(typ.)

6MBP100VFN060-50

IGBT Modules
■ Absolute Maximum Ratings
 $T_c=25^{\circ}\text{C}$, $V_{CC}=15\text{V}$ unless otherwise specified.

| Items | | Symbol | Min. | Max. | Units | |
|---------------------------------|--------------------------|---------------|---------|--------------|--------------------|----|
| Collector-Emitter Voltage *1 | | V_{CES} | 0 | 600 | V | |
| Short Circuit Voltage | | V_{sc} | 200 | 400 | V | |
| Inverter | Collector Current | DC | - | 100 | A | |
| | | 1ms | - | 200 | A | |
| | | Duty=100% *2 | - I_C | - | 100 | A |
| Collector Power Dissipation | | 1 device *3 | P_C | - | 403 | W |
| Brake | Collector Current | DC | - | - | A | |
| | | 1ms | - | - | A | |
| | Forward Current of Diode | | I_F | - | - | A |
| Collector Power Dissipation | | 1 device *3 | P_C | - | - | W |
| Supply Voltage of Pre-Driver *4 | | V_{CC} | -0.5 | 20 | V | |
| Input Signal Voltage *5 | | V_{in} | -0.5 | $V_{CC}+0.5$ | V | |
| Alarm Signal Voltage *6 | | V_{ALM} | -0.5 | V_{CC} | V | |
| Alarm Signal Current *7 | | I_{ALM} | - | 20 | mA | |
| Junction Temperature | | T_j | - | 150 | $^{\circ}\text{C}$ | |
| Operating Case Temperature | | T_{opr} | -20 | 110 | $^{\circ}\text{C}$ | |
| Storage Temperature | | T_{stg} | -40 | 125 | $^{\circ}\text{C}$ | |
| Solder Temperature *8 | | T_{sol} | - | 260 | $^{\circ}\text{C}$ | |
| Isolating Voltage *9 | | V_{iso} | - | AC2500 | V _{rms} | |
| Screw Torque | | Mounting (M4) | - | - | 1.7 | Nm |

Notes

*1: V_{CES} shall be applied to the input voltage between terminal P-(U,V, W,B) and (U,V, W,B)-N.

*2: $Duty=125^{\circ}\text{C}/R_{th(j-c)D}/(I_F \times V_F \text{ Max.}) \times 100$

*3: $P_C=125^{\circ}\text{C}/R_{th(j-c)Q}$ (Inverter & Brake)

*4: V_{CC} shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9,14 and 13.

*5: V_{in} shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9,15~18 and 13.

*6: V_{ALM} shall be applied to the voltage between terminal No.2 and 1, 6 and 5, 10 and 9,19 and 13.

*7: I_{ALM} shall be applied to the input current to terminal No.2,6,10 and 19.

*8: Immersion time $10 \pm 1\text{sec}$. 1time

*9: Terminal to base, 50/60Hz sine wave 1min. All terminals should be connected together during the test.

■ Electrical Characteristics ($T_j=25^{\circ}\text{C}$, $V_{CC}=15\text{V}$ unless otherwise specified.)
● Main circuit

| Item | | Symbol | Conditions | Min. | Typ. | Max. | Units | |
|------------------------|---------------------------------------|---------------------|--|----------|------|------|---------------|---|
| Inverter | Collector Current at off signal input | I_{CES} | $V_{CE} = 600\text{V}$ | - | - | 1.0 | mA | |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $I_C = 100\text{A}$ | Terminal | - | - | 1.95 | V |
| | | | | Chip | - | 1.25 | - | V |
| Forward voltage of FWD | V_F | $I_F = 100\text{A}$ | Terminal | - | - | 2.2 | V | |
| | | | Chip | - | 1.6 | - | V | |
| Brake | Collector Current at off signal input | I_{CES} | $V_{CE} =$ | - | - | - | mA | |
| | Collector-Emitter saturation voltage | $V_{CE(sat)}$ | $I_C =$ | Terminal | - | - | - | V |
| | | | | Chip | - | - | - | V |
| Forward voltage of FWD | V_F | $I_F =$ | Terminal | - | - | - | V | |
| | | | Chip | - | - | - | V | |
| Switching time | t_{on} | | $V_{DC} = 300\text{V}$, $T_j=125^{\circ}\text{C}$ | 1.1 | - | - | μs | |
| | t_{off} | | $I_C = 100\text{A}$ | - | - | 2.1 | μs | |
| | t_{rr} | | $V_{DC} = 300\text{V}$ $I_F = 100\text{A}$ | - | - | 0.3 | μs | |

6MBP100VFN060-50

IGBT Modules

● **Control circuit**

| Item | Symbol | Conditions | Min. | Typ. | Max. | Units | |
|--|-------------------|---|------|------|------|-------|---|
| Supply current of P-side pre-driver (per one unit) | I_{ccp} | Switching Frequency = 0-15kHz $T_c = -20 \sim 110^\circ\text{C}$ | - | - | 17 | mA | |
| Supply current of N-side pre-driver | I_{ccn} | | - | - | 51 | mA | |
| Input signal threshold voltage | $V_{in(th)(on)}$ | V_{in-GND} | ON | 1.2 | 1.4 | 1.6 | V |
| | $V_{in(th)(off)}$ | | OFF | 1.5 | 1.7 | 1.9 | V |

● **Protection Circuit**

| Item | Symbol | Conditions | Min. | Typ. | Max. | Units |
|--|--------------------|--|------|------|------|------------------|
| Over Current Protection Level | I_{oc} | $T_j = 125^\circ\text{C}$ Resistance Load | 200 | - | - | A |
| Over Current Protection Delay time | t_{dOC} | $T_j = 125^\circ\text{C}$ | - | 5 | - | μs |
| Short Circuit Protection Delay time | t_{sc} | $T_j = 125^\circ\text{C}$ | - | 2 | 3 | μs |
| IGBT Chips Over Heating Protection Temperature Level | T_{jOH} | Surface of IGBT Chips | 150 | - | - | $^\circ\text{C}$ |
| Over Heating Protection Hysteresis | T_{jH} | | - | 20 | - | $^\circ\text{C}$ |
| 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 | 1.0 | 2.0 | 2.4 | ms |
| | $t_{ALM(UV)}$ | $T_c = -20 \sim 110^\circ\text{C}$ $V_{cc} \geq 10\text{V}$ | 2.5 | 4.0 | 4.9 | ms |
| | $t_{ALM(T_{jOH})}$ | | 5.0 | 8.0 | 11.0 | ms |
| Resistance for current limit | R_{ALM} | | 960 | 1265 | 1570 | Ω |

■ **Thermal Characteristics ($T_c = 25^\circ\text{C}$)**

| Item | Symbol | Min. | Typ. | Max. | Units | |
|--|---------------|------|------|------|--------------------|--------------------|
| Junction to Case Thermal Resistance*10 | Inverter | IGBT | - | - | 0.31 | $^\circ\text{C/W}$ |
| | | FWD | - | - | 0.55 | $^\circ\text{C/W}$ |
| | Brake | IGBT | - | - | - | $^\circ\text{C/W}$ |
| | | FWD | - | - | - | $^\circ\text{C/W}$ |
| Case to Fin Thermal Resistance with Compound | $R_{th(c-f)}$ | - | 0.05 | - | $^\circ\text{C/W}$ | |

*10: For 1device , the measurement point of the case is just under the chip.

■ **Noise Immunity ($V_{DC}=300\text{V}$, $V_{CC}=15\text{V}$)**

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

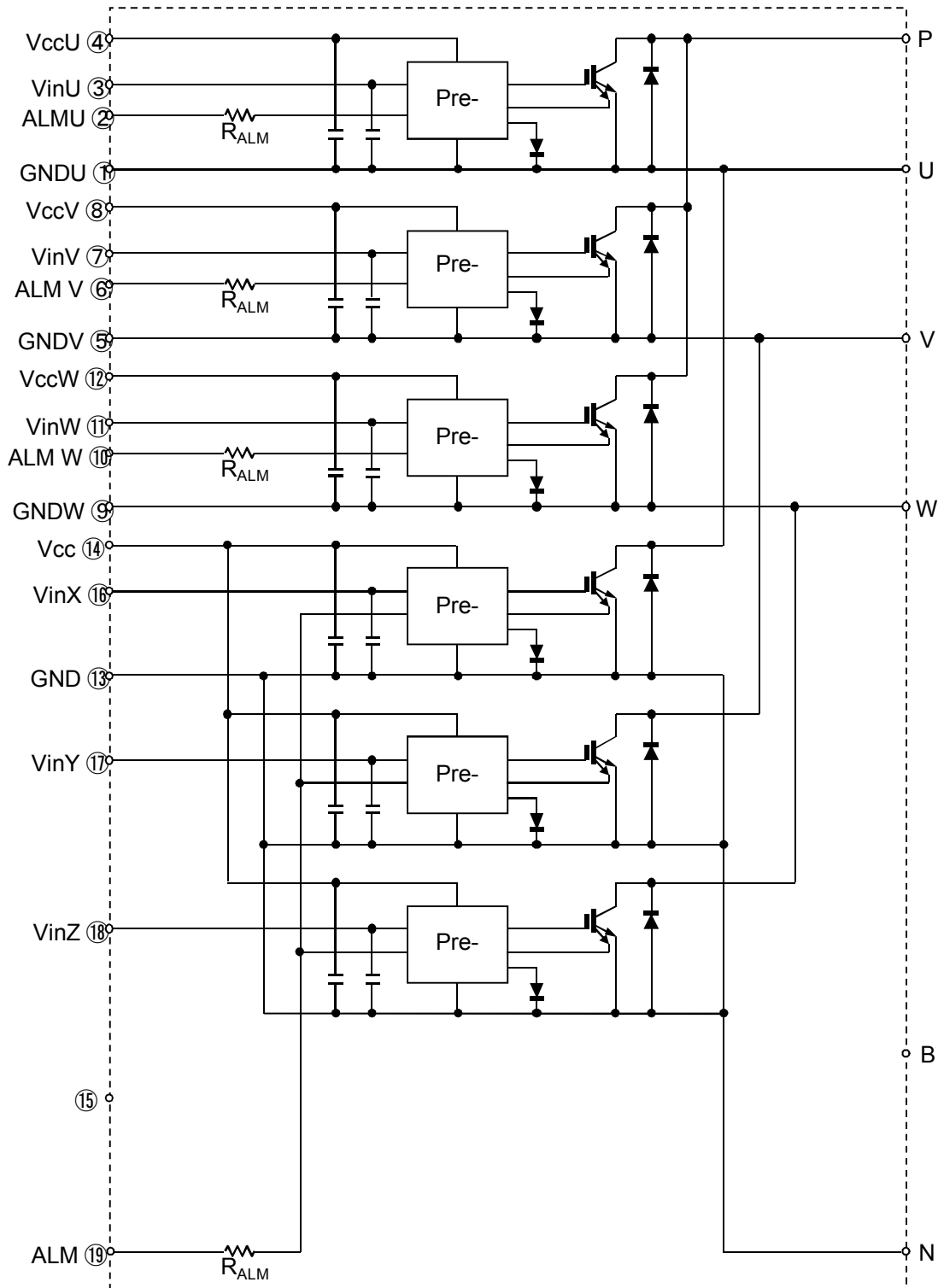
■ **Recommended Operating Conditions**

| 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 | kHz |
| Arm shoot through blocking time for IPM's input signal | t_{dead} | 1.0 | - | - | μs |
| Screw Torque (M4) | - | 1.3 | - | 1.7 | Nm |

6MBP100VFN060-50

IGBT Modules

■ Block Diagram



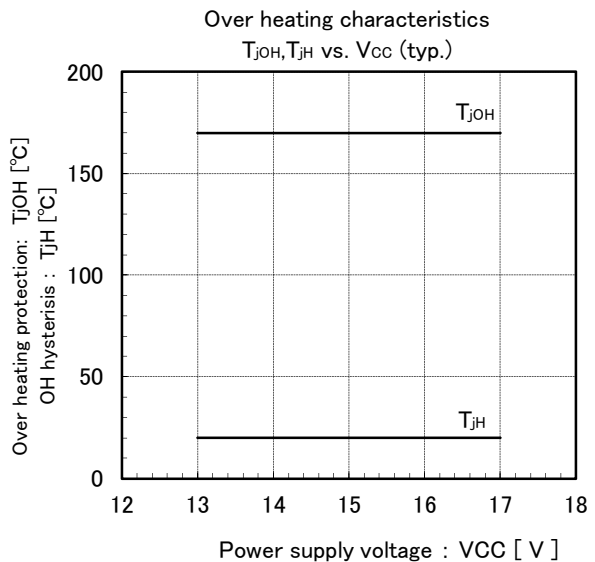
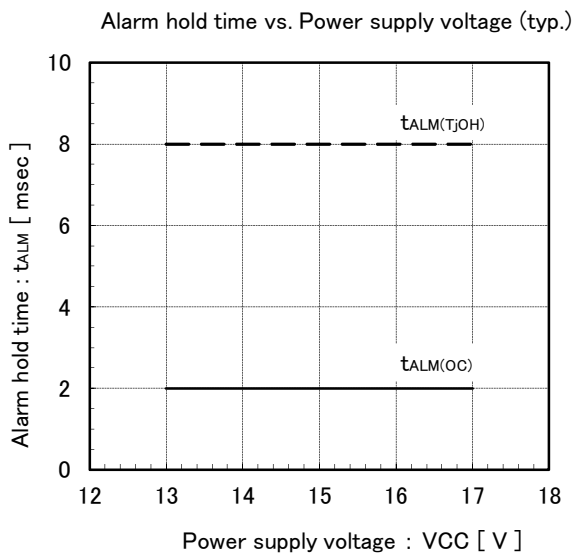
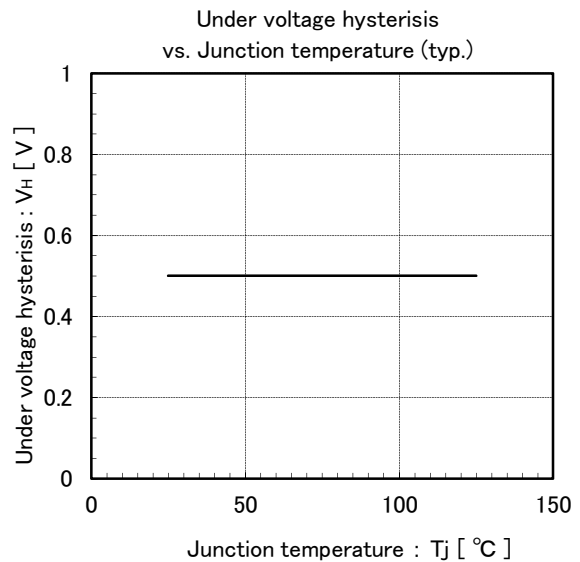
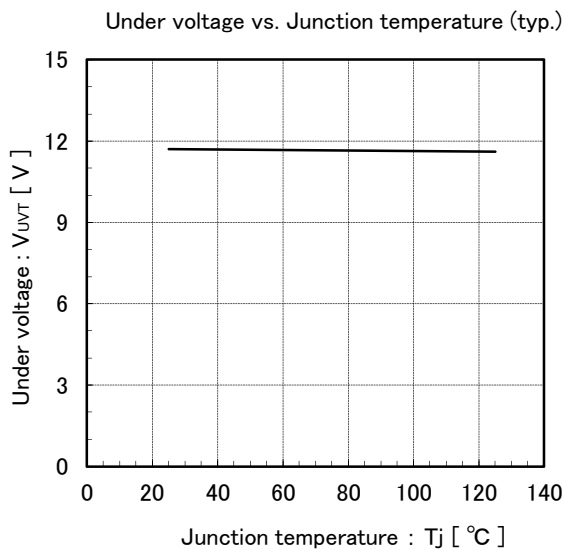
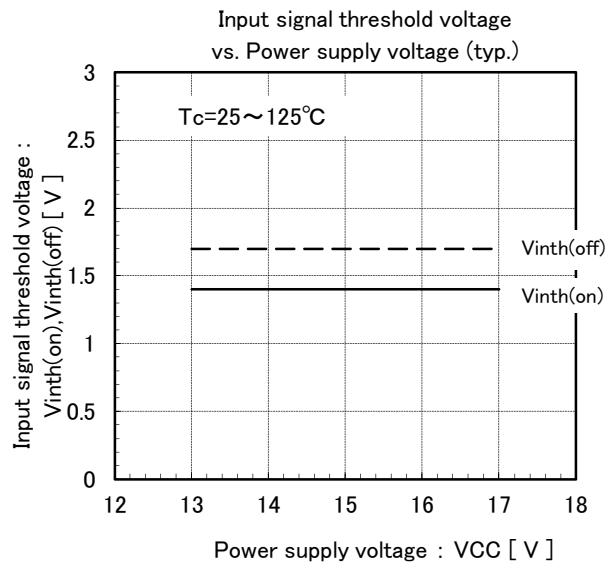
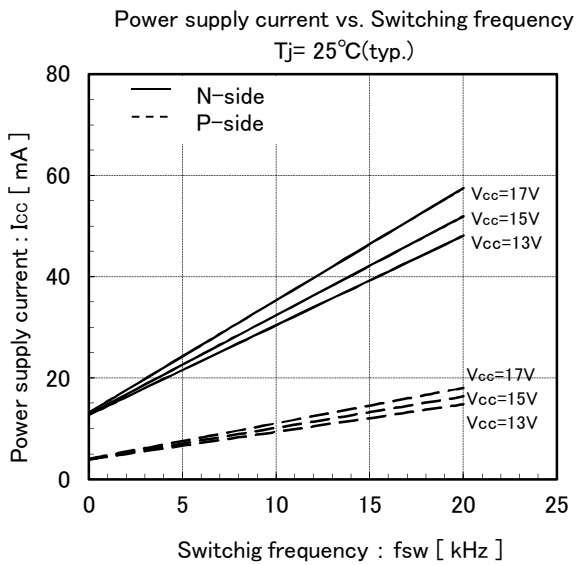
Pre-drivers include following functions

1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

6MBP100VFN060-50

IGBT Modules

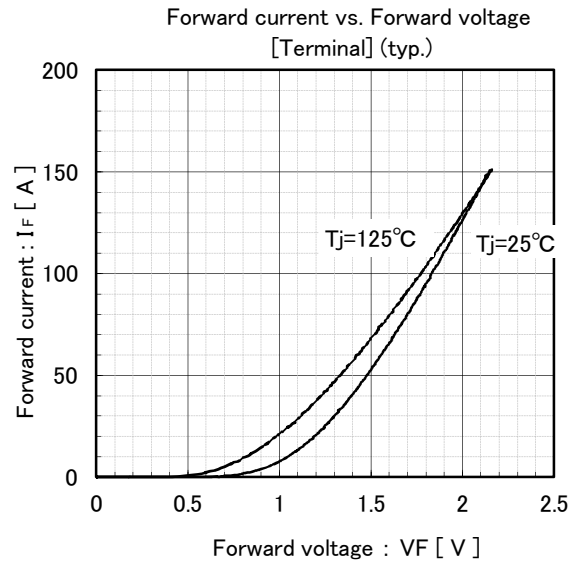
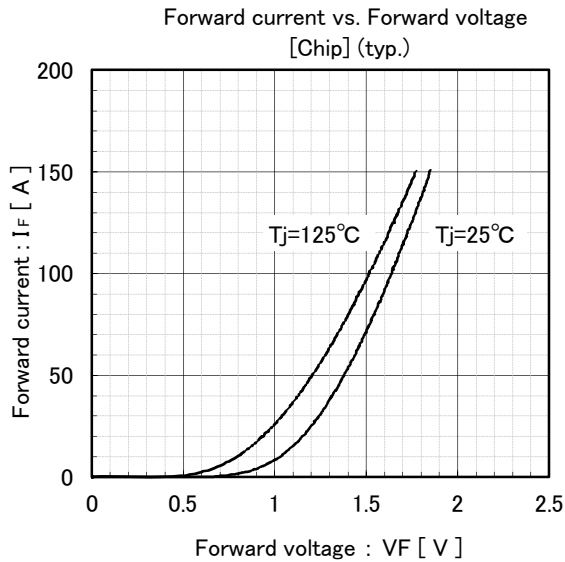
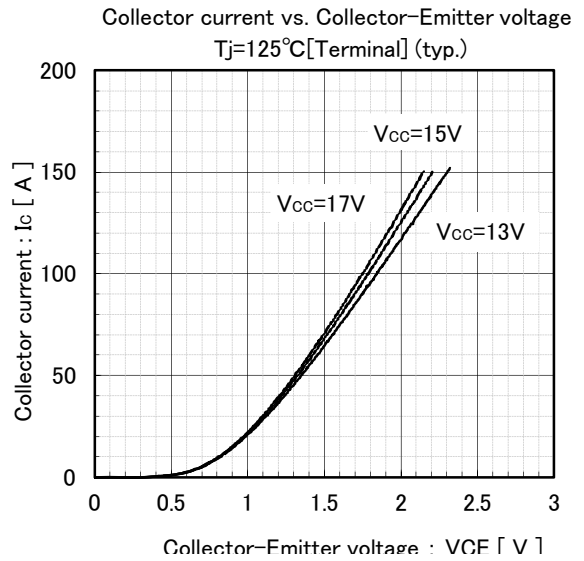
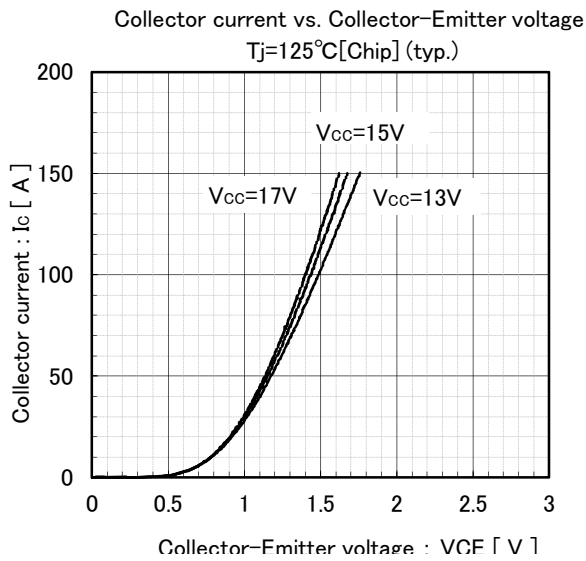
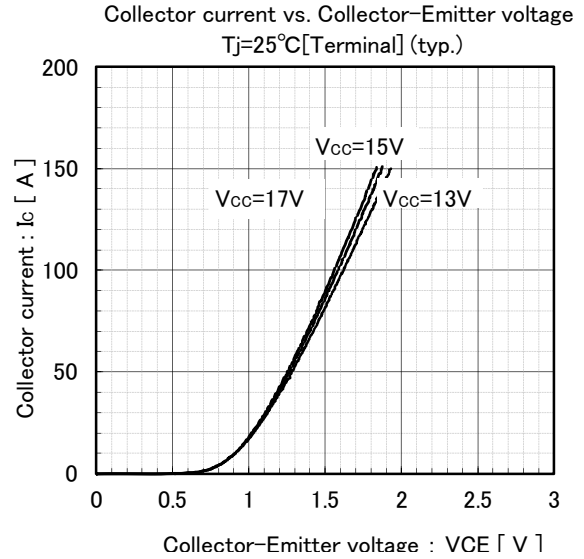
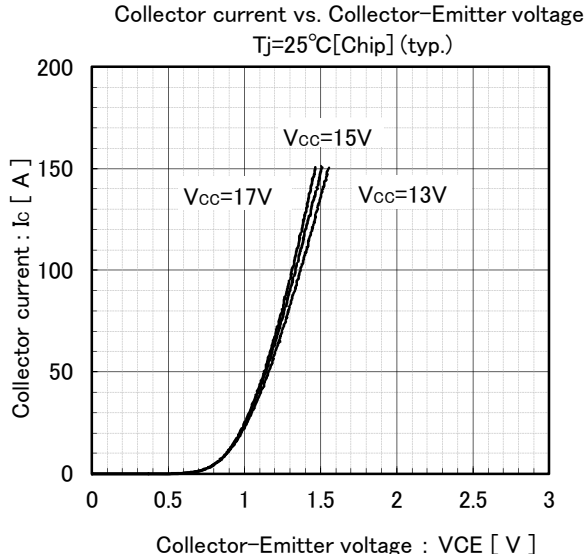
■ Characteristics (Representative)
● Control Circuit



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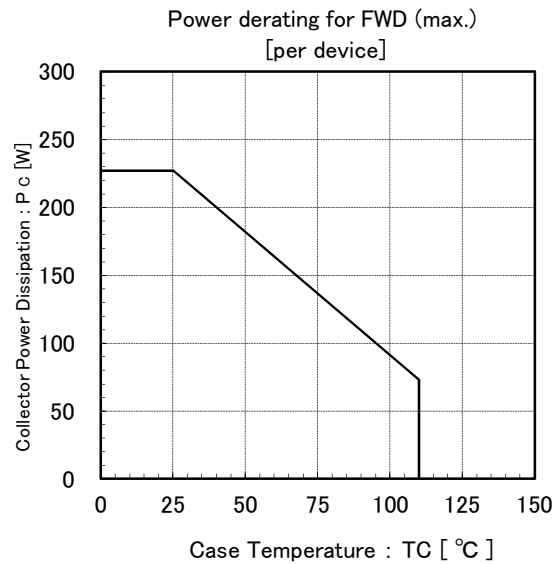
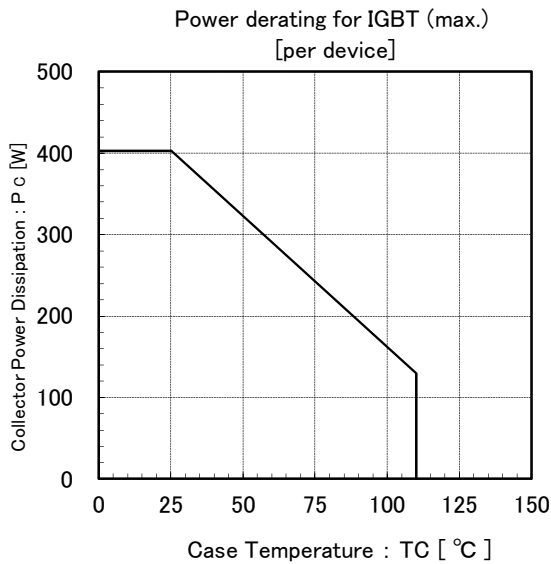
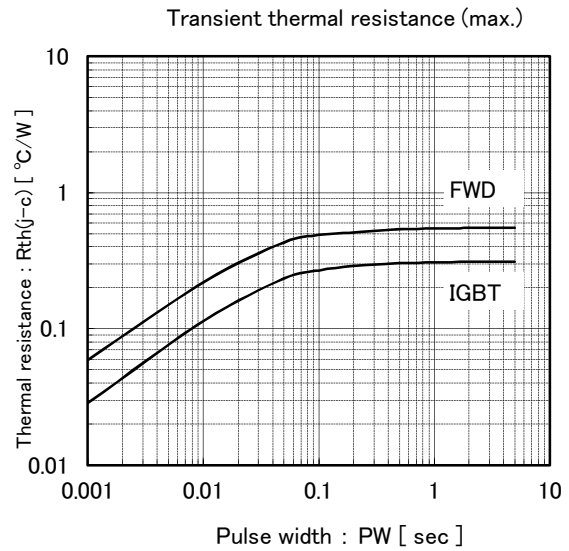
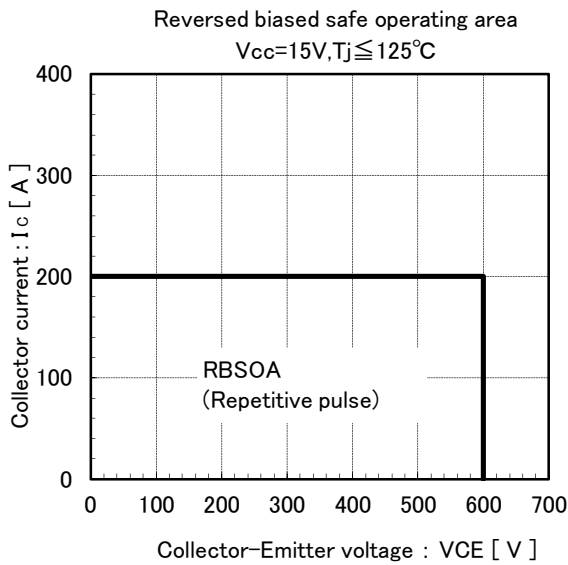
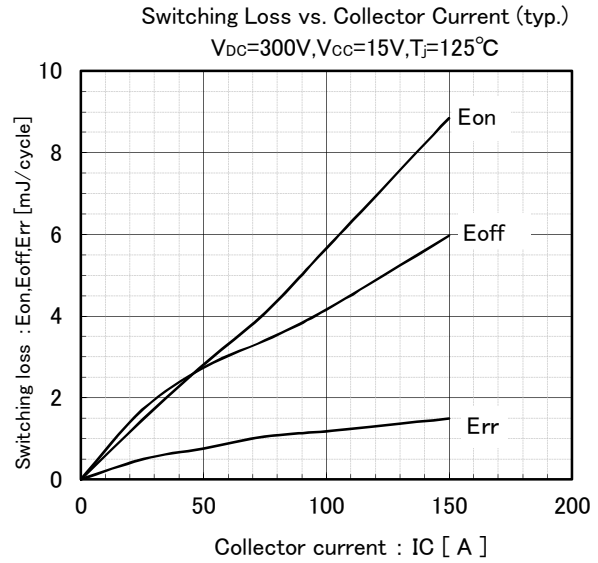
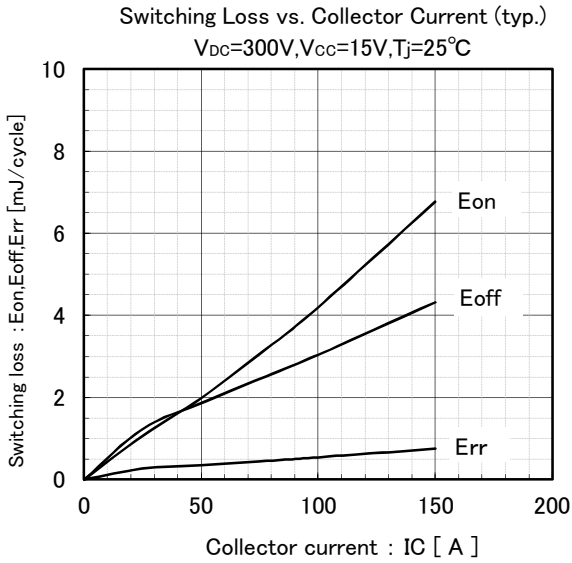
IGBT Modules

● Inverter



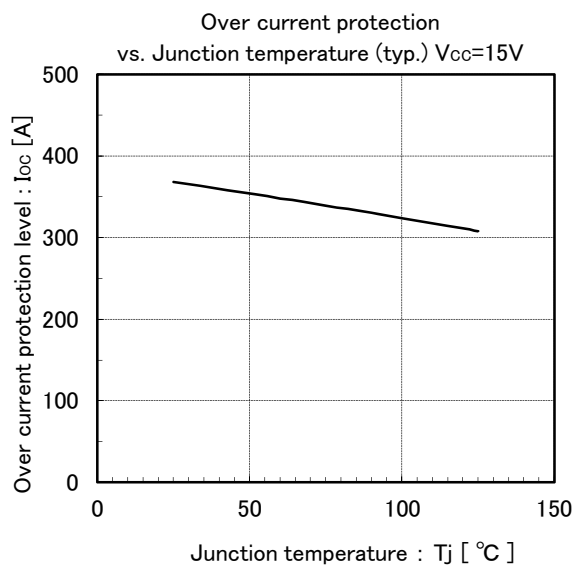
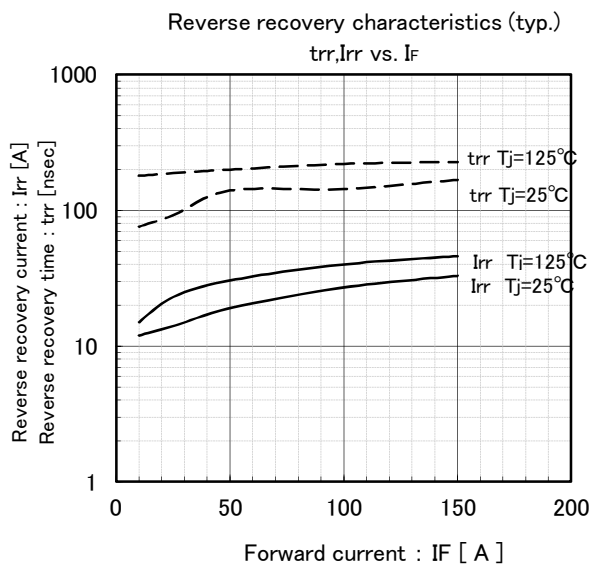
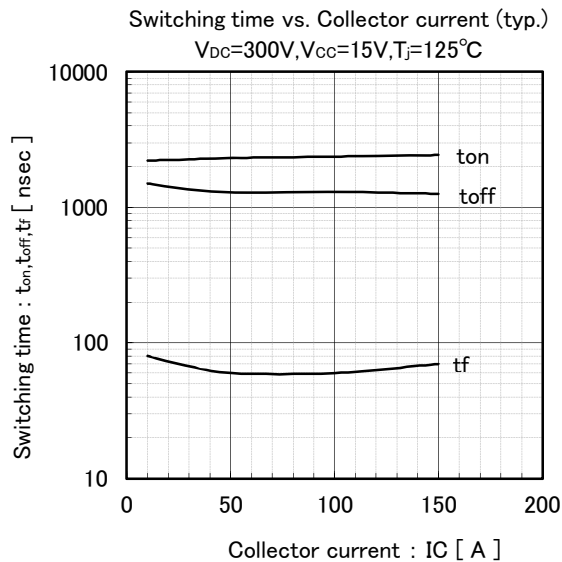
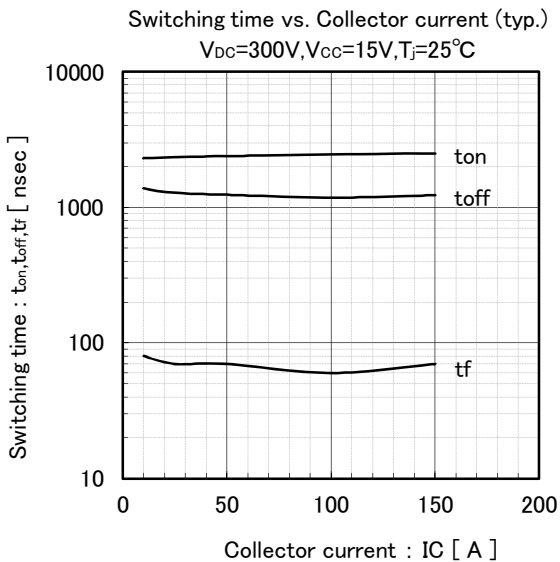
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6MBP100VFN060-50

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