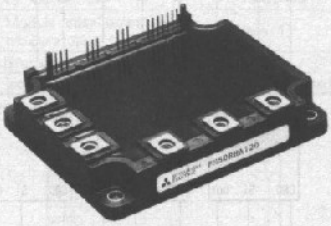
PM50RHA120

FLAT-BASE TYPE
INSULATED PACKAGE

PM50RHA120



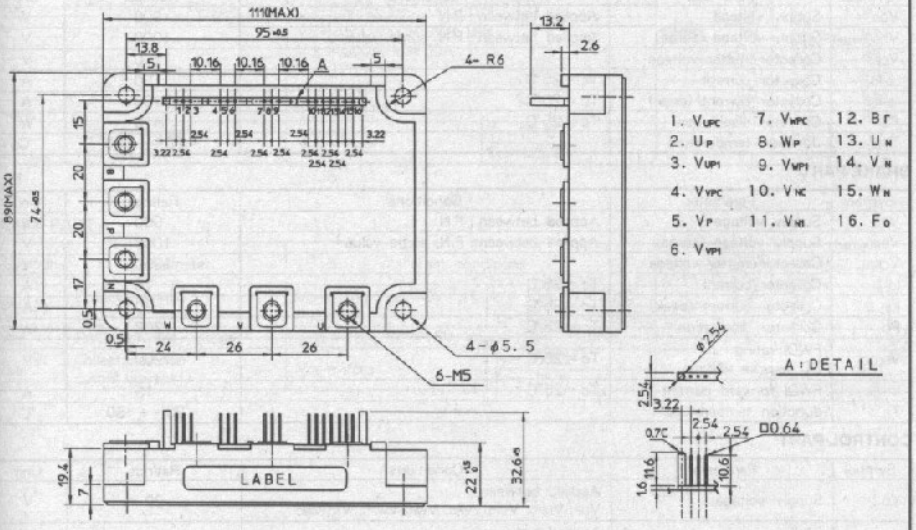
- 3ϕ 50A, 1200V Current-sense IGBT type inverter
- Monolithic gate drive & protection logic
- Detection, protection & statusindication circuits for over-current, short-circuit, over-temperature & under-voltage
- Acoustic noise-less 7.5kW class inverter application
- UL Recognized
  Yellow Card No. E80276 (N)
  File No. E80271

APPLICATION

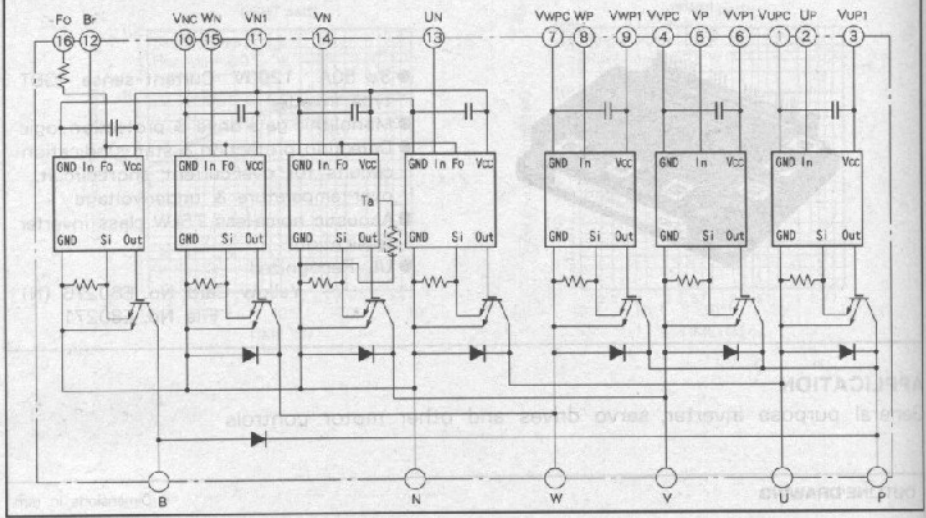
General purpose inverter, servo drives and other motor controls

OUTLINE DRAWING

Dimensions in mm



EQUIVALENT CIRCUIT DIAGRAM



MAXIMUM RATINGS (T_j = 25°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
± 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	416	W
T_j	Junction temperature		− 20~ + 150	°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°C	15	A
I_{CP}	Collector current (peak)	T_C = 25°C	30	A
P_C	Collector dissipation	T_C = 25°C	208	W
$V_{R(DC)}$	FWDi rating DC reverse voltage	T_C = 25°C	1200	V
I_F	FWDi forward current	T_C = 25°C	15	A
T_j	Junction temperature		− 20~ + 150	°C

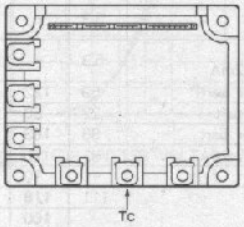
CONTROL PART

Symbol	Parameter	Conditions	Ratings	Unit
V_D	Supply voltage	Applied between : V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC}	20	V
V_{CIN}	Input voltage	Applied between : U_P-U_{PC}, V_P-V_{PC}, W_P-W_{PC}, U_N · V_N · W_N · 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 of Fo terminal	20	mA

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	800	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, AC, 1min	2500	Vrms

Note 1. TC measuring point is as shown below



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

INVERTER PART

Symbol	Parameter	Test conditions		Limits Min	Limits Typ	Limits Max	Unit
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_D = 15V, V_{CIN} = 0V, Pulsed	I_C = 50A, T_j = 25°C	−	2.8	3.8	V
			I_C = 50A, T_j = 125°C	−	2.5	3.5	
V_{EC}	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↔15V V_{CC} = 600V, I_C = 50A T_j = 125°C (Per 1 arm) Inductive load		0.5	1.0	2.5	μs
t_{rr}				−	0.3	0.6	μs
$t_{c(on)}$				−	0.4	1.5	μs
t_{off}				−	2.5	3.8	μs
$t_{c(off)}$				−	0.8	1.4	μs
I_{CES}	Collector-emitter cutoff current	V_{CE} = V_{CES}	T_j = 25°C	−	−	1	mA
			T_j = 125°C	−	−	10	

BRAKE PART

Symbol	Parameter	Test conditions		Limits Min	Limits Typ	Limits Max	Unit
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_D = 15V, V_{CIN} = 0V, Pulsed	I_C = 15A, T_j = 25°C	−	2.8	3.8	V
			I_C = 15A, T_j = 125°C	−	2.5	3.5	
V_{EC}	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}	T_j = 25°C	−	−	1	mA
			T_j = 125°C	−	−	10	

CONTROL PART

Symbol	Parameter	Test conditions		Limits Min	Limits Typ	Limits Max	Unit
V_D	Supply voltage	Applied between : V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC}		13.5	15	16.5	V
I_D	Circuit current	V_D = 15V, V_{DIN} = 15V	V_{N1}-V_{NC}	–	80	120	mA
			V_{XP1}-V_{XPC}	–	25	35	
$V_{DIN(ON)}$	Input on threshold voltage	Applied between : U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}, U_N · V_N · W_N · B_R-V_{NC}		1.2	1.5	1.8	V
$V_{DIN(OFF)}$	Input off threshold voltage			1.7	2.0	2.3	V
f_{PWM}	PWM input frequency	3 ϕ sinusoidal		–	15	20	kHz
t_{dead}	Arm shoot-through blocking time	For each pulse input U_P-U_N, V_P-V_N, W_P-W_N		3.3	–	–	µs
		Using application circuit Opto-coupler's input signal I_F = 12mA		5.3	–	–	
OC	Over current trip level	– 20℃≤ T_j ≤ 125℃ V_D = 15V	Inverter part	59	122	–	A
			Brake part	22	50	–	
SC	Short circuit trip level	– 20℃≤ T_j ≤ 125℃ V_D = 15V	Inverter part	88	183	–	A
			Brake part	–	95	–	
$t_{off(oc)}$	Over current delay time	V_D = 15V		–	10	–	µs
OT	Over temperature protection	Trip level	Base-plate Temperature detection	111	118	125	℃
OTr		Reset level		–	100	–	℃
UV	Supply circuit under voltage protection	Trip level		11.5	12.0	12.5	V
UVr		Reset level		–	12.5	–	V
$I_{FO(H)}$	Fault output current (Note 2)	V_D = 15V, V_{FO} = 15V		–	–	0.01	mA
$I_{FO(L)}$				–	10	15	mA
t_{FO}	Minimum fault output pulse width (Note 2)	V_D = 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 Min	Limits Typ	Limits Max	Unit
$R_{th(j-c)Q}$	Junction-to-case thermal resistances	Inverter IGBT part, per 1/6 module	–	–	0.3	℃/W
$R_{th(j-c)F}$		Inverter FWDi part, per 1/6 module	–	–	1.0	℃/W
$R_{th(j-c)Q}$		Brake IGBT	–	–	0.6	℃/W
$R_{th(j-c)F}$		Brake FWDi	–	–	2.0	℃/W
$R_{th(c-f)}$	Contact thermal resistance	Thermal grease applied, per 1/6 module	–	–	0.19	℃/W

MECHANICAL RATINGS AND CHARACTERISTICS

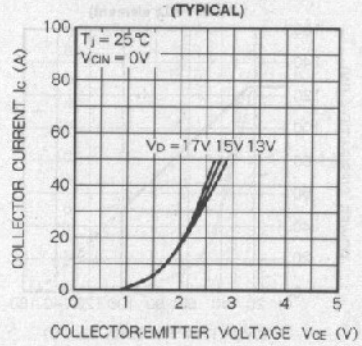
Symbol	Parameter	Test conditions	Limits Min	Limits Typ	Limits Max	Unit
–	Mounting torque	Mounting part screw : M5	1.47	1.67	1.96	N · m
			15	17	20	kg · cm
–	Mounting torque	Main terminals part screw : M5	1.47	1.67	1.96	N · m
			15	17	20	kg · cm
–	Weight	–	–	550	–	g

RECOMMENDED CONDITIONS FOR USE

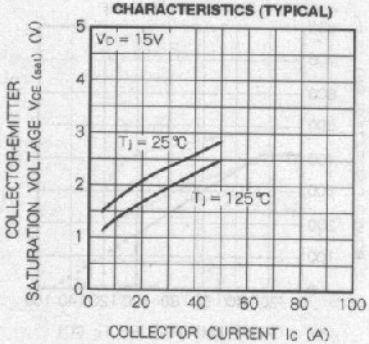
Symbol	Parameter	Test conditions	Value Min	Value Typ	Value Max	Unit
V_{CC}	Supply voltage	Applied across P-N terminals	0	600	600	V
V_D		Applied between : V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC}	13.5	15	16.5	V
$V_{DIN(ON)}$	Input on voltage	Applied between : U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}, U_N, V_N, W_N, B_R-V_{NC}	0	–	0.8	V
$V_{DIN(OFF)}$	Input off voltage		12	–	V_D	V
f_{PWM}	PWM input frequency	Using application circuit	5	15	20	kHz
t_{dead}	Arm shoot-through blocking time	Using application circuit opto-coupler's input signal	5.3	–	–	µs

PERFORMANCE CURVES (INVETER PART)

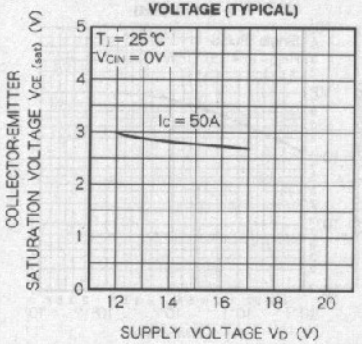
OUTPUT CHARACTERISTICS (TYPICAL)



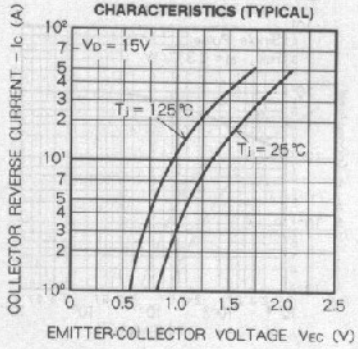
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



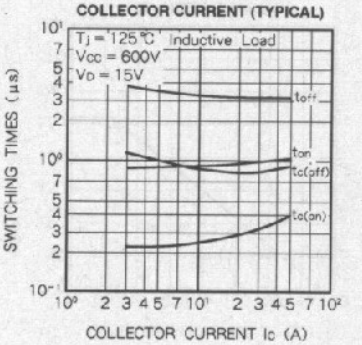
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



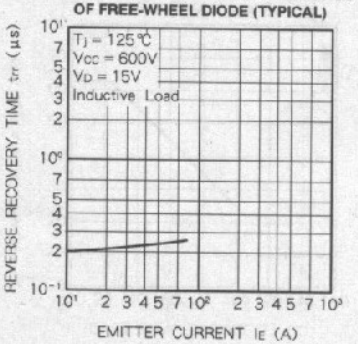
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)

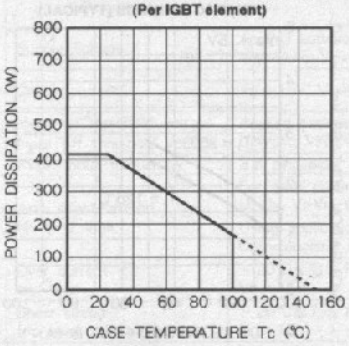


REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)

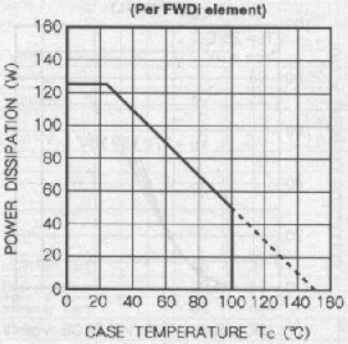


(INVERTER PART)

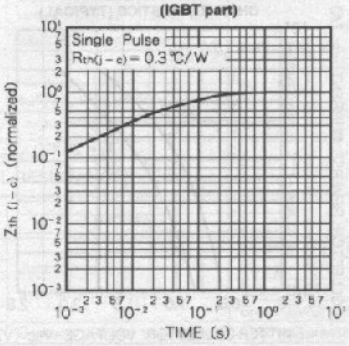
POWER DISSIPATION DERATING CURVE
(Per IGBT element)



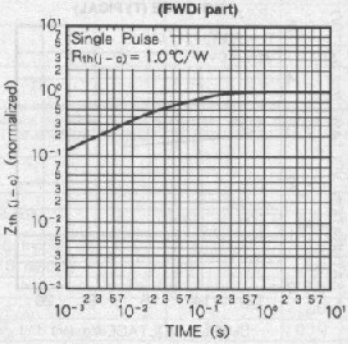
POWER DISSIPATION DERATING CURVE
(Per FWDi element)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(IGBT part)

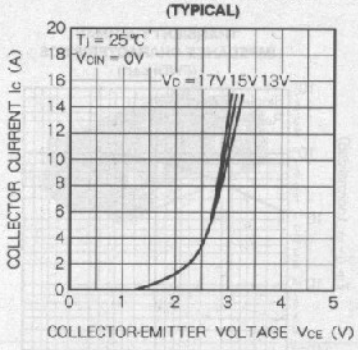


TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(FWDi part)

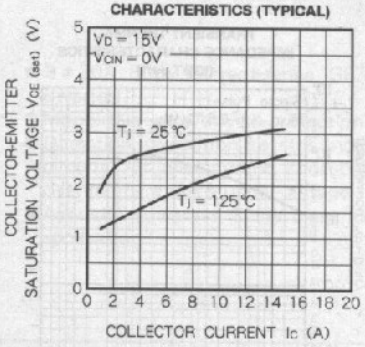


PERFORMANCE CURVES (BRAKE PART)

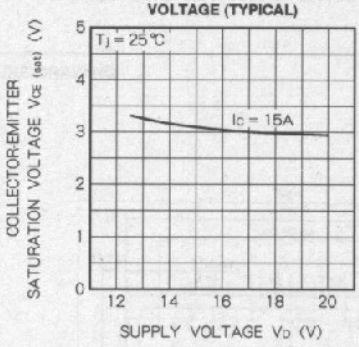
OUTPUT CHARACTERISTICS (TYPICAL)



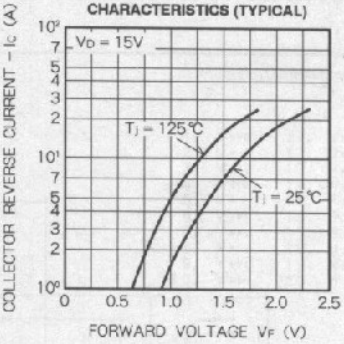
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



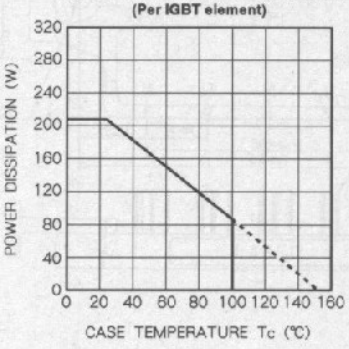
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



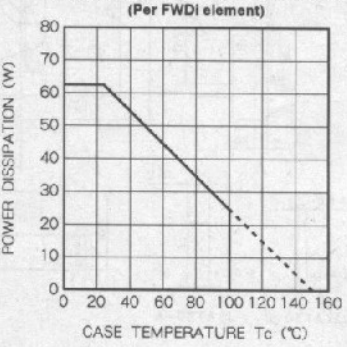
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



POWER DISSIPATION DERATING CURVE (Per IGBT element)

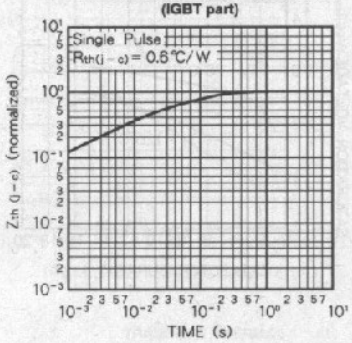


POWER DISSIPATION DERATING CURVE (Per FWDi element)



(BRAKE PART)

TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT part)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi part)