

SPECIFICATION

Device Name : IGBT-IPM

Type Name : 7MBP75RE120

Spec. No. : MS6M 0350

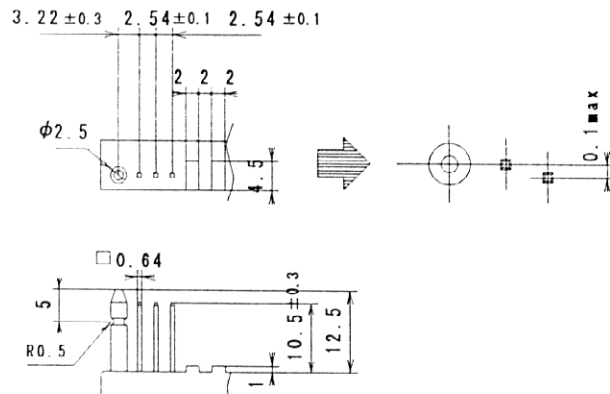
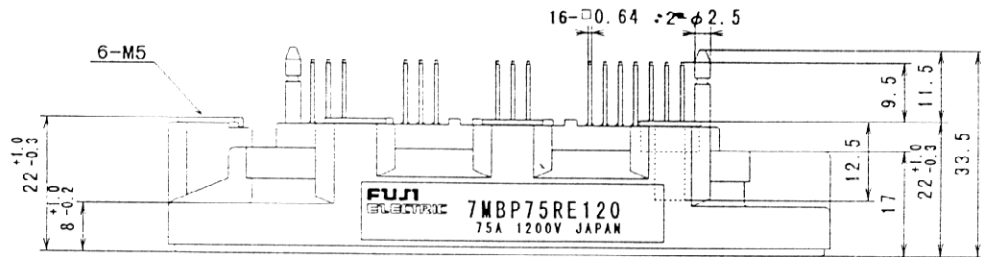
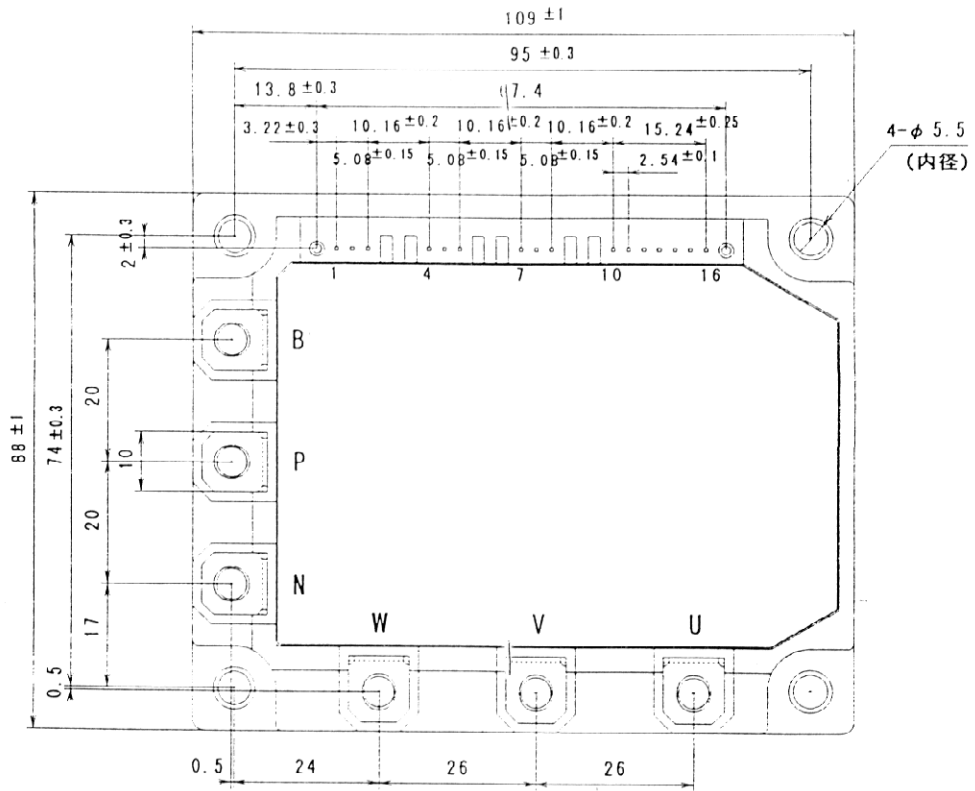
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Fuji Electric Co., Ltd.
Matsumoto Factory



DATE	NAME	APPROVED

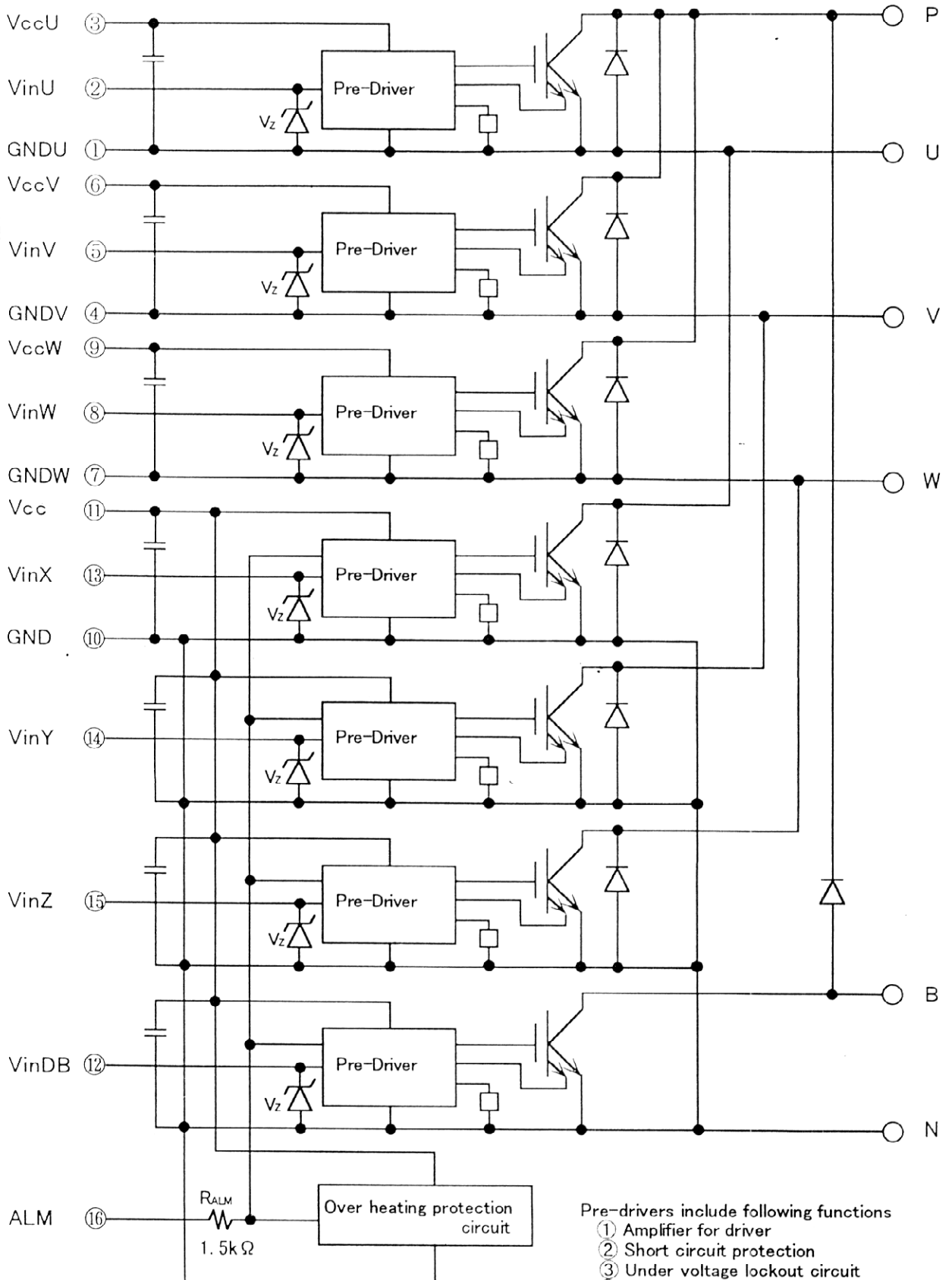
1. Outline



Details of control terminals

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2. Block Diagram



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- Pre-drivers include following functions
- ① Amplifier for driver
 - ② Short circuit protection
 - ③ Under voltage lockout circuit
 - ④ Over current protection
 - ⑤ IGBT chip over heating protection

3. Absolute Maximum Ratings (at $T_c=25^{\circ}\text{C}$ unless otherwise specified)
絶対最大定格

Items		Symbols	Ratings		Unit	
			min.	max.		
DC Bus Voltage		V _{DC}	0	900	V	
DC Bus Voltage (surge)		V _{DC(surge)}	0	1000	V	
DC Bus Voltage (short operating)		V _{SC}	200	800	V	
Collector-Emitter Voltage		V _{CES}	0	1200	V	
DB Reverse Voltage		V _R	0	1200	V	
INV	Collector Current	DC	I _C	—	75	A
		1 mS	I _{CP}	—	150	A
		DC	-I _C	—	75	A
	Collector Power Dissipation	One Transistor	P _C	—	500	W
DB	Collector Current	DC	I _C	—	25	A
		1 mS	I _{CP}	—	50	A
	Forward Current of Diode		I _F	—	25	A
	Collector Power Dissipation	One Transistor	P _C	—	198	W
Junction Temperature		T _j	—	150	°C	
Input Voltage of Power Supply for Pre-Driver		V _{CC} *1	0	20	V	
Input Signal Voltage		V _{in} *2	0	V _Z	V	
Input Signal Current		I _{in}	—	1	mA	
Alarm Signal Voltage		V _{ALM} *3	0	V _{CC}	V	
Alarm Signal Current		I _{ALM} *4	—	15	mA	
Storage Temperature		T _{stg}	-40	125	°C	
Operating Case Temperature		T _{op}	-20	100	°C	
Isolating Voltage (Case-Terminal)		V _{iso} *5	—	AC2500	V	
Screw Torque	Mounting (M5)	—	—	3.5 *6	N·m	
	Terminal (M5)	—	—	3.5 *6	N·m	

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Note

- *1 : V_{CC} shall be applied to the input voltage between terminal No.3 and 1, 6 and 4, 9 and 7, 11 and 10
- *2 : V_{in} 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.
- *6 : Recommendable Value : 2.5~3.0 N·m

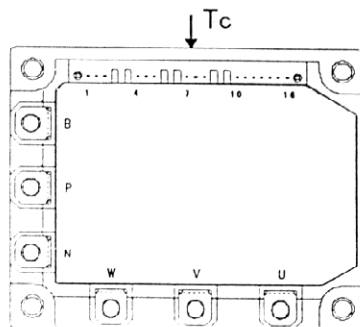


Fig. 1 Measurement of case temperature (T_c) for T_cOH

4. Electrical Characteristics

電気的特性

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
INV	Collector Current at off Signal Input	I_{CES}	$V_{CE}=1200\text{V}$ Input Terminal Open	—	—	1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=75\text{A}$	—	—	2.6	V
	Forward Voltage of FWD	V_F	$-I_c=75\text{A}$	—	—	3.0	V
DB	Collector Current at off Signal Input	I_{CES}	$V_{CE}=1200\text{V}$ Input Terminal Open	—	—	1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=25\text{A}$	—	—	2.6	V
	Forward Voltage of Diode	V_F	$-I_c=25\text{A}$	—	—	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.	Unit
Power Supply Current of P-line Side Pre-driver (one unit)		I_{CCP}	$f_{sw}=0\sim 15\text{kHz} *7$ $T_c=-20\sim 100^\circ\text{C}$	3	—	18	mA
Power Supply Current of N-line Side three Pre-driver		I_{CCN}	$f_{sw}=0\sim 15\text{kHz} *7$ $T_c=-20\sim 100^\circ\text{C}$	10	—	65	mA
Input Signal Threshold Voltage (on/off)		$V_{in(th)}$	ON	1.00	1.35	1.70	V
			OFF	1.25	1.60	1.95	
Input Zener Voltage		V_z	$R_{in}=20\text{k}\Omega$	—	8.0	—	V

*7 : Switching frequency of IPM

Over Heating Protective Section ($V_{cc}=15\text{V}$)

Items		Symbols	Conditions	min.	typ.	max.	Unit
Over Heating Protection Temperature Level		T_{COH}	$V_{DC}=0\text{V}$, $I_c=0\text{A}$, Fig.1 Case Temperature	110	—	125	$^\circ\text{C}$
Hysteresis		T_{CH}	—	—	20	—	$^\circ\text{C}$
IGBT chips Over Heating Protection Temperature Level		T_{JOH}	surface of IGBT chips	150	—	—	$^\circ\text{C}$
Hysteresis		T_{JH}	—	—	20	—	$^\circ\text{C}$

Over Current Protection Section ($V_{cc}=15\text{V}$)

Items		Symbols	Conditions	min.	typ.	max.	Unit
INV	Collector Current Protection Level	I_{OC}	$T_j=125^\circ\text{C}$	113	—	—	A
	Protection Delay	t_{BOC}	Fig.2 $T_j=25^\circ\text{C}$	—	5	—	μS
	SC Protection Delay	t_{SC}	Fig.3 $T_j=25^\circ\text{C}$	—	—	10	
DB	Collector Current Protection Level	I_{OC}	$T_j=125^\circ\text{C}$	38	—	—	A
	Protection Delay	t_{BOC}	Fig.2 $T_j=25^\circ\text{C}$	—	10	—	μS
	SC Protection Delay	t_{SC}	Fig.3 $T_j=25^\circ\text{C}$	—	—	12	

Alarm Signal Output Section (at $T_j=T_c=25^\circ\text{C}$, $V_{CC}=15\text{V}$)

Items	Symbols	Conditions	min.	typ.	max.	Unit
Alarm Signal Hold Time	t_{ALM}	—	1.5	2	—	mS
Limiting resistor for Alarm	R_{ALM}	—	1425	1500	1575	Ω

Under Voltage Lockout Section (at $T_j=T_c=25^\circ\text{C}$, $V_{CC}=15\text{V}$)

Items	Symbols	Conditions	min.	typ.	max.	Unit
Under Voltage Protection Level	V_{UV}	—	11.0	—	12.5	V
Hysteresis	V_{H}	—	0.2	—	—	V

5. Dynamic Characteristics (at $T_c=T_j=125^\circ\text{C}$, $V_{CC}=15\text{V}$)

スイッチング特性

Items	Symbols	Conditions	min.	typ.	max.	Unit
Switching Time (IGBT)	t_{on}	$I_c=75\text{A}$, $V_{\text{DC}}=600\text{V}$	0.3	—	—	μS
	t_{off}					
Switching Time (FWD)	t_{rr}	$I_f=75\text{A}$, $V_{\text{DC}}=600\text{V}$	—	—	0.4	

6. Thermal Characteristics ($T_c=25^\circ\text{C}$)

熱特性

Items		Symbols	min.	typ.	max.	Unit
Junction to Case Thermal Resistance	INV	IGBT	$R_{\text{th}(j-c)}$	—	—	0.25
		FWD	$R_{\text{th}(j-c)}$	—	—	0.73
Junction to Case Thermal Resistance	DB	IGBT	$R_{\text{th}(j-c)}$	—	—	0.63
Case to Fin Thermal Resistance with Compound			$R_{\text{th}(c-f)}$	—	0.05	—

7. Recommendable Value

推奨値

Items	Symbols	Conditions	min.	typ.	max.	Unit
DC Bus Voltage	V_{DC}	—	200	—	800	V
Operating Power Supply Voltage Range of Pre-driver	V_{CC}	—	13.5	15	16.5	V
Switching frequency of IPM	f_{sw}	—	1	—	20	kHz
Screw torque	Mounting(M5)	—	2.5	—	3.0	N·m
	Terminal (M5)	—	2.5	—	3.0	N·m

8. Weight

重量

Items	min.	typ.	max.	Unit
Weight	—	440	—	g

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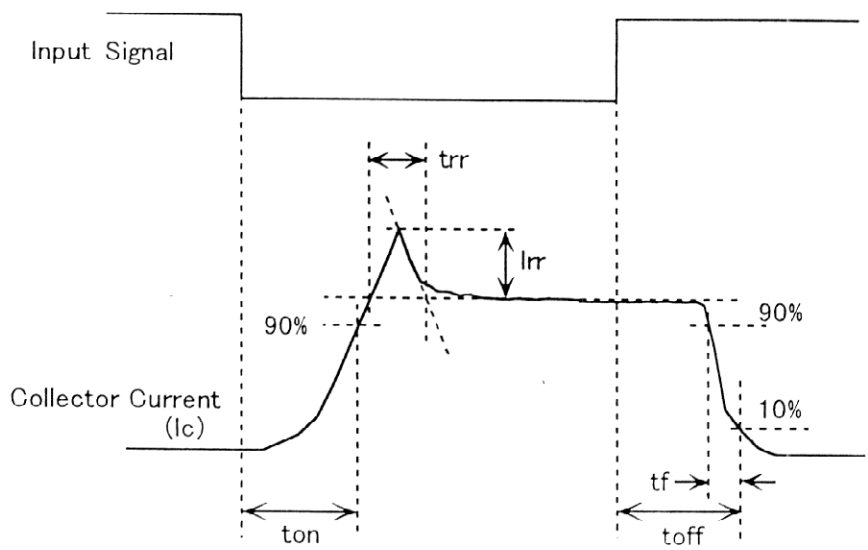
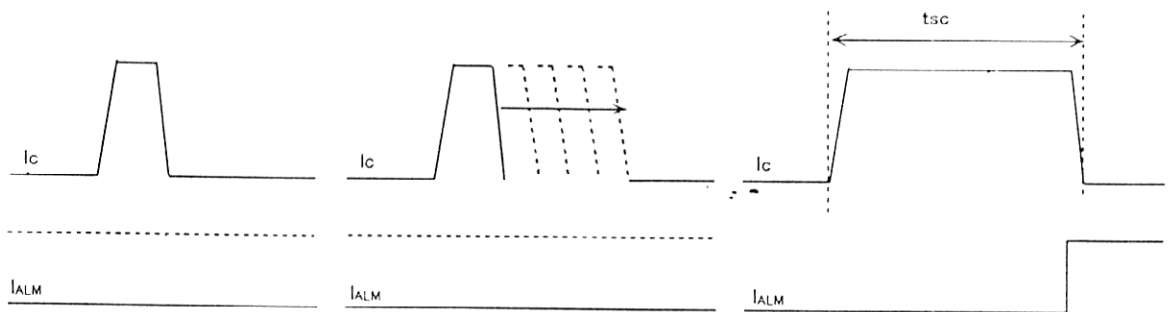
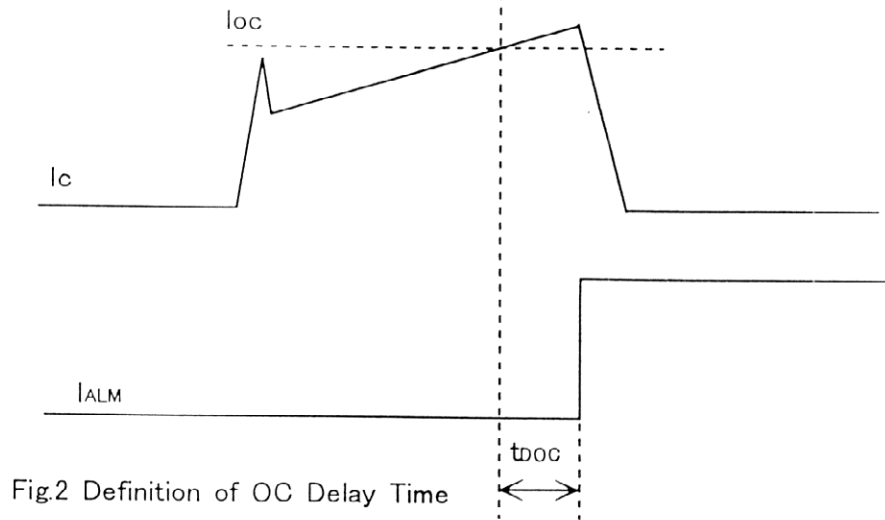
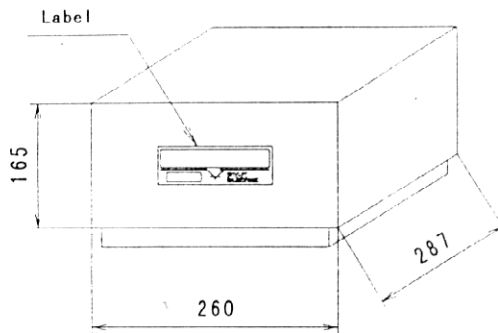


Fig.4 Definition of Switching Time

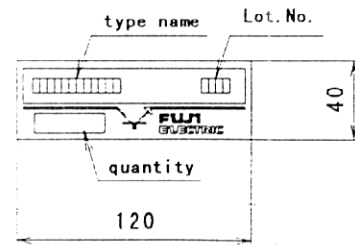
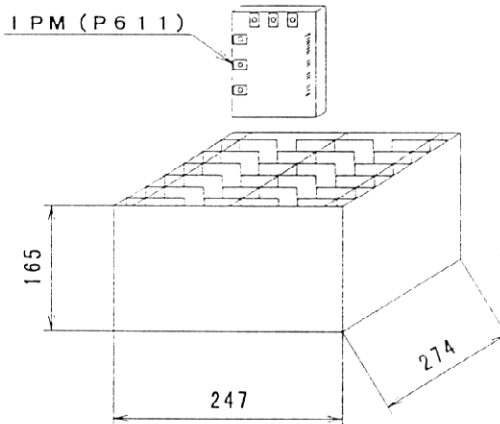
9. Packing and labeling (梱包箱と表示)

Outer carton (外箱)



material: corrugated cardboard
材料 ダンボール
weight : 5.0kg(max.)
総重量 約5.0kg(最大)
products: 10pcs(max.)
製品 10個(最大)

Inner carton (内装箱)



10. 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 module.
半導体製品に荷重がかからない様に注意すること。
- 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 or otherwise shock the modules when transporting.
運搬時に衝撃を与えたり落下させないこと。

11. 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。

12. Applicable category (適用範囲)

This specification is applied to IGBT-IPM named 7MBP75RE120.
本仕様書は、IGBT-IPM(型式:7MBP75RE120)に適用する。

13. UL approval (準拠安全規格)

UL840 (Operating condition: Table 6. 1—Operating voltage 500V, Pollution degree 2, Material group IIIa)
(適用条件: 表6. 1—動作電圧500V、汚れ度2、材料グループⅢa)

UL94V-0

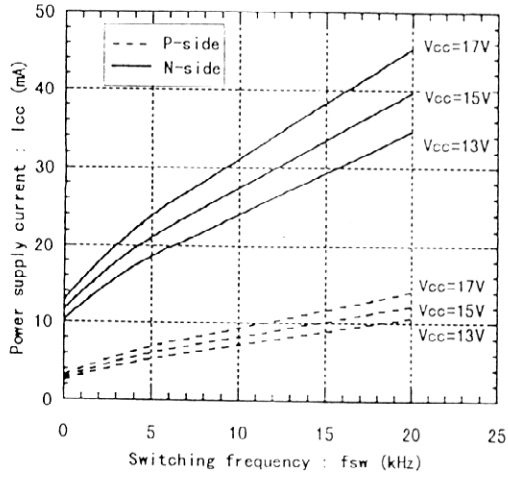
14. Characteristics (Representative)

特性カーブ (代表例)

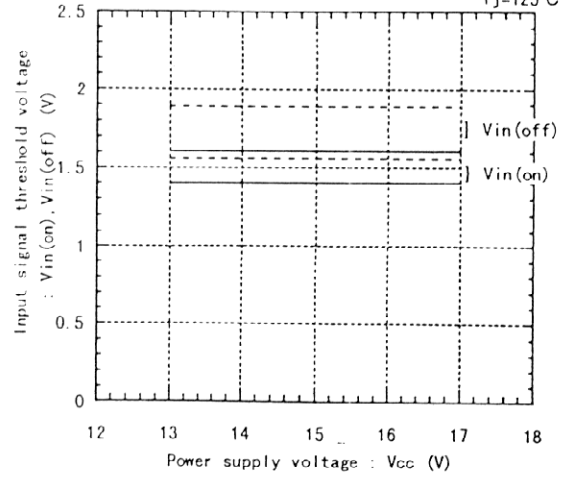
14-1. Control Circuit

制御部

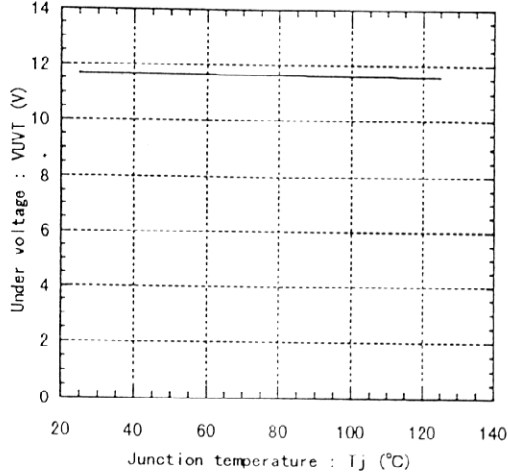
Power supply current vs. Switching frequency
Tj=100°C



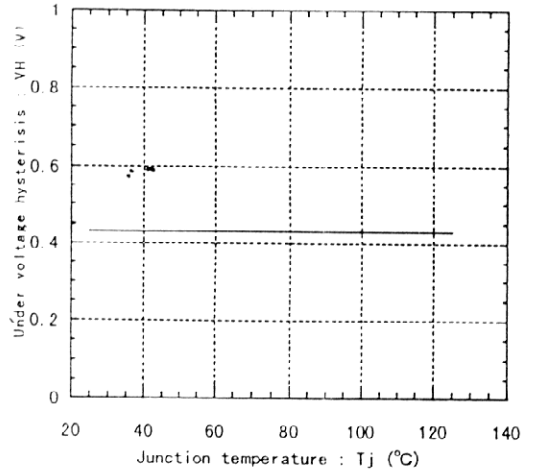
Input signal threshold voltage vs. Power supply voltage
— Tj=25°C
--- Tj=125°C



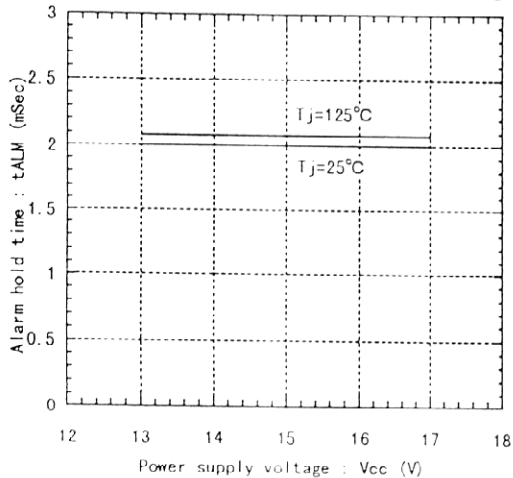
Under voltage vs. Junction temperature



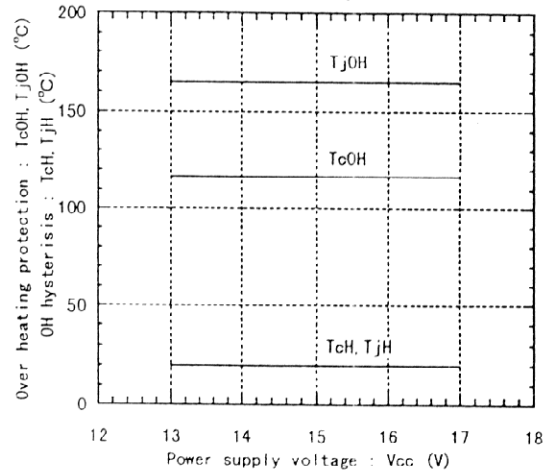
Under voltage hysteresis vs. Junction temperature



Alarm hold time vs. Power supply voltage



Over heating characteristics
TcOH, TjOH, TcH, TjH vs. Vcc

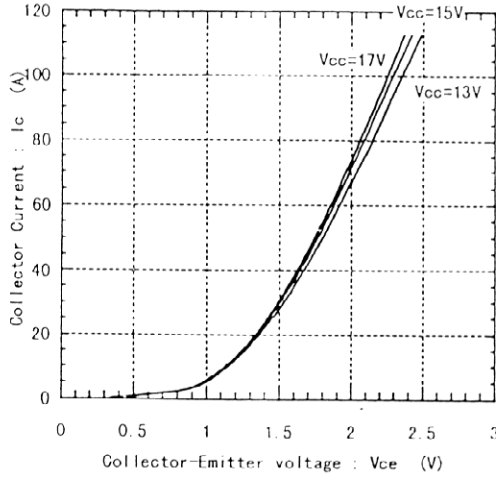


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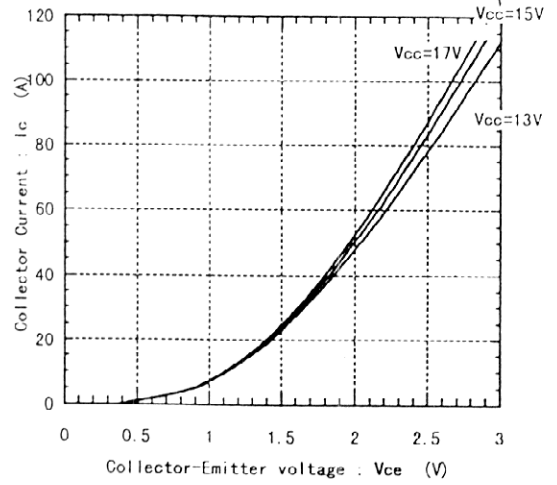
14-2. Inverter

インバータ部

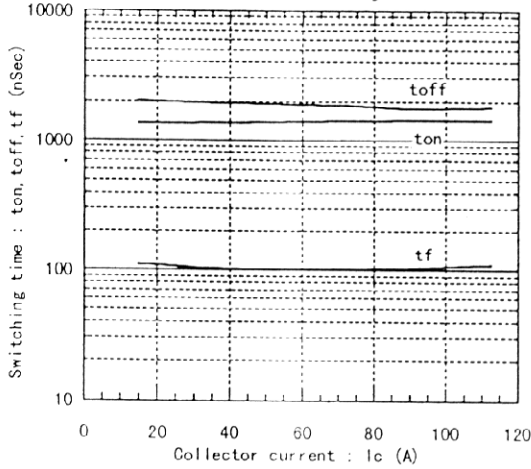
Collector current vs. Collector-Emitter voltage
T_j=25°C



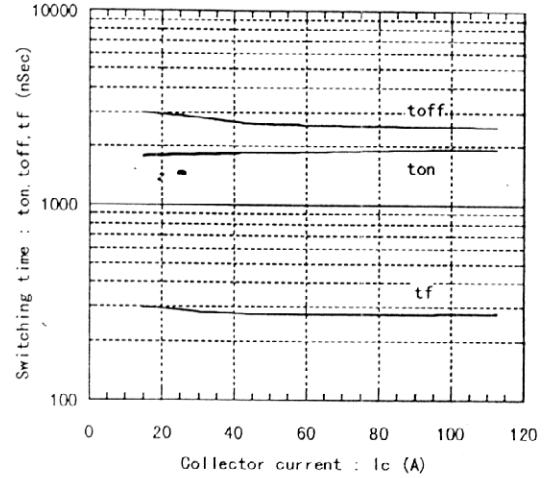
Collector current vs. Collector-Emitter voltage
T_j=125°C



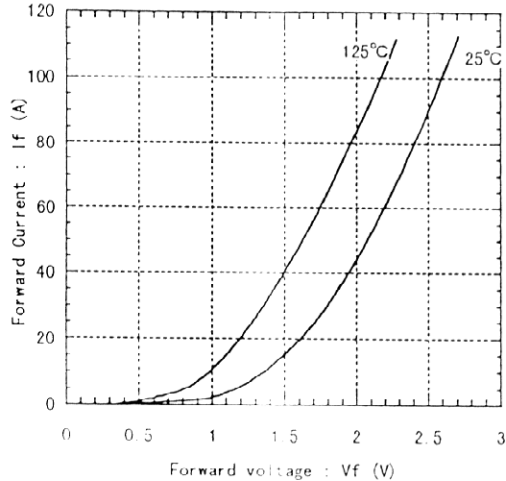
Switching time vs. Collector current
E_{dc}=600V, V_{cc}=15V, T_j=25°C



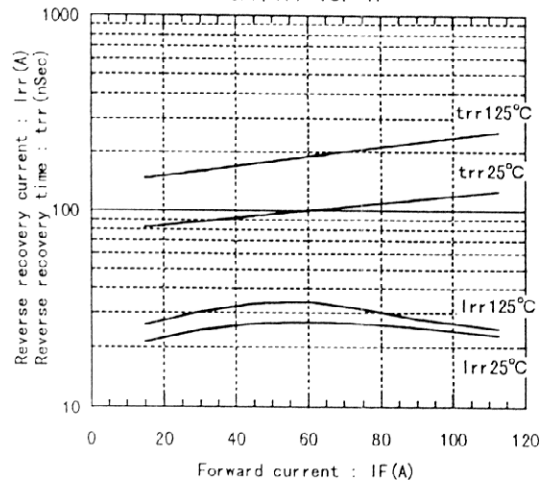
Switching time vs. Collector current
E_{dc}=600V, V_{cc}=15V, T_j=125°C



Forward current vs. Forward voltage

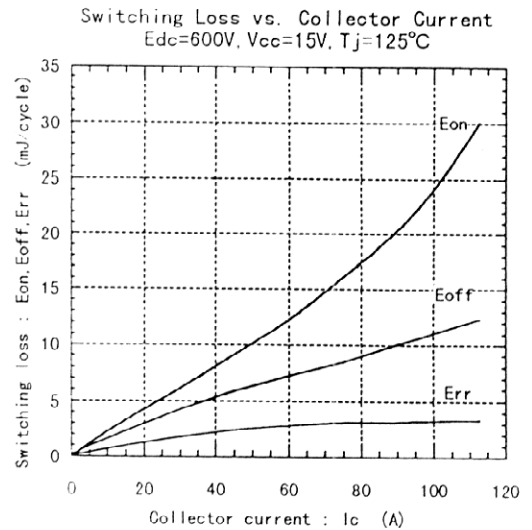
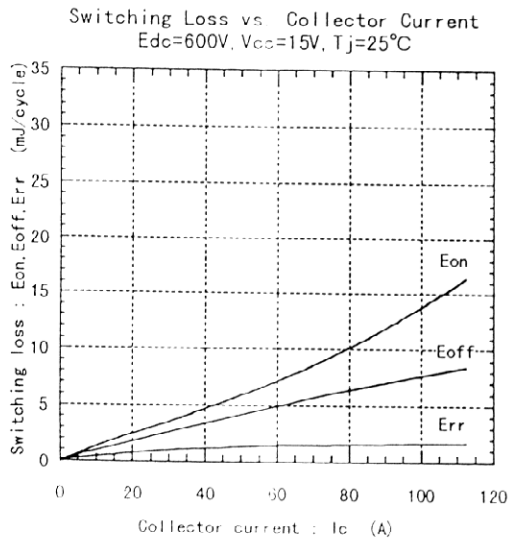
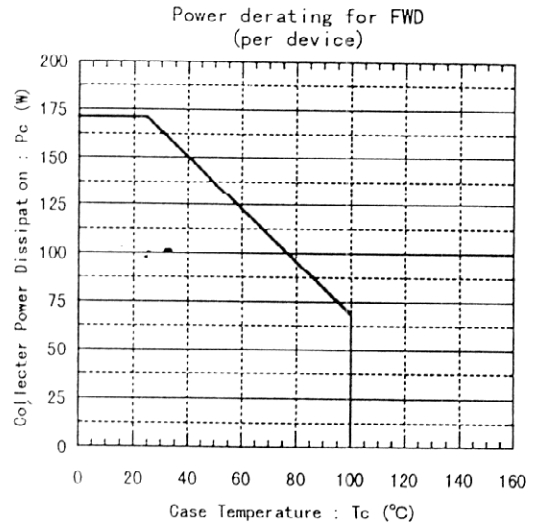
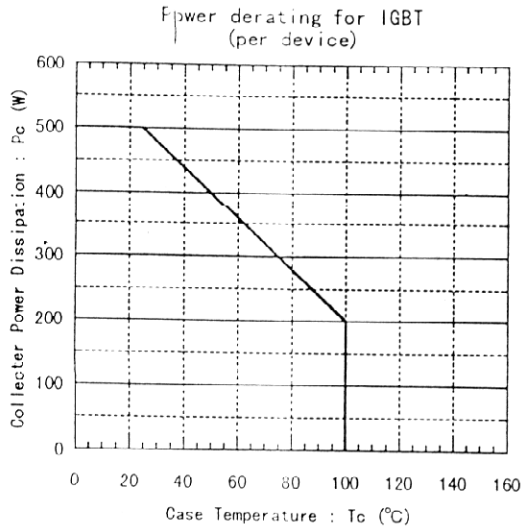
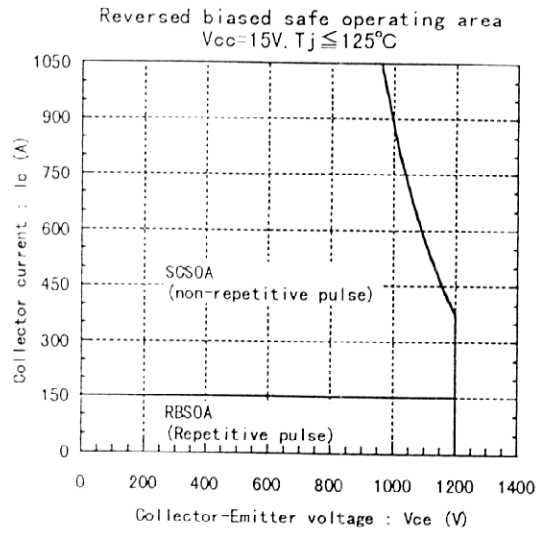
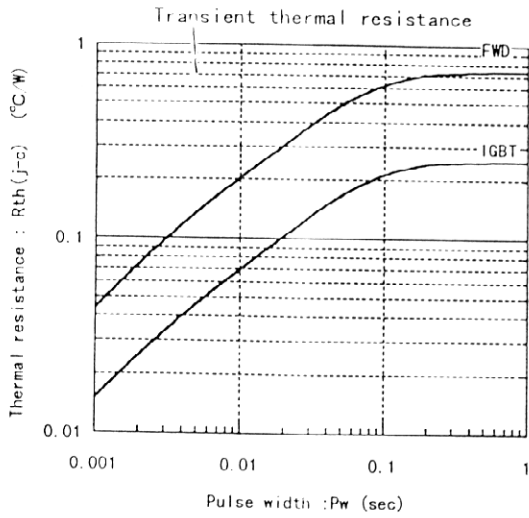


Reverse recovery characteristics
trr, Irr vs. IF

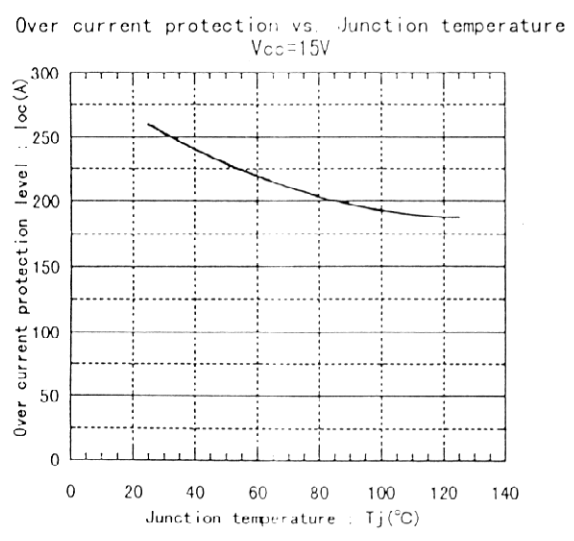


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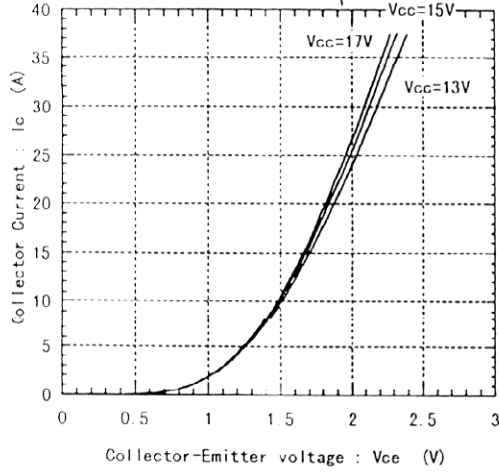
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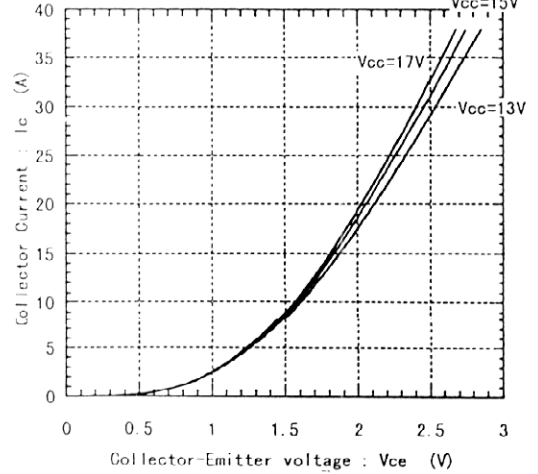
14-3. DB

ブレーキ部

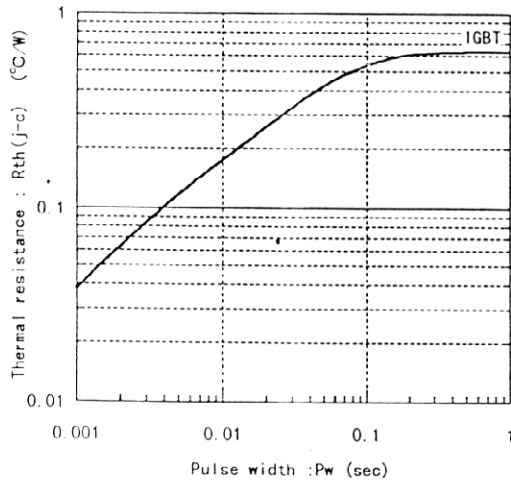
Collector current vs. Collector-Emitter voltage
T_j=25°C



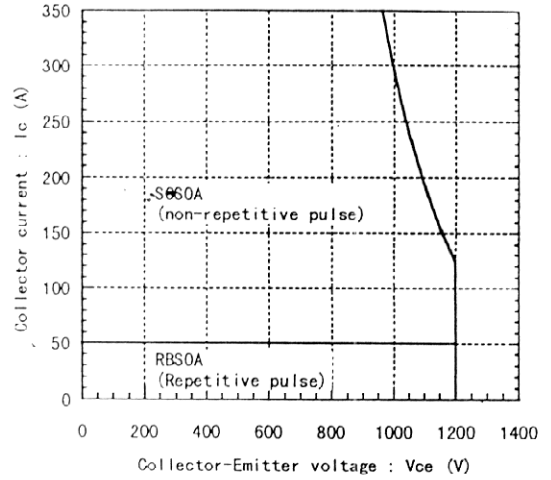
Collector current vs. Collector-Emitter voltage
T_j=125°C



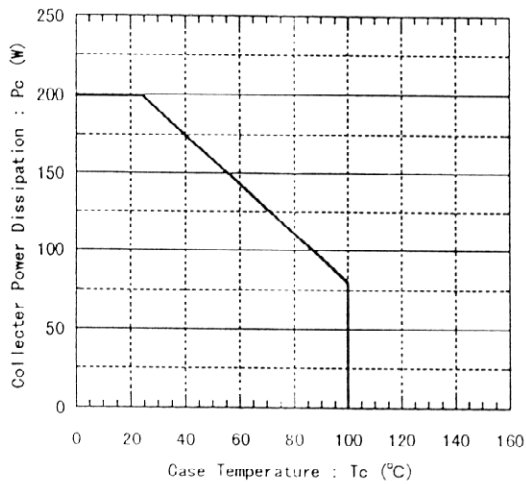
Transient thermal resistance



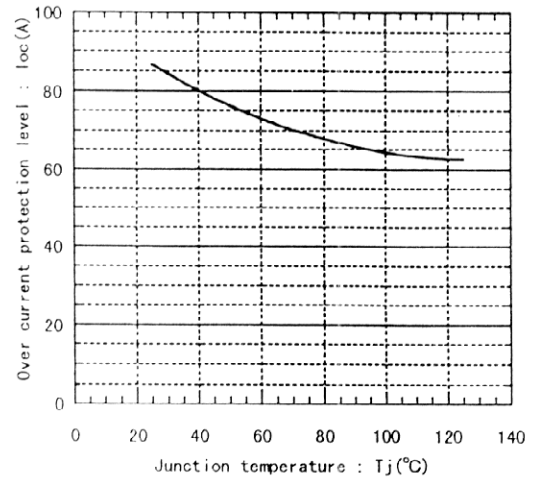
Reversed biased safe operating area
V_{cc}=15V, T_j ≤ 125°C



Power derating for IGBT
(per device)



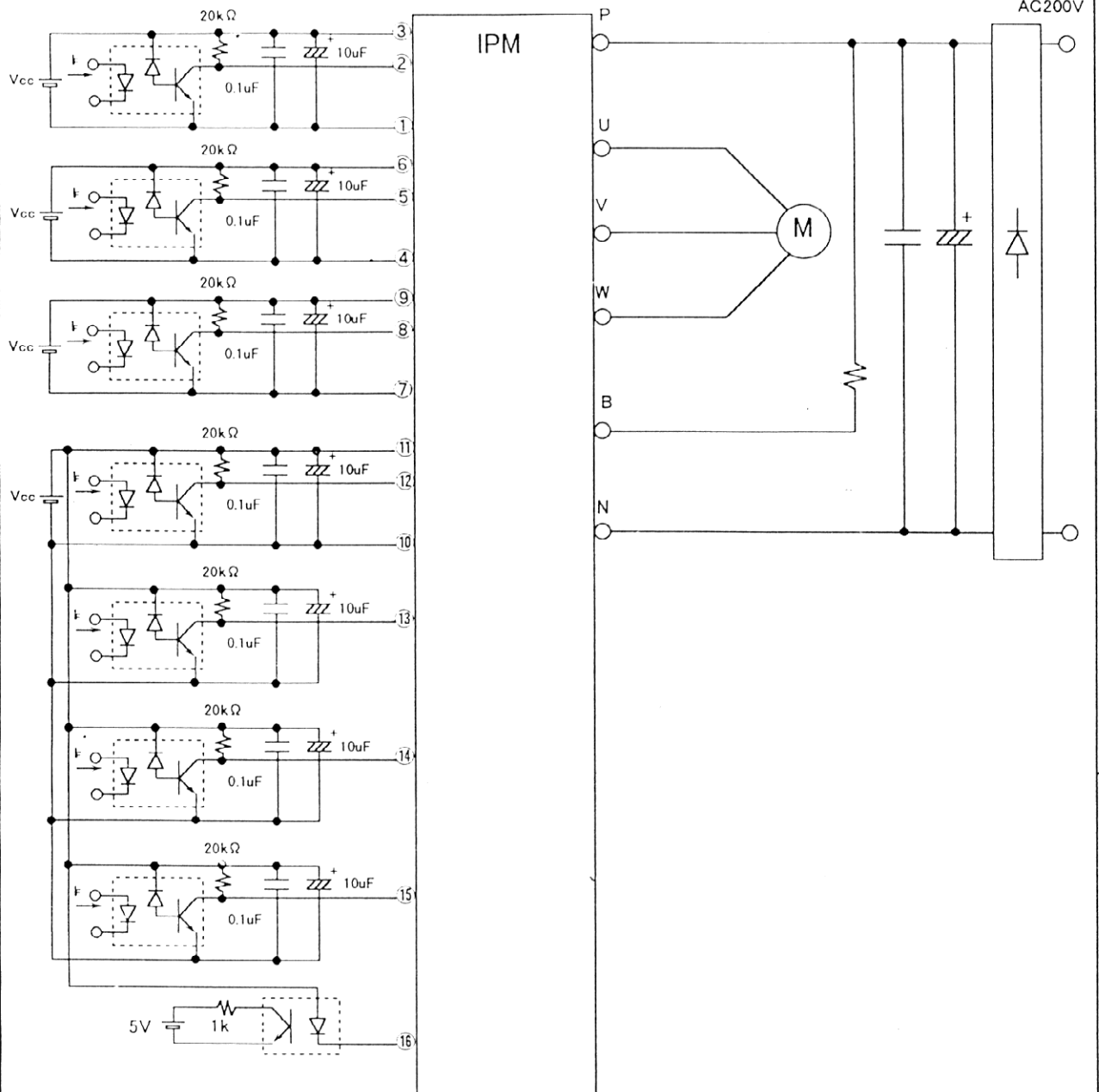
Over current protection vs. Junction temperature
V_{cc}=15V



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15. Example of applied circuit

応用回路例



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- The wiring between opto-coupler and input terminals 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 a pattern lay-out.

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下さい。

- Capacitor should be installed to Vcc-GND terminal of high-speed opto-coupler closely as much as possible.

高速フォトカプラの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下さい。

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

高速フォトカプラ: $t_{PHL}, t_{PLH} \leq 0.8 \mu S$, 高CMRタイプをご使用下さい。(例: HCPL-4504)

- Use Low-speed opto-coupler for alarm output : $CTR \geq 100\%$

アラーム出力用の低速フォトカプラ: $CTR \geq 100\%$ タイプをご使用下さい。

- 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、絶縁されたものを4個独立に使用して下さい。
- The DC bus lines to the P-N terminals 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 4.7nF) 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-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 capacitors are connected between input and GND terminals, pay attention to longer delay time after signals 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フォトカップラ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。