

# SPECIFICATION

Device Name : IGBT-IPM

Type Name : 4MBP100RA060

Spec. No. : MS6M 0358

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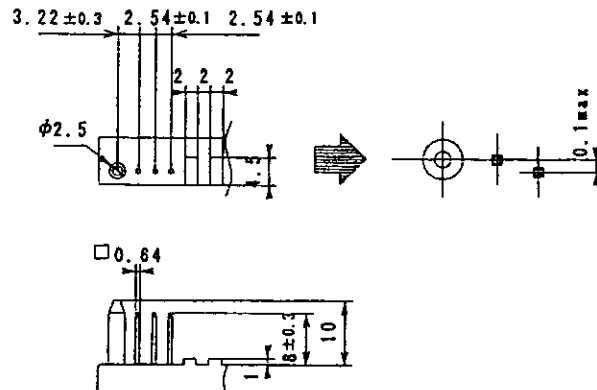
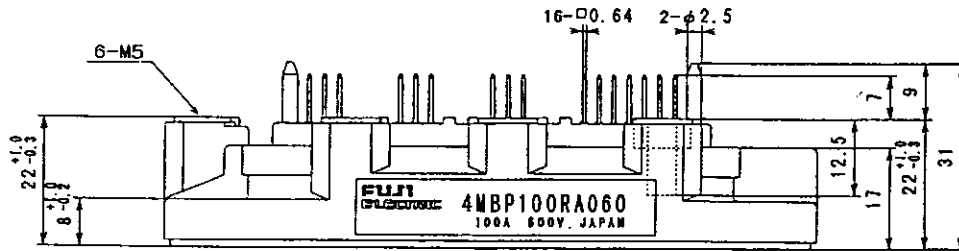
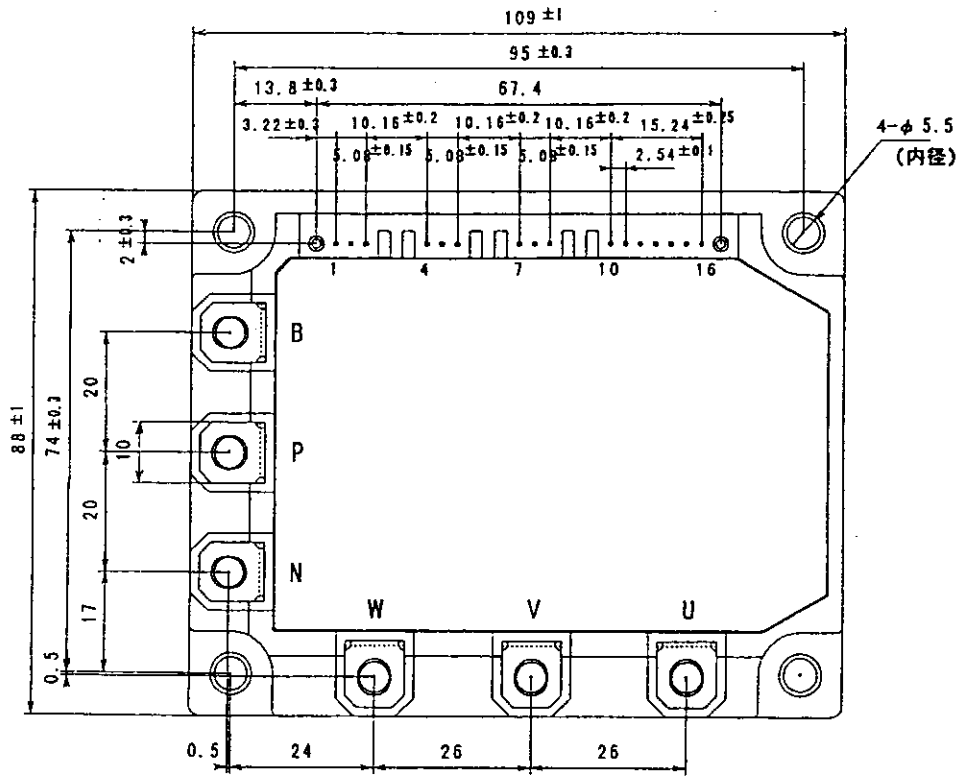
Fuji Electric Co., Ltd.  
Matsumoto Factory

	DATE	NAME	APPROVED		
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CHECKED	'98-Jun-24	Mishima		DWG. NO.	MS6M 0358 1/15



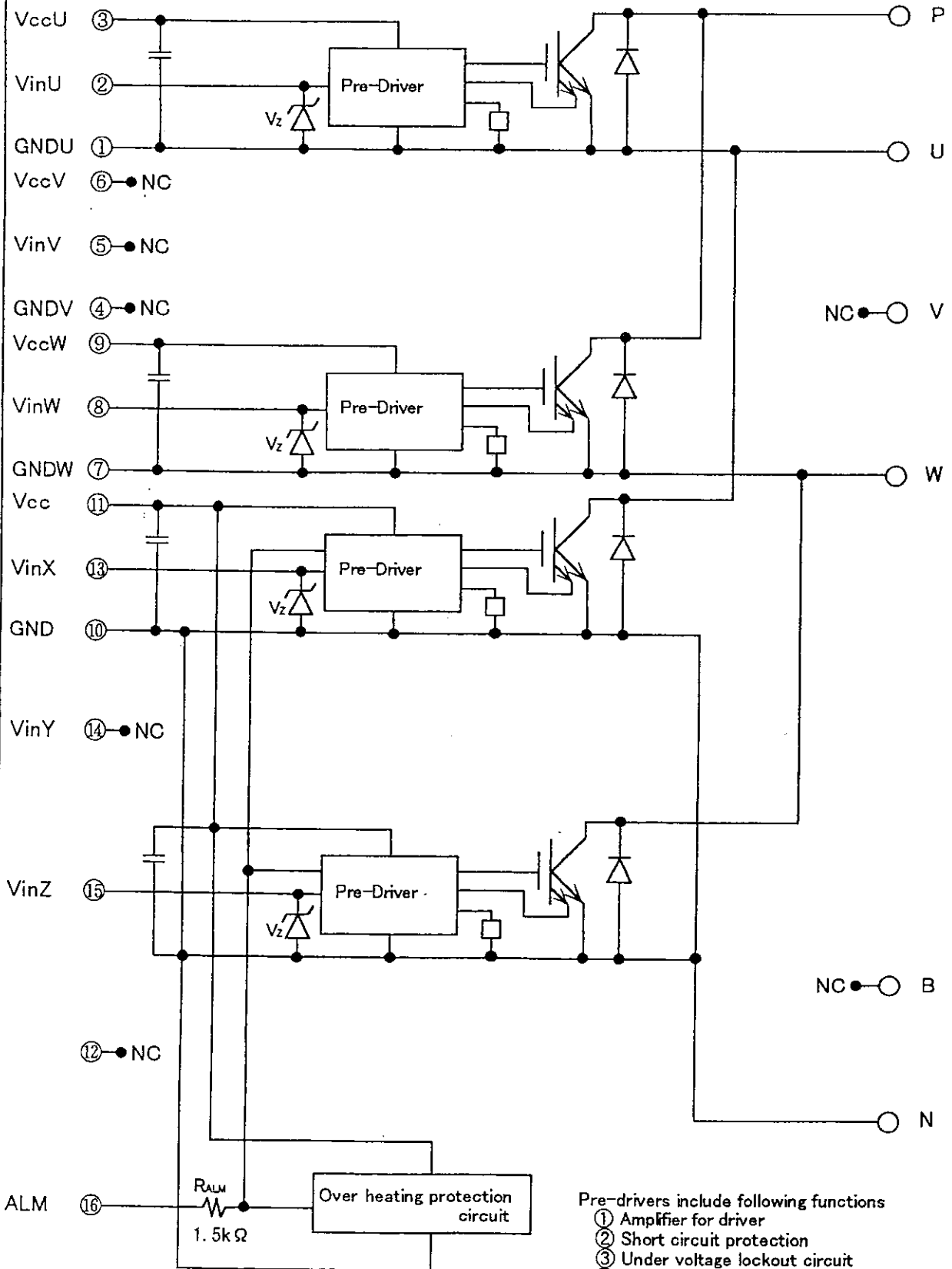
# 1. Outline

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Details of control terminals

## 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	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	
INV	Collector Current	DC	I <sub>C</sub>	—	100	A
		1 mS	I <sub>CP</sub>	—	200	A
		Duty=59.5%	-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		T <sub>op</sub>	-20	100	°C	
Isolating Voltage (Case—Terminal)		V <sub>iso</sub> *5	—	AC2500	V	
Screw Torque	Mounting(M5)	—	—	3.5 *6	N·m	
	Terminal (M5)	—	—	3.5 *6	N·m	

#### Note

- \*1 : V<sub>CC</sub> shall be applied to the input voltage between terminal No.3 and 1, 9 and 7, 11 and 10
- \*2 : V<sub>in</sub> shall be applied to the input voltage between terminal No.2 and 1, 8 and 7, 13,15 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.
- \*6 : Recommendable Value : 2.5~3.0 N·m

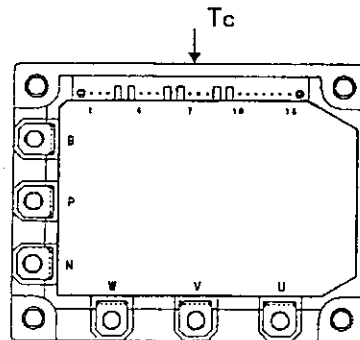


Fig. 1 Measurement of case temperature for T<sub>cOH</sub> (T<sub>c</sub>)

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#### 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	$I_{CES}$	$V_{CE}=600\text{V}$ Input Terminal Open	—	—	1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_c=100\text{A}$	—	—	2.8	V
	Forward Voltage of FWD	$V_F$	$-I_c=100\text{A}$	—	—	3.0	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		$I_{CCN}$	$f_{sw}=0\sim 15\text{kHz} *7$ $T_c=-20\sim 100^\circ\text{C}$	6	—	36	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		$T_{COH}$	$V_{DC}=0\text{V}$ , $I_c=0\text{A}$ 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	$I_{OC}$	$T_j=125^\circ\text{C}$	150	—	—	A
Protection Delay time		$t_{DOC}$	Fig.2 $T_j=25^\circ\text{C}$	—	10	—	$\mu\text{S}$
SC Protection Delay time		$t_{SC}$	Fig.3 $T_j=25^\circ\text{C}$	—	—	12	

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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	$t_{\text{ALM}}$	—	1.5	2	—	mS
Limiting resistor for Alarm	$R_{\text{ALM}}$	—	1425	1500	1575	$\Omega$

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	$V_{\text{UV}}$	—	11.0	—	12.5	V
Hysteresis	$V_{\text{H}}$	—	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)	$t_{\text{on}}$	$I_c=100\text{A}$ , $V_{\text{DC}}=300\text{V}$	0.3	—	—	$\mu\text{S}$
	$t_{\text{off}}$		—	—	3.6	
Switching Time (FWD)	$t_{\text{rr}}$	$I_f=100\text{A}$ , $V_{\text{DC}}=300\text{V}$	—	—	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	$R_{\text{th}(j-c)}$	—	—	0.31	$^\circ\text{C}/\text{W}_j$
	IGBT	$R_{\text{th}(j-c)}$	—	—	0.70	
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	$V_{\text{DC}}$	—	200	—	400	V
Operating Power Supply Voltage Range of Pre-driver	$V_{\text{CC}}$	—	13.5	15	16.5	V
Switching frequency of IPM	$f_{\text{sw}}$	—	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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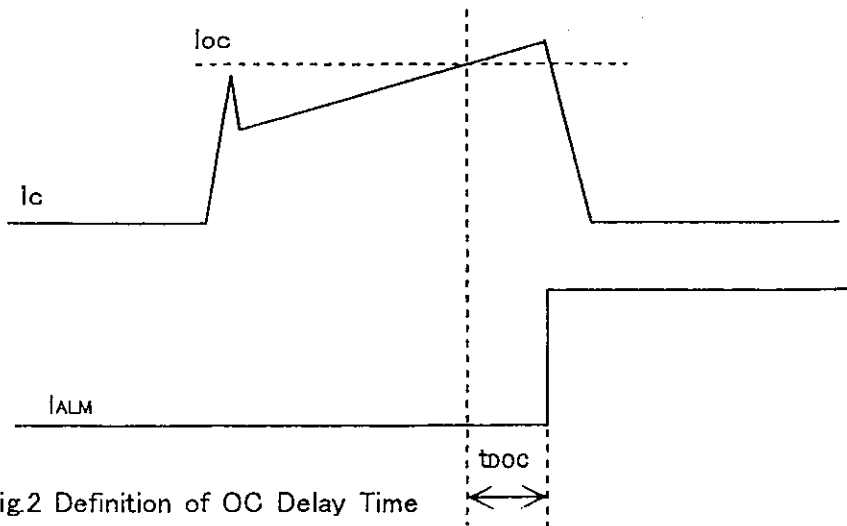


Fig.2 Definition of OC Delay Time

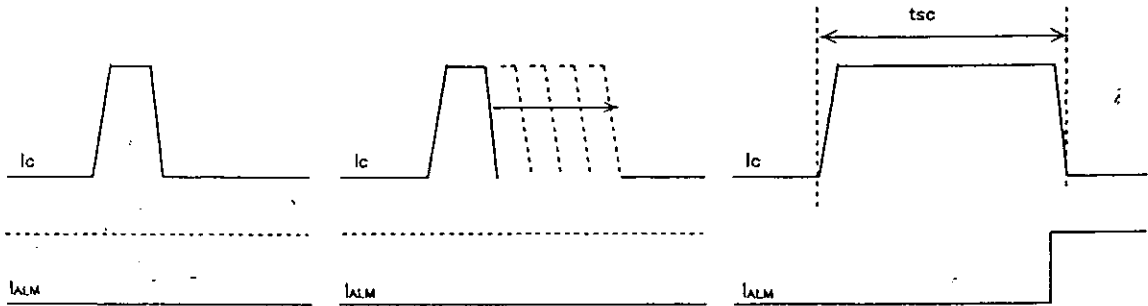


Fig.3 Definition of tsc

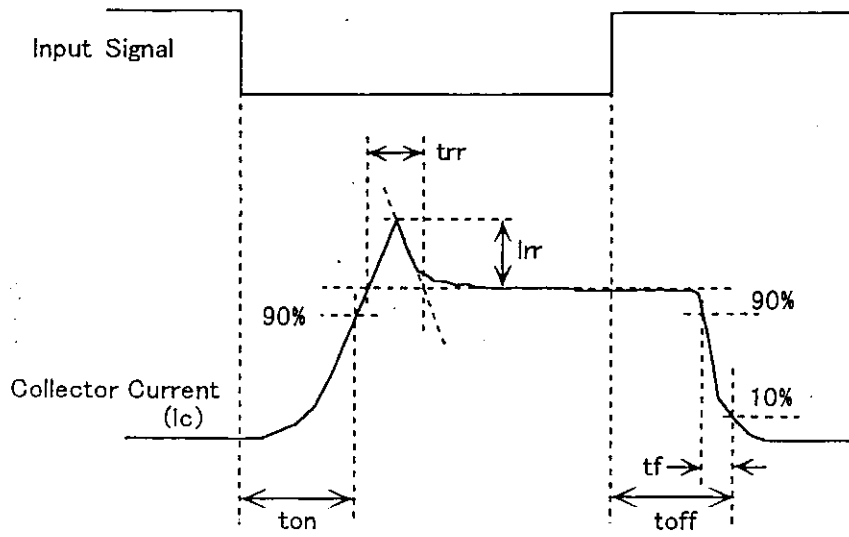
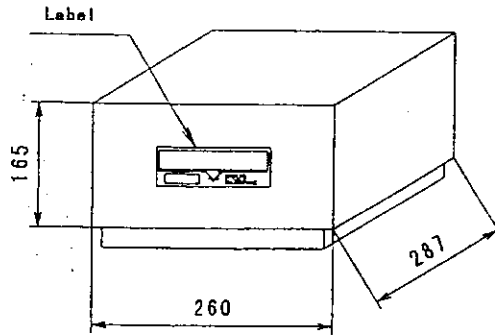


Fig.4 Definition of Switching Time



## 9. Packing and labeling (梱包箱と表示)

### Outer carton (外箱)



material: corrugated cardboard

材料 ダンボール

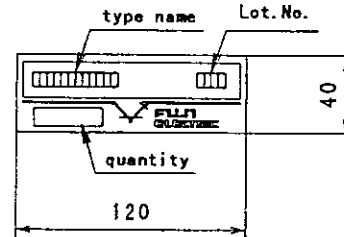
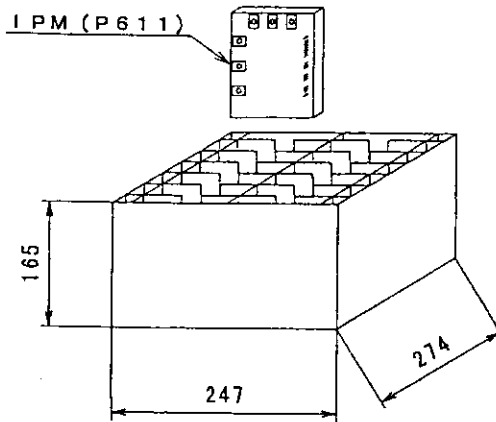
weight : 5.0kg(max.)

総重量 約5.0kg(最大)

products: 10pcs(max.)

製品 10個(最大)

### Inner carton (内装箱)



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## 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 4MBP100RA060.  
本仕様書は、IGBT-IPM(型式:4MBP100RA060)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 III a)  
(適用条件: 表6. 1-動作電圧500V、汚れ度2、材料グループIII a)

UL94V-0

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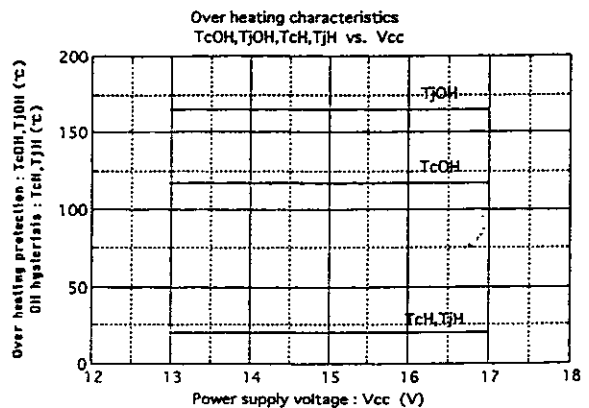
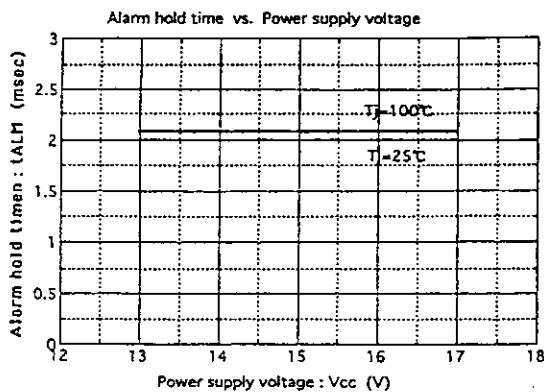
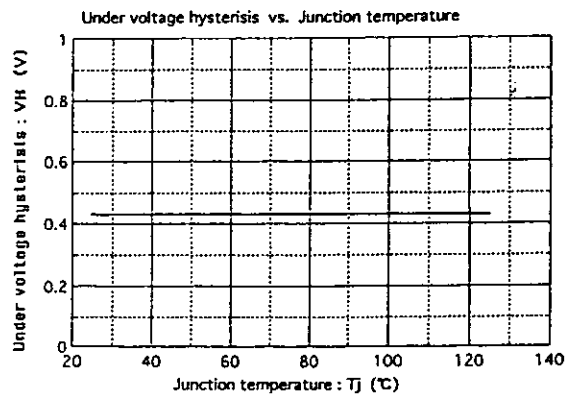
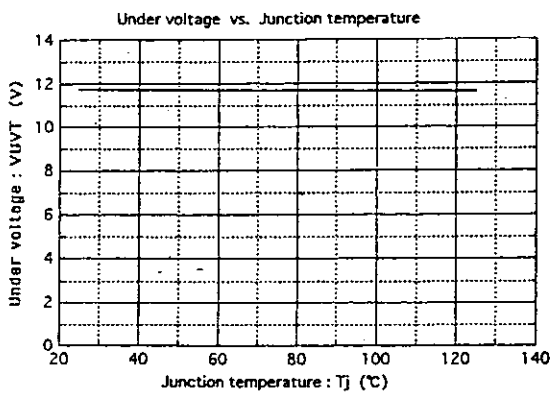
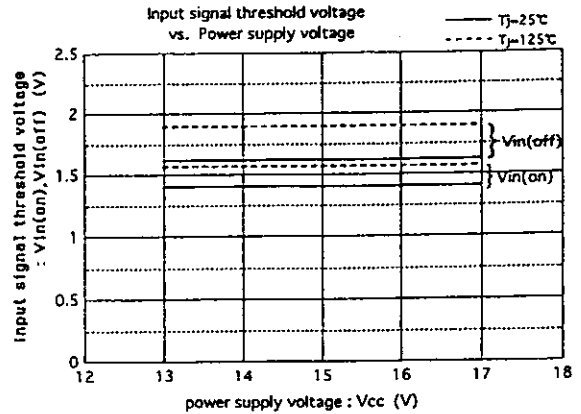
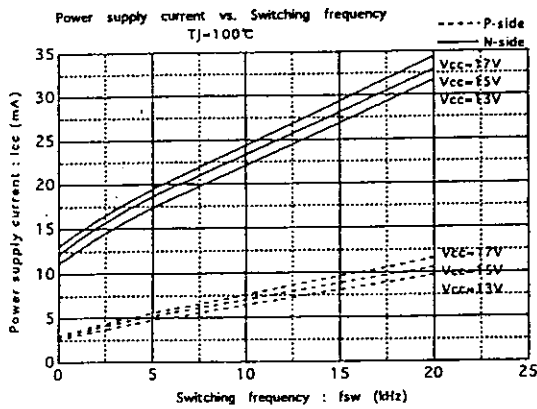
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# 14.Characteristics(Representative)

## 特性カーブ (代表例)

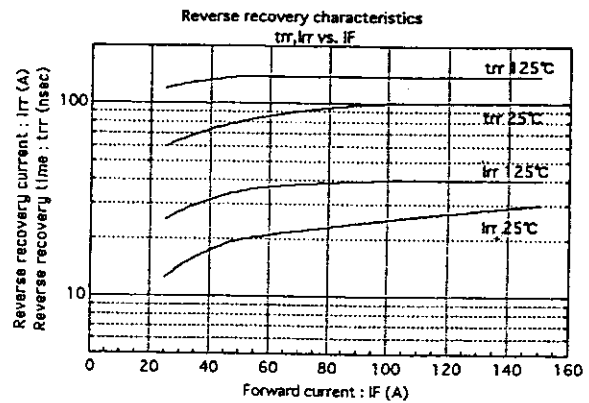
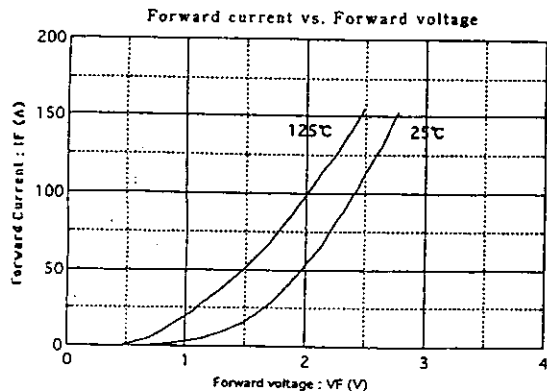
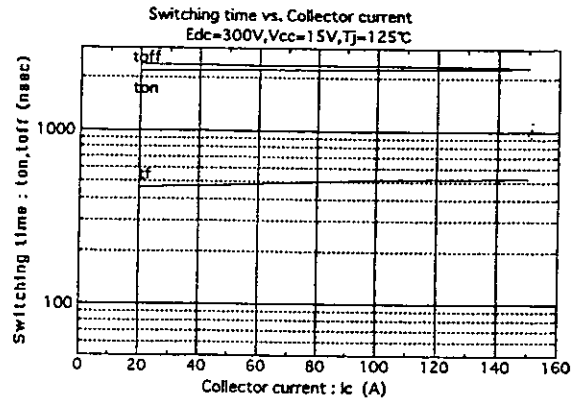
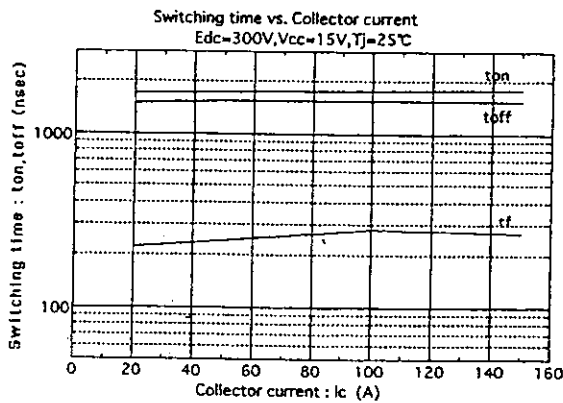
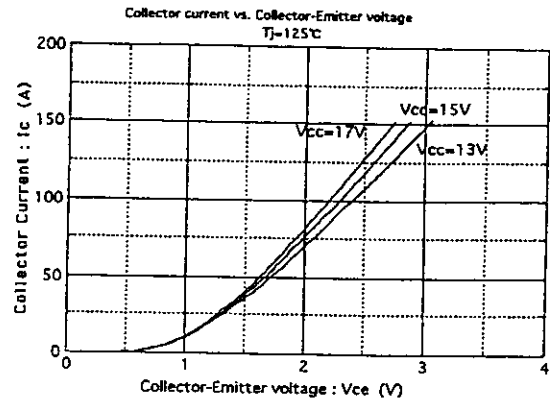
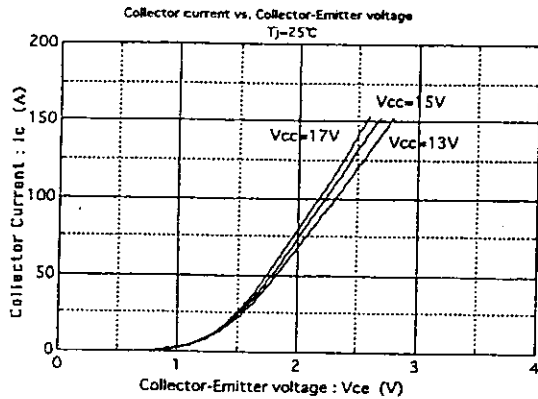
### 14-1.Control Circuit

#### 制御部



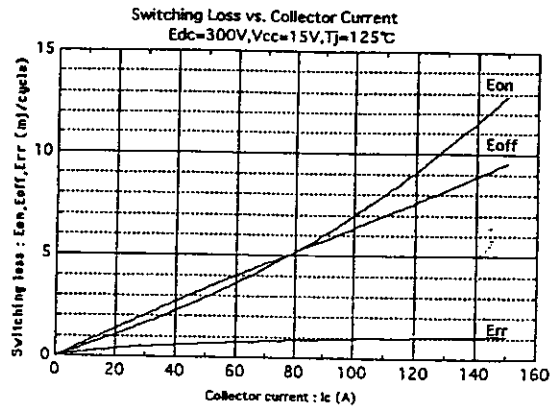
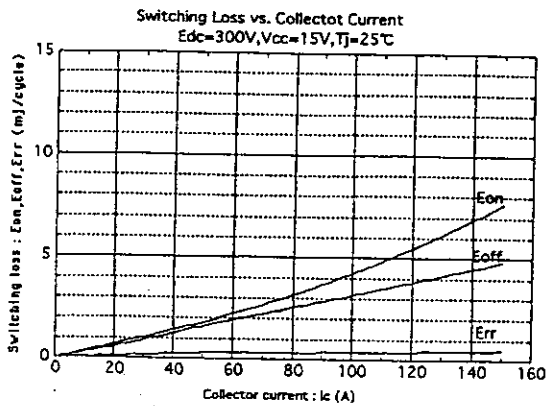
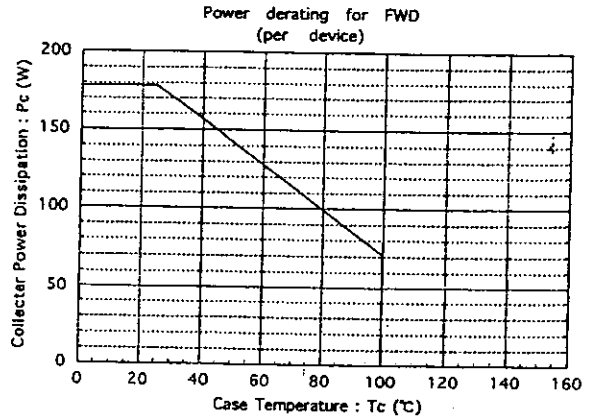
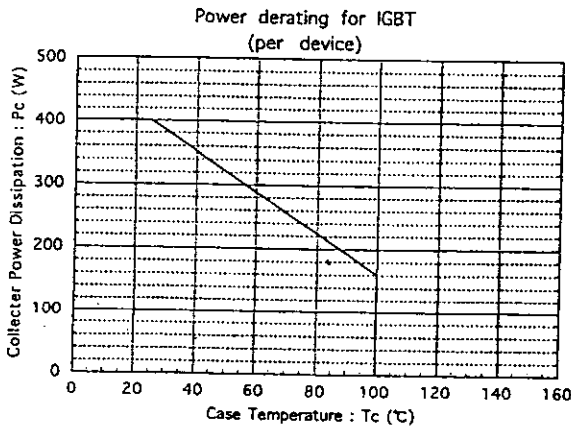
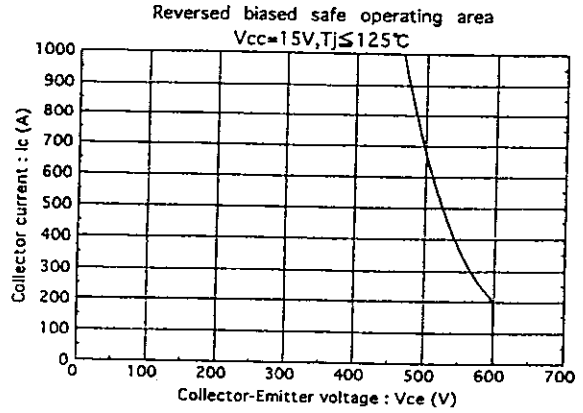
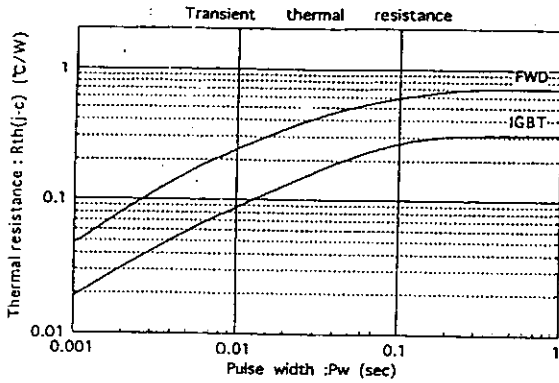
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# 14-2. Inverter インバータ部

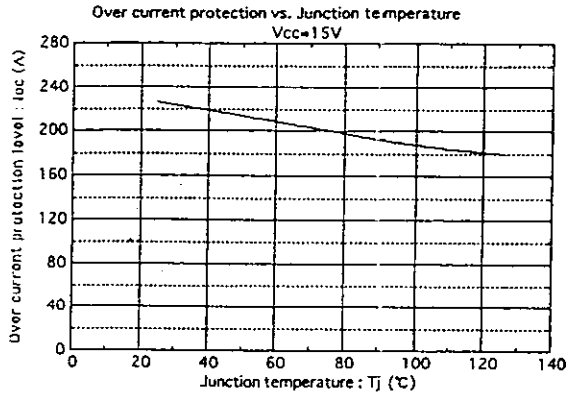


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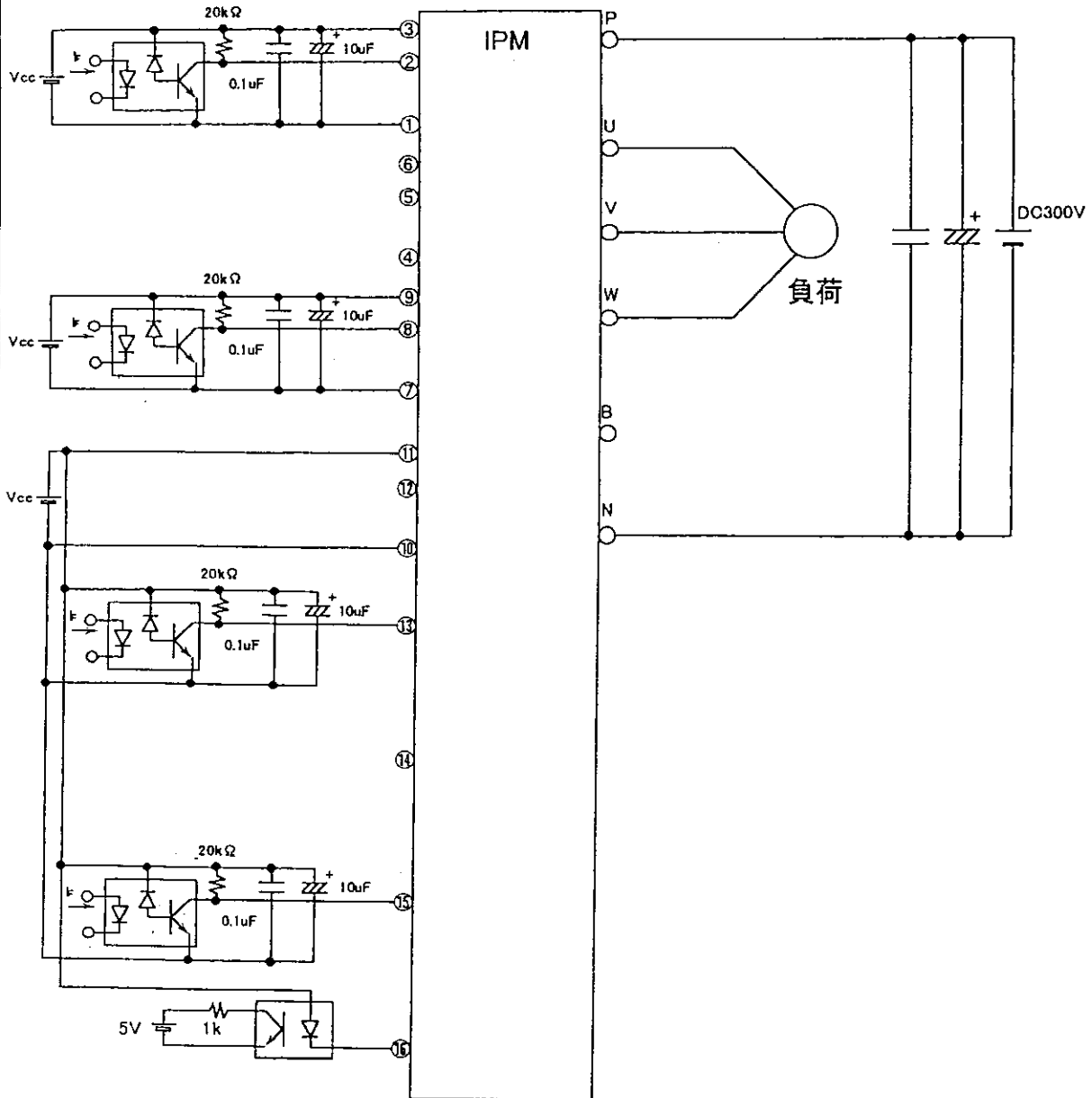
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# 15. Example of applied circuit

## 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して下さい。

- 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。

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- Each power supply for drive circuit should not have transient voltage fluctuation.  
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 terminals, 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、2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。

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