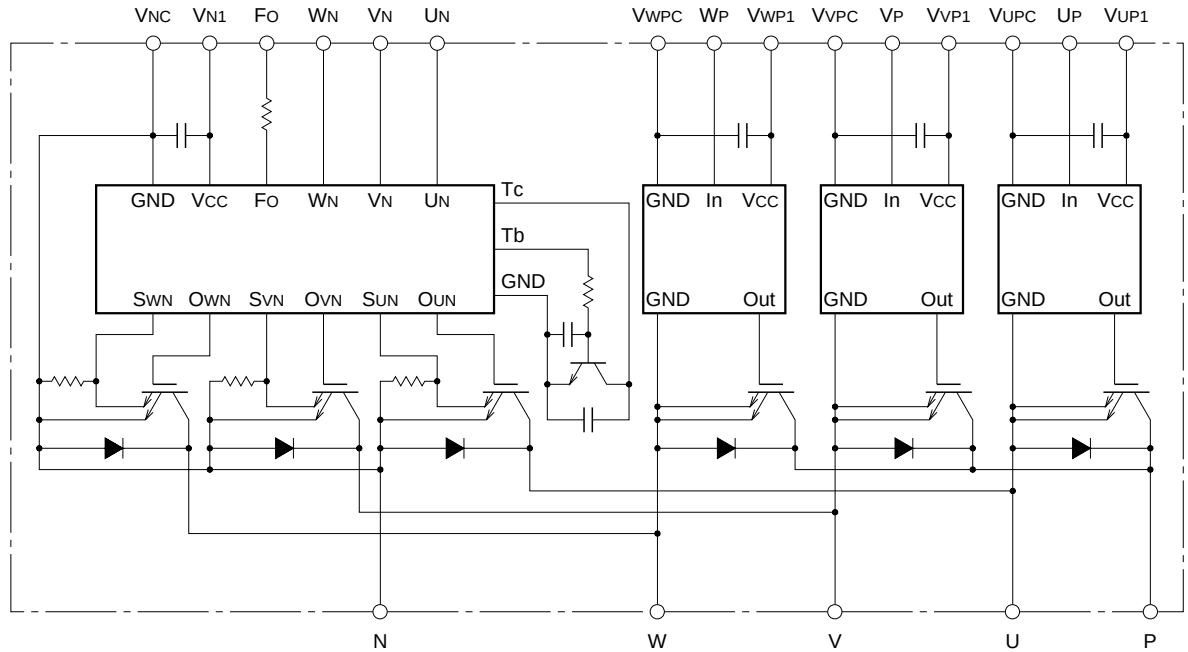


PM50CTJ060-3

INSULATED PACKAGE
FLAT-BASE TYPE

EQUIVALENT CIRCUIT DIAGRAM



MAXIMUM RATINGS (T_j = 25°C, unless otherwise noted)

INVERTER PART

Symbol	Parameter	Conditions	Ratings	Unit
V _{CC}	Supply voltage	Applied between : P-N	450	V
V _{CC(surge)}	Supply voltage (surge)	Applied between : P-N, Surge value	500	V
V _{CES}	Collector-emitter voltage		600	V
±I _C	Collector current	T _c = 25°C	50	A
±I _{CP}	Collector current (peak)	T _c = 25°C	100	A
P _C	Collector dissipation	T _c = 25°C	100	W
T _j	Junction temperature		-20 ~ +125*	°C

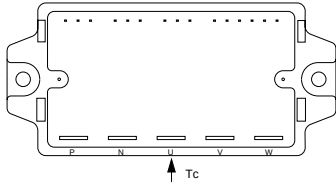
* The item defines the maximum junction temperature for the power elements (IGBT/Diode) of the IPM to ensure safe operation. However, these power elements can endure junction temperature as high as 150°C instantaneously. To make use of this additional temperature allowance, a detailed study of the exact application conditions is required and, accordingly, necessary information is requested to be provided before use.

CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
V _D	Supply voltage	Applied between : V _{UP1} -V _{UPC} , V _{VP1} -V _{VP1} V _{WP1} -V _{WPC} , V _{UN1} -V _{VNC}	20	V
I _{CIN}	Input current	At : U _P , V _P , W _P , U _N , V _N , W _N terminals	20	mA
V _{FO}	Fault output supply voltage	Applied between : F _O -V _{NC}	20	V
I _{FO}	Fault output current	Sink current of F _O terminals	20	mA

PM50CTJ060-3**INSULATED PACKAGE
FLAT-BASE TYPE****TOTAL SYSTEM**

Symbol	Parameter	Conditions	Ratings	Unit
V _{CC(Prot)}	Supply voltage protected by OC & SC	V _D = 13.5 ~ 16.5V, Inverter part, T _j = 125°C start	400	V
T _C	Module case operating temperature	(Note 1)	-20 ~ +100	°C
T _{stg}	Storage temperature		-40 ~ +125	°C
V _{iso}	Isolation voltage	60Hz, sinusoidal, Charged part to Base, AC · 1 min.	2500	V _{rms}

Note 1 : T_C measurement point.**THERMAL RESISTANCES**

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
R _{th(j-c)Q}	Junction to case thermal resistances	Inverter IGBT part (per 1/6 module)	—	—	1.2	°C / W
R _{th(j-c)F}		Inverter FWD part (per 1/6 module)	—	—	2.9	°C / W
R _{th(c-f)}	Contact thermal resistance	Case to fin, (per 1 module) thermal grease applied	—	—	0.4	°C / W

ELECTRICAL CHARACTERISTICS (T_j = 25°C, unless otherwise noted)**INVERTER PART**

Symbol	Parameter	Test conditions		Limits			Unit
				Min.	Typ.	Max.	
V _{CE(sat)}	Collector-emitter saturation voltage	V _D = 15V, I _{CIN} = 10mA I _C = 50A, Pulsed (Fig. 1)	T _j = 25°C	—	1.8	2.6	V
			T _j = 125°C	—	2.0	3.0	
V _{EC}	FWD forward voltage	-I _C = 50A, V _D = 15V, I _{CIN} = 0mA (Fig. 2)		—	2.5	3.5	V
t _{on}	Switching time	V _D = 15V, I _{CIN} = 0mA↔10mA V _{CC} = 300V, I _C = 50A T _j = 125°C Inductive Load (Upper-Lower Arm) (Fig. 3)		0.5	1.0	2.0	μs
t _{rr}				—	0.1	—	μs
t _{c(on)}				—	0.3	0.9	μs
t _{off}				—	3.0	4.0	μs
t _{c(off)}				—	1.0	2.0	μs
I _{CES}	Collector-emitter cutoff current	V _{CE} = V _{CES} , V _D = 15V (Fig. 4)	T _j = 25°C	—	—	1	mA
			T _j = 125°C	—	—	10	

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INSULATED PACKAGE
FLAT-BASE TYPE

CONTROL PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
I_D	Circuit current	$V_D = 15V$, $I_{CIN} = 0mA$	—	25	35	mA
		V_{N1-VNC}	—	5	10	
$I_{th(ON)}$	Input on threshold current	At : U_P-V_{UPC} , V_P-V_{VPC} , W_P-V_{WPC}	1	3	5	mA
$I_{th(OFF)}$	Input off threshold current	$U_N \cdot V_N \cdot W_N-V_{NC}$ terminals	1	3	5	
OC	Over current trip level	$-20^\circ C \leq T_j \leq 125^\circ C$, $V_D = 15V$ (Fig. 5, 6) (Lower Arm only)	65	91	—	A
SC	Short circuit trip level	$-20^\circ C \leq T_j \leq 125^\circ C$, $V_D = 15V$ (Fig. 5, 6) (Lower Arm only)	—	130	—	A
$t_{off(OC)}$	Over current delay time	$V_D = 15V$ (Fig. 5, 6)	—	10	—	μs
OT	Over temperature protection	Baseplate	Trip level	100	110	$^\circ C$
OTr		Temperature detection, $V_D = 15V$	Reset level	—	90	$^\circ C$
UV	Supply circuit under voltage protection	$-20^\circ C \leq T_j \leq 125^\circ C$ (Lower Arm only)	Trip level	11.5	12.0	V
UVr			Reset level	—	12.5	V
$I_{FO(H)}$	Fault output current	$V_D = 15V$, $V_{FO} = 15V$ (Note 2)	—	—	0.01	mA
$I_{FO(L)}$			—	10	15	
t_{FO}	Minimum fault output pulse width	$V_D = 15V$ (Note 2)	1.0	1.8	—	ms

Note 2 : Fault output is given only when the internal OC, SC, OT & UV protections schemes of lower arm device operate to protect it.

MECHANICAL RATINGS AND CHARACTERISTICS

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
—	Mounting torque	Mounting part screw : M4	0.98	1.18	1.47	N·m
—	Weight		—	80	—	g

RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
V_{CC}	Supply voltage	Applied across P-N terminals	0	300	400	V
V_D		Applied between : $V_{UP1-VUPC}$, $V_{VP1-VVPC}$ $V_{WP1-VWPC}$, V_{N1-VNC}	13.5	15.0	16.5	V
$I_{CIN(ON)}$	Input on current	At : U_P , V_P , W_P , U_N , V_N , W_N terminals	5	10	20	mA
$I_{CIN(OFF)}$	Input off current		0	—	1	
f_{PWM}	PWM input frequency	For IPM's each input signals, (Fig. 7)	—	—	8	kHz
t_{dead}	Arm shoot-through blocking time	For IPM's each input signals, (Fig. 7)	3.5	—	—	μs

PRECAUTIONS FOR TESTING

- Before applying any control supply voltage (V_D), the input signals should be turned on from its off state.
After this, the specified ON and OFF level setting for each input signal should be done.
- When performing "OC" and "SC" tests, the turn-off surge voltage spike at the corresponding protection operation should not be allowed to rise above V_{CES} rating of the device.
(These test should not be done by using a curve tracer or its equivalent.)

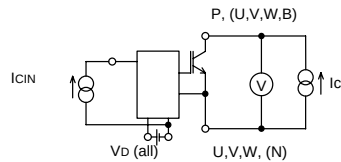


Fig.1 VCE(sat) Test

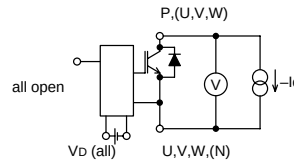


Fig.2 VEC Test

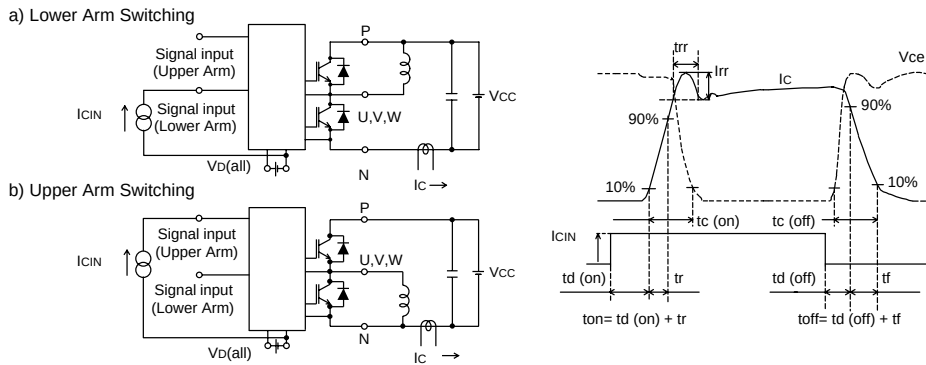


Fig. 3 Switching time Test circuit and waveform

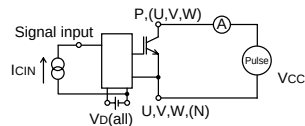


Fig.4 ICES Test

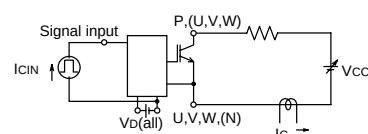


Fig. 5 OC and SC Test

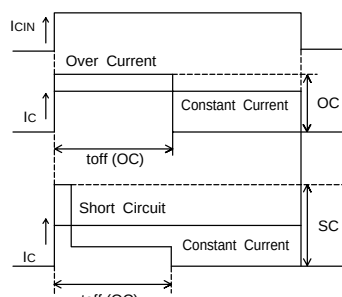


Fig. 6 OC and SC Test waveform

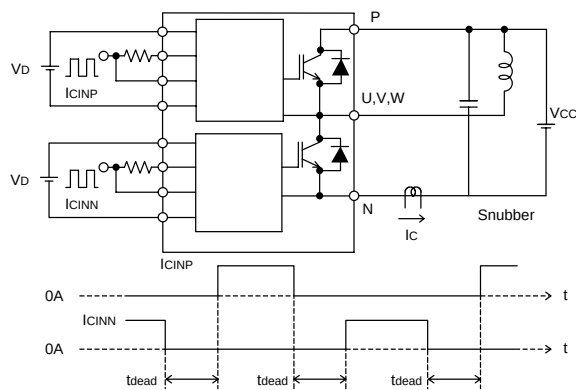
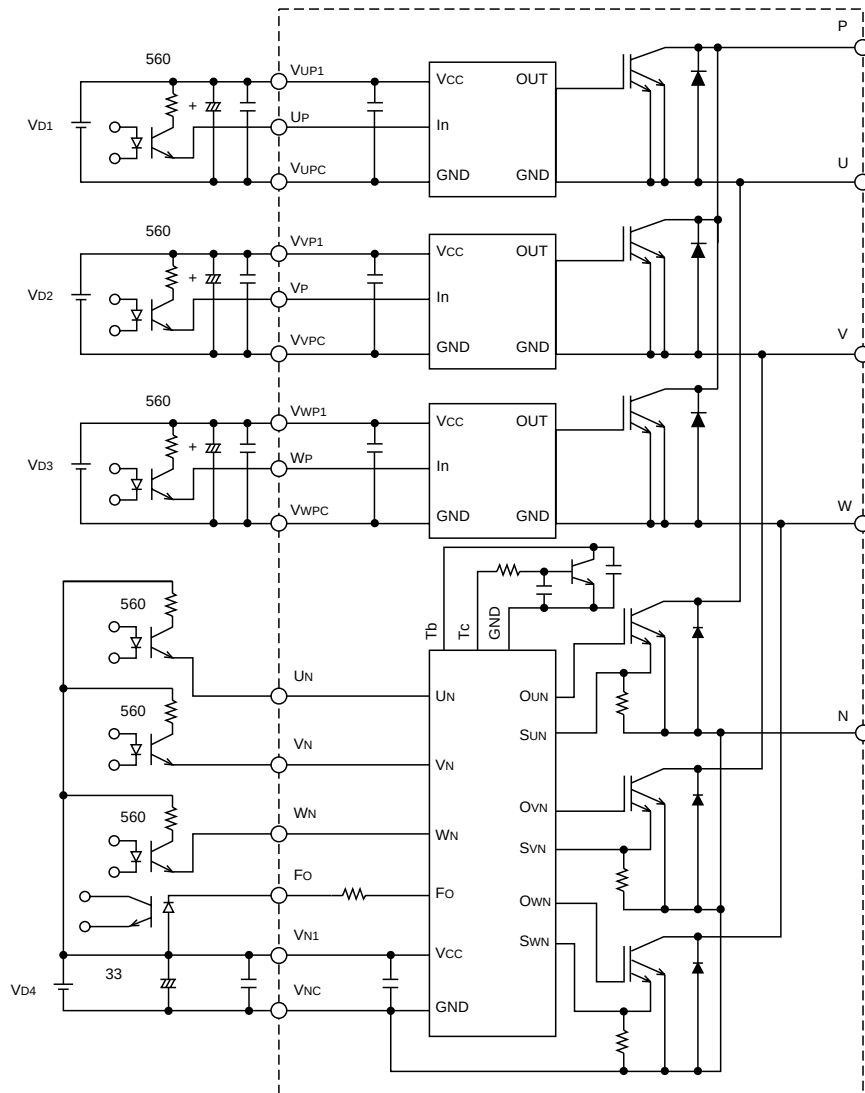


Fig. 7 Dead time measurement point example

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INSULATED PACKAGE
FLAT-BASE TYPE



NOTES FOR STABLE AND SAFE OPERATION ;

- Design the PCB pattern to minimize wiring length between opto-coupler and IPM's input terminal, and also to minimize the stray capacity between the input and output wirings of opto-coupler.
- Connect low impedance capacitor between the Vcc and GND terminal of each switching opto-coupler.
- Slow switching opto-coupler : CTR = 100%~200%
- Use 4 isolated control power supplies (V_D). Also, care should be taken to minimize the instantaneous voltage charge of the power supply.
- Make inductance of DC bus line as small as possible, and minimize surge voltage using snubber capacitor between P and N terminal.
- Use line noise filter capacitor (ex. 4.7nF) between each input AC line and ground to reject common-mode noise from AC line and improve noise immunity of the system.