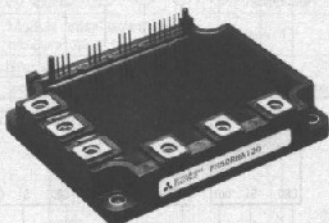


# PM50RHA120

FLAT-BASE TYPE  
INSULATED PACKAGE

PM50RHA120



- 3 $\phi$  50A, 1200V Current-sense IGBT type inverter
- Monolithic gate drive & protection logic
- Detection, protection & status indication circuits for over-current, short-circuit, over-temperature & under-voltage
- Acoustic noise-less 7.5kW class inverter application
- UL Recognized

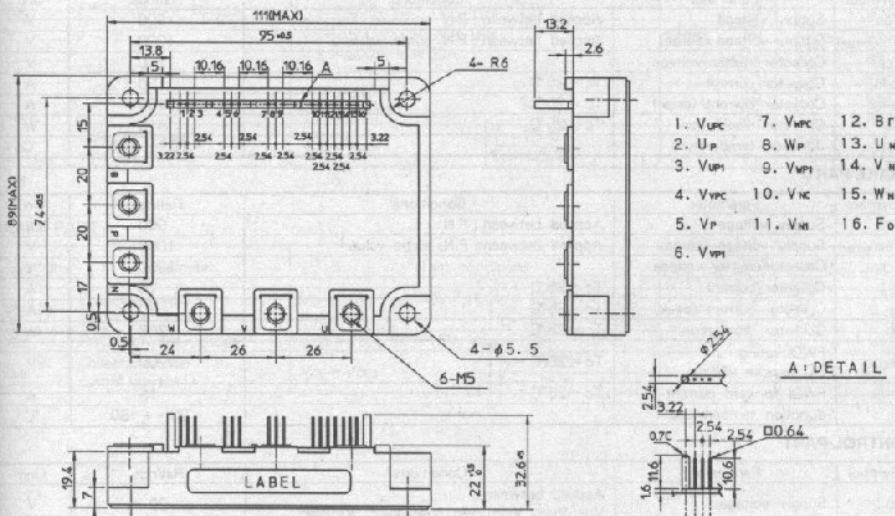
Yellow Card No. E80276 (N)  
File No. E80271

## APPLICATION

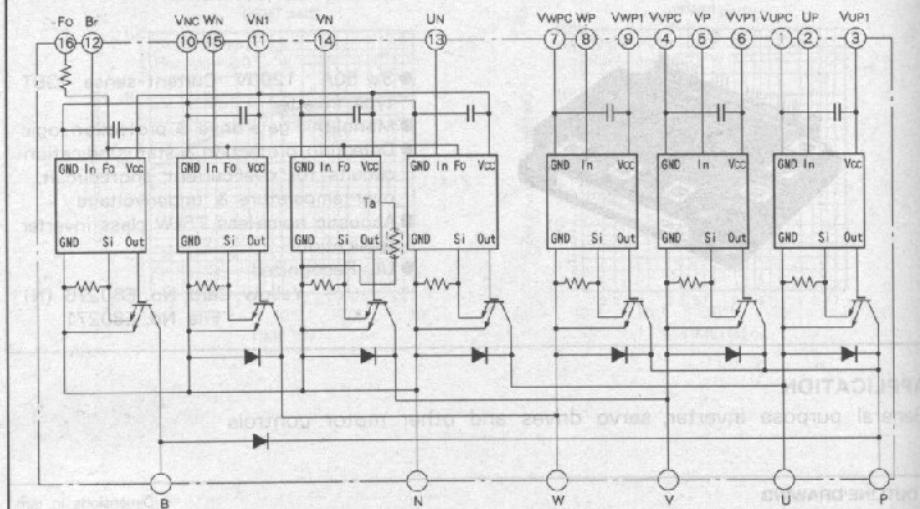
General purpose inverter, servo drives and other motor controls

## OUTLINE DRAWING

Dimensions in mm



## EQUIVALENT CIRCUIT DIAGRAM


 MAXIMUM RATINGS ( $T_j = 25^\circ\text{C}$ , unless otherwise noted)

## INVERTER PART

Symbol	Parameter	Conditions	Ratings	Unit
$V_{cc}$	Supply voltage	Applied between : P-N	900	V
$V_{cc(surge)}$	Supply voltage (surge)	Applied between : P-N, surge value	1000	V
$V_{CES}$	Collector-emitter voltage		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	$T_c = 25^\circ\text{C}$	416	W
$T_j$	Junction temperature		-20~+150	$^\circ\text{C}$

## BRAKE PART

Symbol	Parameter	Conditions	Ratings	Unit
$V_{cc}$	Supply voltage	Applied between : P-N	900	V
$V_{cc(surge)}$	Supply voltage (surge)	Applied between : P-N, surge value	1000	V
$V_{CES}$	Collector-emitter voltage		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	$T_c = 25^\circ\text{C}$	208	W
$V_{R(DC)}$	FWDi rating 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~+150	$^\circ\text{C}$

## CONTROL PART

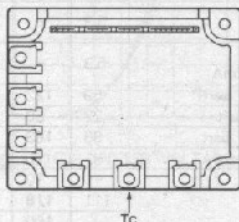
Symbol	Parameter	Conditions	Ratings	Unit
$V_D$	Supply voltage	Applied between : $V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{VN1}-V_{NC}$	20	V
$V_{CIN}$	input voltage	Applied between : $U_P-U_{PC}, V_P-V_{PC}, W_P-W_{PC}, U_N \cdot V_N \cdot W_N \cdot B_P-V_{NC}$	20	V
$V_{FO}$	Fault output supply voltage	Applied between : Fo-V <sub>NC</sub>	20	V
$I_{FO}$	Fault output current	Sink current of Fo terminal	20	mA

## PM50RHA120

FLAT-BASE TYPE  
INSULATED PACKAGE

## TOTAL SYSTEM

Symbol	Parameter	Conditions	Ratings	Unit
$V_{CC(Prot)}$	Supply voltage protected by OC & SC	$V_D = 13.5 \sim 16.5V$ Inverter part, $T_j = 125^\circ C$ start	800	V
$T_c$	Module case operating temperature	(Note 1)	-20 ~ +100	$^\circ C$
$T_{sto}$	Storage temperature	-	-40 ~ +125	$^\circ C$
$V_{iso}$	Isolation voltage	60Hz, sinusoidal, AC, 1min	2500	Vrms

Note 1.  $T_c$  measuring point is as shown belowELECTRICAL CHARACTERISTICS ( $T_j = 25^\circ C$ , unless otherwise noted)  
INVERTER PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_D = 15V, V_{CIN} = 0V$ Pulsed				V
			$I_c = 50A, T_j = 25^\circ C$	2.8	3.8	
$V_{FC}$	FWDI forward voltage	$I_c = 50A, V_D = 15V, V_{CIN} = 15V$	-	1.9	3.0	V
$t_{on}$	Switching time	$V_D = 15V, V_{CIN} = 0V \leftrightarrow 15V$ $V_{CC} = 600V, I_c = 50A$ $T_j = 125^\circ C$ (Per 1 arm) Inductive load	0.5	1.0	2.5	$\mu s$
$t_{rr}$			-	0.3	0.6	$\mu s$
$t_{e(on)}$			-	0.4	1.5	$\mu s$
$t_{off}$			-	2.5	3.8	$\mu s$
$t_{e(off)}$			-	0.8	1.4	$\mu s$
$I_{CES}$	Collector-emitter cutoff current	$V_{CE} = V_{CES}$				mA
			$T_j = 25^\circ C$	-	1	
			$T_j = 125^\circ C$	-	10	

## BRAKE PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_D = 15V, V_{CIN} = 0V$ Pulsed				V
			$I_c = 15A, T_j = 25^\circ C$	2.8	3.8	
$V_{FC}$	FWDI forward voltage	$I_c = 15A, V_D = 15V, V_{CIN} = 15V$	-	1.9	3.0	V
$I_{CES}$	Collector-emitter cutoff current	$V_{CE} = V_{CES}$				mA
			$T_j = 25^\circ C$	-	1	
			$T_j = 125^\circ C$	-	10	

## CONTROL PART

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
V <sub>D</sub>	Supply voltage	Applied between: V <sub>U-P1</sub> -V <sub>U-PC</sub> , V <sub>V-P1</sub> -V <sub>V-PC</sub> , V <sub>W-P1</sub> -V <sub>W-PC</sub> , V <sub>N1</sub> -V <sub>N-C</sub>	13.5	15	16.5	V
I <sub>C</sub>	Circuit current	V <sub>D</sub> = 15V, V <sub>CIN</sub> = 15V V <sub>N1</sub> -V <sub>N-C</sub> V <sub>X-P1</sub> -V <sub>X-PC</sub>	-	80	120	mA
V <sub>CIN(ON)</sub>	Input on threshold voltage	Applied between: U <sub>P</sub> -V <sub>U-PC</sub> , V <sub>P</sub> -V <sub>V-PC</sub> , W <sub>P</sub> -V <sub>W-PC</sub> , U <sub>N</sub> · V <sub>N</sub> · W <sub>N</sub> · B <sub>-V</sub> -V <sub>N-C</sub>	1.2	1.5	1.8	
V <sub>CIN(OFF)</sub>	Input off threshold voltage	U <sub>P</sub> -V <sub>U-PC</sub> , V <sub>P</sub> -V <sub>V-PC</sub> , W <sub>P</sub> -V <sub>W-PC</sub> , U <sub>N</sub> · V <sub>N</sub> · W <sub>N</sub> · B <sub>-V</sub> -V <sub>N-C</sub>	1.7	2.0	2.3	V
f <sub>PWM</sub>	PWM input frequency	3 φ sinusoidal	-	15	20	kHz
t <sub>dead</sub>	Arm shoot-through blocking time	For each pulse input U <sub>P</sub> -U <sub>N</sub> , V <sub>P</sub> -V <sub>N</sub> , W <sub>P</sub> -W <sub>N</sub> Using application circuit Oto coupler's input signal I <sub>F</sub> = 12mA	3.3	-	-	μs
OC	Over current trip level	- 20°C ≤ T <sub>J</sub> ≤ 125°C V <sub>D</sub> = 15V	59	122	-	
SC	Short circuit trip level	- 20°C ≤ T <sub>J</sub> ≤ 125°C V <sub>D</sub> = 15V	88	183	-	A
t <sub>off(oc)</sub>	Over current delay time	V <sub>D</sub> = 15V	-	10	-	
OT	Over temperature	Trip level	111	118	125	°C
OTr	protection	Reset level	-	100	-	°C
UV	Supply circuit under	Trip level	11.5	12.0	12.5	V
UVr	voltage protection	Reset level	-	12.5	-	V
I <sub>FO(ON)</sub>	Fault output current	V <sub>D</sub> = 15V, V <sub>FO</sub> = 15V	-	-	0.01	mA
I <sub>FO(L)</sub>	(Note 2)		-	10	15	mA
t <sub>FO</sub>	Minimum fault output pulse width (Note 2)	V <sub>D</sub> = 15V	1.0	2.0	-	ms

Note 2. Fault output is given only when the internal OC, SC, OT & UV protections schemes of any lower arm device operate to protect the device. For each upper arm device, the internal OC, SC & UV protection schemes are provided to protect the device but, no fault output is given.

## THERMAL RESISTANCES

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
R <sub>th(j-c)</sub>	Junction-to-case thermal resistances	Inverter IGBT part, per 1/6 module	-	-	0.3	°C/W
R <sub>th(j-f)</sub>		Inverter FWDi part, per 1/6 module	-	-	1.0	°C/W
R <sub>th(j-c)</sub>		Brake IGBT	-	-	0.6	°C/W
R <sub>th(j-f)</sub>		Brake FWDi	-	-	2.0	°C/W
R <sub>th(c-s)</sub>	Contact thermal resistance	Thermal grease applied, per 1/6 module	-	-	0.19	°C/W

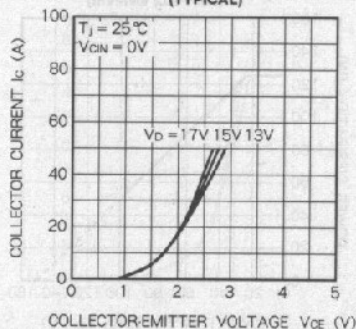
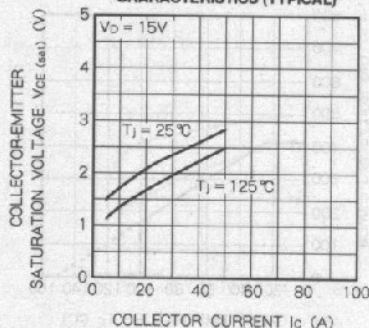
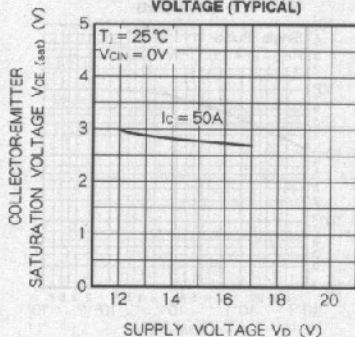
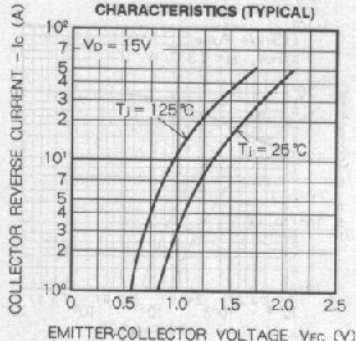
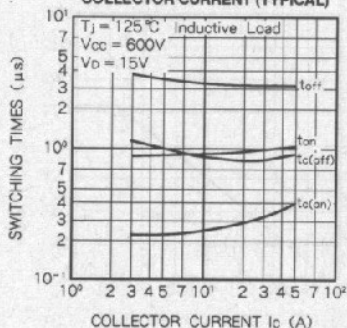
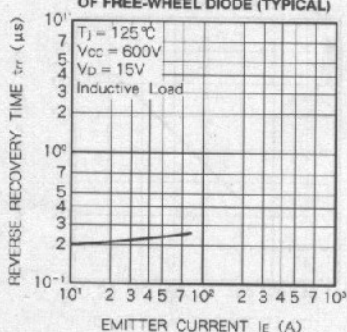
## MECHANICAL RATINGS AND CHARACTERISTICS

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
-	Mounting torque	Mounting part screw: M5	1.47	1.67	1.96	N · m
-	Mounting torque	Main terminals part screw: M5	15	17	20	kg · cm
-	Weight	-	1.47	1.67	1.96	N · m
-	Weight	-	15	17	20	kg · cm
-	Weight	-	-	550	-	g

## RECOMMENDED CONDITIONS FOR USE

Symbol	Parameter	Test conditions	Value			Unit
			Min	Typ	Max	
V <sub>CC</sub>	Supply voltage	Applied across P-N terminals	0	800	800	V
V <sub>D</sub>		Applied between: V <sub>U-P1</sub> -V <sub>U-PC</sub> , V <sub>V-P1</sub> -V <sub>V-PC</sub> , V <sub>W-P1</sub> -V <sub>W-PC</sub> , V <sub>N1</sub> -V <sub>N-C</sub>	13.5	15	16.5	V
V <sub>CIN(ON)</sub>	Input on voltage	Applied between: U <sub>P</sub> -V <sub>U-PC</sub> , V <sub>P</sub> -V <sub>V-PC</sub> , W <sub>P</sub> -V <sub>W-PC</sub> , U <sub>N</sub> · V <sub>N</sub> · W <sub>N</sub> · B <sub>-V</sub> -V <sub>N-C</sub>	0	-	0.8	V
V <sub>CIN(OFF)</sub>	Input off voltage	U <sub>P</sub> -V <sub>U-PC</sub> , V <sub>P</sub> -V <sub>V-PC</sub> , W <sub>P</sub> -V <sub>W-PC</sub> , U <sub>N</sub> · V <sub>N</sub> · W <sub>N</sub> · B <sub>-V</sub> -V <sub>N-C</sub>	12	-	V <sub>D</sub>	V
f <sub>PWM</sub>	PWM Input frequency	Using application circuit	5	15	20	kHz
t <sub>dead</sub>	Arm shoot-through blocking time	Using application circuit oto-coupler's input signal	5.3	-	-	μs

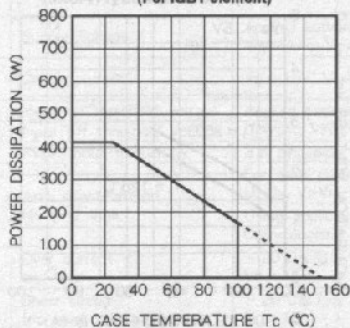
## PERFORMANCE CURVES (INVERTER PART)

OUTPUT CHARACTERISTICS  
(TYPICAL)SATURATION VOLTAGE  
CHARACTERISTICS (TYPICAL)COLLECTOR-EMITTER SATURATION  
VOLTAGE (TYPICAL)FREE-WHEEL DIODE FORWARD  
CHARACTERISTICS (TYPICAL)SWITCHING TIME VS.  
COLLECTOR CURRENT (TYPICAL)REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE (TYPICAL)

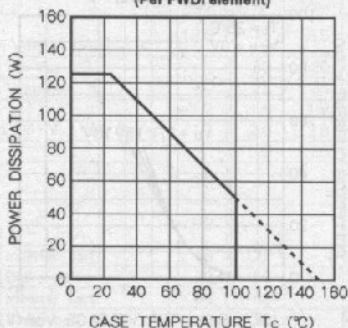


(INVERTER PART)

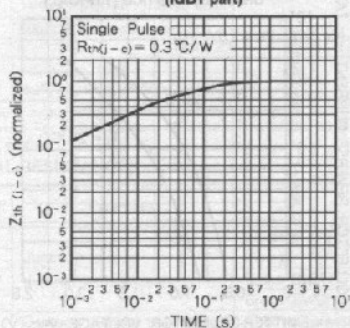
POWER DISSIPATION DERATING CURVE  
(Per IGBT element)



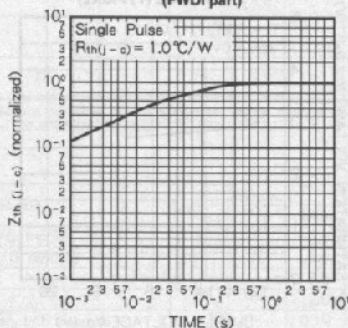
POWER DISSIPATION DERATING CURVE  
(Per FWDI element)



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT part)

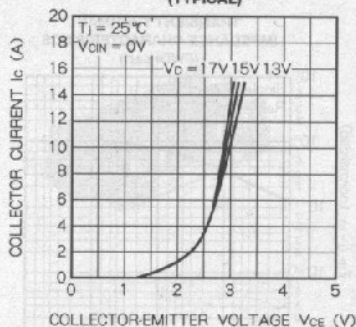


TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWDI part)

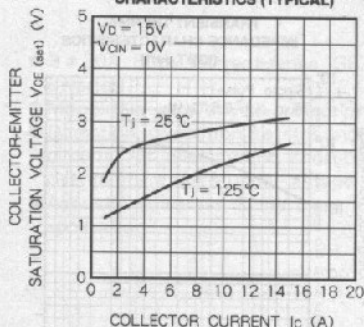


PERFORMANCE CURVES (BRAKE PART)

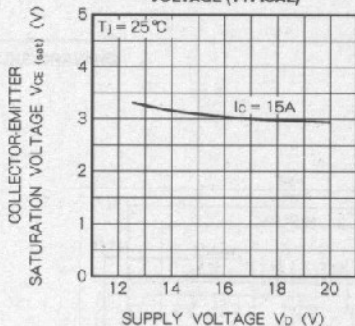
OUTPUT CHARACTERISTICS (TYPICAL)



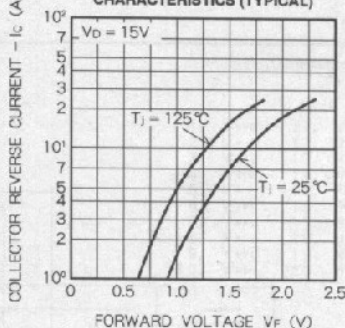
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



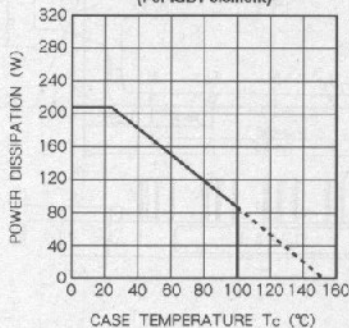
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



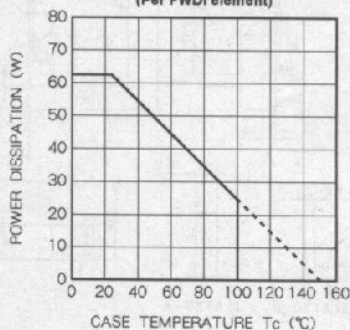
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



POWER DISSIPATION DERATING CURVE (Per IGBT element)



POWER DISSIPATION DERATING CURVE (Per FWDI element)



## PM50RHA120

FLAT-BASE TYPE  
INSULATED PACKAGE

## (BRAKE PART)

