# SPECIFICATION

Device Name : IGBT-IPM

Type Name : 7MBP100NA060-01

Spec. No. : MS6M0280



Fuji Electric Co.,Ltd.
Matsumoto Factory

| | DATE | NAME | APPROVED |
|---|---|---|---|
| DRAWN | Mar.-27-'96 | H.Kawakami | T. HOSEN |
| CHECKED | " | N.Terashima | |
| | | | |

Fuji Electric Co.,Ltd.

DWG.NO. MS6M0280 1/16

H04-004-07

# Revised Records

| Date | Classi-fication | Ind. | Content | Applied date | Drawn | Checked | Approved |
|---|---|---|---|---|---|---|---|
| Mar.-27-'96 | enactment | — | ——————— | Issued date | ——— | N.Terasawa | T.HOSEN |
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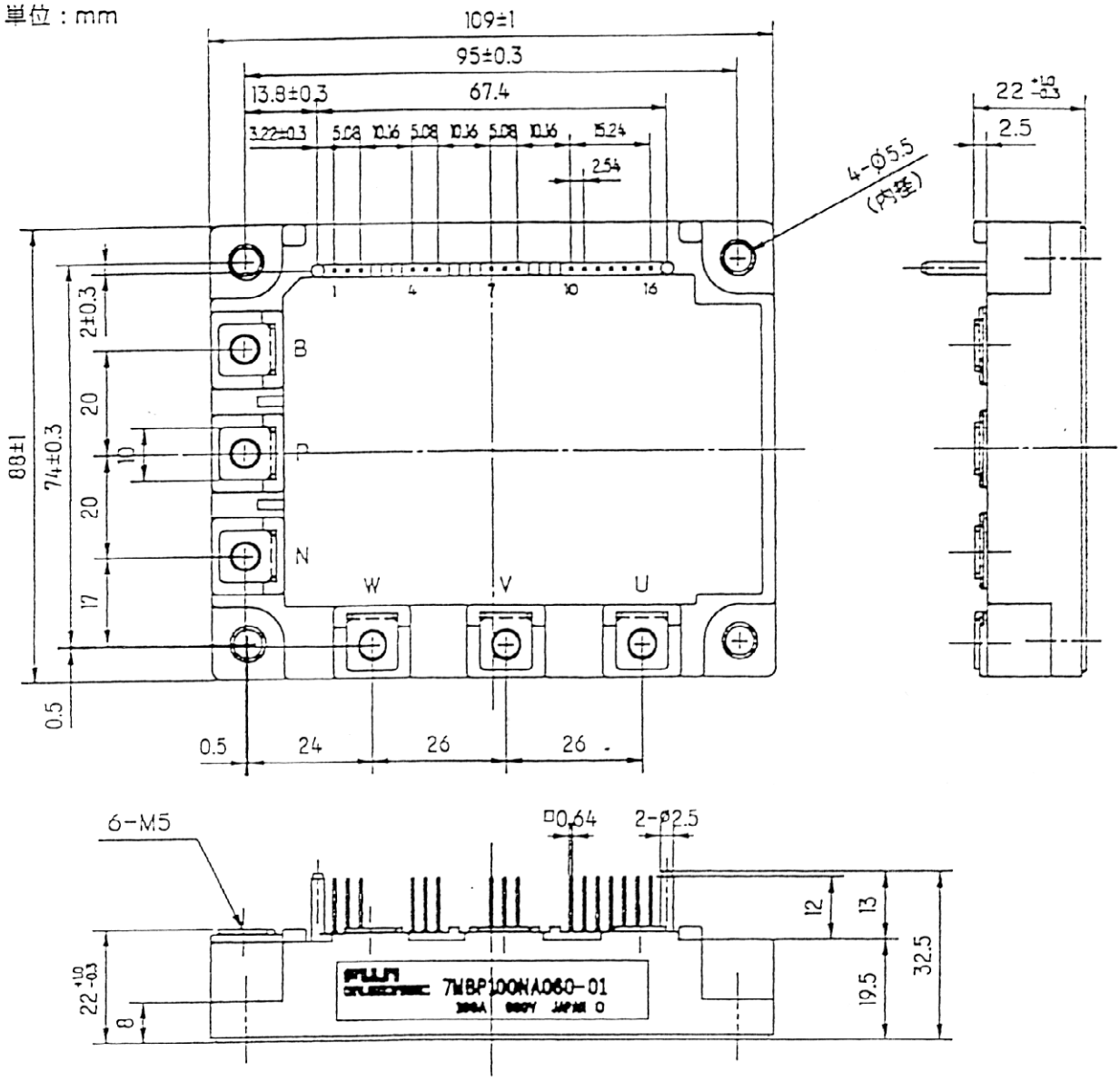
1. Outline Drwing

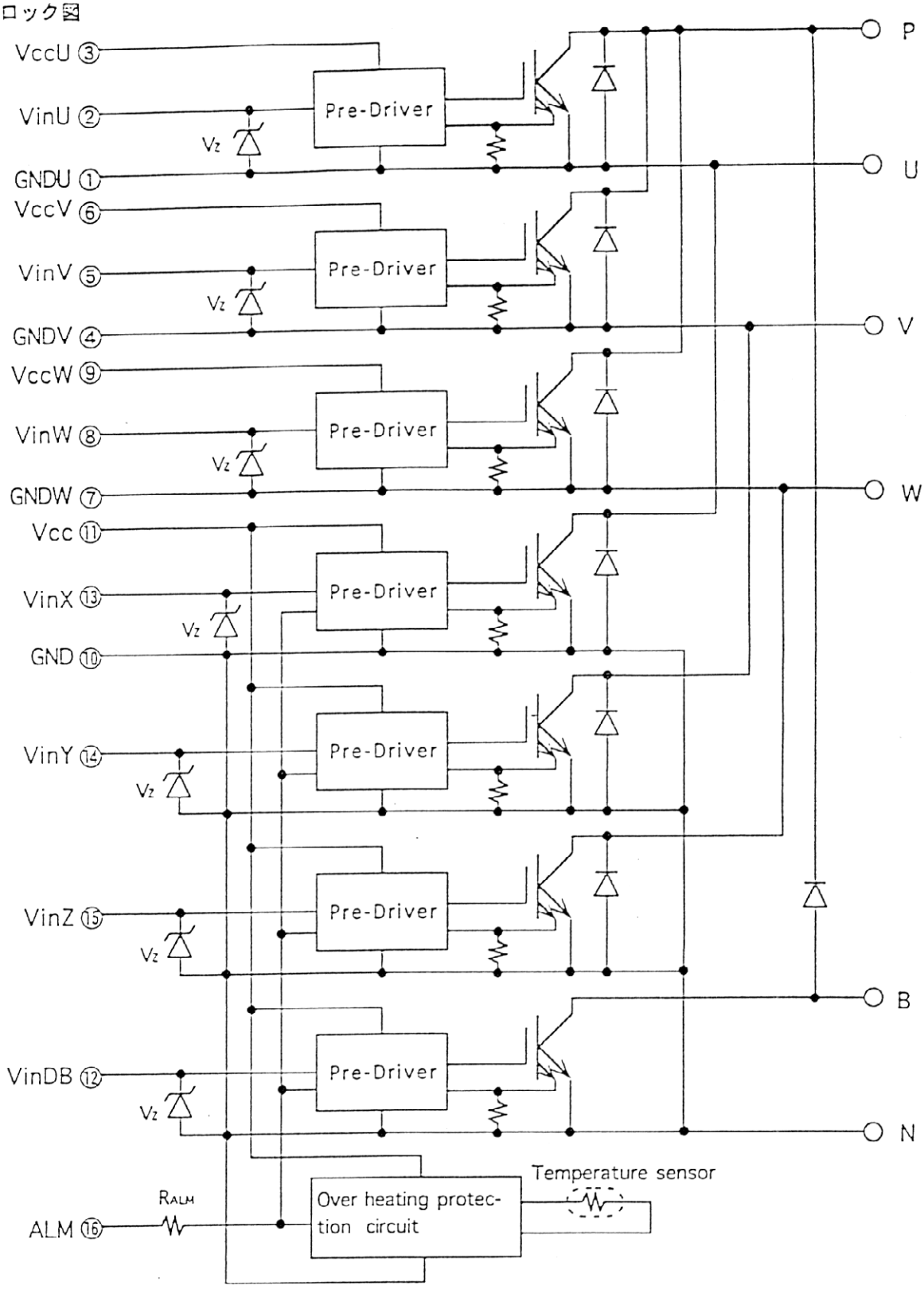
外形図

Unit : mm

単位 : mm



## 2 Block Diagram
ブロック図




Pre-Drivers include following functions
① Short Circuit Protection Circuit
② Amplifier for Driver
③ Under Voltage Lockout Circuit
④ Over current Protection Circuit

3. Absolute Maximum Ratings (at Tc=25℃ unless otherwise specified)

| Items | | | Symbols | Ratings | | Units |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| DC Bus Voltage | | | $V_{DC}$ | 0 | 450 | V |
| DC Bus Voltage (surge) | | | $V_{DC(SURGE)}$ | 0 | 500 | V |
| DC Bus Voltage (short operating) | | | $V_{SC}$ | 200 | 400 | V |
| Collector-Emitter Voltage | | | $V_{CES}$ | 0 | 600 | V |
| INV | Collector Current | DC | Ic | — | 100 | A |
| | | 1mS | Icp | — | 200 | A |
| | | Duty=42.0% | -Ic | — | 100 | A |
| | Collector Power Dissipation | One Transistor | Pc | — | 400 | W |
| DB | Collector Current | DC | Ic | — | 50 | A |
| | | 1mS | Icp | — | 100 | A |
| | Forward Current of Diode | | $I_F$ | — | 50 | A |
| | Collector Power Dissipation | One Transistor | Pc | — | 198 | W |
| Junction Temperature | | | Tj | — | 150 | ℃ |
| Input Voltage of Power Supply for Pre-Driver | | | Vcc ※1 | 0 | 20 | V |
| Input Signal Voltage | | | Vin ※2 | 0 | Vz | V |
| Input Signal Current | | | Iin | — | 1 | mA |
| Alarm Signal Voltage | | | $V_{ALM}$ ※3 | 0 | Vcc | V |
| Alarm Signal Current | | | $I_{ALM}$ ※4 | — | 15 | mA |
| Storage Temperature | | | Tstg | -40 | 125 | ℃ |
| Operating Case Temperature (Fig.1) | | | $T_{OP}$ | -20 | 100 | ℃ |
| Isolation Voltage (Case-Terminal) | | | Viso ※5 | — | AC2.5 | kV |

Note ※1 Vcc shall be applied to the input Voltage between terminal No. 3 and 1, 6 and 4, 9 and 7, 11 and 10.
※2 Vin shall be applied to the input Voltage between terminal No. 2 and 1, 5 and 4, 8 and 7, 12 13 14 15 and 10.
※3 $V_{ALM}$ shall be applied to the Voltage between terminal No. 16 and 10.
※4 $I_{ALM}$ shall be applied to the input current to terminal No. 16.
※5 50Hz/60Hz sine wave 1 minute.

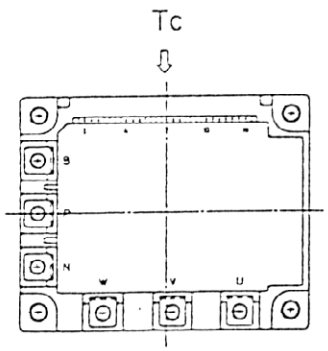



Fig.1 Measurement of case temperature

4. Electrical Characteristics

4.1 Electrical Characteristics of Power Circuit (at Tc=Tj=25℃,Vcc=15V)

| | Items | Symbols | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| I N V | Collector Current at off Signal Input | $I_{CES}$ | VCE=600V | — | — | 1.0 | mA |
| | Collector-Emitter Saturation Voltage | $V_{CE}$(sat) | Ic=100A | — | — | 2.9 | V |
| | Forward Voltage of FWD | $V_F$ | -Ic=100A | — | — | 3.3 | V |
| D B | Collector Current at off Signal Input | $I_{CES}$ | VCE=600V | — | — | 1.0 | mA |
| | Collector-Emitter Saturation Voltage | $V_{CE}$(sat) | Ic=50A | — | — | 2.9 | V |
| | Forward Voltage of Diode | $V_F$ | -Ic=50A | — | — | 3.3 | V |

4.2 Electrical Characteristics of Control Circuit (at Tc=Tj=25℃,Vcc=15V)

| Items | | Symbols | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Power Supply Current of P-Line Side Pre-Driver (One Unit) | | $I_{CCP}$ | fsw=15kHz ※6 Duty=50% | — | 8 | 18 | mA |
| Power Supply Current of N-Line Side Three Pre-Drivers and Protection Circuits | | $I_{CCN}$ | fsw=15kHz Duty=50% | — | 28 | 68 | mA |
| Input signal Threshold Voltage | | $V_{in(ON)}$ | ON | 1.00 | 1.35 | 1.70 | V |
| | | $V_{in(OFF)}$ | OFF | 1.25 | 1.60 | 1.95 | |
| Zener Voltage | | $V_Z$ | | 6.9 | — | 7.7 | V |
| Over Heating Protection(OH) Level | | $T_{OH}$ | VDC=0V,Ic=0A Case Temperature | 100 | — | 125 | ℃ |
| OH Hysterisis | | $T_H$ | | — | 20 | — | ℃ |
| Over Current Protection(OC) Level | INV | Ioc | Tj=125℃ Collector Current | 130 | — | — | A |
| Over Current Protection(OC) Level | DB | Ioc | Tj=125℃ Collector Current | 60 | — | — | A |
| OC Delay Time (Fig.2) | | $t_{DOC}$ | Tj=25℃ | — | 8 | — | μS |
| Under Voltage Protection(UV) Level | | $V_{UVT}$ | | 11.0 | 12.0 | 12.5 | V |
| UV Hysterisis | | $V_H$ | | 0.2 | — | — | V |
| Alarm Signal Hold Time | | $t_{ALM}$ | | 0.8 | 2 | — | mS |
| Delay Time of Short Circuit Protection (Fig.3) | | tsc | | 12 | — | — | μS |
| Limiting Resistor for Alarm | | $R_{ALM}$ | | 1425 | 1500 | 1575 | Ω |

※6 Switching frequency of IPM

4.3 Dynamic Characteristics (at Tc=Tj=125℃,Vcc=15V)

| Items | Symbols | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Switching Time | ton | Ic=100A | 0.3 | — | — | μS |
| Fig.4 | toff | Vdc=300V | — | — | 3.6 | μS |
| Switching Time (FWD) | trr | IF=100A,Vdc=300V | — | — | 400 | nS |

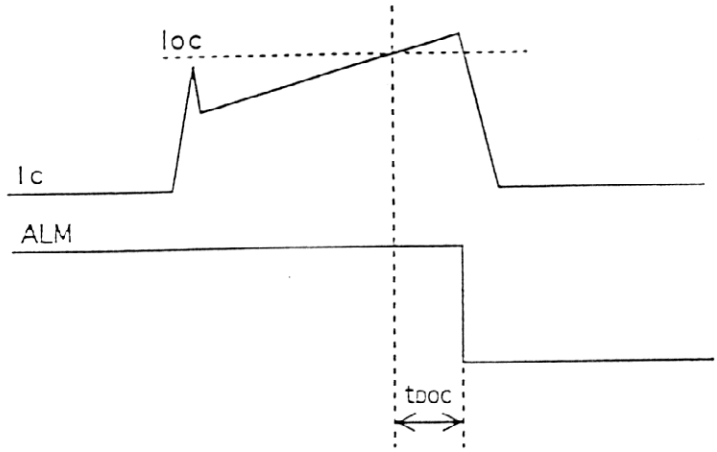



Fig.2 : Definition of OC Delay Time

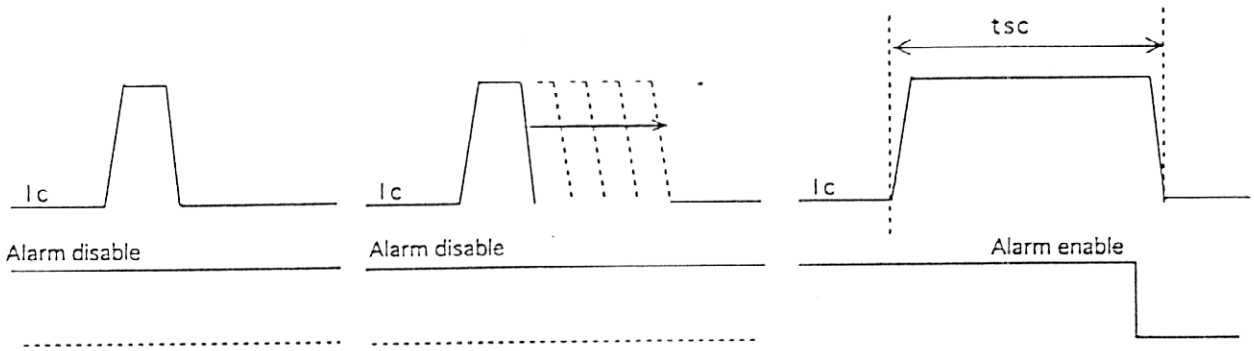



Fig.3 : Definition of tsc

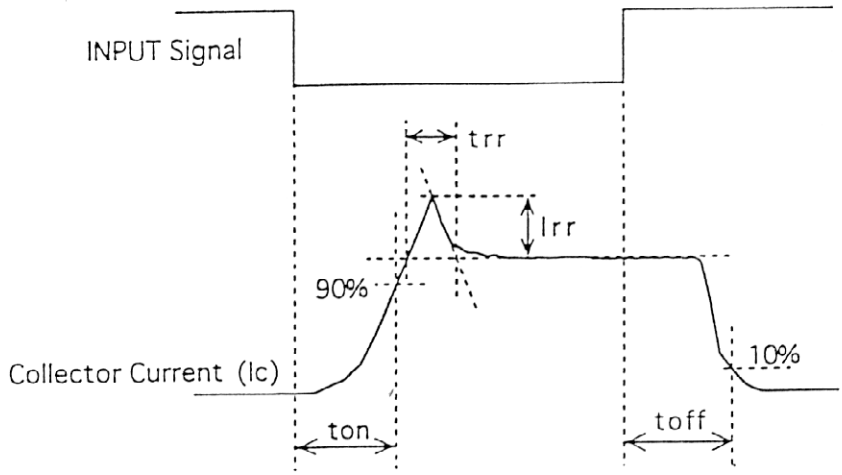



Fig.4 : Definition of switching time

5. Thermal Characteristics (Tc=25℃)

| Items | | | Symbols | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Junction to Case Thermal Resistance | INV | IGBT | Rth(j-c) | — | — | 0.31 | ℃/W |
| | | FWD | Rth(j-c) | — | — | 0.90 | ℃/W |
| Junction to Case Thermal Resistance | DB | IGBT | Rth(j-c) | — | — | 0.63 | ℃/W |
| Case to Fin Thermal Resistance with Compound | | | Rth(c-f) | — | 0.05 | — | ℃/W |

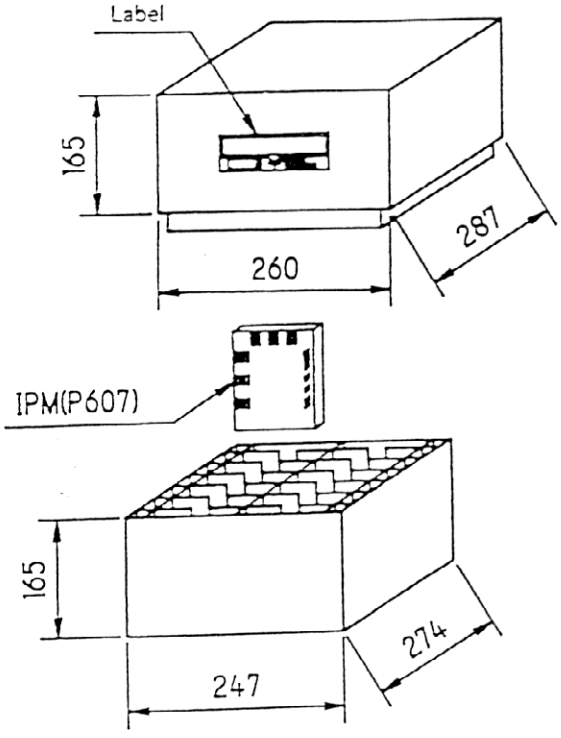
6.Mechanical Characteristics

| Items | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Screw Torque | Mounting (M5) | — | — | 3.5 | N·m |
| | Terminal (M5) | — | — | 3.5 | N·m |
| Weight | | — | 550 | — | g |

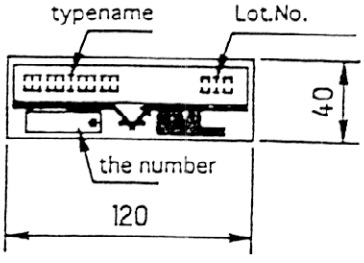
7.Recommendable Value

| Items | | Symbols | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| DC Bus Voltage | | Vbc | | 200 | — | 400 | V |
| Operating Power Supply Voltage Range of Pre-Driver | | Vcc | | 13.5 | 15 | 16.5 | V |
| Switching frequency of IPM | | fsw | | 1 | — | 20 | kHz |
| Screw Torque | Mounting (M5) | — | | 2.5 | — | 3.5 | N·m |
| | Terminal (M5) | — | | 2.5 | — | 3.5 | N·m |

## 8. Packing and labeling
梱包箱と表示




material card board
weight 5.5 kg (Max.)
products 10pcs (Max.)




## 9. Storage and transportation notes (保管、運搬上の注意事項)

- The IGBT-IPM should be stored at a standard temperature of 5 to 35 ℃ and humidity of 45 to 75%.
  常温保存が望ましい。(5～35℃、45～75%)
- Store modules in a place with few temperature changes in order to avoid condensation on the module surface.
  急激な温度変化の無きこと。(モジュール表面が結露しないこと)
- Avoid exposure to corrosive gases and dust.
  腐食性ガスの発生場所、塵埃の多い場所は避けること。
- Avoid excessive extermal force on the module.
  製品に荷重がかからないように十分に注意すること。
- Store modules with unprocessed terminals.
  モジュールの端子は未加工の状態で保管すること。
- Do not drop or otherwise shock the modules when transporting.
  製品の運搬時に衝撃を与えたり、落下させたりしないこと。

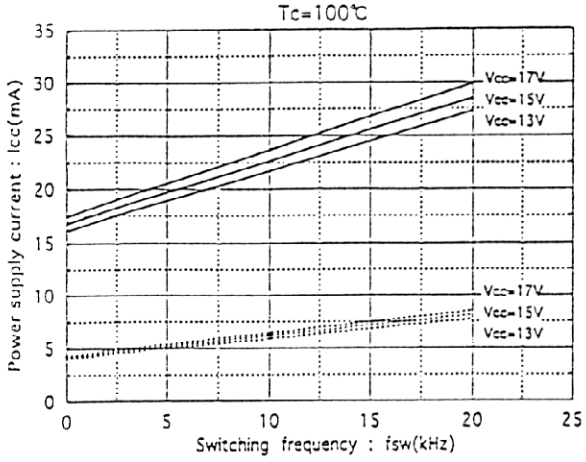
## 10. Applicable category (適用範囲)

This specification is applied to IGBT-IPM named 7MBP100NA060-01.
本納入仕様書は、IGBT-IPM 7MBP100NA060-01 に適用する。

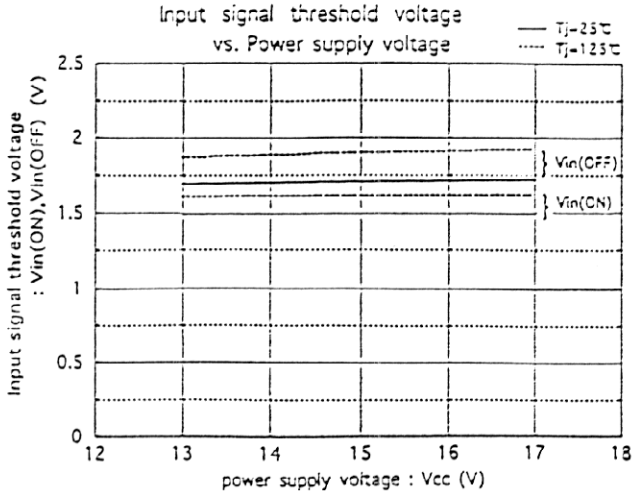
## 11. Characteristic (Representative)
特性カーブ（代表例）

### 11-1.Control Circuit
制御部

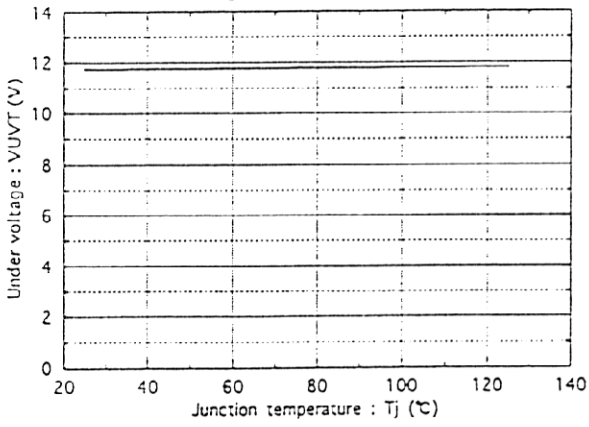
Power supply current vs. Switching frequency
Tc=100℃



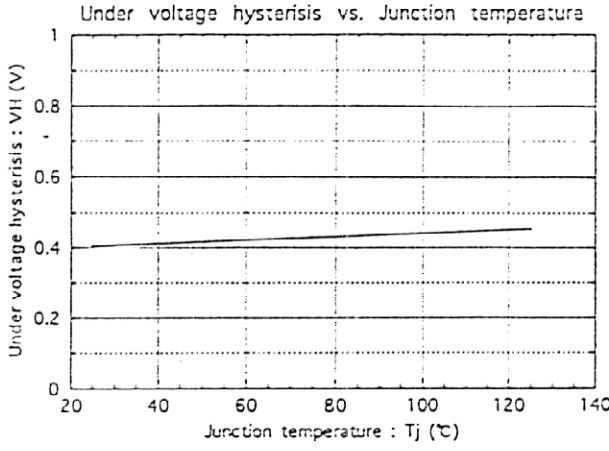

Input signal threshold voltage
vs. Power suppiy voltage



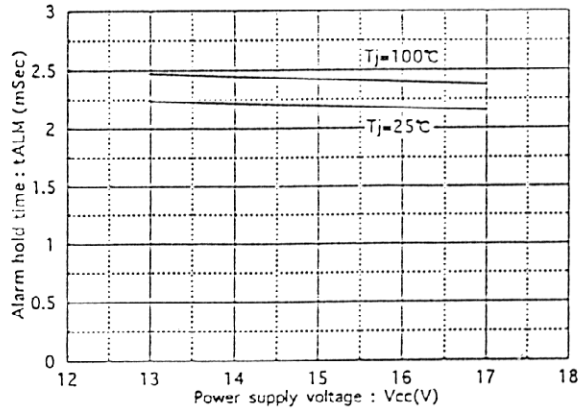

Under voltage vs. Junction temperature



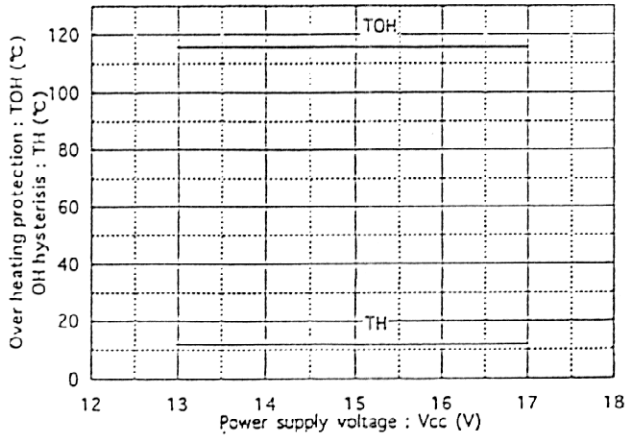

Under voltage hysterisis vs. Junction temperature




Alarm hold time vs. Power supply voltage




Over heating characteristics
TOH,TH vs. Vcc

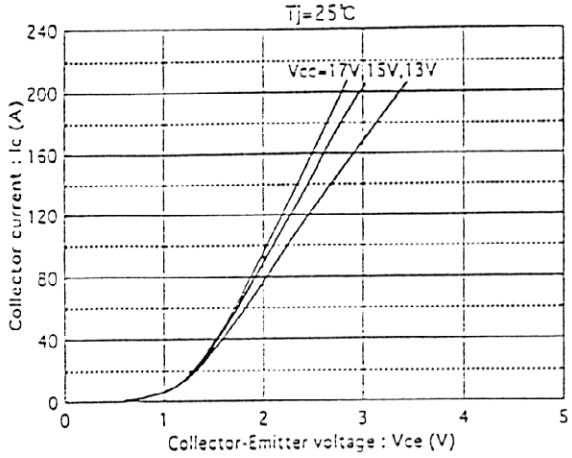


11-2.Inverter

インバータ部

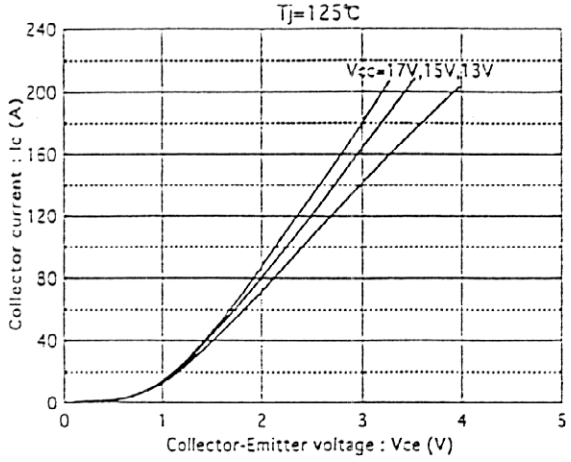
Collector current vs. Collector-Emitter voltage

Tj=25℃



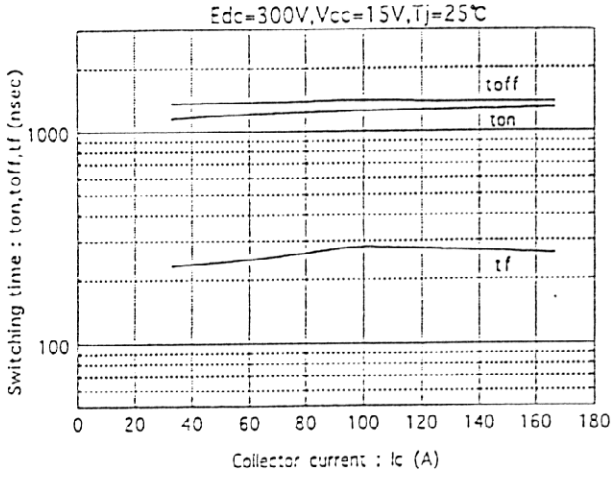

Collector current vs. Collector-Emitter voltage

Tj=125℃



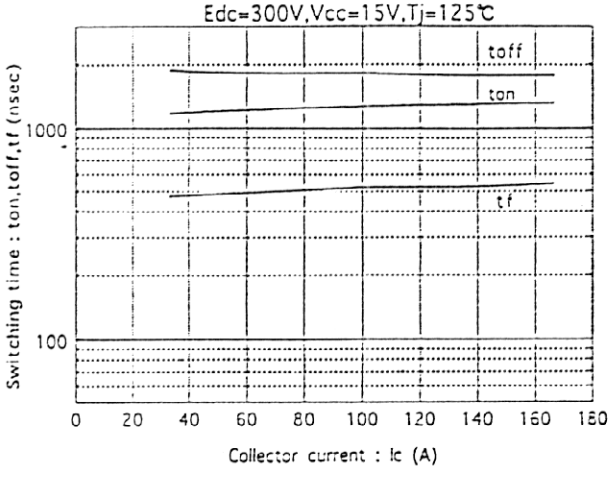

Switching time vs. Collector current

Edc=300V,Vcc=15V,Tj=25℃

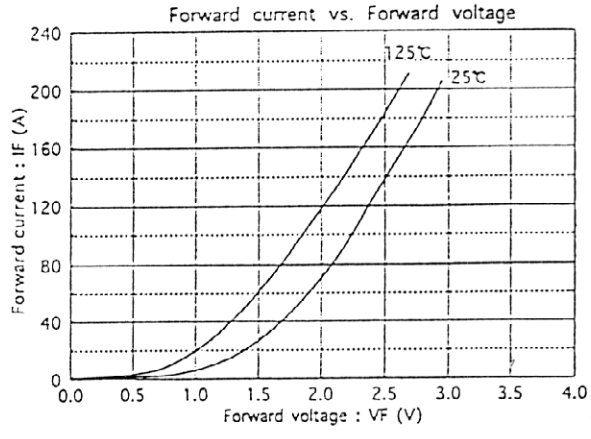



Switching time vs. Collector current

Edc=300V,Vcc=15V,Tj=125℃

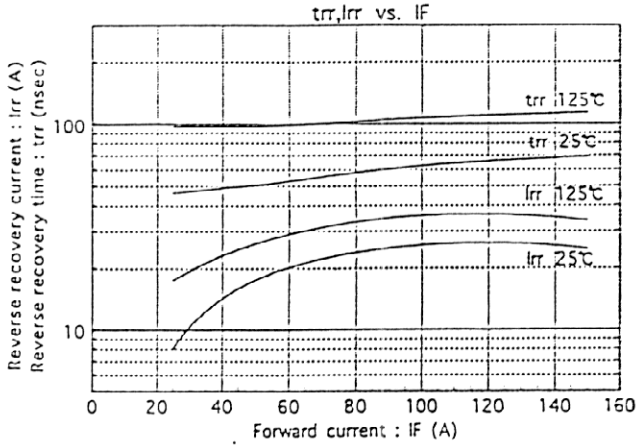



Forward current vs. Forward voltage

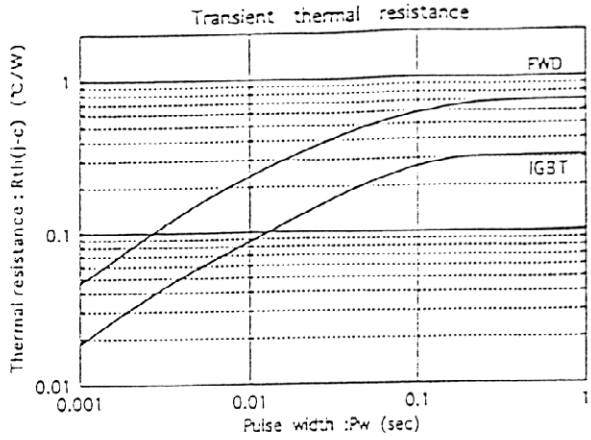



Reverse recovery characteristics

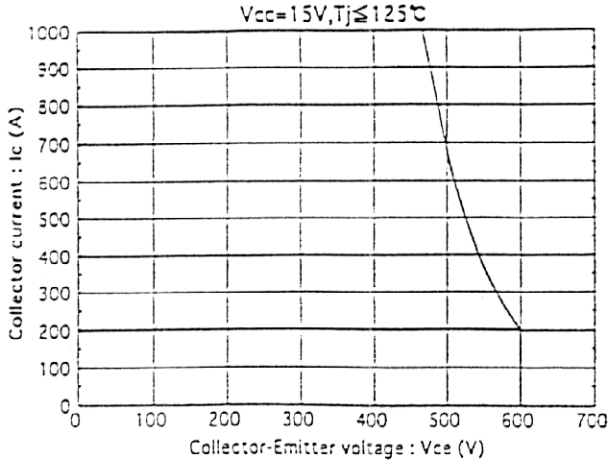
trr,Irr vs. IF



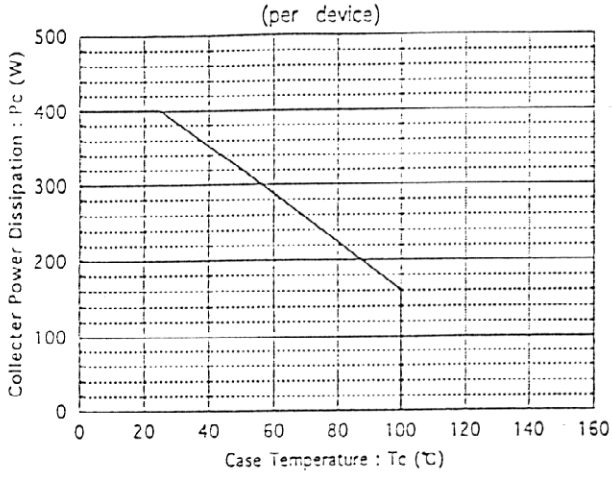
Transient thermal resistance



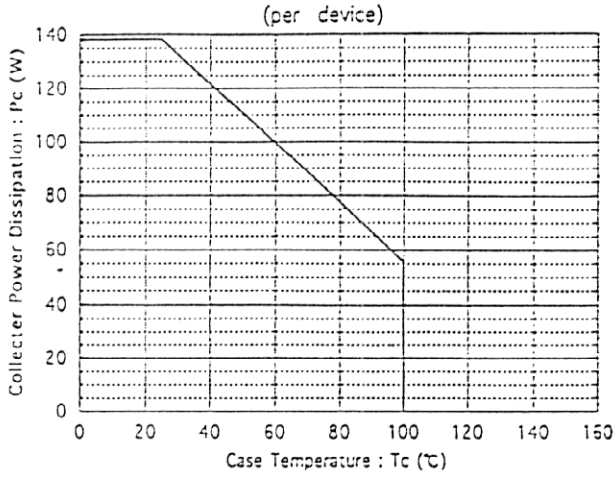

Reversed biased safe operating area
Vcc=15V,Tj≦125℃



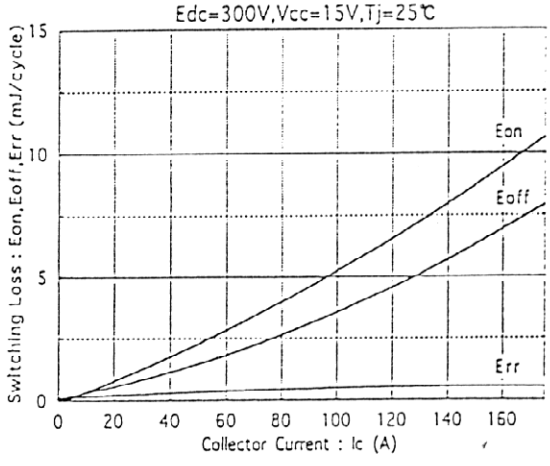

Power derating for IGBT
(per device)



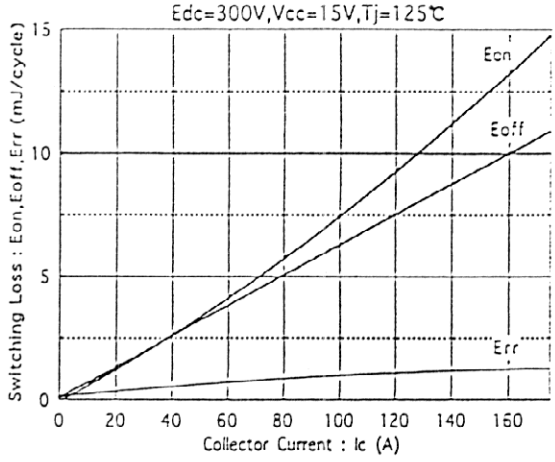

Power derating for FWD
(per device)

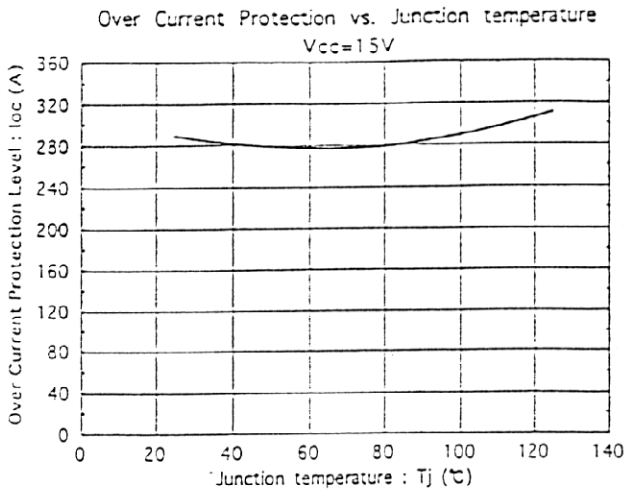



Switching Loss vs. Collector Current
Edc=300V,Vcc=15V,Tj=25℃




Switching Loss vs. Collector Current
Edc=300V,Vcc=15V,Tj=125℃



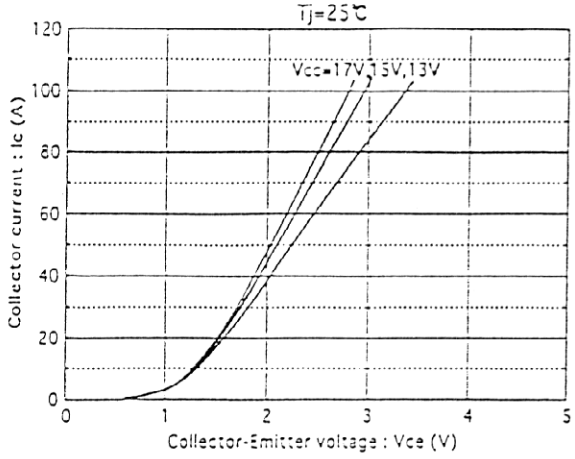


11-3.DB

ブレーキ部

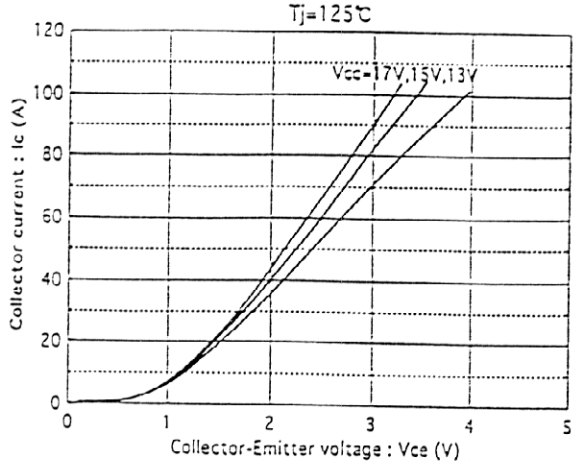
Collector current vs. Collector-Emitter voltage

Tj=25℃

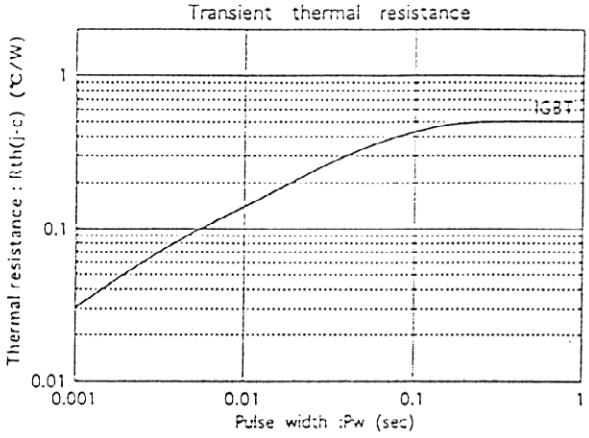



Collector current vs. Collector-Emitter voltage

Tj=125℃

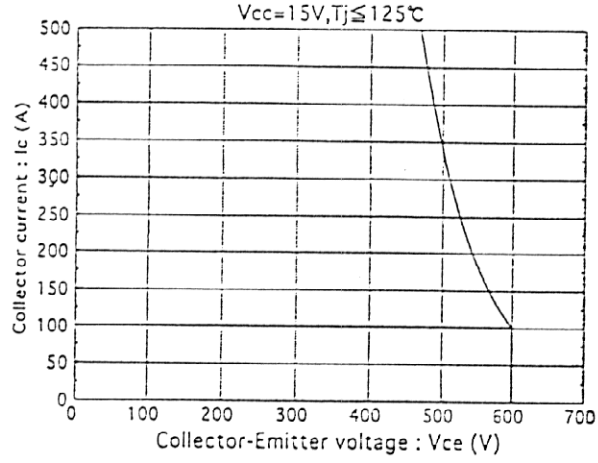



Transient thermal resistance



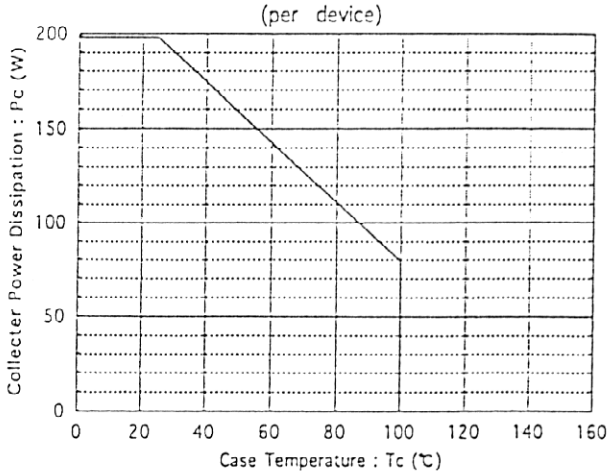

Reversed biased safe operating area

Vcc=15V,Tj≦125℃



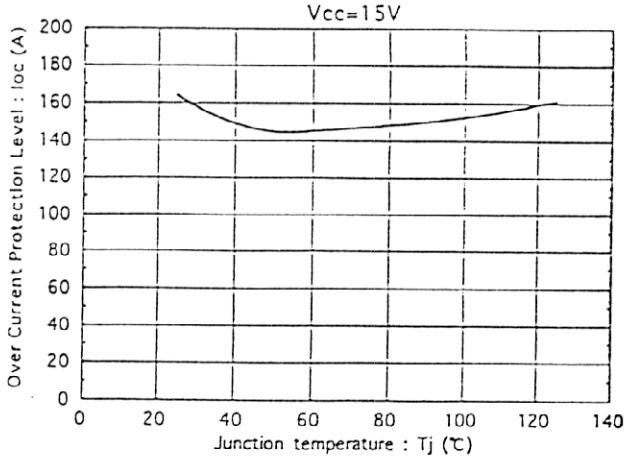

Power derating for IGBT

(per device)

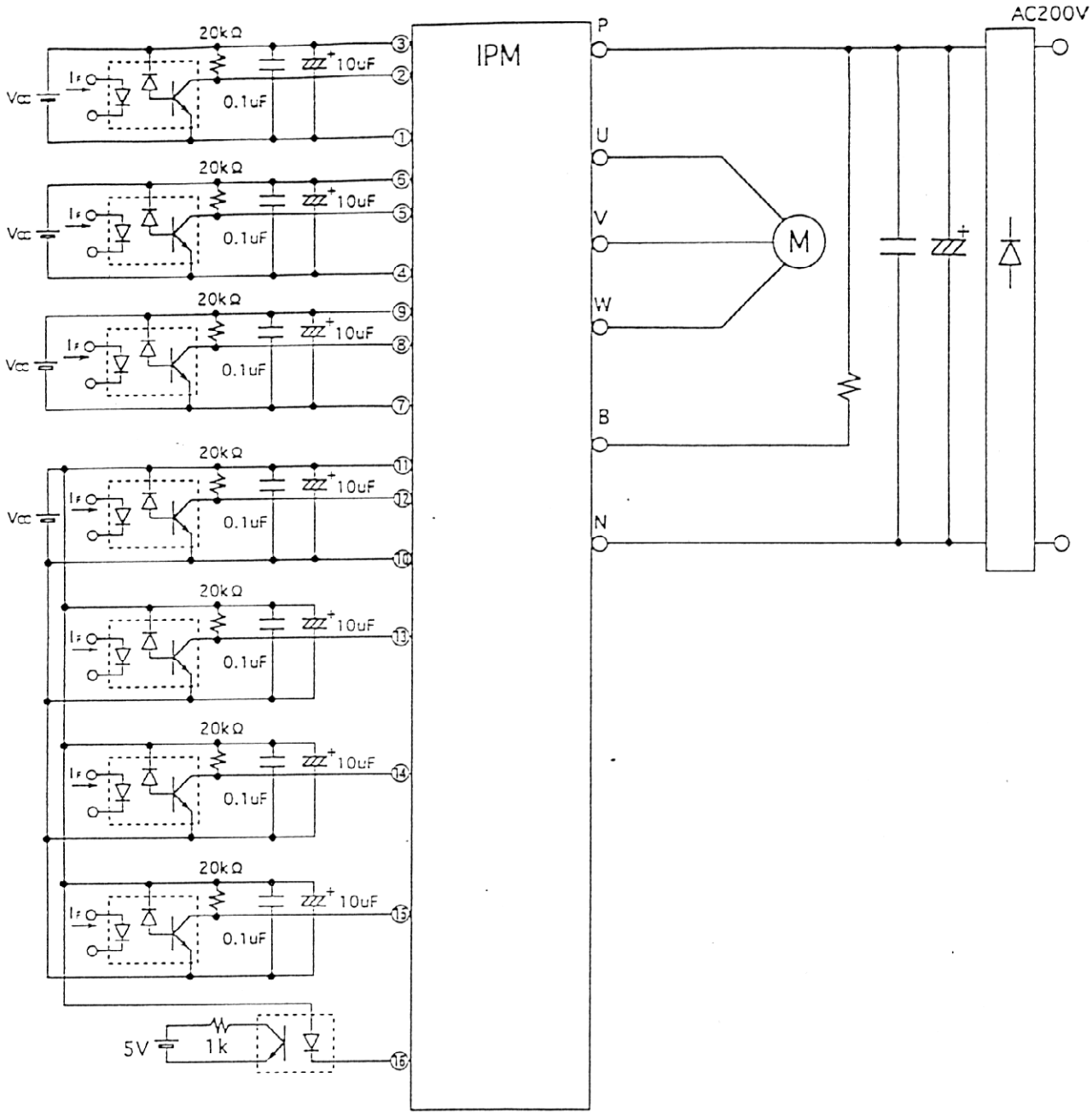



Over Current Protection vs. Junction temperature

Vcc=15V



## 12.Example of applied circuit (応用回路例)






- The wiring between opto-coupler and input terminal of IPM should be shorter as much as possible. The stray-capacitance between primary and secondary side of opto-coupler should not be increased by pattern lay-out.
  ホトカプラとIPMの入力端子間配線は、できるだけ短くしホトカプラの１次・２次間の浮遊容量を増加させないパターンレイアウトとして下さい。
- Capacitor should be installed to VCC-GND terminal of high-speed opto- coupler closely as much as possible.
  高速ホトカプラのVcc-GND間には、コンデンサをできるだけ近接して取り付けて下さい。
- Use high-speed opto-coupler : tPLH,tPHL ≦ 0.8us, high CMR type. (Example : HCPL-4504)
  高速ホトカプラ : tPLH,tPHL ≦ 0.8 μs , 高 CMR タイプをご使用下さい。(例 HPCL-4504)
- Low-speed opto-coupler : CTR ≧ 100%
  低速ホトカプラ : CTR ≧ 100%

・Each power supply for drive circuit should not have transient voltage fluctuation. Four power supplies which are isolated should be supplied individually.
各制御用電源は過渡電圧変動の少ない、絶縁したものを４個独立にして供給して下さい。

・The DC bus line to the P-N terminal should have lower inductance as much as possible, such as connecting capacitor to P-N terminal, in order to reduce surge voltage.
P-N間の直流母線はできるだけ低インダクタンス化し、P-N端子間にコンデンサを接続するなどしてサージ電圧を低減して下さい。

・In order to avoid noise from AC line, connect capacitor (about 4.7uF) between three-phase line and earth.
ACラインからのノイズ侵入を防ぐため、三相各線-大地間に4.7nF程度のコンデンサを接続して下さい。

・Do not connect N-terminal of main circuit to ground (GND) of input circuit.
入力回路のグランド（GND）と主回路Ｎ端子をIPMの外側で接続しないで下さい。

・In case of using connector for connection to control terminal, it must be Au-plated electrode and 2.54mm of pitch.
制御端子との接続にコネクタを用いる場合は、金メッキ電極・2.54mmピッチのものをご使用下さい。

・When capacitor is connected between input and GND terminal, pay attention to longer delay time after signal inputted to primary side of opto-coupler.
入力端子-GND間にコンデンサを接続するとホトカプラ１次側入力信号に対する応答時間が長くなりますのでご注意下さい。