

# SPECIFICATION

Device Name : IGBT-IPM

Type Name : 7MBP100NA060-01

Spec. No. : MS6M0280

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Fuji Electric Co., Ltd.  
Matsumoto Factory

	DATE	NAME	APPROVED	Fuji Electric Co., Ltd.	
DRAWN	Mar. 27 '96	H. Kawakami		DWG. NO.	MS6M0280
CHECKED	" 4 "	N. Terasawa			
			T. HOSEN		
					1/16

# Revised Records

Date	Classi- fication	Ind.	Content	Applied date	Drawn	Checked	Approved
Mar.-27-'76	enactment	—	—————	Issued date	—————	N.Terasawa	T.HOSEN

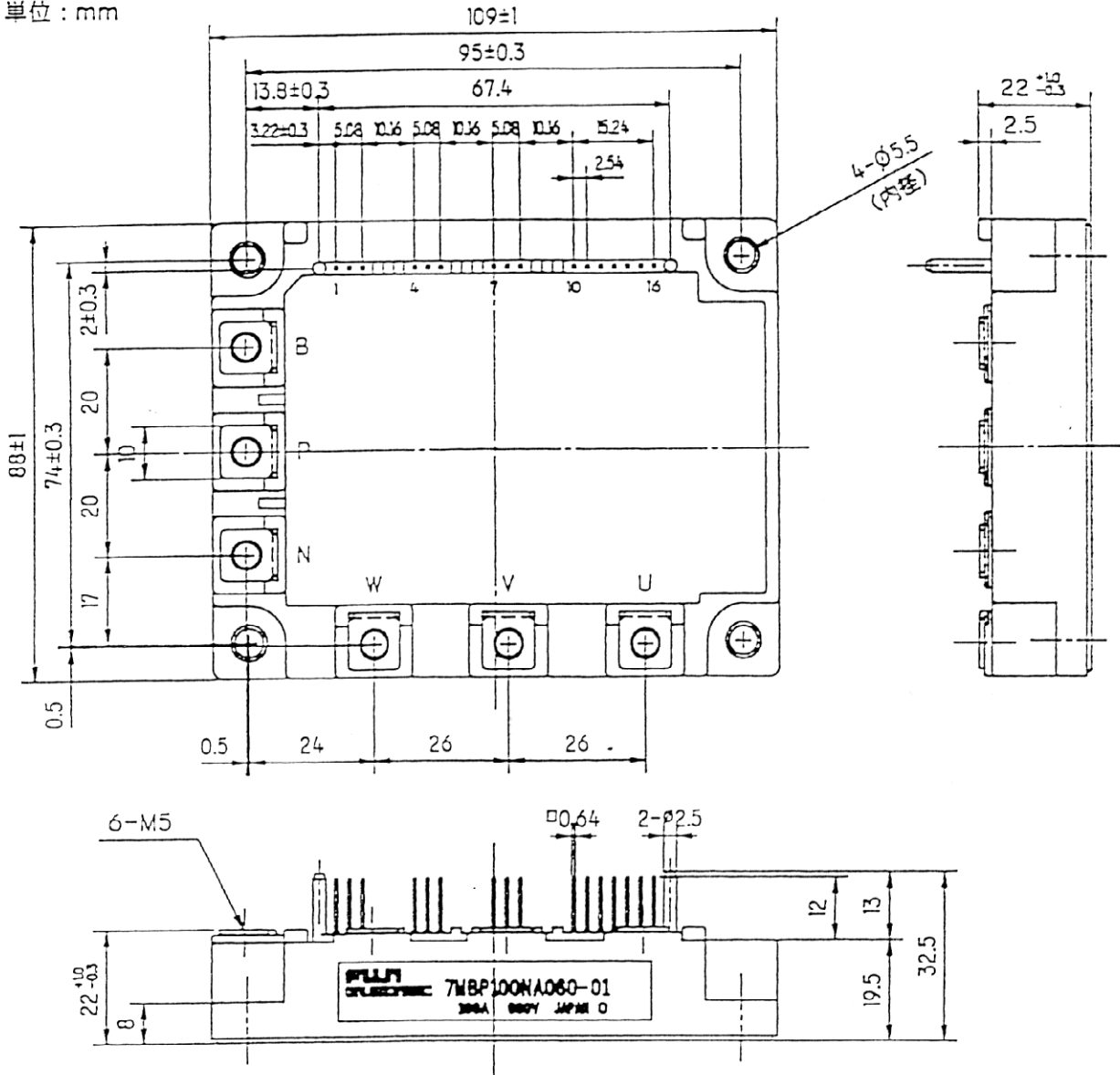
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1. Outline Drawing

外形図

Unit : mm

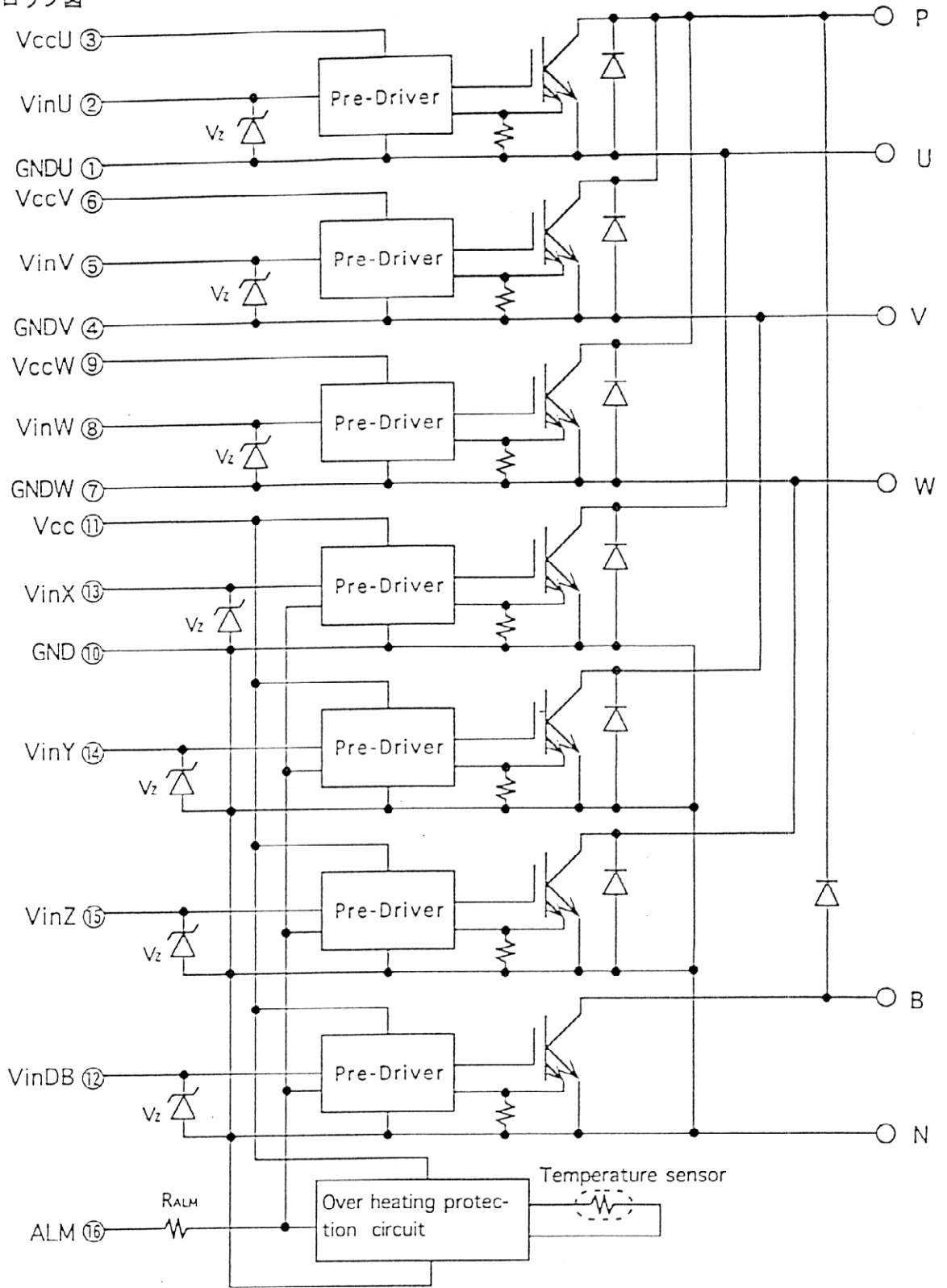
単位 : mm



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2 Block Diagram

ブロック図



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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°C unless otherwise specified)

Items		Symbols	Ratings		Units	
			Min.	Max.		
DC Bus Voltage		Vbc	0	450	V	
DC Bus Voltage (surge)		V <sub>DC(SURGE)</sub>	0	500	V	
DC Bus Voltage (short operating)		Vsc	200	400	V	
Collector-Emitter Voltage		V <sub>CE(S)</sub>	0	600	V	
I N 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
D	Collector Current	DC	I <sub>c</sub>	—	50	A
		1mS	I <sub>cp</sub>	—	100	A
B	Forward Current of Diode		I <sub>F</sub>	—	50	A
	Collector Power Dissipation		One Transistor	P <sub>c</sub>	—	198
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.

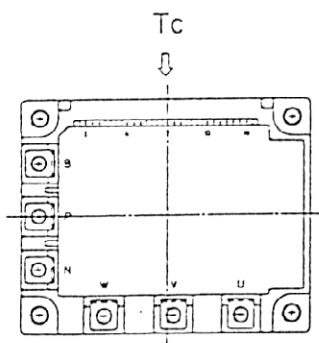


Fig.1 Measurement of case temperature

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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.	Unit
I N V	Collector Current at off Signal Input	$I_{CES}$	$V_{CE}=600\text{V}$	—	—	1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=100\text{A}$	—	—	2.9	V
	Forward Voltage of FWD	$V_f$	$-I_c=100\text{A}$	—	—	3.3	V
D B	Collector Current at off Signal Input	$I_{CES}$	$V_{CE}=600\text{V}$	—	—	1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=50\text{A}$	—	—	2.9	V
	Forward Voltage of Diode	$V_f$	$-I_c=50\text{A}$	—	—	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 Side Pre-Driver (One Unit)		$I_{CCP}$	$f_{sw}=15\text{kHz} \times 6$ Duty=50%	—	8	18	mA
Power Supply Current of N-Line Side Three Pre-Drivers and Protection Circuits		$I_{CCN}$	$f_{sw}=15\text{kHz}$ 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		$T_{OH}$	$V_{DC}=0\text{V}, I_c=0\text{A}$ Case Temperature	100	—	125	$^\circ\text{C}$
OH Hysteresis		$T_H$		—	20	—	$^\circ\text{C}$
Over Current Protection(OC) Level	INV	$I_{OC}$	$T_j=125^\circ\text{C}$ Collector Current	130	—	—	A
Over Current Protection(OC) Level	DB	$I_{OC}$	$T_j=125^\circ\text{C}$ Collector Current	60	—	—	A
OC Delay Time (Fig.2)		$t_{DOC}$	$T_j=25^\circ\text{C}$	—	8	—	$\mu\text{S}$
Under Voltage Protection(UV) 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 Protection (Fig.3)		$t_{SC}$		12	—	—	$\mu\text{S}$
Limiting Resistor for Alarm		$R_{ALM}$		1425	1500	1575	$\Omega$

※6 Switching frequency of IPM

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### 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 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	$\text{nS}$

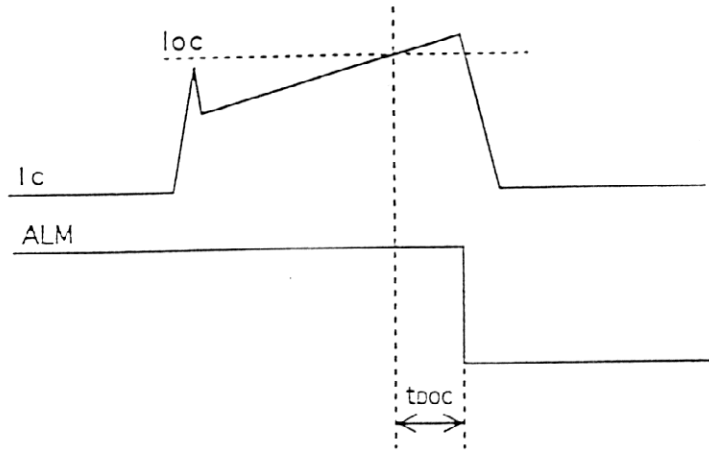


Fig.2 : Definition of OC Delay Time

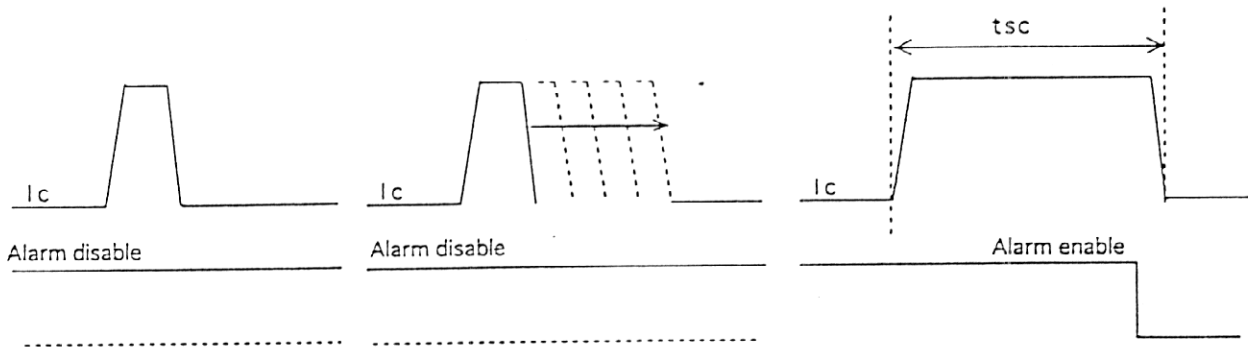


Fig.3 : Definition of  $t_{sc}$

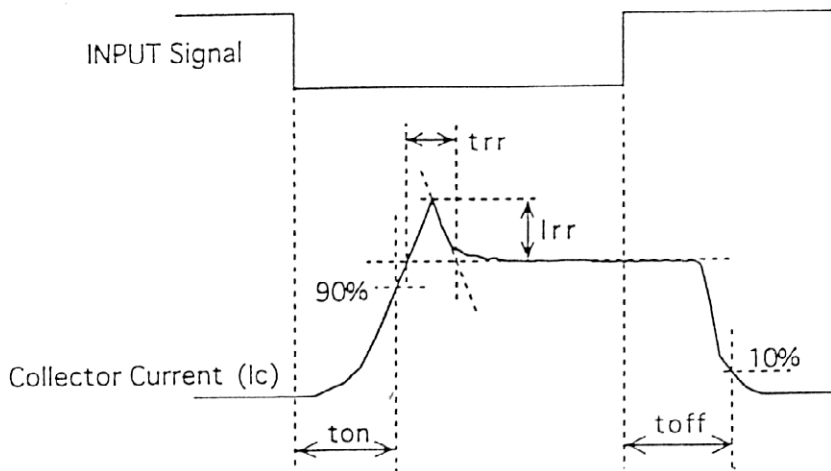


Fig.4 : Definition of switching time

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

Items			Symbols	Min.	Typ.	Max.	Unit
Junction to Case Thermal Resistance	INV	IGBT	Rth(j-c)	—	—	0.31	°C/W
		FWD	Rth(j-c)	—	—	0.90	°C/W
Junction to Case Thermal Resistance	DB	IGBT	Rth(j-c)	—	—	0.63	°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

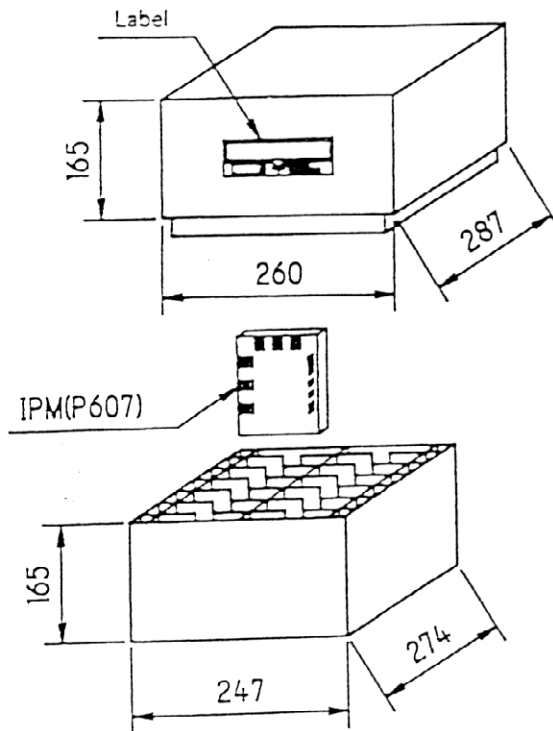
Items		Symbols	Conditions	Min.	Typ.	Max.	Units
DC Bus Voltage		Vbc		200	—	400	V
Operating Power Supply Voltage Range of Pre-Driver		Vcc		13.5	15	16.5	V
Switching frequency of IPM		fsw		1	—	20	kHz
Screw Torque	Mounting (M5)	—		2.5	—	3.5	N·m
	Terminal (M5)	—		2.5	—	3.5	N·m

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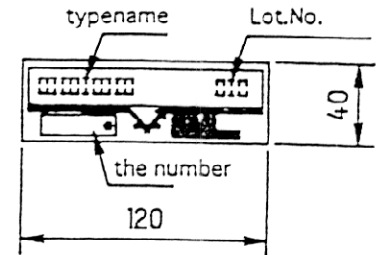


## 8. Packing and labeling

梱包箱と表示



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



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## 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°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 7MBP100NA060-01.

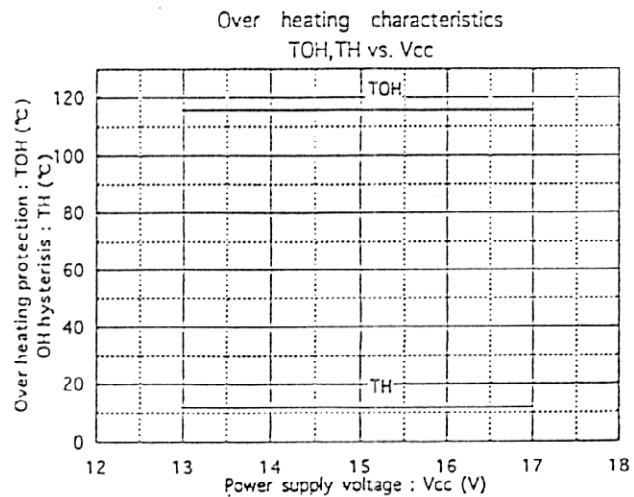
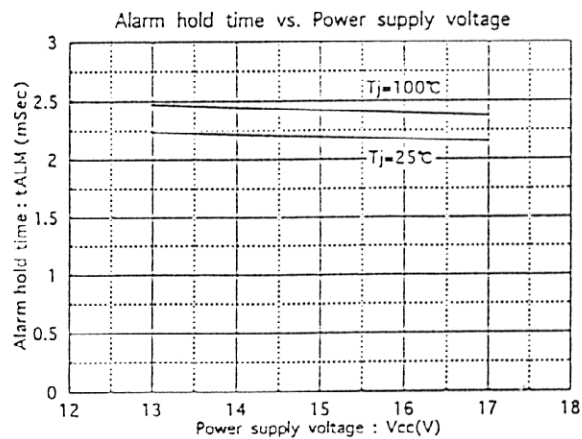
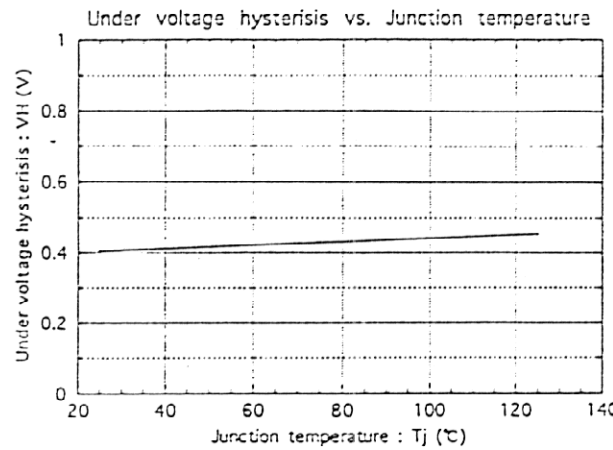
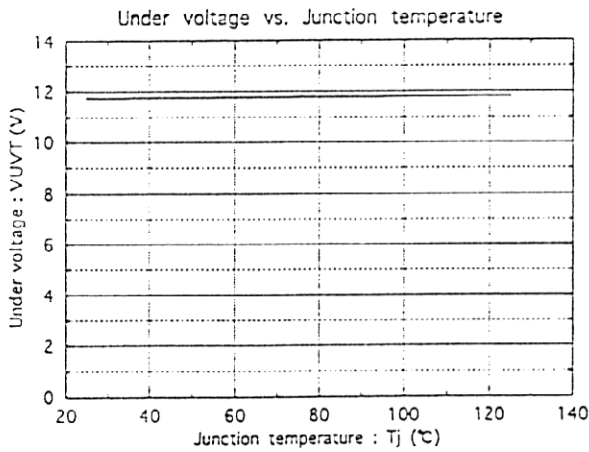
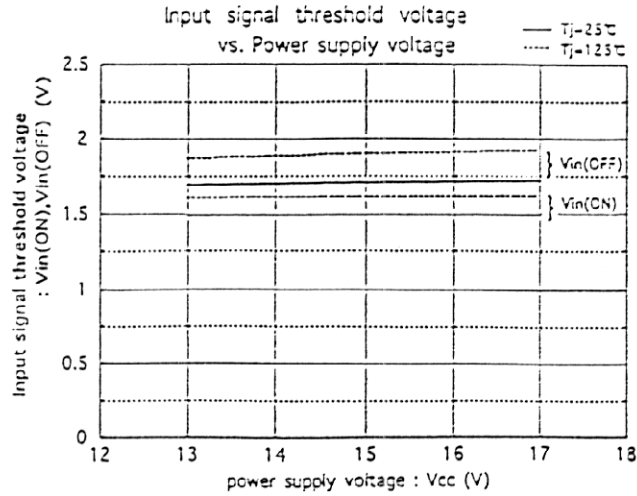
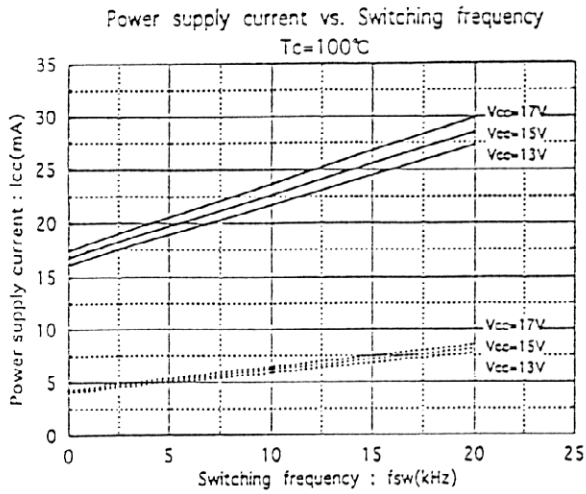
本納入仕様書は、IGBT-IPM 7MBP100NA060-01 に適用する。

# 11. Characteristic (Representative)

## 特性カーブ (代表例)

### 11-1. Control Circuit

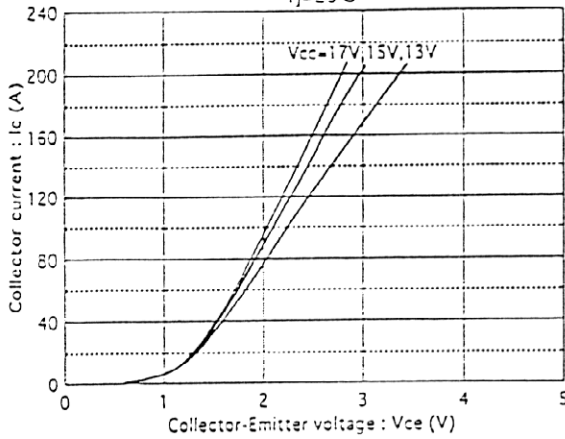
#### 制御部



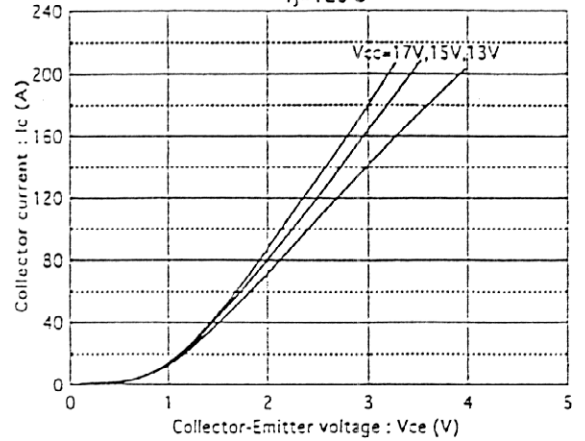
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11-2. Inverter  
インバータ部

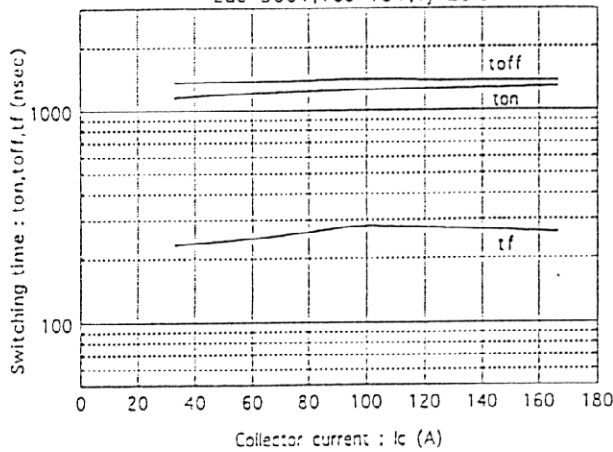
Collector current vs. Collector-Emitter voltage  
 $T_j=25^\circ\text{C}$



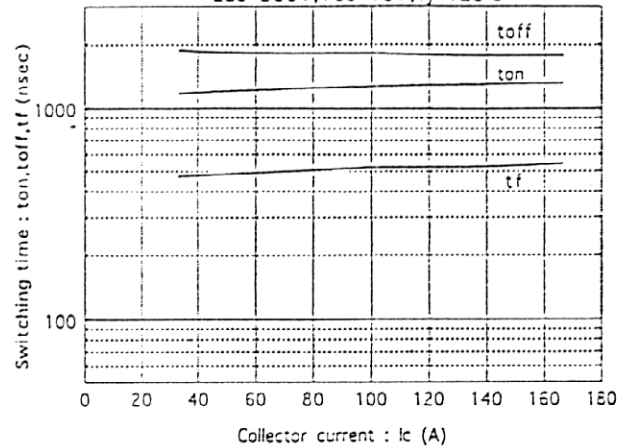
Collector current vs. Collector-Emitter voltage  
 $T_j=125^\circ\text{C}$



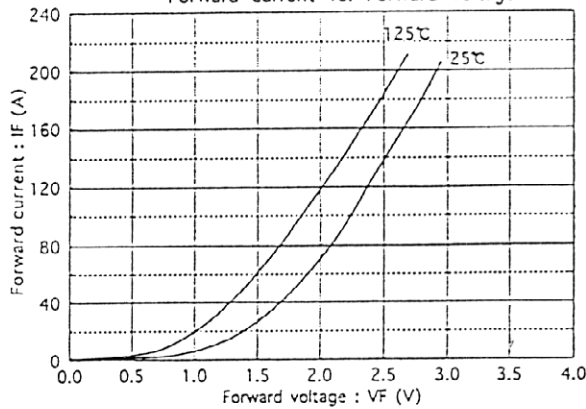
Switching time vs. Collector current  
 $E_{dc}=300\text{V}, V_{cc}=15\text{V}, T_j=25^\circ\text{C}$



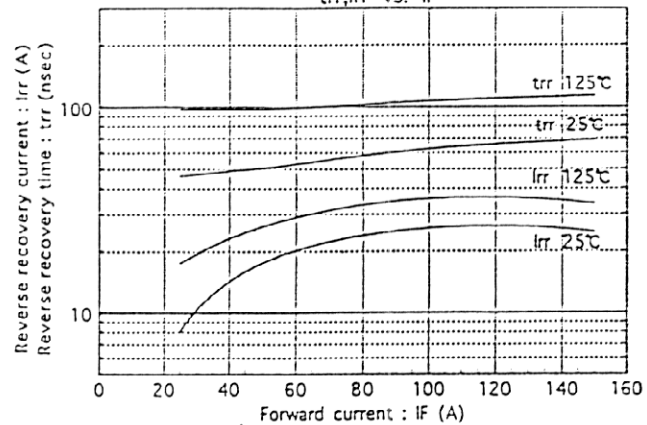
Switching time vs. Collector current  
 $E_{dc}=300\text{V}, V_{cc}=15\text{V}, T_j=125^\circ\text{C}$



Forward current vs. Forward voltage

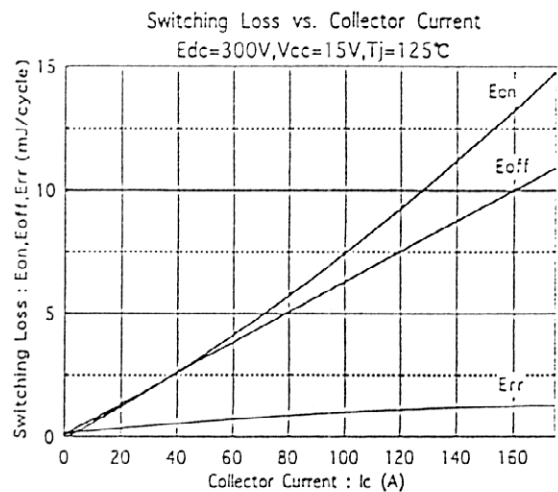
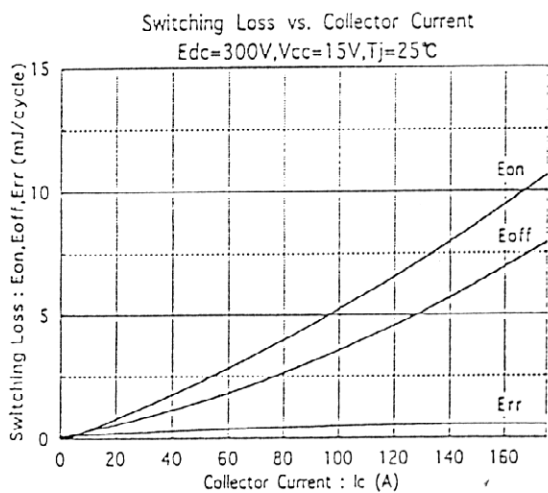
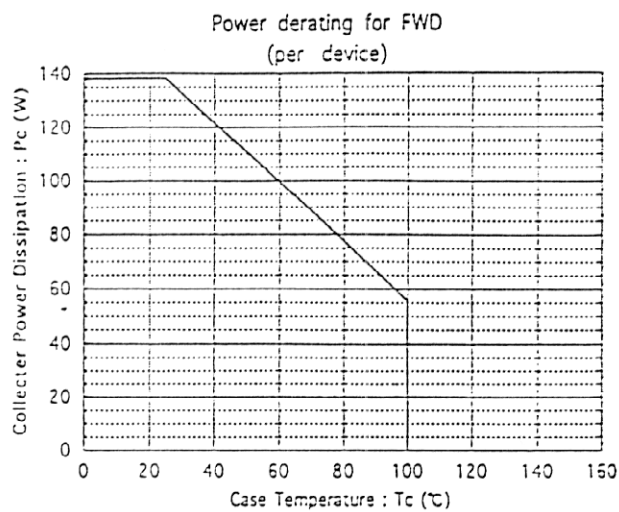
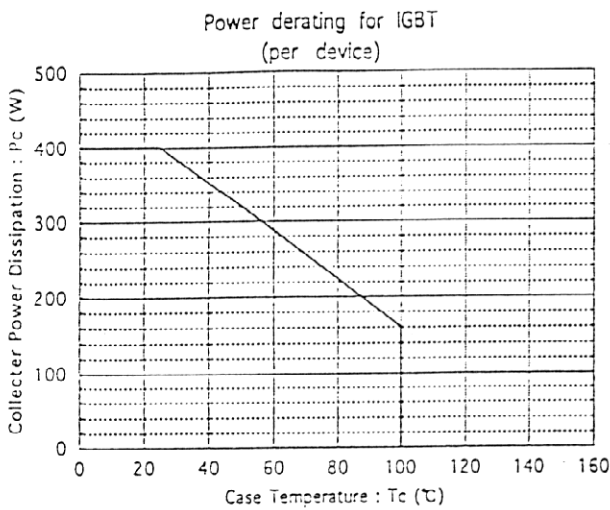
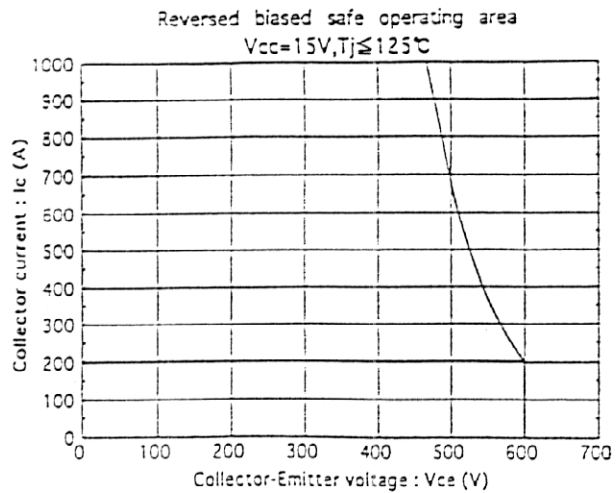
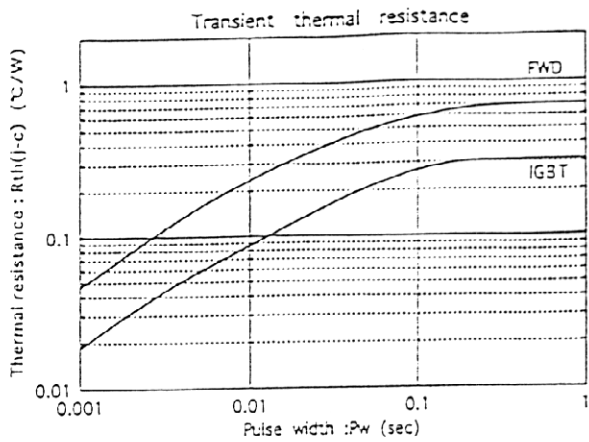


Reverse recovery characteristics  
 $t_{rr}, I_{rr}$  vs.  $I_F$

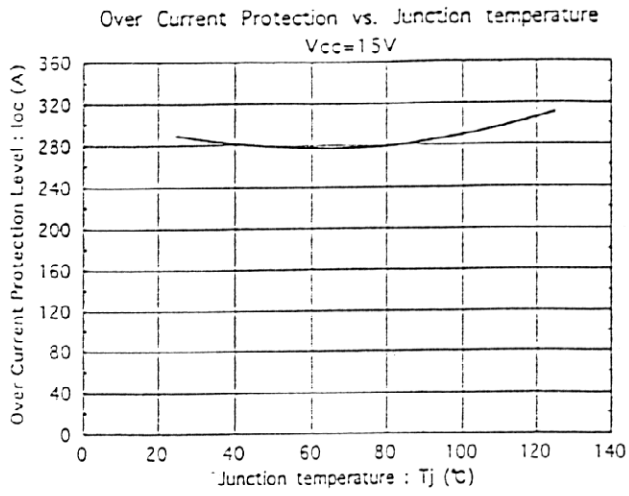


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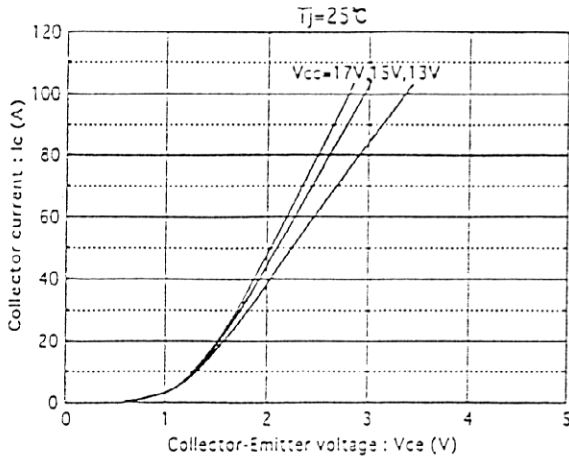
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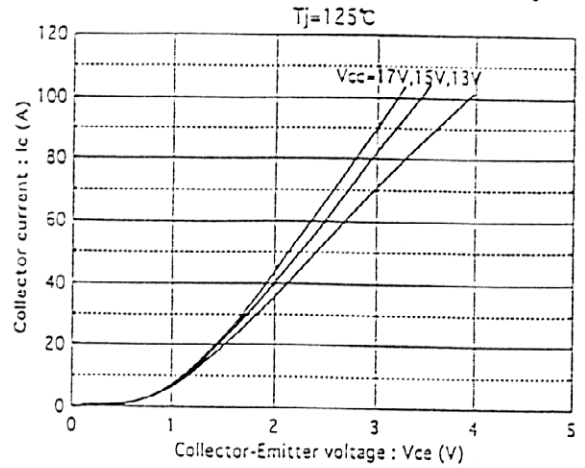
11-3.DB

ブレーキ部

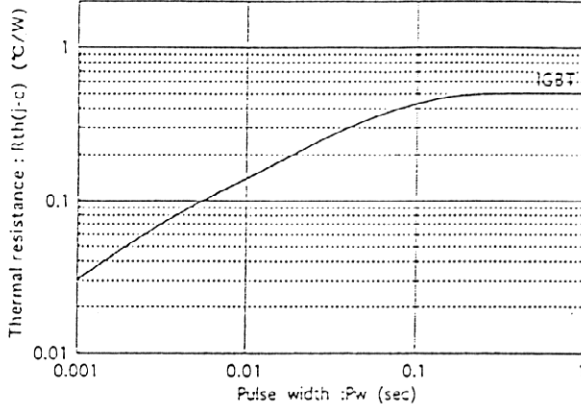
Collector current vs. Collector-Emitter voltage



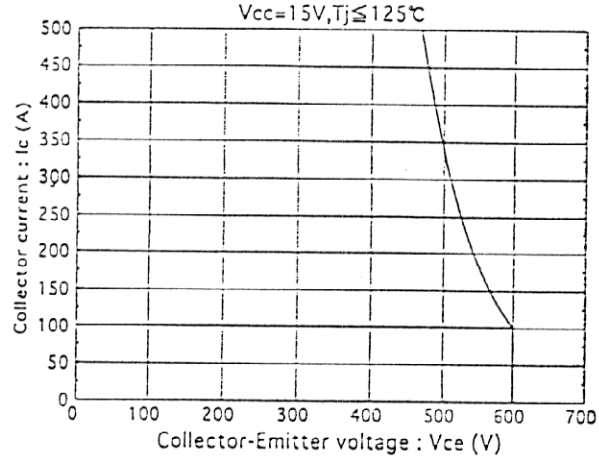
Collector current vs. Collector-Emitter voltage



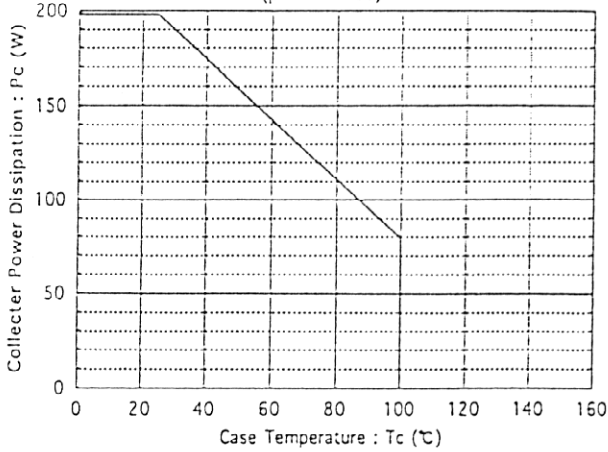
Transient thermal resistance



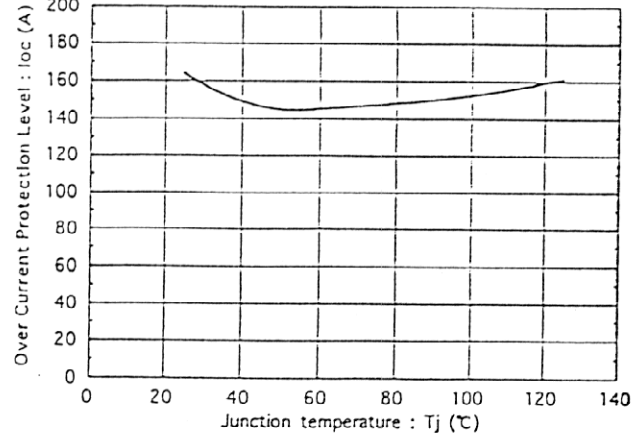
Reversed biased safe operating area



Power derating for IGBT  
(per device)

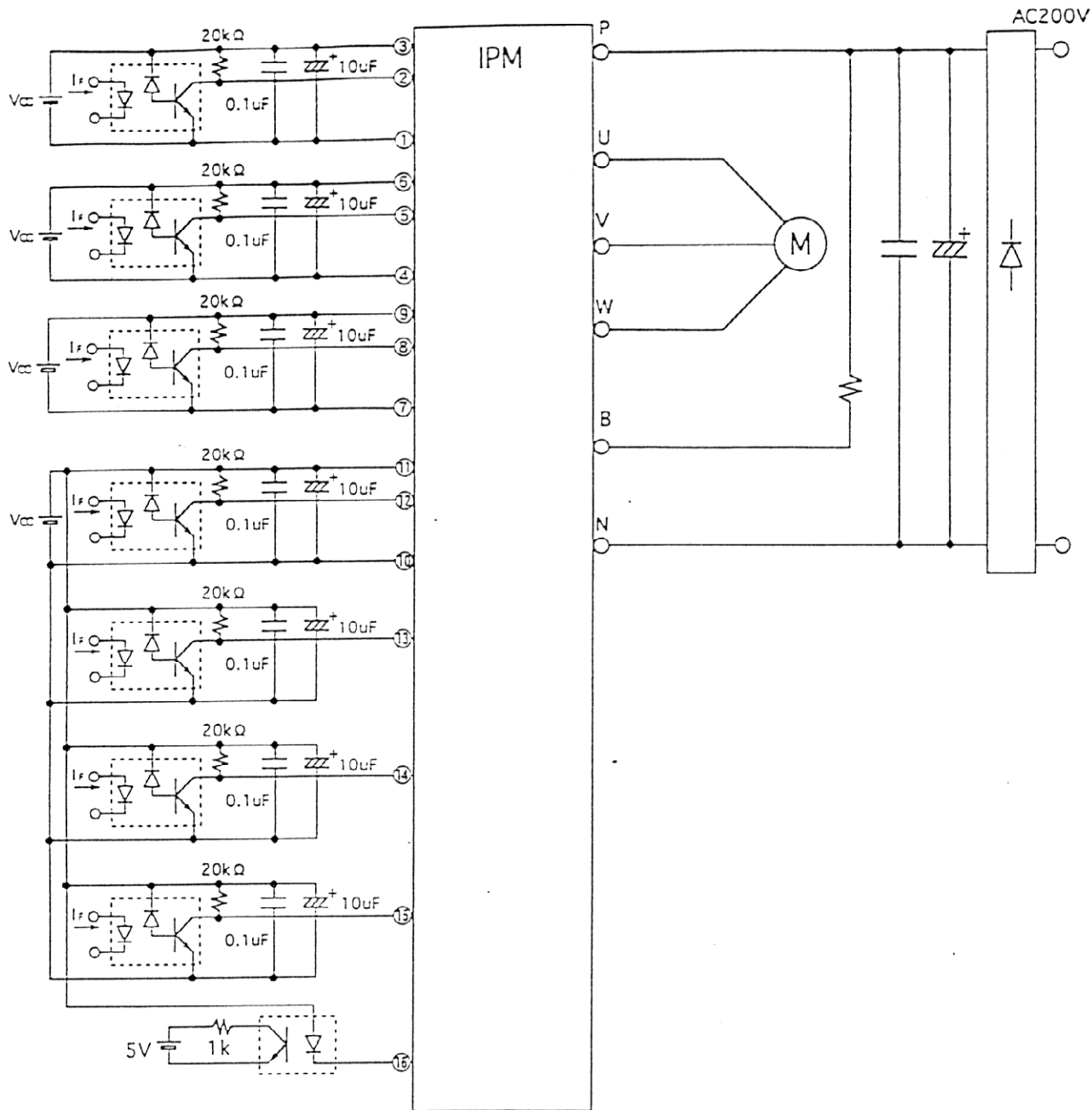


Over Current Protection vs. Junction temperature



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12.Example of applied circuit (応用回路例)



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- 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 4.7 $\mu$ F) 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4.7 $\mu$ F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ブラ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。