

# SPECIFICATION

Device Name : IGBT-IPM

Type Name : 6MBP100NA060-01

Spec. No. : MS6M0277

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Fuji Electric Co.,Ltd.  
Matsumoto Factory

|         | DATE        | NAME        | APPROVED | Fuji Electric Co.,Ltd. |          |        |
|---------|-------------|-------------|----------|------------------------|----------|--------|
| DRAWN   | Mar. 27 '96 | H. Kawakami | T. HOSEN | DWG. NO.               | MS6M0277 | 1 / 15 |
| CHECKED | " "         | N. Terasawa |          |                        |          |        |
|         |             |             |          |                        |          |        |

# Revised Records

| Date         | Classi-<br>fication | Ind. | Content | Applied<br>date | Drawn | Checked     | Approved |
|--------------|---------------------|------|---------|-----------------|-------|-------------|----------|
| Mar. -27-'96 | enactment           | —    | —————   | Issued<br>date  | ————— | N. Terasawa | J. HOSEN |
|              |                     |      |         |                 |       |             |          |
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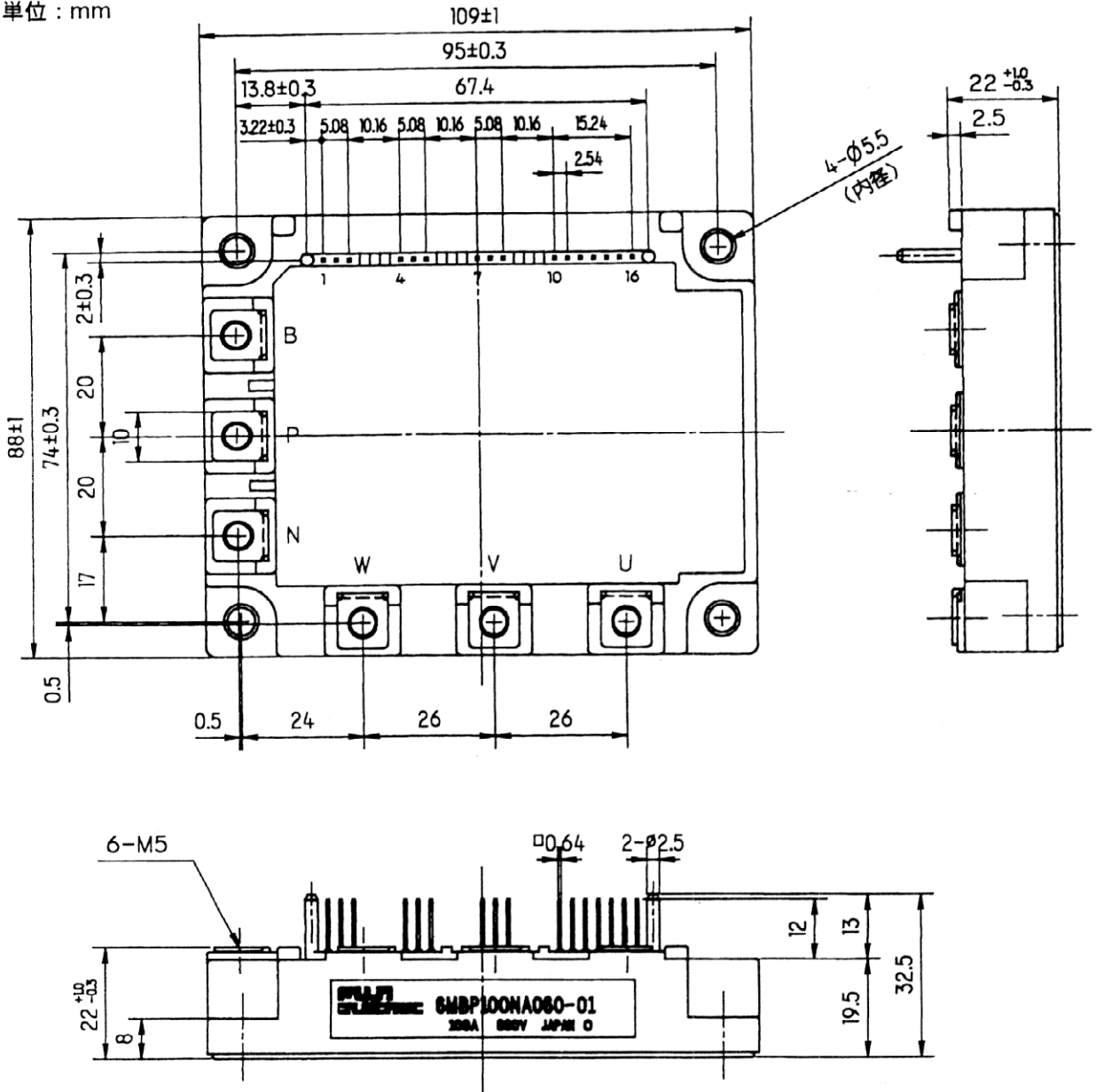
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1. Outline Drawing

外形図

Unit : mm

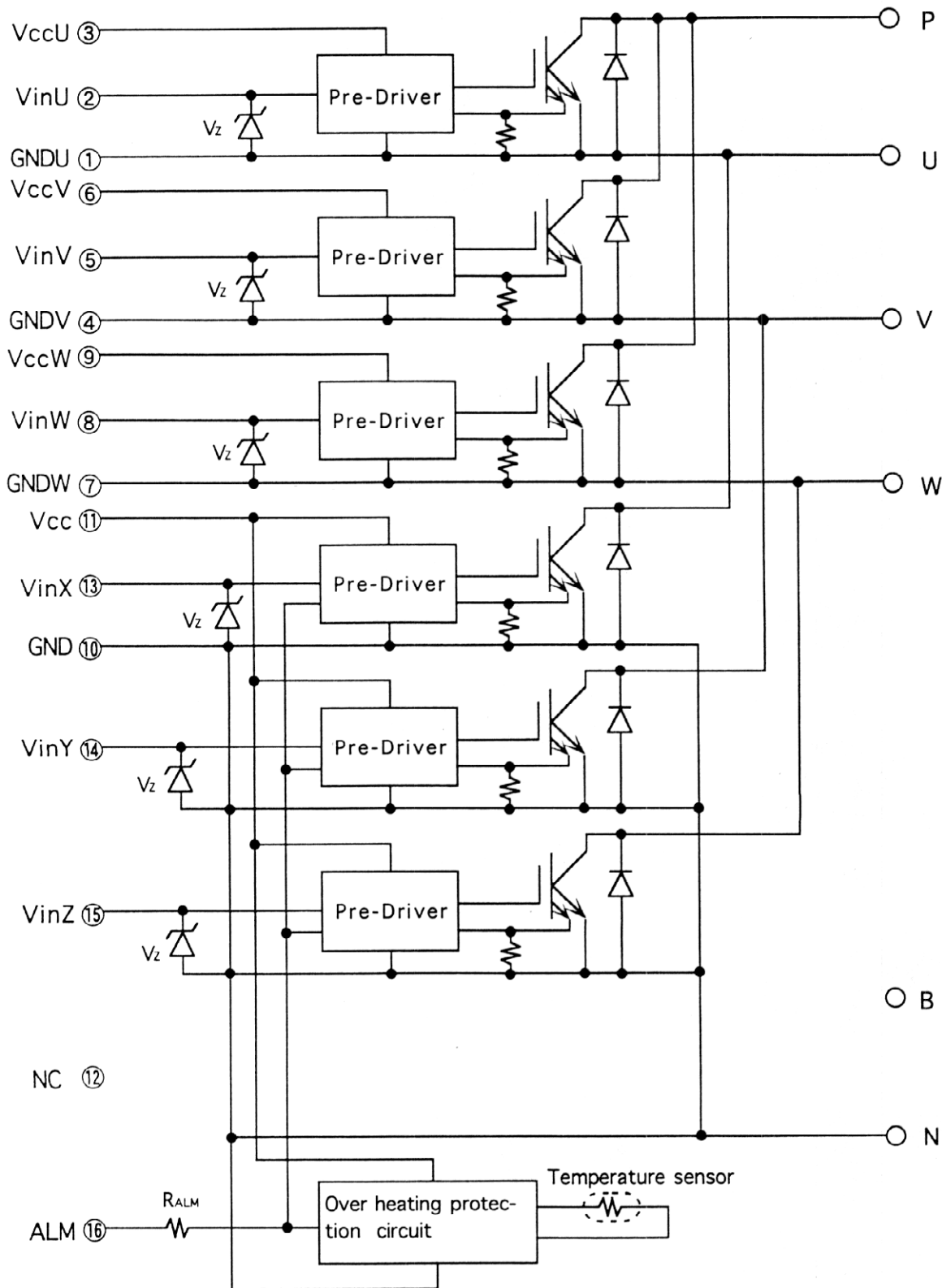
单位 : mm



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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

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

| Items  |                   | Symbols                | Ratings         |                 | Units |   |
|--|-------------------|------------------------|-----------------|-----------------|-------|---|
|  |                   |                        | Min.            | Max.            |       |   |
| DC Bus Voltage                               |                   | V <sub>DC</sub>        | 0               | 450             | V     |   |
| DC Bus Voltage (surge)                       |                   | V <sub>DC(SURGE)</sub> | 0               | 500             | V     |   |
| DC Bus Voltage (short operating)             |                   | V <sub>SC</sub>        | 200             | 400             | V     |   |
| Collector-Emitter Voltage                    |                   | V <sub>CES</sub>       | 0               | 600             | V     |   |
| I<br>N<br>V                                  | Collector Current | DC                     | I <sub>c</sub>  | —               | 100   | A |
|  |                   | 1mS                    | I <sub>cp</sub> | —               | 200   | A |
|  |                   | Duty=42.0%             | -I <sub>c</sub> | —               | 100   | A |
| Collector Power Dissipation One Transistor   |                   | P <sub>c</sub>         | —               | 400             | W     |   |
| Junction Temperature                         |                   | T <sub>j</sub>         |                 | 150             | °C    |   |
| Input Voltage of Power Supply for Pre-Driver |                   | V <sub>CC</sub> ※1     | 0               | 20              | V     |   |
| Input Signal Voltage                         |                   | V <sub>in</sub> ※2     | 0               | V <sub>Z</sub>  | V     |   |
| Input Signal Current                         |                   | I <sub>in</sub>        | —               | 1               | mA    |   |
| Alarm Signal Voltage                         |                   | V <sub>ALM</sub> ※3    | 0               | V <sub>CC</sub> | V     |   |
| Alarm Signal Current                         |                   | I <sub>ALM</sub> ※4    | —               | 15              | mA    |   |
| Storage Temperature                          |                   | T <sub>stg</sub>       | -40             | 125             | °C    |   |
| Operating Case Temperature (Fig.1)           |                   | T <sub>OP</sub>        | -20             | 100             | °C    |   |
| Isolation Voltage (Case-Terminal)            |                   | V <sub>iso</sub> ※5    | —               | AC2.5           | kV    |   |

- Note ※ 1 V<sub>CC</sub> shall be applied to the input Voltage between terminal No. 3 and 1 , 6 and 4, 9 and 7, 11 and 10.  
 ※ 2 V<sub>in</sub> 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<sub>ALM</sub> shall be applied to the Voltage between terminal No. 16 and 10.  
 ※ 4 I<sub>ALM</sub> shall be applied to the input current to terminal No. 16.  
 ※ 5 50Hz/60Hz sine wave 1 minute.

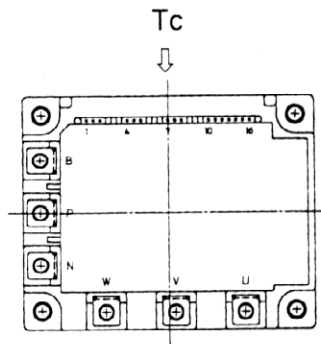


Fig.1 Measurement of case temperature

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## 4. Electrical Characteristics

### 4.1 Electrical Characteristics of Power Circuit (at $T_c=T_j=25^\circ\text{C}$ , $V_{cc}=15\text{V}$ )

| Items                  |  | Symbols       | Conditions           | Min. | Typ. | Max. | Units |
|------------------------|--|---------------|----------------------|------|------|------|-------|
| I<br>N<br>V            | Collector Current<br>at off Signal Input | $I_{CES}$     | $V_{CE}=600\text{V}$ | —    | —    | 1.0  | mA    |
|                        | Collector-Emitter<br>Saturation Voltage  | $V_{CE(sat)}$ | $I_c=100\text{A}$    | —    | —    | 2.9  | V     |
| Forward Voltage of FWD |  | $V_F$         | $-I_c=100\text{A}$   | —    | —    | 3.3  | V     |

### 4.2 Electrical Characteristics of Control Circuit (at $T_c=T_j=25^\circ\text{C}$ , $V_{cc}=15\text{V}$ )

| Items   |     | Symbols       | Conditions  | Min. | Typ. | Max. | Units            |
|---|-----|---------------|---|------|------|------|------------------|
| Power Supply Current of P-Line<br>Side Pre-Driver (One Unit)                        |     | $I_{CCP}$     | $f_{sw}=15\text{kHz} \times 6$<br>Duty=50%            | —    | 8    | 18   | mA               |
| Power Supply Current of N-Line<br>Side Three Pre-Drivers and<br>Protection Circuits |     | $I_{CCN}$     | $f_{sw}=15\text{kHz}$<br>Duty=50%                     | —    | 24   | 54   | 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)<br>Level  |     | $T_{OH}$      | $V_{DC}=0\text{V}, I_c=0\text{A}$<br>Case Temperature | 100  | —    | 125  | $^\circ\text{C}$ |
| OH Hysteresis   |     | $T_H$         |   | —    | 20   | —    | $^\circ\text{C}$ |
| Over Current<br>Protection(OC) Level  | INV | $I_{oc}$      | $T_j=125^\circ\text{C}$<br>Collector Current          | 130  | —    | —    | A                |
| OC Delay Time (Fig.2)   |     | $t_{DOC}$     | $T_j=25^\circ\text{C}$                                | —    | 8    | —    | $\mu\text{S}$    |
| Under Voltage Protection(UV)<br>Level   |     | $V_{UVT}$     |   | 11.0 | 12.0 | 12.5 | V                |
| UV Hysteresis   |     | $V_H$         |   | 0.2  | —    | —    | V                |
| Alarm Signal Hold Time  |     | $t_{ALM}$     |   | 0.8  | 2    | —    | mS               |
| Delay Time of Short Circuit<br>Protection (Fig.3)                                   |     | $t_{SC}$      |   | 12   | —    | —    | $\mu\text{S}$    |
| Limiting Resistor for Alarm   |     | $R_{ALM}$     |   | 1425 | 1500 | 1575 | $\Omega$         |

※6 Switching frequency of IPM

### 4.3 Dynamic Characteristics (at $T_c=T_j=125^\circ\text{C}$ , $V_{cc}=15\text{V}$ )

| Items                   |           | Symbols  | Conditions                            | Min. | Typ. | Max. | Units         |
|-------------------------|-----------|----------|---------------------------------------|------|------|------|---------------|
| Switching Time<br>Fig.4 | $t_{on}$  |          | $I_c=100\text{A}$                     | 0.3  | —    | —    | $\mu\text{S}$ |
|                         | $t_{off}$ |          | $V_{bc}=300\text{V}$                  | —    | —    | 3.6  | $\mu\text{S}$ |
| Switching Time (FWD)    |           | $t_{rr}$ | $I_F=100\text{A}, V_{DC}=300\text{V}$ | —    | —    | 400  | nS            |

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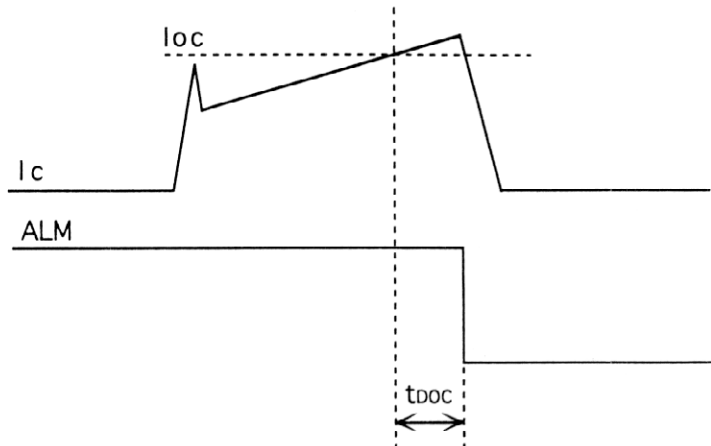


Fig.2 : Definition of OC Delay Time

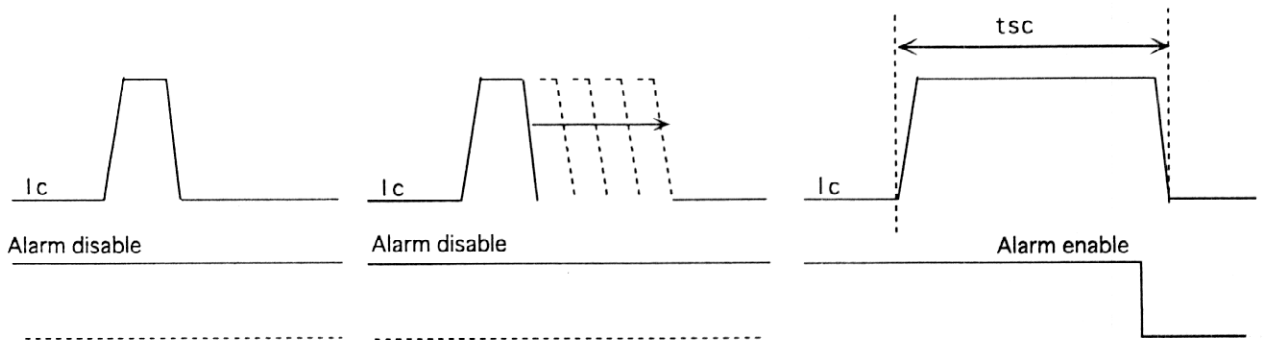


Fig.3 : Definition of tsc

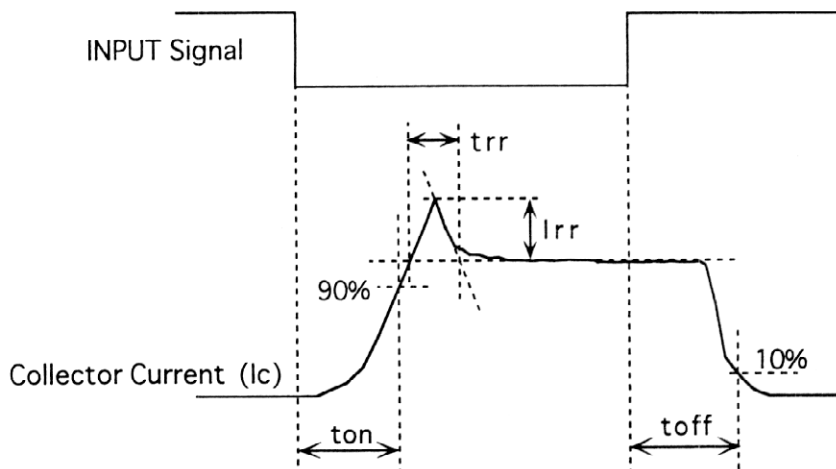


Fig.4 : Definition of switching time

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### 5. Thermal Characteristics (Tc=25°C)

| Items  |     |      | Symbols  | Min. | Typ. | Max. | Units |
|--|-----|------|----------|------|------|------|-------|
| Junction to Case<br>Thermal Resistance       | INV | IGBT | Rth(j-c) | —    | —    | 0.31 | °C/W  |
|  |     | FWD  | Rth(j-c) | —    | —    | 0.90 | °C/W  |
| Case to Fin Thermal Resistance with Compound |     |      | Rth(c-f) | —    | 0.05 | —    | °C/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

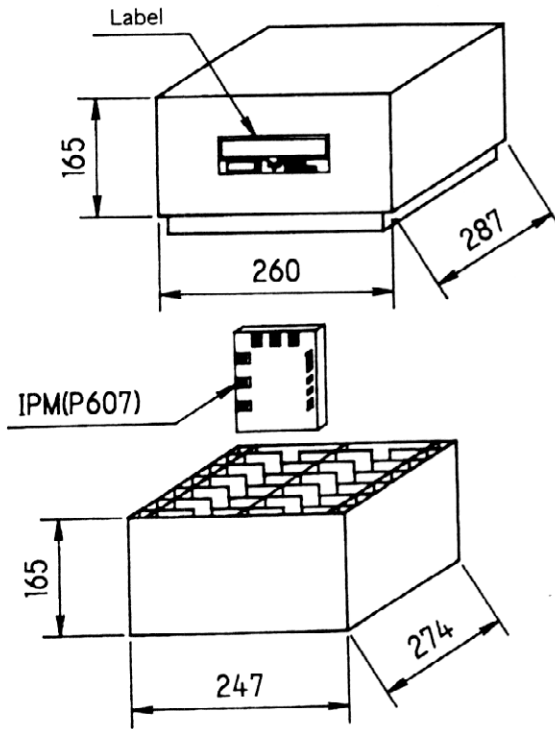
| Items   |               | Symbols         | Conditions | Min. | Typ. | Max. | Units |
|---|---------------|-----------------|------------|------|------|------|-------|
| DC Bus Voltage  |               | V <sub>dc</sub> |            | 200  | —    | 400  | V     |
| Operating Power Supply Voltage<br>Range of Pre-Driver |               | V <sub>cc</sub> |            | 13.5 | 15   | 16.5 | V     |
| Switching frequency of IPM                            |               | f <sub>sw</sub> |            | 1    | —    | 20   | kHz   |
| Screw Torque  | Mounting (M5) | —               |            | 2.5  | —    | 3.5  | N·m   |
|   | Terminal (M5) | —               |            | 2.5  | —    | 3.5  | N·m   |

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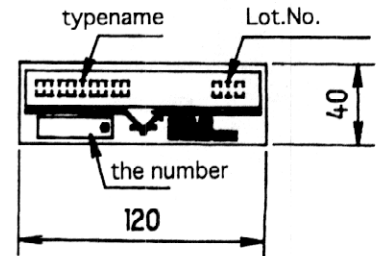


## 8. Packing and labeling

### 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 °C 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 external 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の保管すること。
- ・ 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 6MBP100NA060-01.

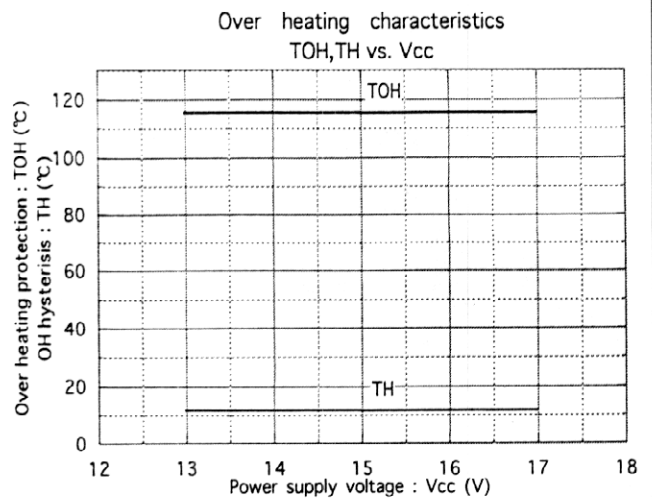
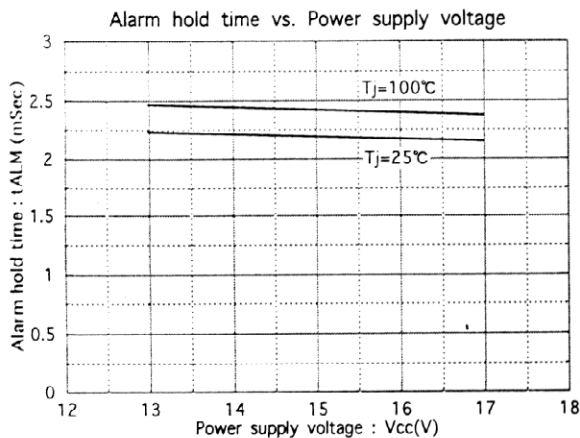
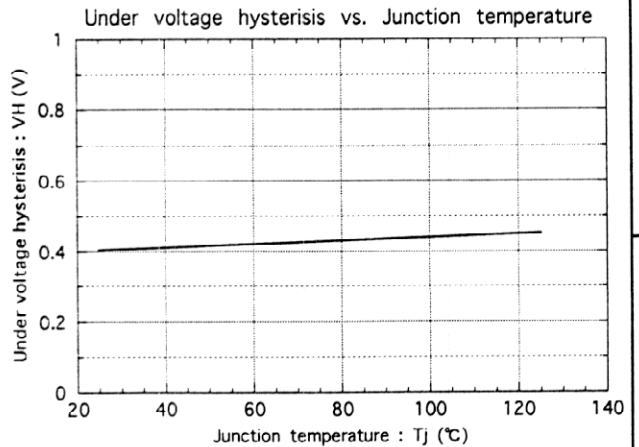
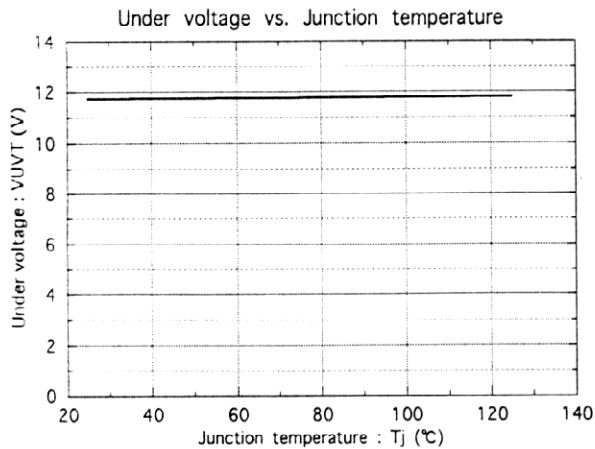
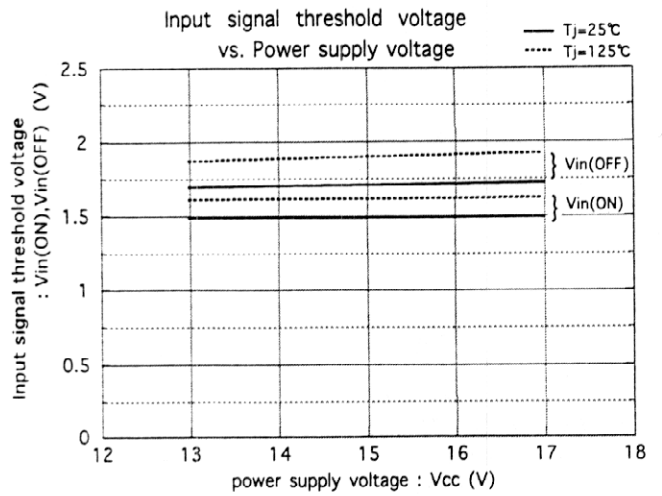
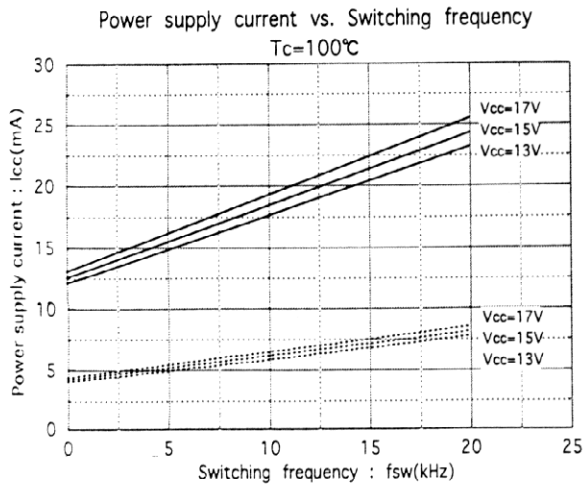
本納入仕様書は、IGBT-IPM 6MBP100NA060-01 に適用する。

# 11. Characteristic (Representative)

## 特性カーブ (代表例)

### 11-1. Control Circuit

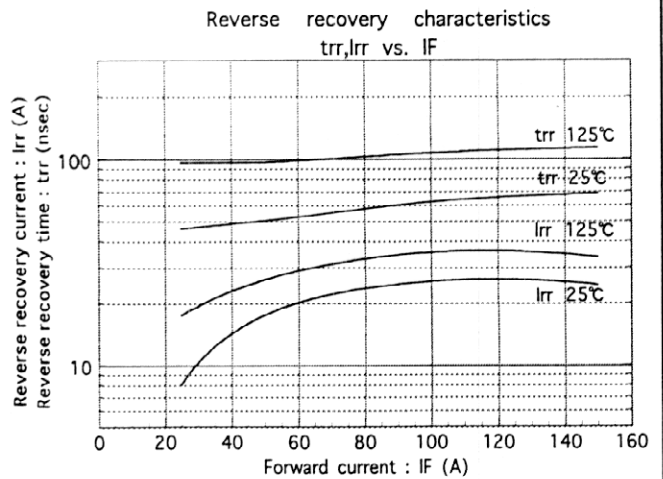
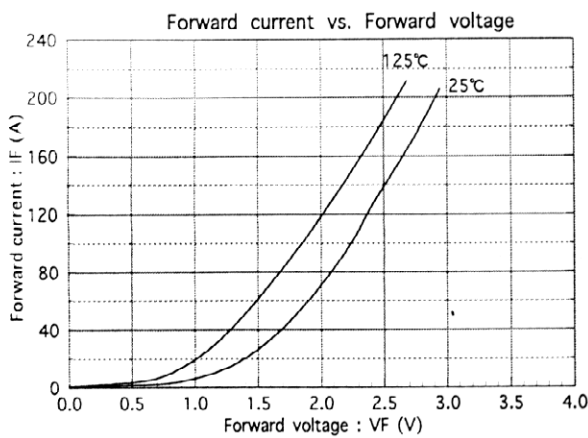
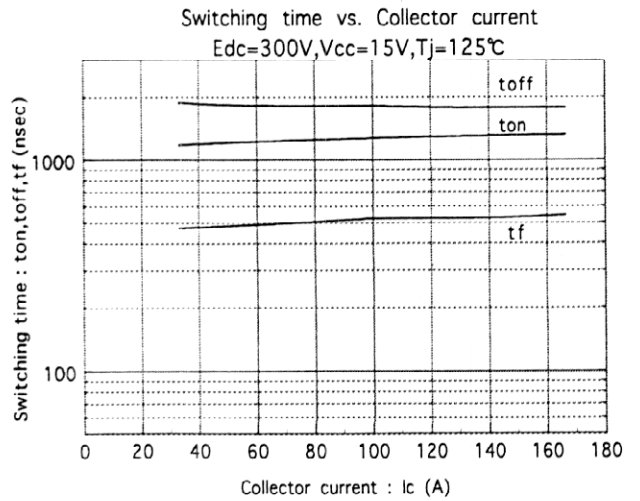
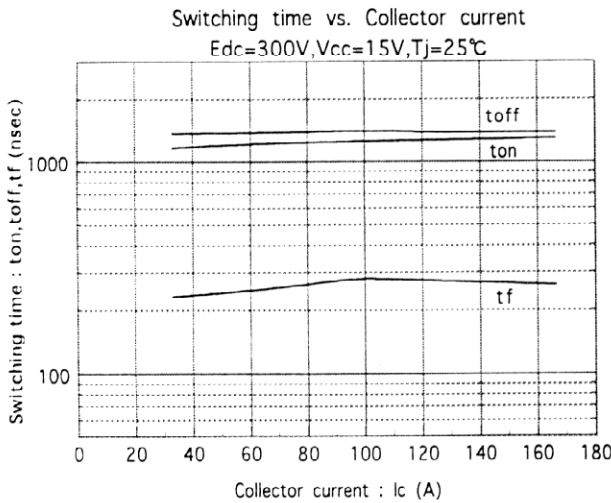
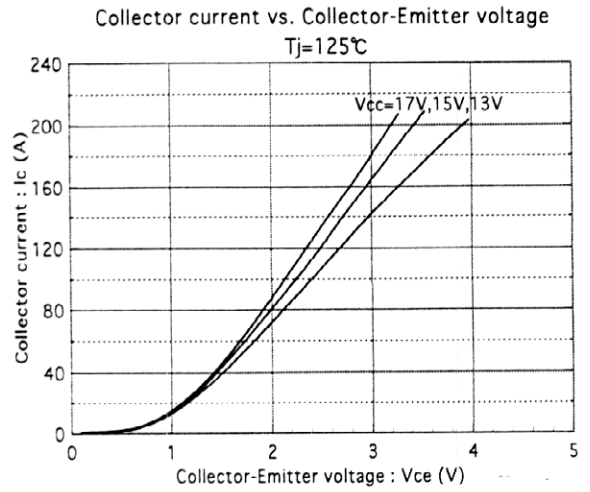
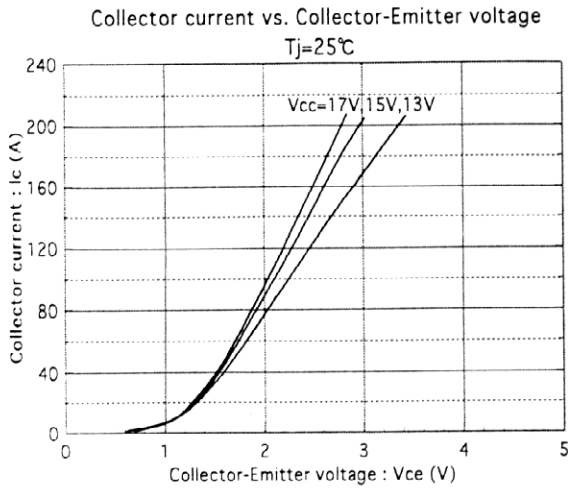
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# 11-2. Inverter

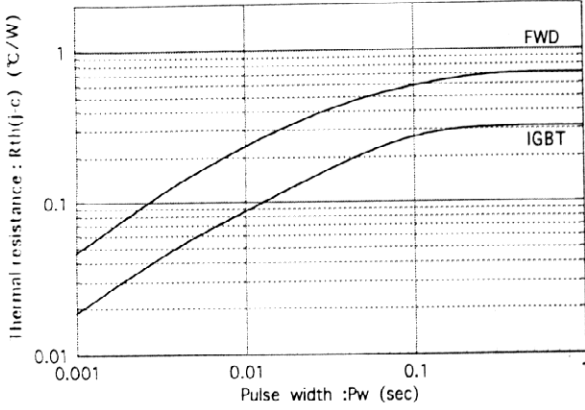
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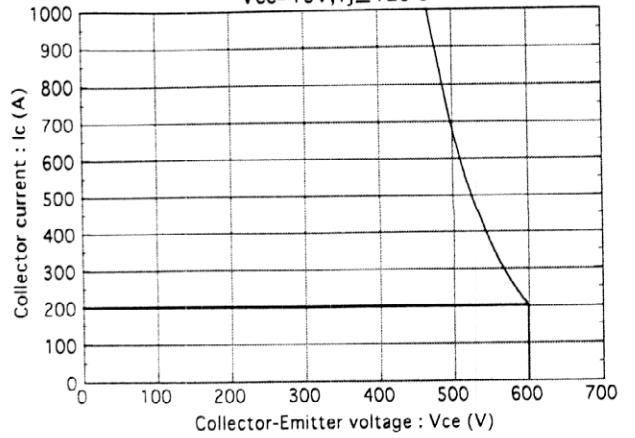
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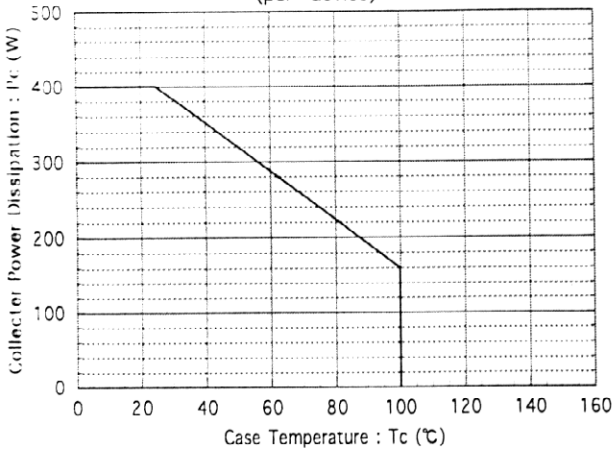
Transient thermal resistance



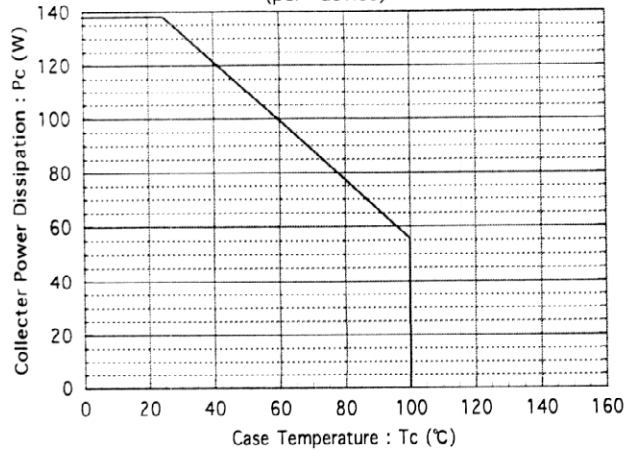
Reversed biased safe operating area  
 $V_{cc}=15V, T_j \leq 125^\circ C$



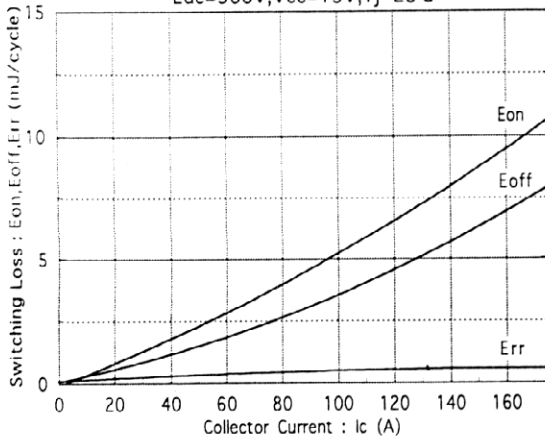
Power derating for IGBT  
(per device)



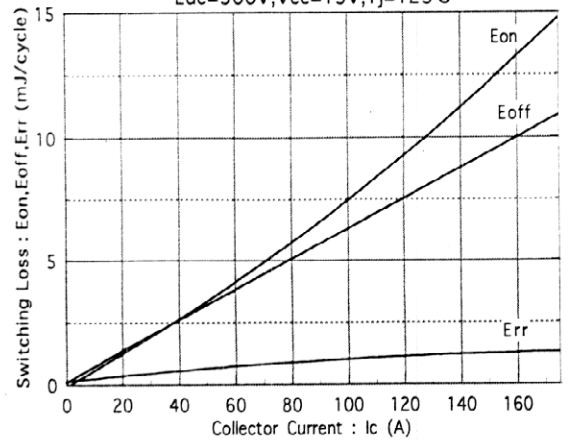
Power derating for FWD  
(per device)



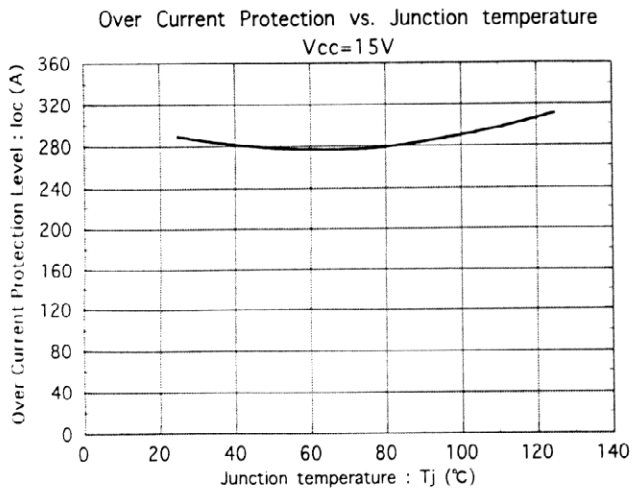
Switching Loss vs. Collector Current  
 $E_{dc}=300V, V_{cc}=15V, T_j=25^\circ C$



Switching Loss vs. Collector Current  
 $E_{dc}=300V, V_{cc}=15V, T_j=125^\circ C$



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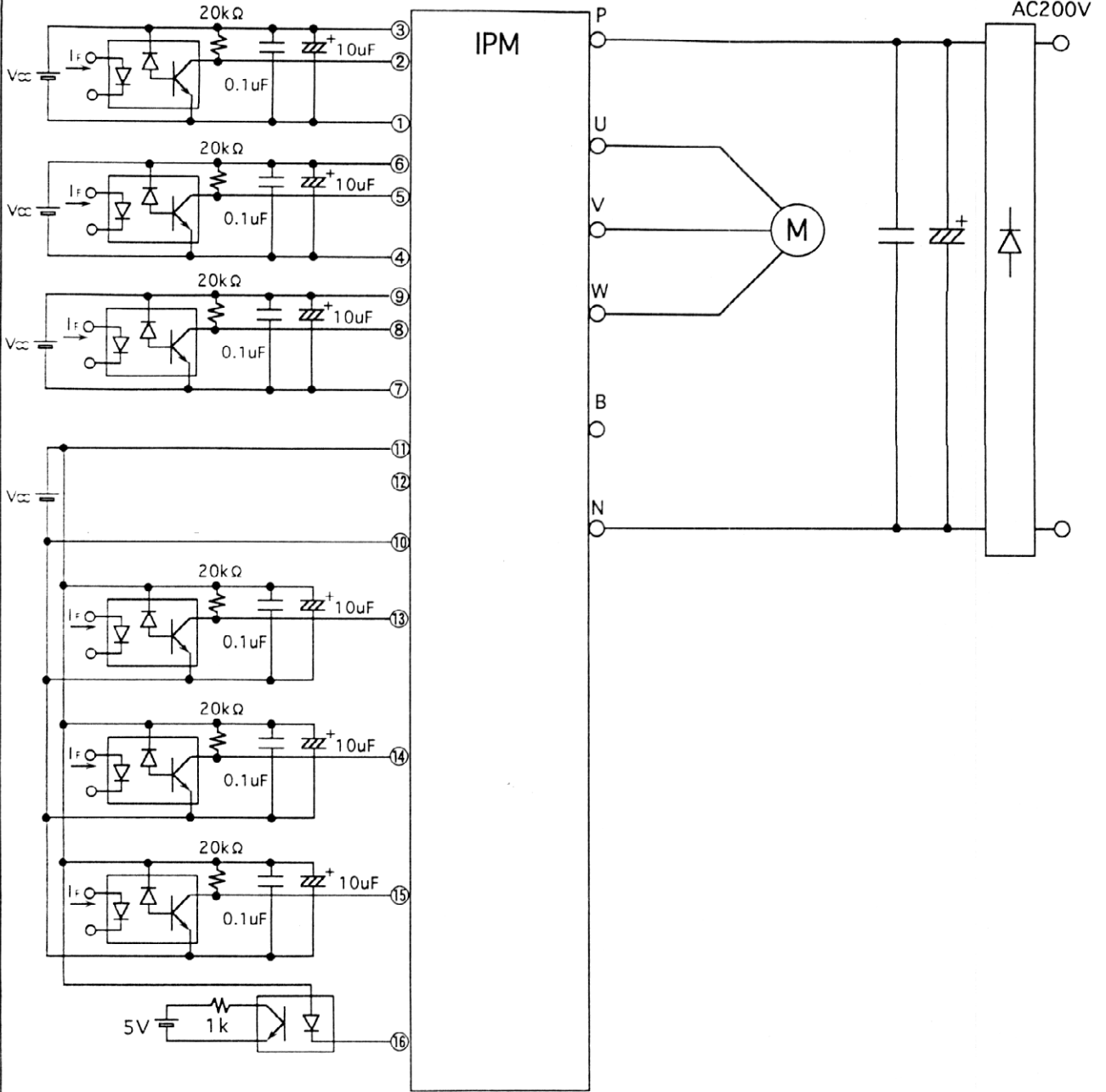
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## 12.Example of applied circuit (応用回路例)



- 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.

ホトカブラとIPMの入力端子間配線は、できるだけ短くしホトカブラの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.

高速ホトカブラのVcc-GND間には、コンデンサをできるだけ近接して取り付けして下さい。

- Use high-speed opto-coupler :  $t_{PLH}, t_{PHL} \leq 0.8\mu s$ , high CMR type. (Example : HCPL-4504)

高速ホトカブラ :  $t_{PLH}, t_{PHL} \leq 0.8\mu s$ , 高CMRタイプをご使用下さい。(例 HPCL-4504)

- Low-speed opto-coupler :  $CTR \geq 100\%$

低速ホトカブラ :  $CTR \geq 100\%$

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- Each power supply for drive circuit should not have transient voltage fluctuation. Four power supplies which are isolated should be supplied individually.  
各制御用電源は瞬時電圧変動の少ない、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.  
入力回路のグラウンド (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。

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