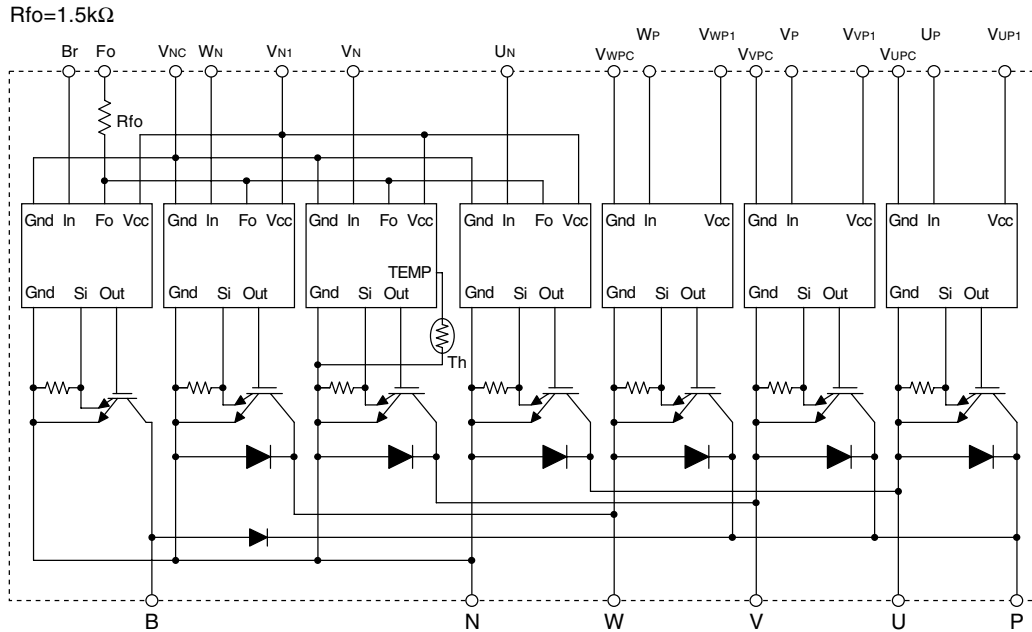


PM50RSE120**FLAT-BASE TYPE
INSULATED PACKAGE****INTERNAL FUNCTIONS BLOCK DIAGRAM****MAXIMUM RATINGS** ($T_j = 25^\circ\text{C}$, unless otherwise noted)**INVERTER PART**

Symbol	Parameter	Condition	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	$V_D = 15\text{V}$, $V_{CIN} = 15\text{V}$	1200	V
$\pm I_C$	Collector Current	$T_c = 25^\circ\text{C}$	50	A
$\pm I_{CP}$	Collector Current (Peak)	$T_c = 25^\circ\text{C}$	100	A
P_C	Collector Dissipation	$T_c = 25^\circ\text{C}$	328	W
T_j	Junction Temperature		$-20 \sim +150$	$^\circ\text{C}$

BRAKE PART

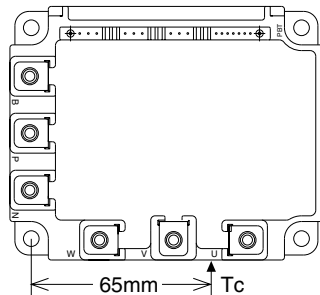
Symbol	Parameter	Condition	Ratings	Unit
V_{CES}	Collector-Emitter Voltage	$V_D = 15\text{V}$, $V_{CIN} = 15\text{V}$	1200	V
I_C	Collector Current	$T_c = 25^\circ\text{C}$	15	A
I_{CP}	Collector Current (Peak)	$T_c = 25^\circ\text{C}$	30	A
P_C	Collector Dissipation	$T_c = 25^\circ\text{C}$	201	W
$V_{R(DC)}$	FWDi Rated DC Reverse Voltage	$T_c = 25^\circ\text{C}$	1200	V
I_F	FWDi Forward Current	$T_c = 25^\circ\text{C}$	15	A
T_j	Junction Temperature		$-20 \sim +150$	$^\circ\text{C}$

CONTROL PART

Symbol	Parameter	Condition	Ratings	Unit
V_D	Supply Voltage	Applied between : $V_{UP1}-V_{UPC}$ $V_{VP1}-V_{VPC}$, $V_{WP1}-V_{WPC}$, $V_{N1}-V_{NC}$	20	V
V_{CIN}	Input Voltage	Applied between : U_P-V_{UPC} , V_P-V_{VPC} W_P-V_{WPC} , $U_N \cdot V_N \cdot W_N \cdot B_r-V_{NC}$	20	V
V_{FO}	Fault Output Supply Voltage	Applied between : $FO-V_{NC}$	20	V
I_{FO}	Fault Output Current	Sink current at FO terminal	20	mA

PM50RSE120**FLAT-BASE TYPE
INSULATED PACKAGE****TOTAL SYSTEM**

Symbol	Parameter	Condition	Ratings	Unit
VCC(prot)	Supply Voltage Protected by OC & SC	V _D = 13.5 ~ 16.5V, Inverter Part, T _j = 125°C Start	800	V
VCC(surge)	Supply Voltage (Surge)	Applied between : P-N, Surge value or without switching	1000	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 is as shown below. (Base plate depth 3mm)**THERMAL RESISTANCES**

Symbol	Parameter	Test Condition	Limits			Unit
			Min.	Typ.	Max.	
R _{th(j-c)Q}	Junction to case Thermal Resistances	Inverter IGBT part (per 1 element), (Note-1)	—	—	0.38	°C/W
R _{th(j-c)F}		Inverter FWDi part (per 1 element), (Note-1)	—	—	0.70	
R _{th(j-c)Q}		Brake IGBT part (Note-1)	—	—	0.62	
R _{th(j-c)F}		Brake FWDi part (Note-1)	—	—	1.33	
R _{th(j-c')Q}		Inverter IGBT part (per 1 element), (Note-2)	—	—	0.23	
R _{th(j-c')F}		Inverter FWDi part (per 1 element), (Note-2)	—	—	0.36	
R _{th(j-c')Q}		Brake IGBT part (Note-2)	—	—	0.40	
R _{th(j-c')F}		Brake FWDi part (Note-2)	—	—	0.77	
R _{th(c-f)}	Contact Thermal Resistance	Case to fin, Thermal grease applied (per 1 module)	—	—	0.027	

(Note-2) T_c measurement point is just under the chips.If you use this value, R_{th(f-a)} should be measured just under the chips.**ELECTRICAL CHARACTERISTICS** (T_j = 25°C, unless otherwise noted)**INVERTER PART**

Symbol	Parameter	Test Condition		Limits			Unit
				Min.	Typ.	Max.	
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _D = 15V, I _C = 50A	T _j = 25°C	—	2.4	3.2	V
		V _{CIN} = 0V, Pulsed (Fig. 1)	T _j = 125°C	—	2.1	2.8	
V _{EC}	FWDi Forward Voltage	-I _C = 50A, V _D = 15V, V _{CIN} = 15V (Fig. 2)		—	2.5	3.5	V
t _{on}	Switching Time	V _D = 15V, V _{CIN} = 15V↔0V V _{CC} = 600V, I _C = 50A T _j = 125°C Inductive Load (upper and lower arm) (Fig. 3)		0.5	1.0	2.5	μs
t _{rr}				—	0.15	0.3	
t _{c(on)}				—	0.4	1.0	
t _{off}				—	2.5	3.5	
t _{c(off)}				—	0.7	1.2	
I _{CES}	Collector-Emitter Cutoff Current	V _{CE} = V _{CES} , V _{CIN} = 15V (Fig. 4)	T _j = 25°C	—	—	1	mA
			T _j = 125°C	—	—	10	

PM50RSE120**FLAT-BASE TYPE
INSULATED PACKAGE****BRAKE PART**

Symbol	Parameter	Test Condition		Limits			Unit
				Min.	Typ.	Max.	
VCE(sat)	Collector-Emitter Saturation Voltage	V _D = 15V, I _C = 15A V _{CIN} = 0V, Pulsed (Fig. 1)	T _j = 25°C	—	2.5	3.3	V
		T _j = 125°C	—	2.2	3.2		
VFM	FWDi Forward Voltage	I _F = 15A (Fig. 2)		—	2.5	3.5	V
ICES	Collector-Emitter Cutoff Current	VCE = V _{CES} , V _{CIN} = 15V (Fig. 4)	T _j = 25°C	—	—	1	mA
			T _j = 125°C	—	—	10	

CONTROL PART

Symbol	Parameter	Test Condition		Limits			Unit
				Min.	Typ.	Max.	
ID	Circuit Current	VD = 15V, V _{CIN} = 15V	V _{N1} -V _N C	—	44	60	mA
			V _{XP1} -V _{XPC}	—	13	18	
V _{th(on)}	Input ON Threshold Voltage	Applied between : UP-VUPC, VP-VVPC, WP-VWPC UN • VN • WN • Br-VNC		1.2	1.5	1.8	V
V _{th(off)}	Input OFF Threshold Voltage			1.7	2.0	2.3	
OC	Over Current Trip Level	Inverter part VD = 15V (Fig. 5,6)	Tj = 25°C	93	157	—	A
			Tj = 125°C	59	—	—	
		Break part −20 ≤ Tj ≤ 125°C, VD = 15V (Fig. 5,6)	22	—	—		
SC	Short Circuit Trip Level	−20≤ Tj ≤ 125°C, VD = 15V (Fig. 5,6)	Inverter part	—	183	—	A
			Brake part	—	95	—	
t _{off(OC)}	Over Current Delay Time	VD = 15V (Fig. 5,6)		—	10	—	μs
OT	Over Temperature Protection	Base-plate	Trip level	111	118	125	°C
OT _r		Temperature detection, VD = 15V	Reset level	—	100	—	
UV	Supply Circuit Under-Voltage Protection	−20 ≤ Tj ≤ 125°C	Trip level	11.5	12.0	12.5	V
UV _r			Reset level	—	12.5	—	
I _{FO(H)}	Fault Output Current	VD = 15V, V _{FO} = 15V (Note-3)		—	—	0.01	mA
I _{FO(L)}				—	10	15	
t _{FO}	Minimum Fault Output Pulse Width	VD = 15V (Note-3)		1.0	1.8	—	ms

(Note-3) Fault output is given only when the internal OC, SC, OT & UV protection.

Fault output of OT protection operate by lower arm.

Fault output of OC, SC protection given pulse.

Fault output of OT, UV protection given pulse while over level.

MECHANICAL RATINGS AND CHARACTERISTICS

Symbol	Parameter	Test Condition	Limits			Unit
			Min.	Typ.	Max.	
—	Mounting torque	Main terminal screw : M5	2.5	3.0	3.5	N • m
—	Mounting torque	Mounting part screw : M5	2.5	3.0	3.5	N • m
—	Weight	—	—	560	—	g

RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Test Condition	Recommended value	Unit
V _{CC}	Supply Voltage	Applied across P-N terminals	≤ 800	V
V _D	Control Supply Voltage	Applied between : VUP1-VUPC, VVP1-VVPC VWP1-VWPC, VN1-VNC (Note-4)	15 ± 1.5	V
V _{CIN(on)}	Input ON Voltage	Applied between : UP-VUPC, VP-VVPC, WP-VWPC UN • VN • WN • Br-VNC	≤ 0.8	V
V _{CIN(off)}	Input OFF Voltage		≥ 4.0	
f _{PWM}	PWM Input Frequency	Using Application Circuit input signal of IPM, 3φ sinusoidal PWM VVVF inverter (Fig. 8)	≤ 20	kHz
t _{dead}	Arm Shoot-through Blocking Time	For IPM's each input signals (Fig. 7)	≥ 3.0	μs

(Note-4) Allowable Ripple rating of Control Voltage : dv/dt ≤ ±5V/μs, 2V_{p-p}

PM50RSE120

FLAT-BASE TYPE
INSULATED PACKAGE

PRECAUTIONS FOR TESTING

- Before applying any control supply voltage (V_D), the input terminals should be pulled up by resistors, etc. to their corresponding supply voltage and each input signal should be kept 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.)

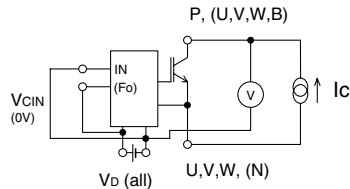


Fig. 1 $V_{CE(sat)}$ Test

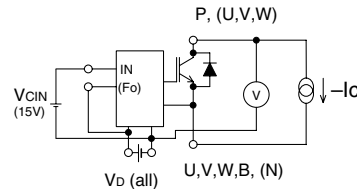
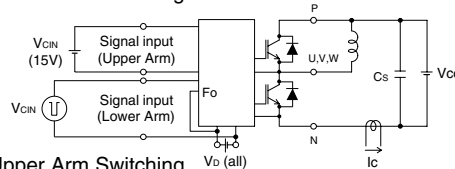


Fig. 2 V_{EC} , (V_{FM}) Test

a) Lower Arm Switching



b) Upper Arm Switching

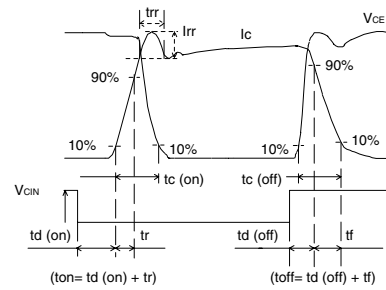
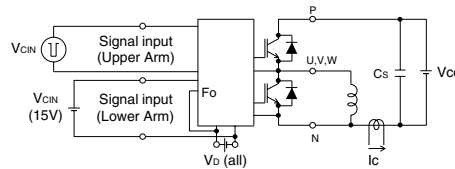


Fig. 3 Switching time Test circuit and waveform

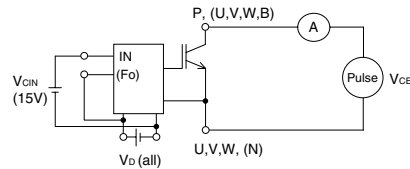


Fig. 4 I_{CES} Test

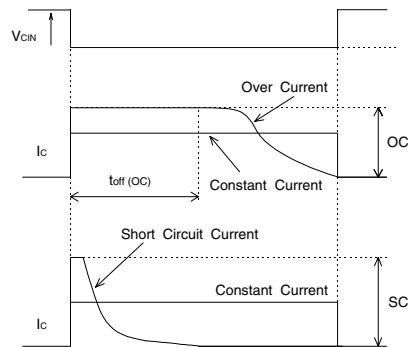


Fig. 6 OC and SC Test waveform

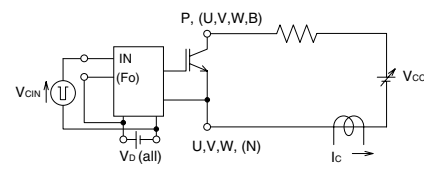


Fig. 5 OC and SC Test

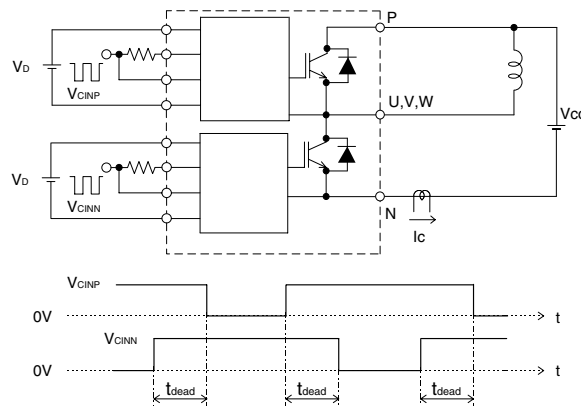


Fig. 7 Dead time measurement point example

