

# SPECIFICATION

Device Name : IGBT-IPM

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Type Name : 6MBP20RY060

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Spec. No. : MS6M0363

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Fuji Electric Co.,Ltd.  
Matsumoto Factory

|         | DATE       | NAME         | APPROVED | Fuji Electric Co.,Ltd. |          |      |   |  |
|---------|------------|--------------|----------|------------------------|----------|------|---|--|
| DRAWN   | Jul-3-98   | T. Kajiura   | S.K      | DWG.NO.                | MS6M0363 | 1/11 | a |  |
| CHECKED | Jul. 3, 98 | S. Kobayashi |          |                        |          | b    |   |  |
|         |            |              |          |                        |          |      | c |  |

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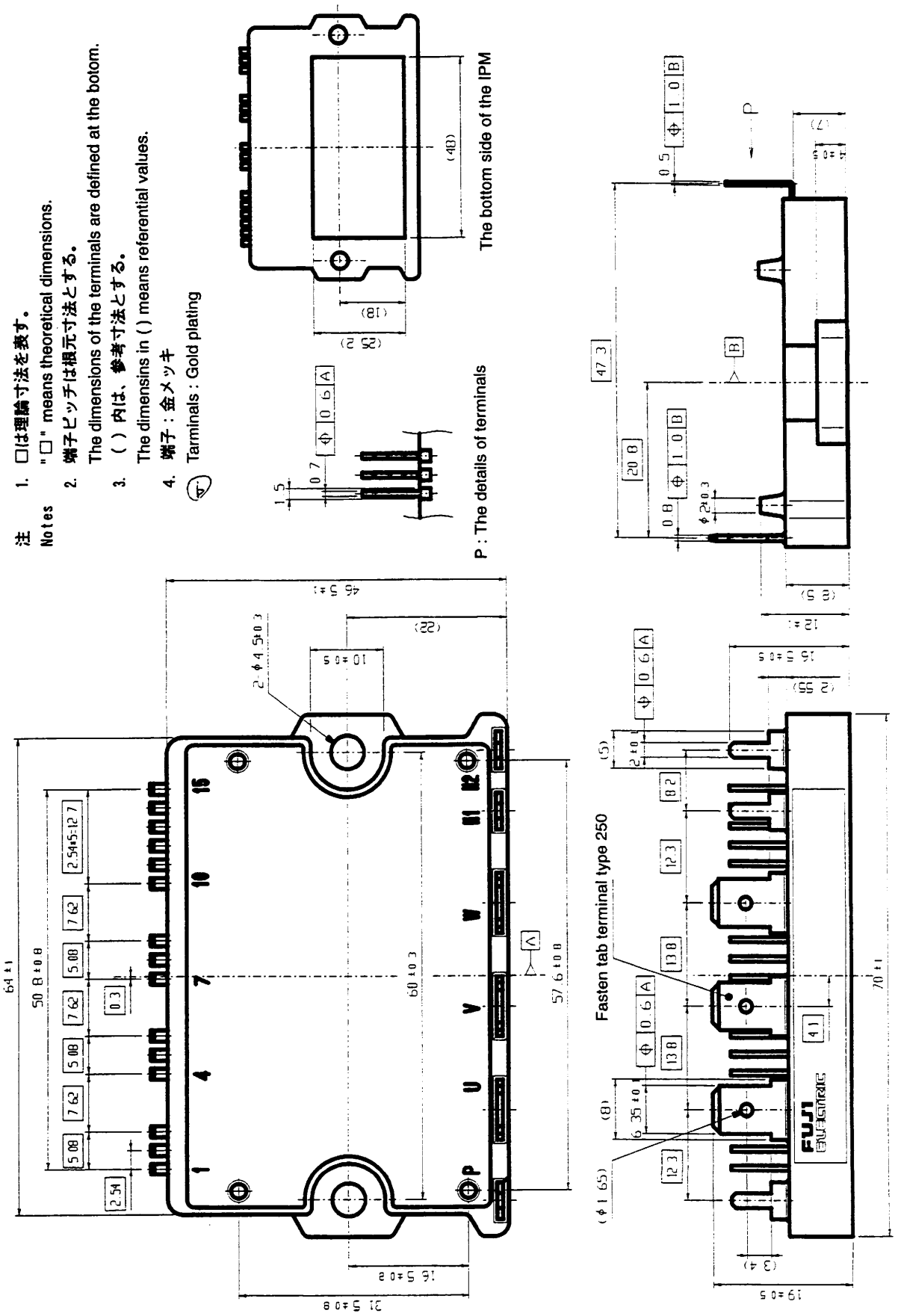
# Revised Record

| Date            | Classification | Ind. | Content  | Applied Date    | Drawn            | Checked             | Approved            |
|-----------------|----------------|------|--|-----------------|------------------|---------------------|---------------------|
| Jul. 3<br>198   | Enactment      | —    | —  | Issued<br>Date  | <i>T. Ueyama</i> | <i>S. Kobayashi</i> | <i>S.K</i>          |
| Sep.-29<br>-198 | Revision       | a    | Addition, packing spec. 1/2<br>Revision. outline 3/4           | Sep.-29<br>-198 | <i>T. Ueyama</i> | <i>A. Nishimura</i> | <i>S. Kobayashi</i> |
| Nov.-10<br>-198 | Correction     | b    | Correction errors in writing<br>Addition plating spec.         | Nov.-10<br>-198 | <i>T. Ueyama</i> | <i>A. Nishimura</i> | <i>S.K</i>          |
| Feb-23<br>-199  | Revision       | c    | Revision: Size of packing box<br>Correction: Errors in writing | Feb-23<br>-199  | <i>T. Ueyama</i> | <i>Nishimura</i>    | <i>S.K</i>          |
|                 |                |      |  |                 |                  |                     |                     |
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1. Outlines (外形図)

Dimensions in mm



注 1. □は理論寸法を表す。

Notes "□" means theoretical dimensions.

2. 端子ピッチは根元寸法とする。

The dimensions of the terminals are defined at the bottom.

3. ( )内は、参考寸法とする。

The dimensions in ( ) means referential values.

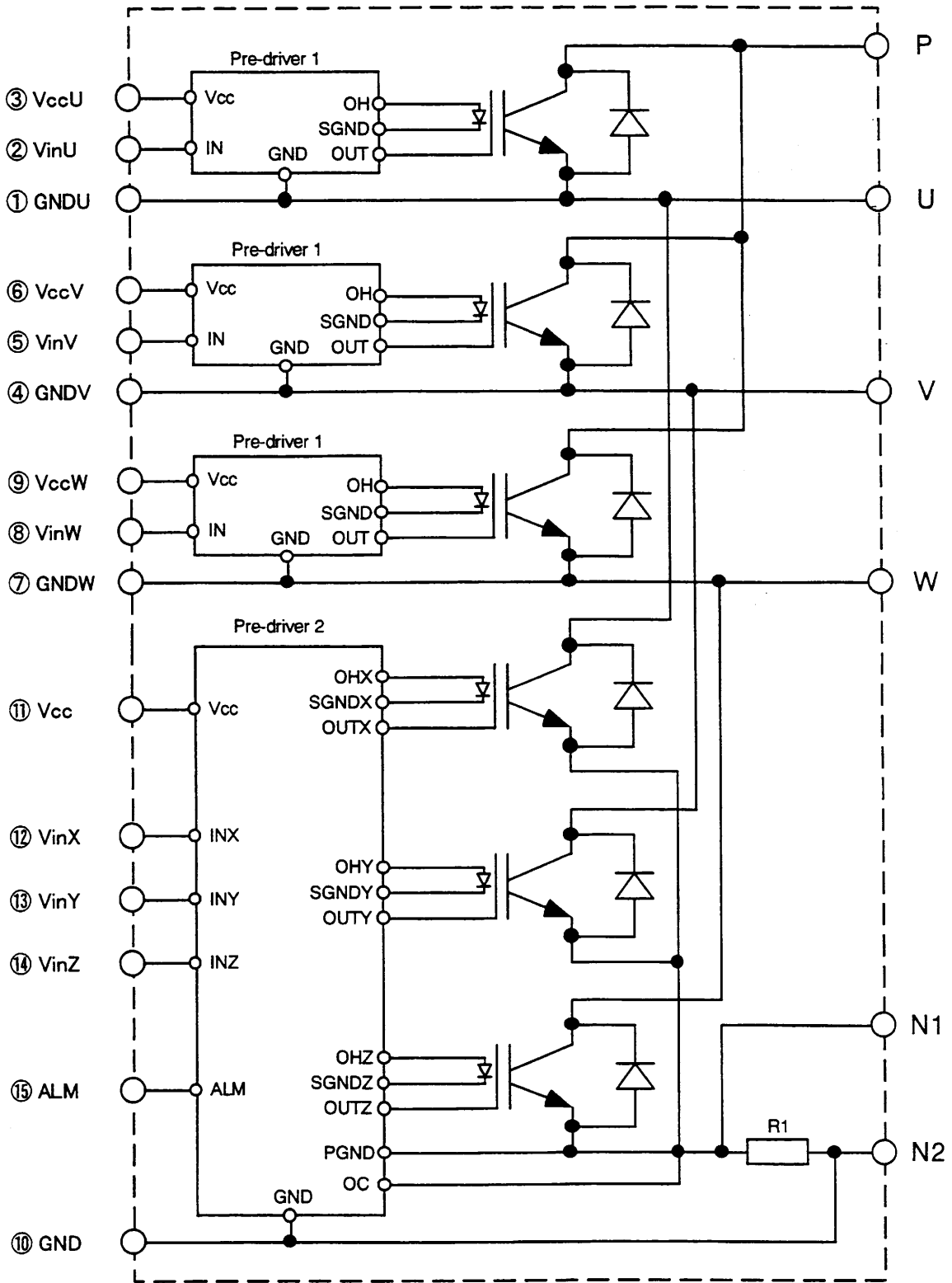
4. 端子：金メッキ

Terminals : Gold plating

P : The details of terminals

The bottom side of the IPM

## 2. Block Diagram (ブロック図)



Pre-driver 1 includes following functions. (P-side)

- (1) Amplifier for drive
- (2) Power supply under voltage protection
- (3) IGBT chip over heating protection

Pre-driver 2 includes following functions. (N-side) <sup>(b)</sup>

- (1) Amplifier for drive
- (2) Power supply under voltage protection
- (3) IGBT chip over heating protection
- (4) Over current protection
- (5) Alarm signal output

### 3. Maximum Ratings ( 最大定格)

(Tc=25°C unless otherwise specified)

| Items  |                | Symbols       | Ratings | Unit |
|--|----------------|---------------|---------|------|
| DC Bus Voltage   |                | VDC           | 450     | V    |
| DC Bus Voltage (surge)                                       |                | VDC(surge)    | 500     | V    |
| DC Bus Voltage (short operating)                             |                | VSC           | 400     | V    |
| Collector-Emitter Voltage                                    |                | VCES          | 600     | V    |
| Collector Current  | DC             | IC            | 20      | A    |
|  | 1ms            | ICP           | 40      | A    |
|  | Duty=49.6%     | -IC           | 20      | A    |
| Collector Power Dissipation                                  | One Transistor | Pc            | 63      | W    |
| Junction Temperature   |                | Tj            | 150     | °C   |
| Input Voltage of Power Supply for Pre-Driver                 |                | VCC           | -0.3~20 | V    |
| Input Signal Current   |                | Iin           | 20      | mA   |
| Alarm Signal Voltage   |                | VALM          | Vcc     | V    |
| Alarm Signal Current   |                | IALM          | 15      | mA   |
| Storage Temperature  |                | Tstg          | -40~125 | °C   |
| Operating Case Temperature                                   |                | Tcop          | -20~100 | °C   |
| Isolating Voltage (Terminal to base,50/60Hz sine wave 1min.) |                | Viso          | AC 2500 | V    |
| Screw Torque   |                | Mounting (M4) | 2.0     | N·m  |

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Fuji Electric Co.,Ltd.

DWGNO.

MS6M0363

5/11

|   |
|---|
| a |
| b |
| c |

#### 4. Electrical Characteristics (電気的特性)

##### 4.1 Electrical Characteristics of Power Circuit (主回路部電気的特性)

( $T_J=T_C=25^\circ\text{C}$ ,  $V_{CC}=15\text{V}$ )

| Items                                 | Symbols       | Conditions                                 | min. | typ. | max. | Unit |
|---------------------------------------|---------------|--|------|------|------|------|
| Collector Current at off Signal Input | ICES          | $V_{CE}=600\text{V}$ , $I_{in}=0\text{mA}$ | -    | -    | 1.0  | mA   |
| Collector-Emitter Saturation Voltage  | $V_{CE(sat)}$ | $I_C=20\text{A}$ , $I_{in}=10\text{mA}$    | -    | -    | 2.7  | V    |
| Forward Voltage of FWD                | VF            | $-I_C=20\text{A}$ , $I_{in}=0\text{mA}$    | -    | -    | 3.5  | V    |

##### 4.2 Electrical Characteristics of Control Circuit (制御部電気的特性)

( $T_J=T_C=25^\circ\text{C}$ ,  $V_{CC}=15\text{V}$ )

| Items  | Symbols       | Conditions                            | min. | typ. | max. | Unit             |
|--|---------------|---------------------------------------|------|------|------|------------------|
| Power Supply Current of P-line Pre-driver (one unit) | $I_{CCP}$     | $I_{in}=0\text{mA}$                   | -    | 2.0  | 5.0  | mA               |
| Power Supply Current of N-line Pre-driver            | $I_{CCN}$     | $I_{in}=0\text{mA}$                   | -    | 4.0  | 10.0 | mA               |
| Input Signal Threshold Current                       | $I_{in(th)}$  | Turn-on                               | -    | 1.8  | 2.3  | mA               |
|  |               | Turn-off                              | 0.8  | 1.3  | -    | mA               |
| Hysteresis of Input Signal Theshold Current          | $I_{inH}$     | -                                     | -    | 0.5  | -    | mA               |
| Input Signal Saturation Voltage                      | $V_{in(sat)}$ | $I_{in}=20\text{mA}$                  | -    | 0.8  | 2.0  | V                |
| Over Heating Protection (過熱保護)                       |               |                                       |      |      |      |                  |
| IGBT chips Over HeatProtection Temperature Level     | $T_{JOH}$     | Surface of IGBT                       | 150  | -    | -    | $^\circ\text{C}$ |
| Hysteresis   | $T_{JH}$      | -                                     | -    | 20   | -    | $^\circ\text{C}$ |
| Over Current Protection (過電流保護)                      |               |                                       |      |      |      |                  |
| Collector Current Protection Level                   | $I_{OC}$      | N-side, (N1-N2 open)                  | 24   | 30   | 36   | A                |
|  | $V_{oc}$      | Between N1 and N2                     | 190  | 200  | 210  | mV               |
| OC detecting resistor value                          | $R_{oc}$      |                                       | -    | 6.6  | -    | m $\Omega$       |
| Protection Delay time                                | $t_{DOC}$     | $T_J=25^\circ\text{C}$ Fig. 1, Fig. 2 | -    | 5.0  | 7.0  | $\mu\text{s}$    |
| Power Supply Under Voltage Protection (電源電圧低下保護)     |               |                                       |      |      |      |                  |
| Under Voltage Protection Level                       | $V_{UV}$      | -                                     | 11.0 | -    | 12.5 | V                |
| Hysteresis   | $V_H$         | -                                     | 0.2  | -    | 0.8  | V                |
| Alarm Signal Output (アラーム信号出力)                       |               |                                       |      |      |      |                  |
| Alarm Signal Hold Time                               | $t_{ALM}$     | -                                     | 1.0  | 2.0  | -    | ms               |

### 5. Switching Characteristics (スイッチング特性)

(T<sub>j</sub>=T<sub>c</sub>=25°C, V<sub>cc</sub>=15V)

| Items                 | Symbols | Conditions                                 | min. | typ. | max. | Unit |
|-----------------------|---------|--|------|------|------|------|
| Switching Time (IGBT) | ton     | I <sub>c</sub> =20A, V <sub>DC</sub> =300V | 0.5  | -    | -    | μs   |
|                       | toff    | I <sub>in</sub> =10mA                      | -    | -    | 5.0  | μs   |
| Switching Time (FWD)  | trr     | Inductive-Load, Fig. 3                     | -    | -    | 0.5  | μs   |

### 6. Thermal Characteristics (熱特性)

(T<sub>j</sub>=T<sub>c</sub>=25°C, V<sub>cc</sub>=15V)

| Items  |      | Symbols              | min. | typ. | max. | Unit |
|--|------|----------------------|------|------|------|------|
| Junction to Case Thermal Resistance          | IGBT | R <sub>th(j-c)</sub> | -    | -    | 2.0  | °C/W |
|  | FWD  | R <sub>th(j-c)</sub> | -    | -    | 3.6  | °C/W |
| Case to Fin Thermal Resistance with Compound |      | R <sub>th(c-f)</sub> | -    | 0.05 | -    | °C/W |

### 7. Recommendable Value (推奨値)

| Items   | Symbols         | Conditions   | min. | typ. | max. | Unit |
|---|-----------------|--------------|------|------|------|------|
| DC Bus Voltage                                    | V <sub>DC</sub> | -            | 200  | -    | 400  | V    |
| Operating Power Supply Voltage Range of Pre-drive | V <sub>CC</sub> | -            | 13.5 | 15   | 16.5 | V    |
| Input Forward Current                             | I <sub>F</sub>  | CTR=100~200% | 8    | -    | 10   | mA   |
| Switching Frequency                               | f <sub>sw</sub> | -            | 1    | 3    | 5    | kHz  |
| Flatness of heat sink                             |                 | -            | -100 | -    | 100  | μm   |
| Mounting Screw Torque (M4)                        |                 | -            | 1.3  | -    | 1.7  | N·m  |

### 8. Weight (重量)

| Items  | Symbols | Conditions | min. | typ. | max. | Unit |
|--------|---------|------------|------|------|------|------|
| Weight | -       | -          | -    | 50   | -    | g    |

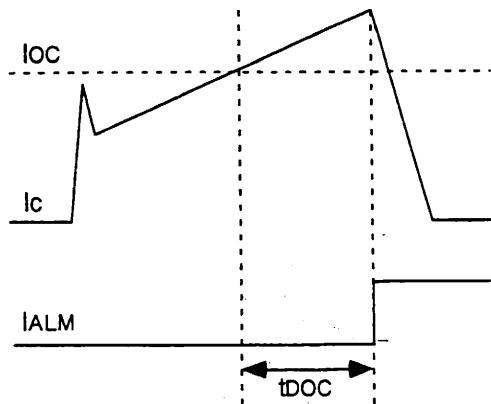


Fig. 1. Definition of OC protection delay time ( 過電流保護遅れ時間の定義 )

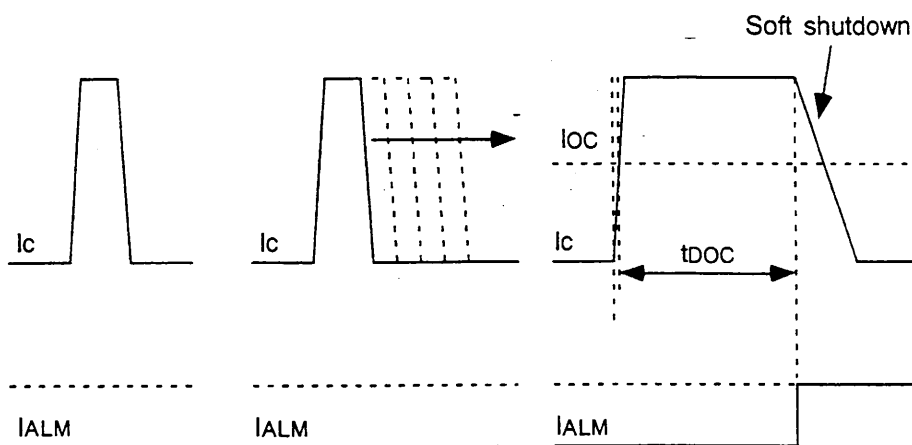


Fig. 2. Definition of protection delay time at short circuit ( 短絡時保護遅れ時間の定義 )

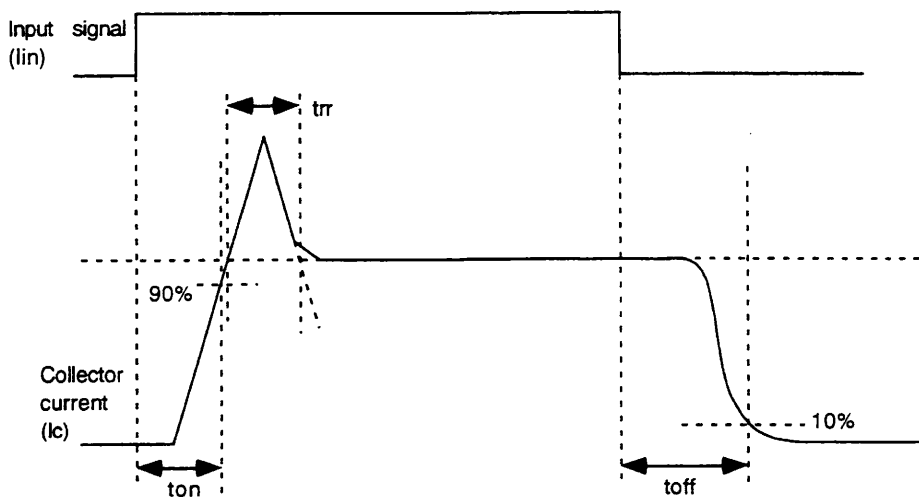
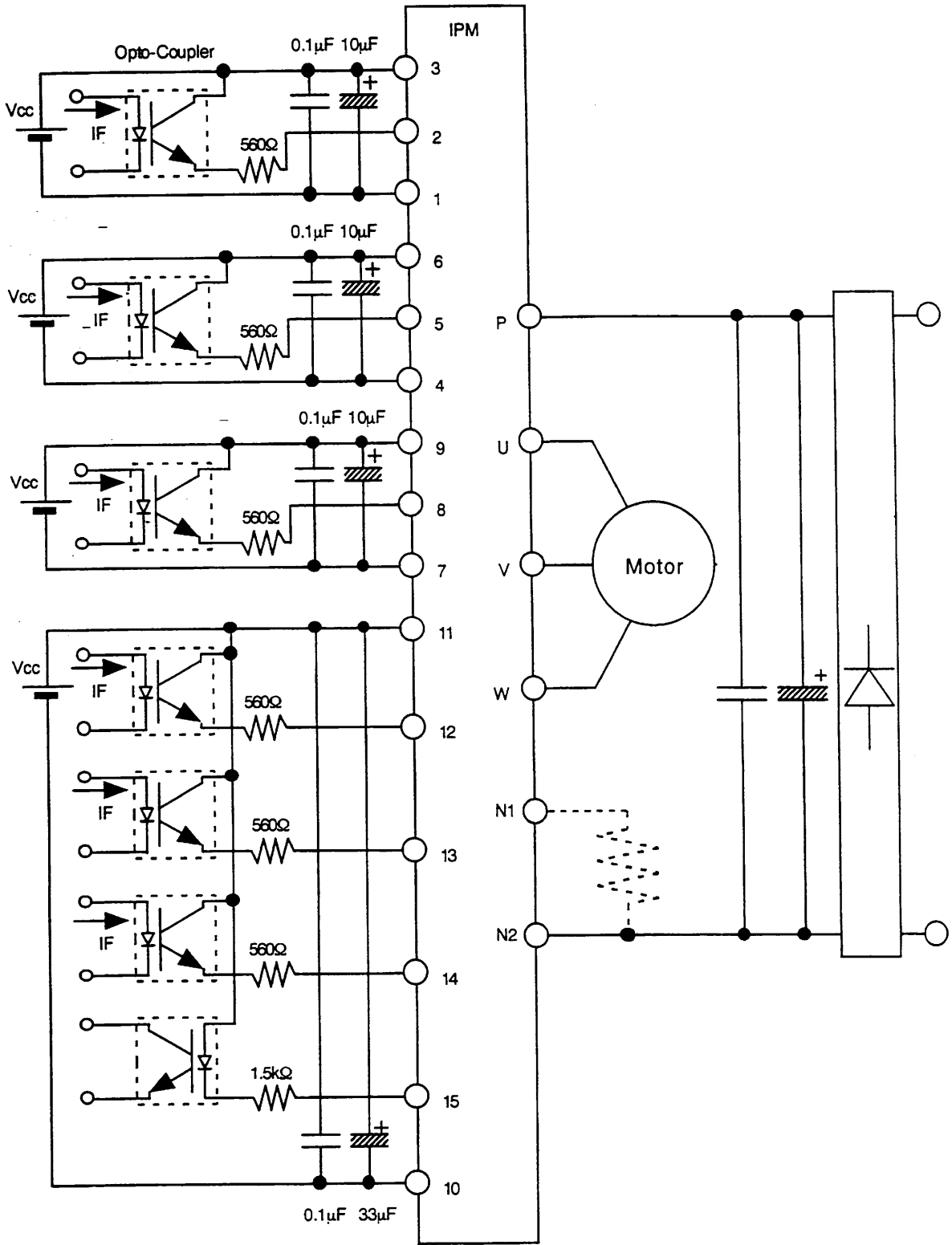


Fig. 3. Definition of switching time ( スイッチング時間の定義 )

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### 9. Typical Application Circuit ( 応用回路例 )



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#### - Recommendable condition of Opto-coupler ( 推奨ホトカプラ使用条件 )

| CTR Classification | Input Forward Current of Opto-Coupler ( $I_F$ ) |
|--------------------|---|
| 100 - 200 %        | 8 - 10 mA                                       |
| 80 - 160 %         | 10 - 12.5 mA                                    |

## 10. Application Guideline (適用時の注意事項)

- The wiring between the opto-couplers and the input terminals of the IPM should be as short as possible. The stray capacitance between primary and secondary side of the opto-couplers should not be increased by pattern lay-out of the control circuits.

フォトカプラとIPMの入力端子間配線はできるだけ短くし、フォトカプラの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ください。

- Capacitors should be connected between Vcc and GND terminals of the opto-coupler as closely as possible.

フォトカプラの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ください。

- Each power supplies for drive circuits should not have transient voltage fluctuation. Four power supplies which are isolated should be applied individually.

各制御電源は瞬時電圧変動の少ない、絶縁されたものを4個独立に使用してください。

- In order to prevent noise from AC line, connect capacitor (approx. 4.7nF) between three-phase line and earth.

ACラインからのノイズの侵入を防ぐため、3相各線—アース間に4.7nF程度のコンデンサを接続してください。

- Do not connect N2-terminal of main circuit to ground (GND) of the control circuit.

入力回路のグラウンド(GND)と主回路N2端子を接続しないでください。

## 11. Heat sink mounting precautions (IPMの取り付け方法)

- A mounting surface of a heat sink should be finished to a roughness below 10 $\mu$ m and a flatness between screw holes below 100 $\mu$ m. If the flatness is below -100 $\mu$ m, a thermal resistance between an IPM and a heat sink is increased. If the flatness is over +100 $\mu$ m, there is the danger of the isolation failure.

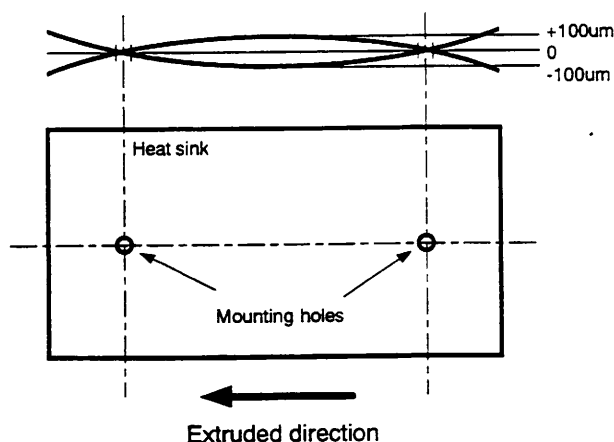
IPMを取り付けるヒートシンク面の仕上げは、粗さ10 $\mu$ m以下、ネジ位置間での面の平坦度(反り)100 $\mu$ m以内にして下さい。平坦度が-100 $\mu$ m以下の場合、ヒートシンクへの接触熱抵抗が増加します。また、平坦度が+100 $\mu$ m以上の場合、絶縁破壊を起こす危険性があります。

- Apply a thermal compound between an IPM and a heat sink to reduce a contact thermal resistance. 接触熱抵抗を小さくするために、IPMとヒートシンクの間にはサーマルコンパウンドを塗布して下さい。

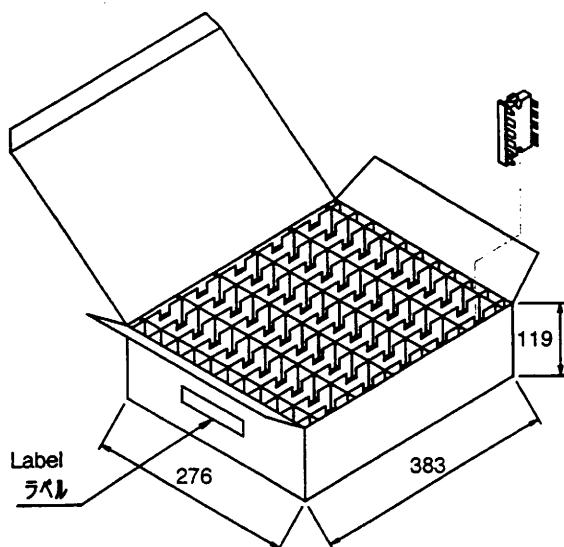
- Mount an IPM in parallel with extruded direction of a heat sink to reduce an influence of a change of a heat sink, when a heat sink which is made by an extruder is applied.

of

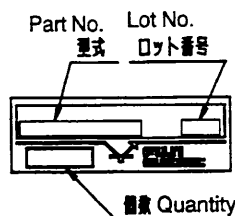
押し出し機によって作られたヒートシンクを使用する場合は、ヒートシンクの変形の影響を小さくするためにIPMをヒートシンクの押し出し方向と平行に取り付けて下さい。



## 12. Packing and indication ( 梱包と表示 ) ©



|          |                        |
|----------|------------------------|
| Material | : Corrugated cardboard |
| 材料       | ダンボール                  |
| Weight   | : Approx. 3.1kg (max.) |
| 重量       | 約3.1kg (最大)            |
| Quantity | : 50pcs (max.)         |
| 数量       | 50個 (最大)               |



## 13. 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%.  
室内で常温常湿保存が望ましい。( 5 ~ 35 °C、45 ~ 75 % )

- Store modules in a place with few temperature changes in order to avoid condensation on the module surface.

急激な温度変化がないこと。( 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 modules.

半導体製品に荷重がかからないように注意すること。

- 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。

- Don't drop and shock the modules during transportation.

運搬時に衝撃を与えたり落下させないこと。

## 14. Operation environment ( 使用環境 )

- Avoid exposure to corrosive gases.

腐食性ガスの雰囲気での使用は避けること。

## 15. Applicable category ( 適用範囲 )

- This specification is applied to the IGBT-IPM named 6MBP20RY060.

本仕様書は、IGBT-IPM ( 型式: 6MBP20RY060 ) に適用する。 ©