

# SPECIFICATION

Device Name : IGBT-IPM

Type Name : 7MBP75NA060-01

Spec. No. : MS6M0279

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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	MS6M0279	1/16
CHECKED	- 4 -	N. Terakawa				

# Revised Records

Date	Classification	Ind.	Content	Applied date	Drawn	Checked	Approved
Mar.-27-'96	enactment	—	_____	Issued date	_____	N. Terrasawa	J. HOSEKI

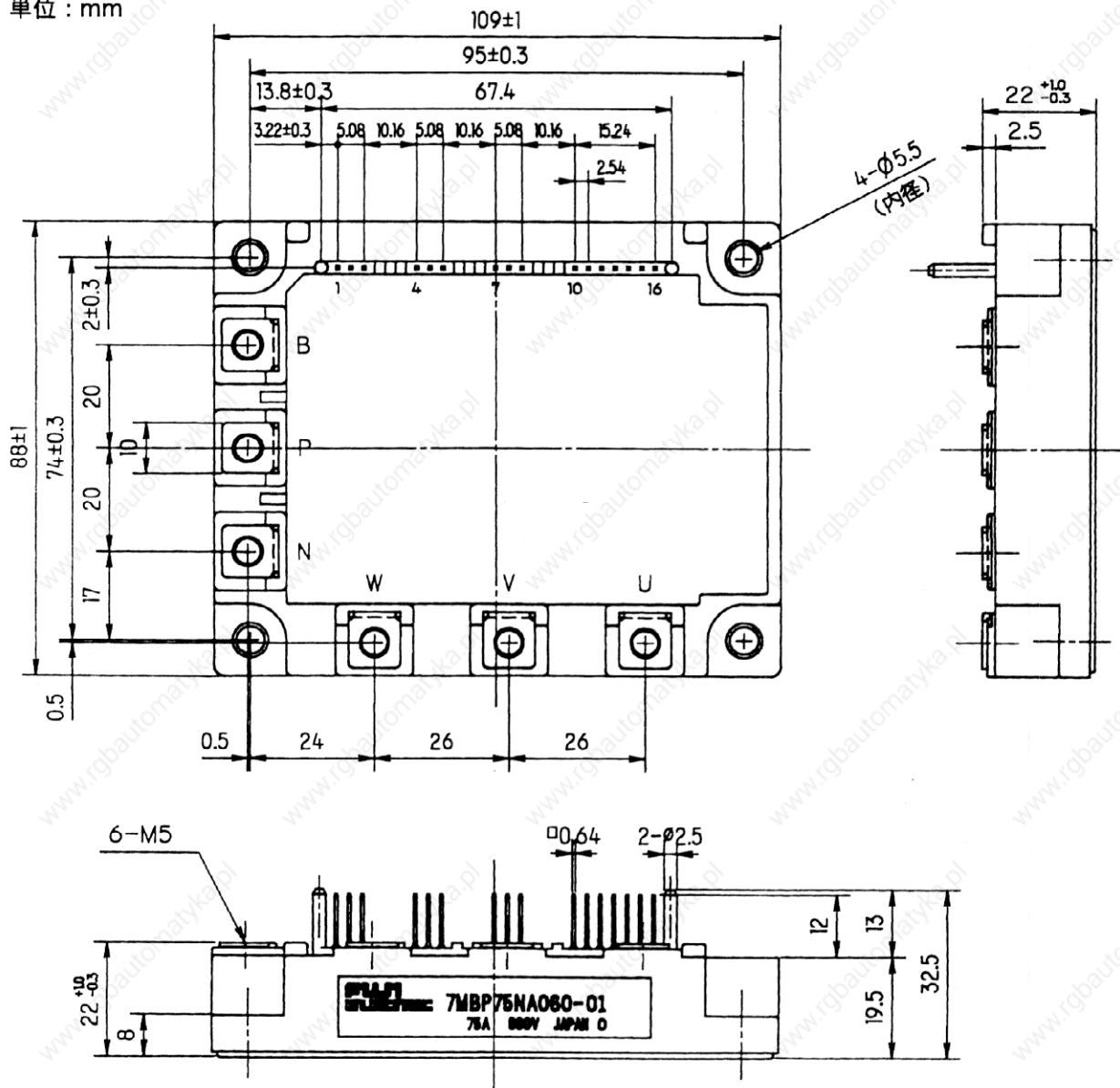
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1. Outline Drawing

外形図

Unit : mm

単位 : mm



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DWG. NO.

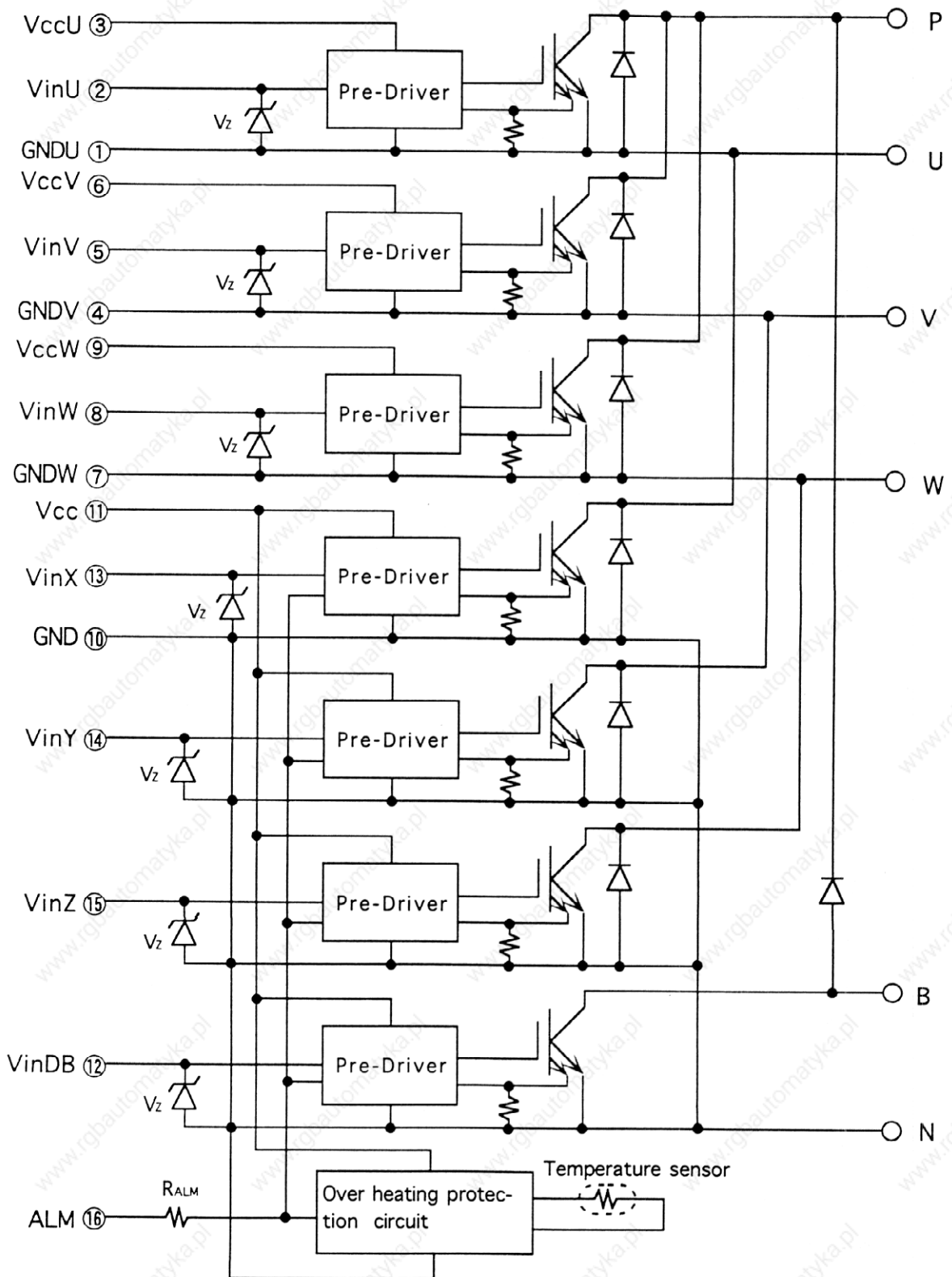
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## 2 Block Diagram

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 N V Collector Current	DC	I <sub>c</sub>	—	75	A
	1mS	I <sub>cp</sub>	—	150	A
	Duty=61.7%	-I <sub>c</sub>	—	75	A
Collector Power Dissipation	One Transistor	P <sub>c</sub>	—	320	W
D B Collector Current	DC	I <sub>c</sub>	—	50	A
	1mS	I <sub>cp</sub>	—	100	A
Forward Current of Diode		I <sub>F</sub>	—	50	A
Collector Power Dissipation	One Transistor	P <sub>c</sub>	—	198	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.

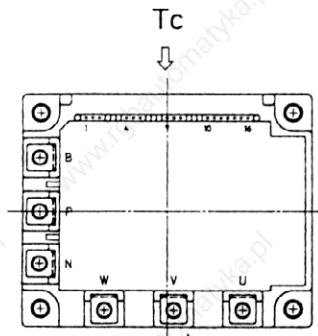


Fig.1 Measurement of case temperature

#### 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 N V	Collector Current at off Signal Input	$I_{CES}$	$V_{CE}=600\text{V}$	—	—	1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=75\text{A}$	—	—	2.9	V
	Forward Voltage of FWD	$V_F$	$-I_c=75\text{A}$	—	—	3.0	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%	—	7	17	mA
Power Supply Current of N-Line Side Three Pre-Drivers and Protection Circuits		$I_{CCN}$	$f_{sw}=15\text{kHz}$ Duty=50%	—	25	65	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	98	—	—	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

### 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	$t_{on}$	$I_c=75\text{A}$	0.3	—	—	$\mu\text{S}$
	$t_{off}$	$V_{bc}=300\text{V}$	—	—	3.6	$\mu\text{S}$
Switching Time (FWD)	$t_{rr}$	$I_F=75\text{A}, V_{DC}=300\text{V}$	—	—	400	$\text{nS}$

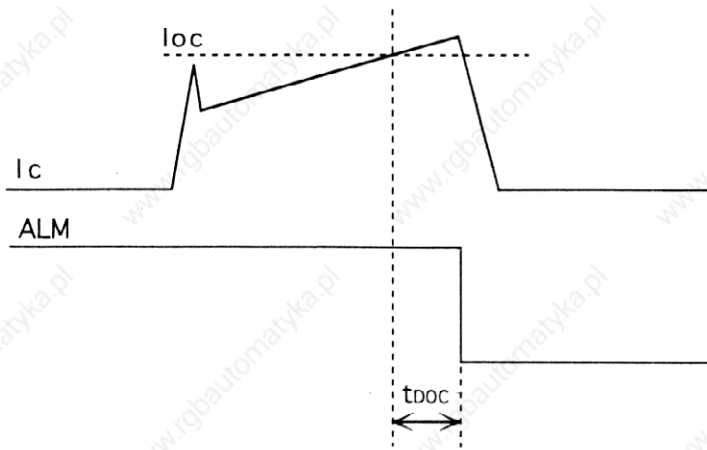


Fig.2 : Definition of OC Delay Time

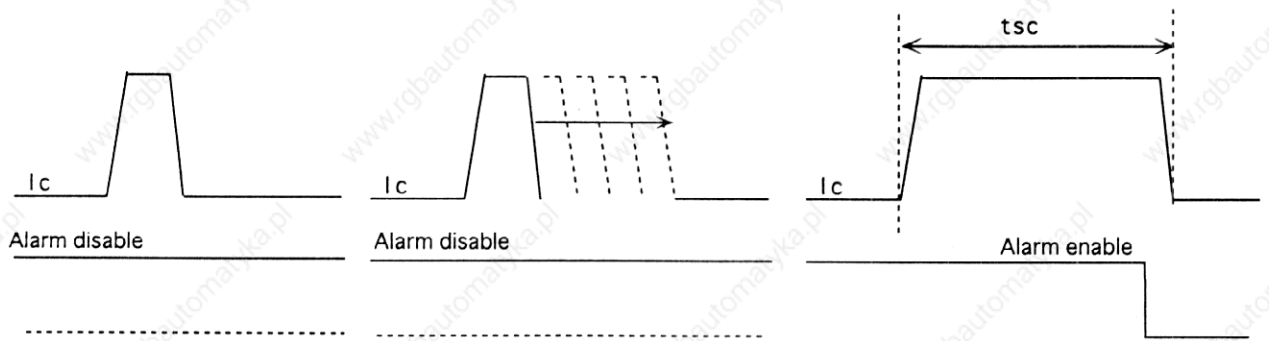


Fig.3 : Definition of  $t_{sc}$

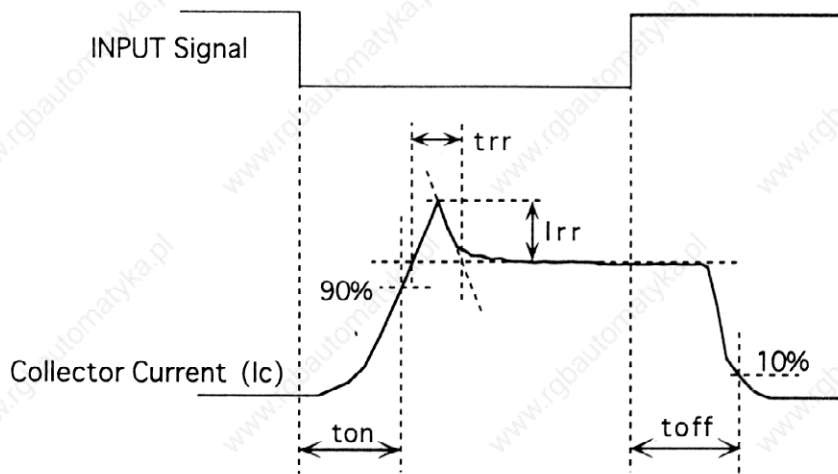


Fig.4 : Definition of switching time

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

Items			Symbols	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	INV	IGBT	Rth(j-c)	—	—	0.39	°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

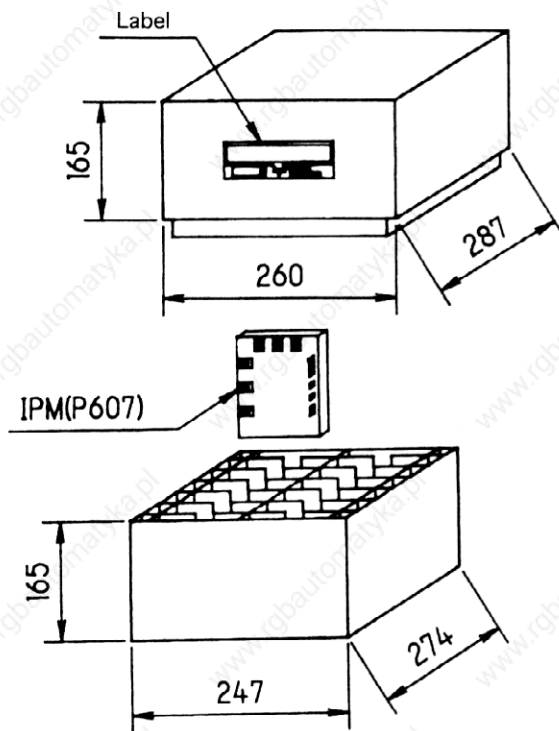
Items		Symbols	Conditions	Min.	Typ.	Max.	Units
DC Bus Voltage		Vdc		200	—	400	V
Operating Power Supply Voltage Range of Pre-Driver		Vcc		13.5	15	16.5	V
Switching frequency of IPM		fsw		1	—	20	kHz
Screw Torque	Mounting (M5)	—		2.5	—	3.5	N·m
	Terminal (M5)	—		2.5	—	3.5	N·m

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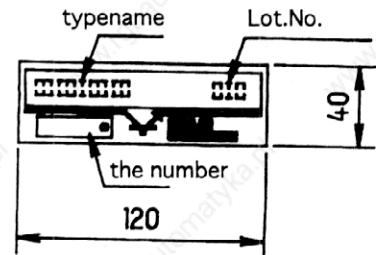


## 8. Packing and labeling

### 梱包箱と表示



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



## 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)

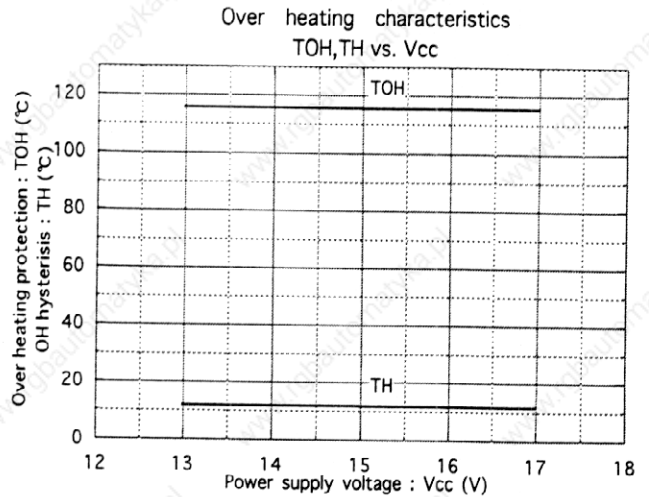
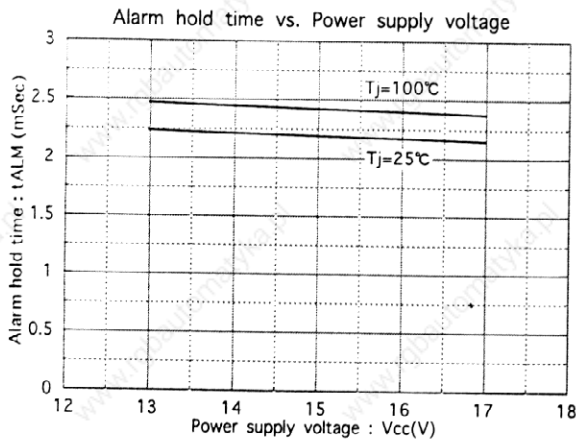
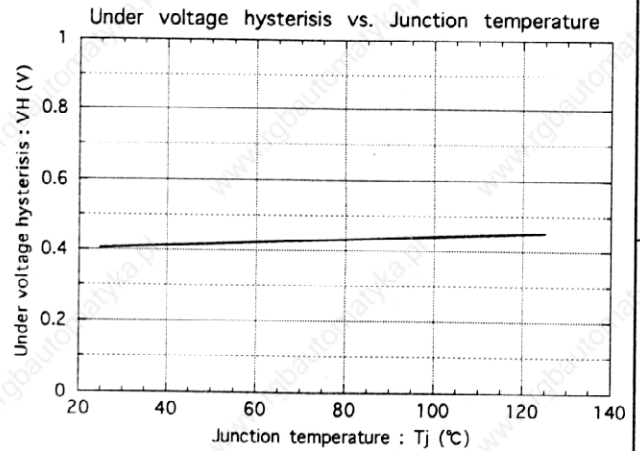
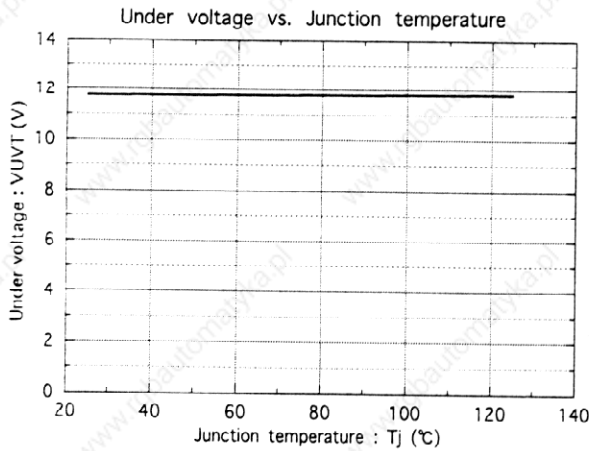
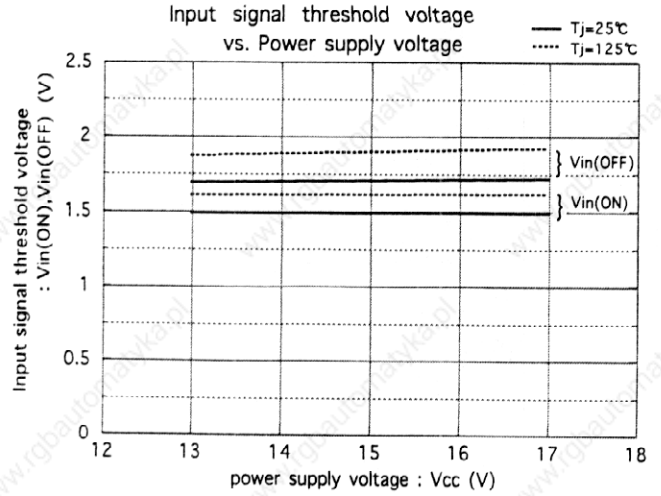
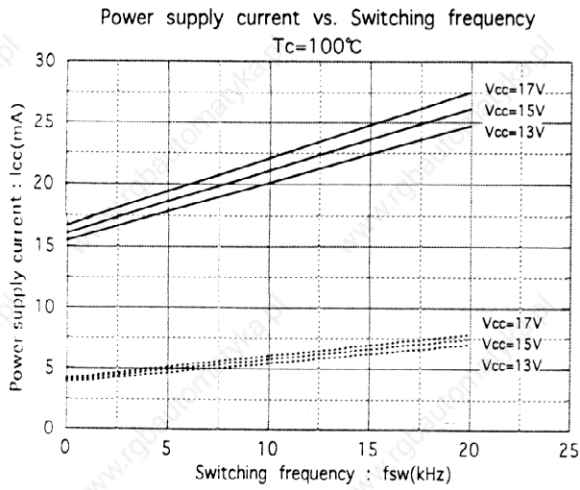
This specification is applied to IGBT-IPM named 7MBP75NA060-01.  
本納入仕様書は、IGBT-IPM 7MBP75NA060-01 に適用する。

# 11. Characteristic (Representative)

## 特性カーブ (代表例)

### 11-1. Control Circuit

#### 制御部

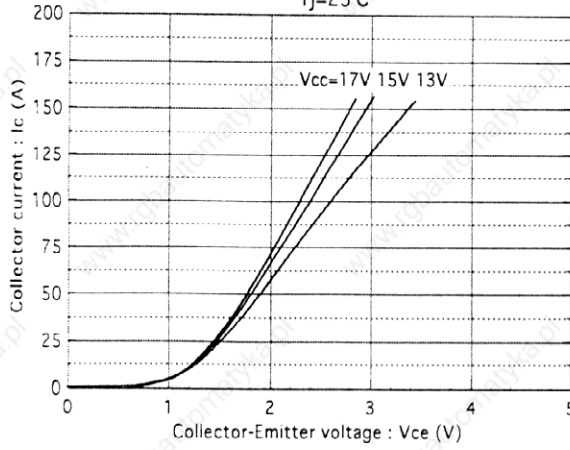


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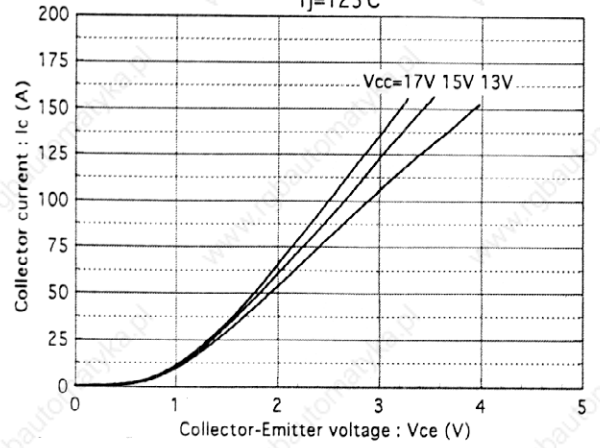
## 11-2. Inverter

### インバータ部

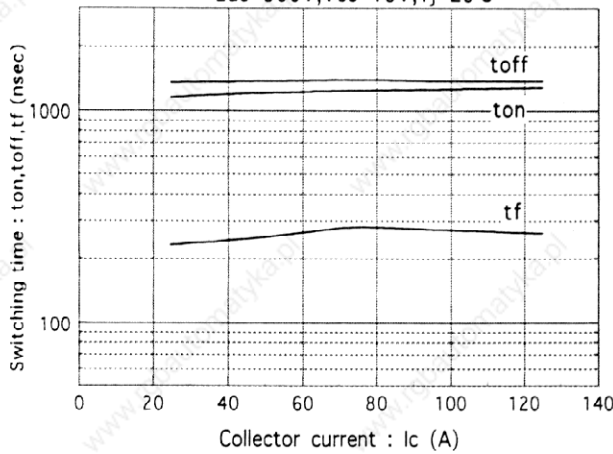
Collector current vs. Collector-Emitter voltage  
T<sub>j</sub>=25°C



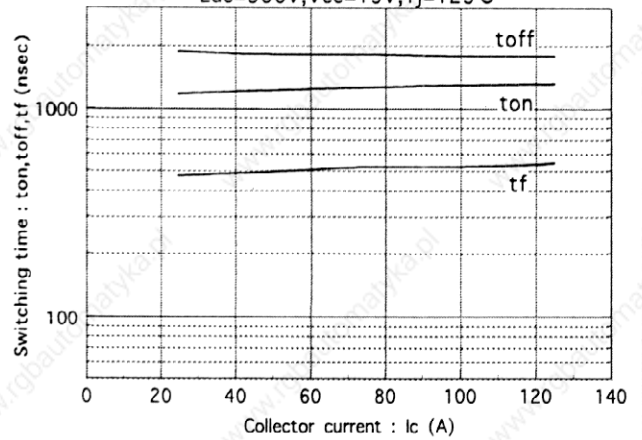
Collector current vs. Collector-Emitter voltage  
T<sub>j</sub>=125°C



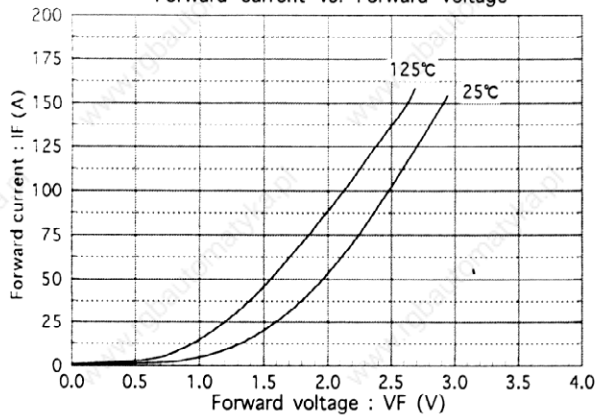
Switching time vs. Collector current  
E<sub>dc</sub>=300V, V<sub>cc</sub>=15V, T<sub>j</sub>=25°C



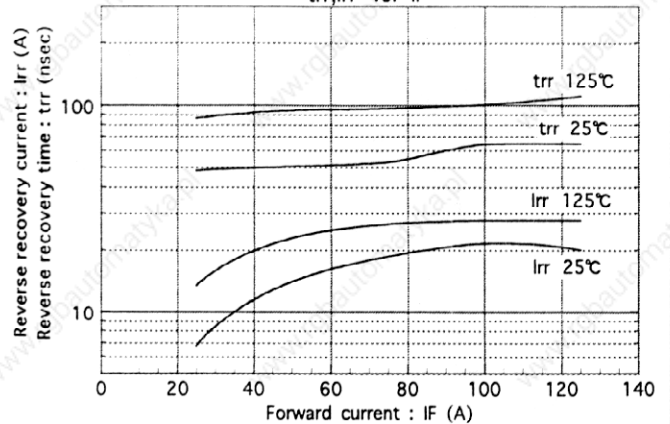
Switching time vs. Collector current  
E<sub>dc</sub>=300V, V<sub>cc</sub>=15V, T<sub>j</sub>=125°C



Forward current vs. Forward voltage

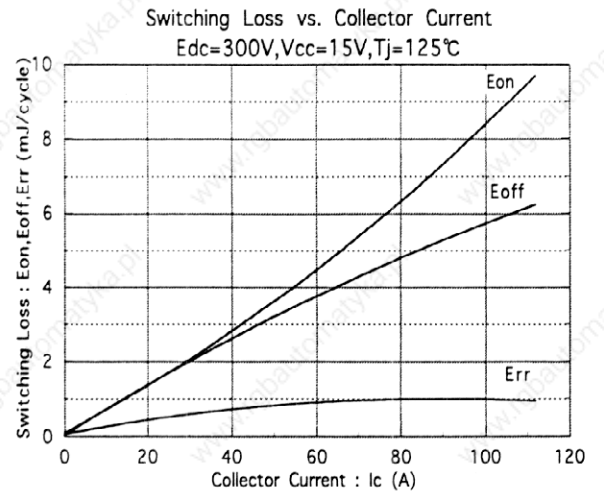
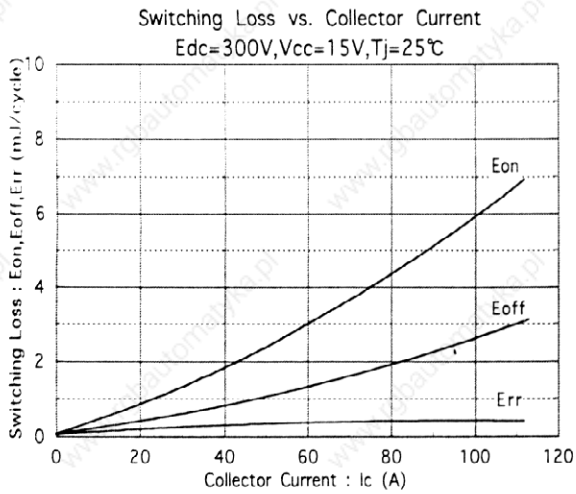
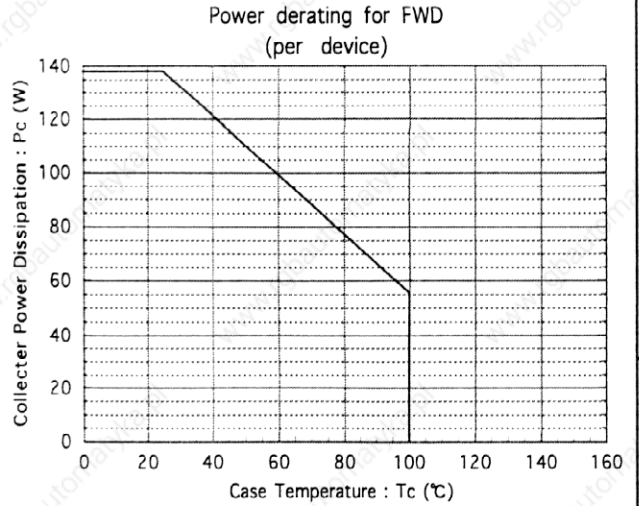
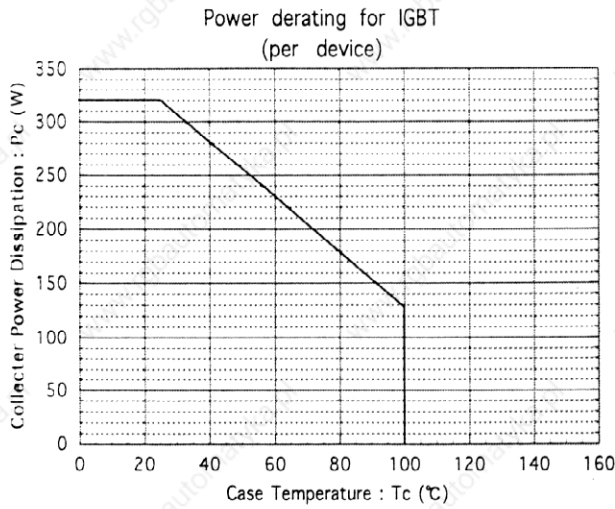
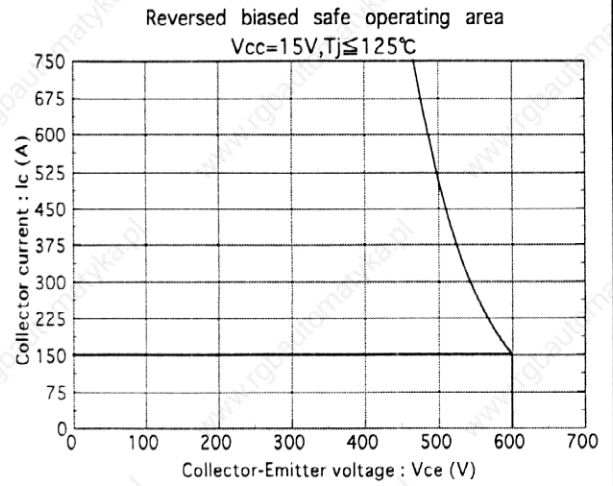
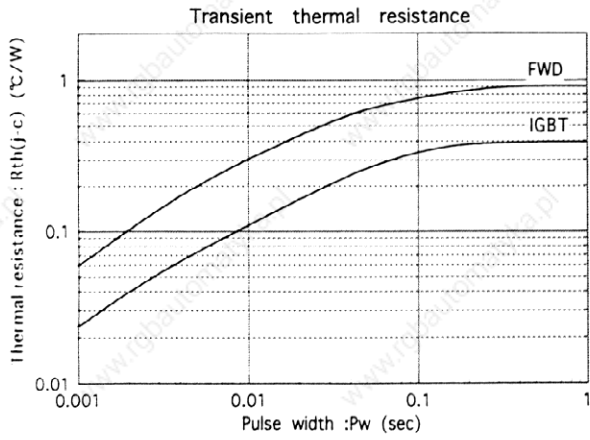


Reverse recovery characteristics  
trr, I<sub>rr</sub> vs. I<sub>F</sub>

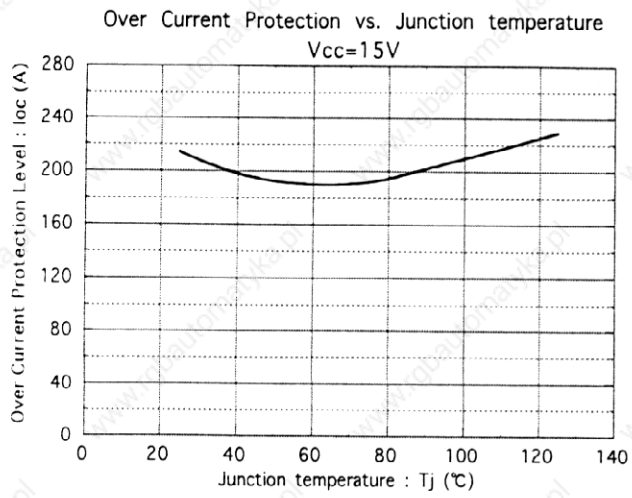


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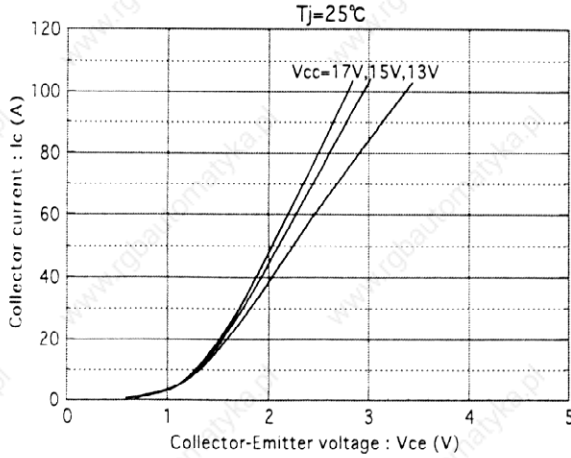
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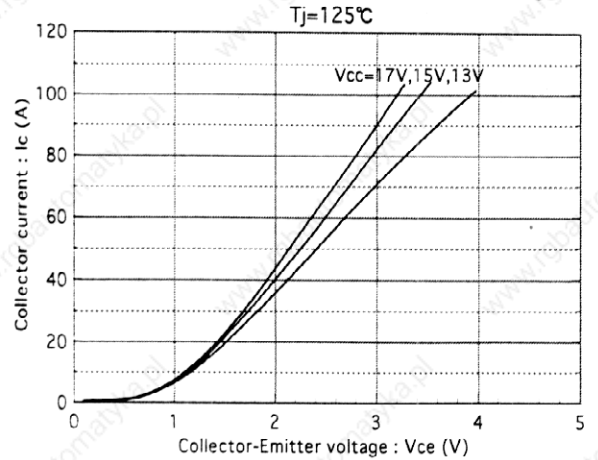
11-3.DB

ブレーキ部

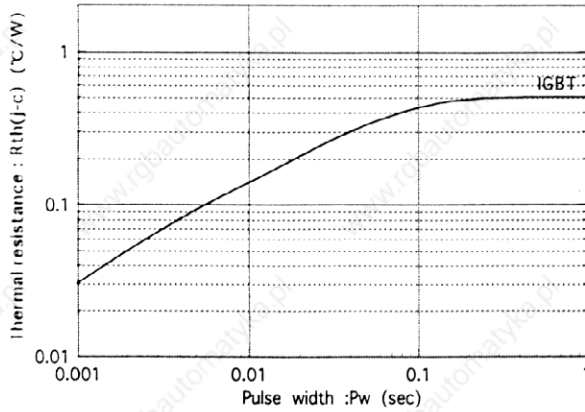
Collector current vs. Collector-Emitter voltage



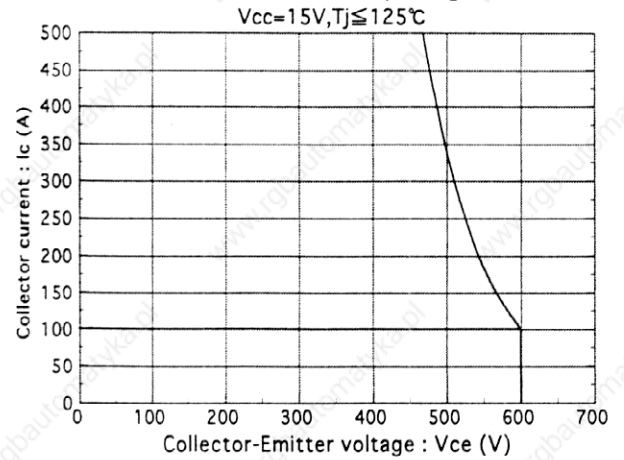
Collector current vs. Collector-Emitter voltage



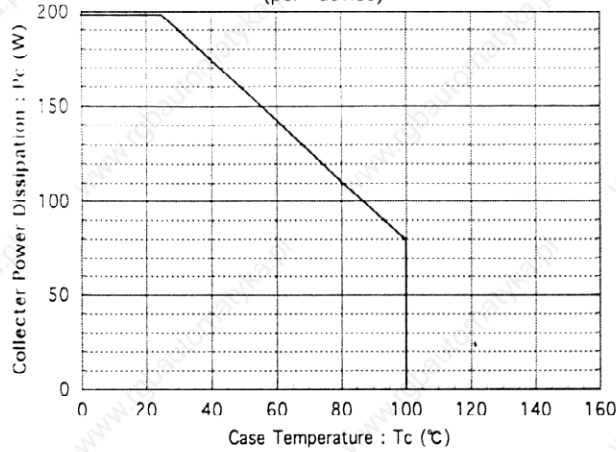
Transient thermal resistance



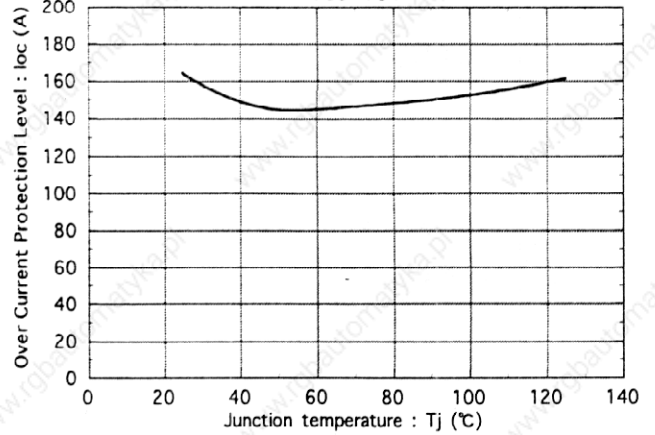
Reversed biased safe operating area



Power derating for IGBT (per device)

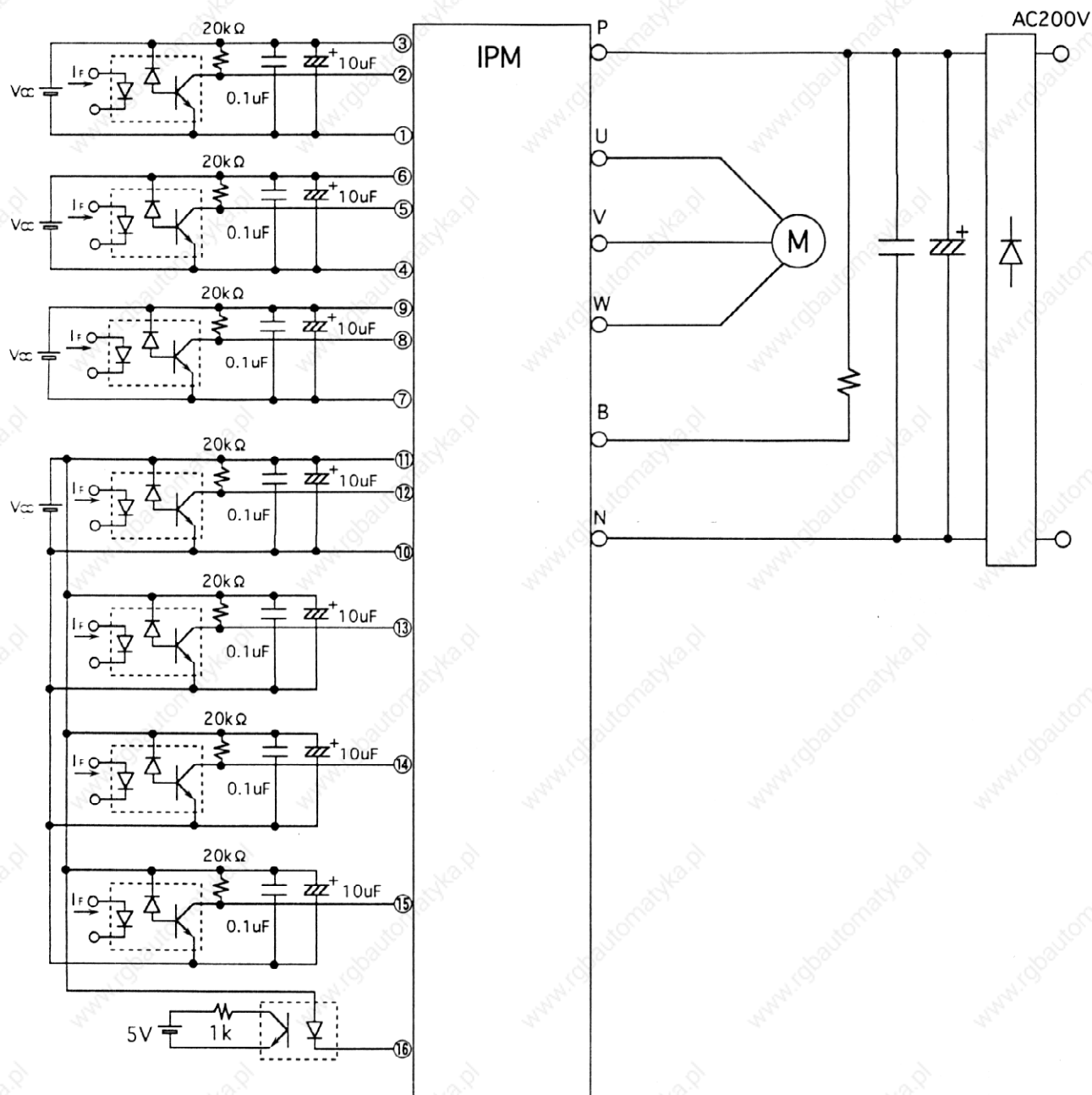


Over Current Protection vs. Junction temperature



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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.  
 ホトコプラとIPMの入力端子間配線は、できるだけ短くしホトコプラの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.  
 高速ホトコプラの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 :  $t_{PLH}, t_{PHL} \leq 0.8\mu s$ , high CMR type. (Example : HCPL-4504)  
 高速ホトコプラ :  $t_{PLH}, t_{PHL} \leq 0.8\mu s$ , 高CMRタイプをご使用下さい。(例 HPCL-4504)
- Low-speed opto-coupler :  $CTR \geq 100\%$   
 低速ホトコプラ :  $CTR \geq 100\%$

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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4.7nF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。