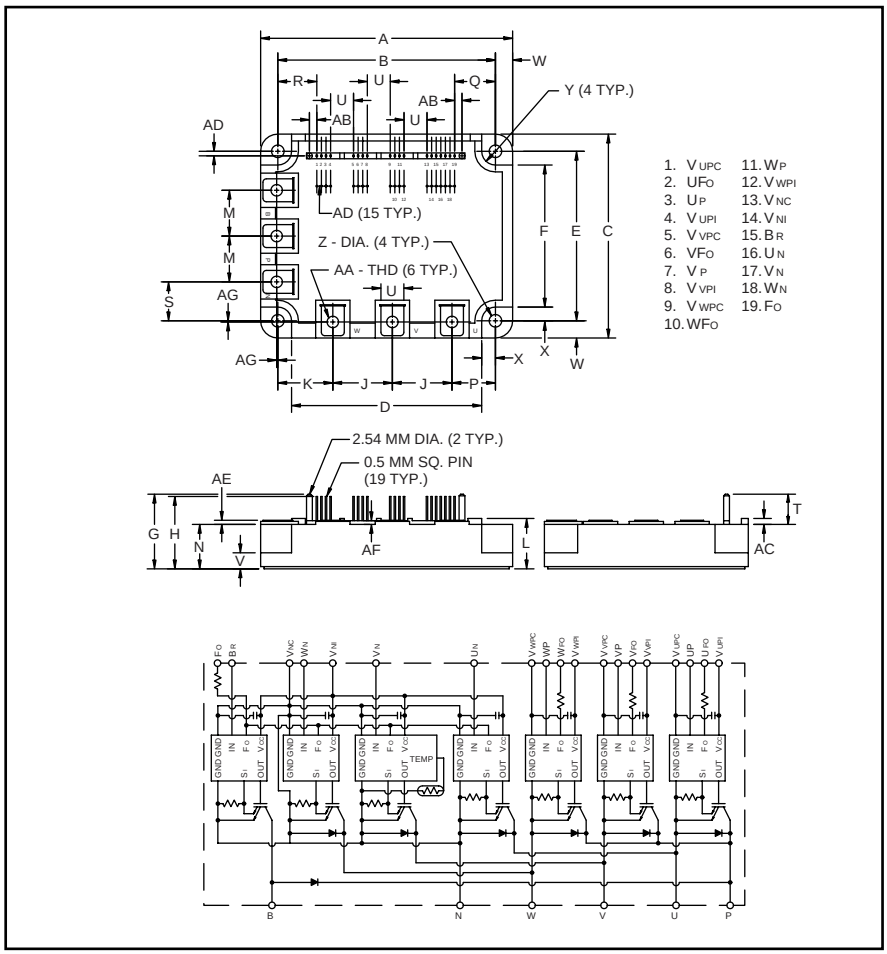
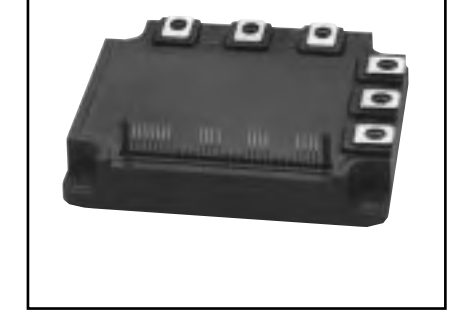
MITSUBISHI INTELLIGENT POWER MODULES

PM50RSA120

FLAT-BASE TYPE
INSULATED PACKAGE



Outline Drawing and Circuit Diagram



Description:
Mitsubishi Intelligent Power Modules are isolated base modules designed for power switching applications operating at frequencies to 20kHz. Built-in control circuits provide optimum gate drive and protection for the IGBT and free-wheel diode power devices.

Features:
- ☐ Complete Output Power Circuit
- ☐ Gate Drive Circuit
- ☐ Protection Logic
  - – Short Circuit
  - – Over Current
  - – Over Temperature
  - – Under Voltage

Applications:
- ☐ Inverters
- ☐ UPS
- ☐ Motion/Servo Control
- ☐ Power Supplies

Ordering Information:
Example: Select the complete part number from the table below -i.e. PM50RSA120 is a 1200V, 50 Ampere Intelligent Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 10)
PM	50	120

Dimensions	Inches	Millimeters
A	4.33±0.04	110.0±1.0
B	3.74±0.02	95.0±0.5
C	3.50±0.04	89.0±1.0
D	3.27	83.0
E	2.91±0.02	74.0±0.5
F	2.44	62.0
G	1.28	32.6
H	1.24	31.6
J	1.02	26.0
K	0.94	24.0
L	0.87 +0.06/-022.0	+1.5/-0.0
M	0.79	20.0
N	0.76	19.4
P	0.75	19.0
Q	0.708	17.98
R	0.670	17.02

Dimensions	Inches	Millimeters
S	0.67	17.0
T	0.52	13.2
U	0.39	10.0
V	0.28	7.0
W	0.30	7.5
X	0.24	6.0
Y	0.24 Rad.	Rad. 6.0
Z	0.22 Dia.	Dia. 5.5
AA	Metric M5	M5
AB	0.127	3.22
AC	0.10	2.6
AD	0.08	2.0
AE	0.07	1.8
AF	0.06	1.6
AG	0.02±0.01	0.5±0.3

MITSUBISHI ELECTRIC

Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

	Symbol	Ratings	Units
Power Device Junction Temperature	T_j	-20 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Case Operating Temperature	T_C	-20 to 100	°C
Mounting Torque, M5 Mounting Screws	—	1.47 ~ 1.96	N · m
Mounting Torque, M5 Main Terminal Screw	—	1.47 ~ 1.96	N · m
Module Weight (Typical)	—	550	Grams
Supply Voltage Protected by OC and SC (V_D = 13.5 - 16.5V, Inverter Part, T_j = 125°C)	$V_{CC(prot.)}$	800	Volts
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	V_{RMS}	2500	Volts

Control Sector

Supply Voltage (Applied between V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC})	V_D	20	Volts
Input 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})	V_{CIN}	20	Volts
Fault Output Supply Voltage Applied between (U_{FO}-V_{UPC}, V_{FO}-V_{VPC}, W_{FO}-V_{WPC}, F_O-V_{NC})	V_{FO}	20	Volts
Fault Output Current (Sink Current at U_{FO}, V_{FO}, W_{FO} and F_O Terminal)	I_{FO}	20	mA

IGBT Inverter Sector

Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	1200	Volts
Collector Current, (T_C = 25°C)	I_C	50	Amperes
Peak Collector Current, (T_C = 25°C)	I_{CP}	100	Amperes
Supply Voltage (Applied between P - N)	V_{CC}	900	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{CC(surge)}$	1000	Volts
Collector Dissipation	P_C	347	Watts

Brake Sector

Collector-Emitter Voltage	V_{CES}	1200	Volts
Collector Current, (T_C = 25°C)	I_C	15	Amperes
Peak Collector Current, (T_C = 25°C)	I_{CP}	30	Amperes
Supply Voltage (Applied between P - N)	V_{CC}	900	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{CC(surge)}$	1000	Volts
Collector Dissipation	P_C	138	Watts
Diode Forward Current	I_F	15	Amperes
Diode DC Reverse Voltage	$V_{R(DC)}$	1200	Volts

Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Over Current Trip Level Inverter Part	OC	-20°C ≤ T ≤ 125°C, V_D = 15V	59	112	—	Amperes
Over Current Trip Level Brake Part			22	50	—	Amperes
Short Circuit Trip Level Inverter Part	SC	-20°C ≤ T ≤ 125°C, V_D = 15V	—	183	—	Amperes
Short Circuit Trip Level Brake Part			—	95	—	Amperes
Over Current Delay Time	$t_{off(OC)}$	V_D = 15V	—	10	—	µs
Over Temperature Protection	OT	Trip Level	111	118	125	°C
	OT_r	Reset Level	—	100	—	°C
Supply Circuit Under Voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
	UV_r	Reset Level	—	12.5	—	Volts
Supply Voltage	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	Volts
Circuit Current	I_D	V_D = 15V, V_{CIN} = 15V, V_{N1}-V_{NC}	—	44	60	mA
		V_D = 15V, V_{CIN} = 15V, V_{XP1}-V_{XPC}	—	13	18	mA
Input ON Threshold Voltage	$V_{th(on)}$	Applied between	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{th(off)}$	U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}, $U_N \cdot V_N \cdot W_N \cdot B_r$-$V_{NC}$	1.7	2.0	2.3	Volts
PWM Input Frequency	f_{PWM}	3-ϕ Sinusoidal	—	15	20	kHz
Fault Output Current	$I_{FO(H)}$	V_D = 15V, V_{FO} = 15V	—	—	0.01	mA
	$I_{FO(L)}$	V_D = 15V, V_{FO} = 15V	—	10	15	mA
Minimum Fault Output Pulse Width	t_{FO}	V_D = 15V	1.0	1.8	—	ms

Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, T_j = 25°C	—	—	1.0	mA
		$V_{CE} = V_{CES}$, T_j = 125°C	—	—	10	mA
Emitter-Collector Voltage	V_{EC}	$-I_C$ = 50A, V_D = 15V, V_{CIN} = 5V	—	2.5	3.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 50A	—	2.5	3.5	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 50A, T_j = 125°C	—	2.2	3.2	Volts
Inductive Load Switching Times	t_{on}	V_D = 15V, V_{CIN} = 0 ↔ 15V, V_{CC} = 600V, I_C = 50A, T_j = 125°C	0.5	1.0	2.5	µs
	t_{rr}		—	0.15	0.3	µs
	$t_{C(on)}$		—	0.4	1.0	µs
	t_{off}		—	2.0	3.0	µs
	$t_{C(off)}$		—	0.7	1.2	µs
Brake Sector						
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 15A, T_j = 25°C	—	2.8	3.8	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 15A, T_j = 125°C	—	2.2	3.2	Volts
Diode Forward Voltage	V_{FM}	$-I_C$ = 15A, V_D = 15V, V_{CIN} = 5V	—	2.5	3.5	Volts
Collector Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, T_j = 25°C	—	—	1	mA
		$V_{CE} = V_{CES}$, T_j = 125°C	—	—	10	mA

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	Each Inverter IGBT	—	—	0.36	°C/Watt
	$R_{th(j-c)F}$	Each Inverter FWDi	—	—	1.0	°C/Watt
	$R_{th(c-f)Q}$	Each Brake IGBT	—	—	0.9	°C/Watt
	$R_{th(c-f)F}$	Each Brake FWDi	—	—	2.0	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.027	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	0 ~ 800	Volts
	V_D	Applied between V_{UP1}-V_{UPC}, V_{N1}-V_{NC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}	15 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between U_P-V_{UPC}, V_P-V_{VPC}, W_P-V_{WPC}, $U_N \cdot V_N \cdot W_N \cdot B_r$-$V_{NC}$	0 ~ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$		4.0 ~ V_D	Volts
PWM Input Frequency	f_{PWM}	Using Application Circuit	5 ~ 20	kHz
Minimum Dead Time	t_{dead}	Input Signal	≥ 3	µs