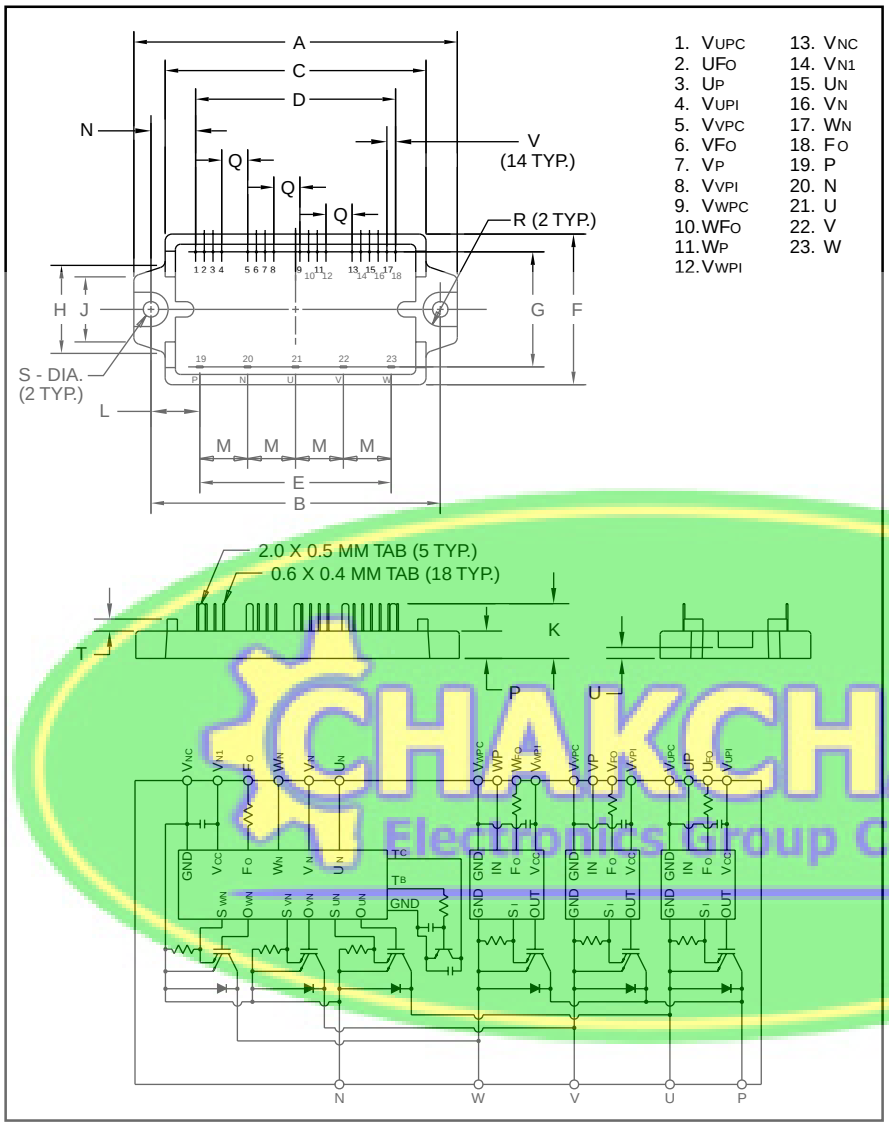
MITSUBISHI INTELLIGENT POWER MODULES

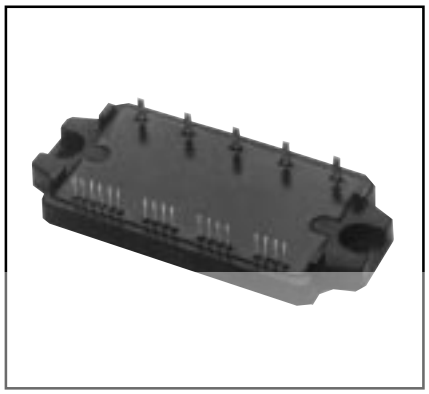
PM20CSJ060

FLAT-BASE TYPE
INSULATED PACKAGE



1. V_{UPC}
2. UF_O
3. U_P
4. V_{UPI}
5. V_{VPC}
6. VF_O
7. V_P
8. V_{VPI}
9. V_{WPC}
10. WF_O
11. W_P
12. V_{WPI}
13. V_{NC}
14. V_{N1}
15. U_N
16. V_N
17. W_N
18. F_O
19. P
20. N
21. U
22. V
23. W

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. PM20CSJ060 is a 600V, 20 Ampere Intelligent Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 10)
PM	20	60

Dimensions	Inches	Millimeters
A	3.72±0.04	94.5±1.0
B	3.33±0.02	84.5±0.5
C	2.99	76.0
D	2.300±0.02	58.42±0.5
E	2.20±0.02	56.0±0.5
F	1.73±0.04	44.0±1.0
G	1.32±0.03	33.6±0.8
H	1.01	25.7
J	0.75	19.0
K	0.71±0.04	18.0±1.0

Dimensions	Inches	Millimeters
L	0.561	14.25
M	0.55±0.01	14.0±0.25
N	0.513	13.04
P	0.31±0.02	8.0±0.5
Q	0.300	7.62
R	0.20 Rad.	Rad. 5.0
S	0.18 Dia.	Dia. 4.5
T	0.14	3.5
U	0.13±0.02	3.2±0.5
V	0.100±0.01	2.54±0.25

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

Ratings	Symbol	PM20CSJ060	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, M4 Mounting Screws	—	0.98 ~ 1.47	N · m
Module Weight (Typical)	—	60	Grams
Supply Voltage Protected by OC and SC (V_D = 13.5 - 16.5V, Inverter Part)	$V_{CC(prot.)}$	400	Volts
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	V_{iso}	2500	Vrms

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-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 of 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}	600	Volts
Collector Current, (T_C = 25°C)	I_C	20	Amperes
Peak Collector Current, (T_C = 25°C)	I_{CP}	40	Amperes
Supply Voltage (Applied between P - N)	V_{CC}	450	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{CC(surge)}$	500	Volts
Collector Dissipation	P_C	56	Watts

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	28	38	—	Amperes
Short Circuit Trip Level Inverter Part	SC	-20°C ≤ T ≤ 125°C, V_D = 15V	—	57	—	Amperes
Over Current Delay Time	$t_{off(OC)}$	V_D = 15V	—	10	—	µs
Over Temperature Protection	OT	Trip Level	100	110	120	°C
	OT_r	Reset Level	—	90	—	°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}	—	18	25	mA
		V_D = 15V, V_{CIN} = 15V, V_{XP1}-V_{XPC}	—	7	10	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 · V_N · W_N-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_{CIN} = 15V, V_{CE} = V_{CES}, T_j = 25°C	—	—	1.0	mA
		V_{CIN} = 15V, V_{CE} = V_{CES}, T_j = 125°C	—	—	10	mA
Diode Forward Voltage	V_{EC}	-I_C = 20A, V_D = 15V, V_{CIN} = 15V	—	2.5	3.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 20A	—	1.8	2.5	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 20A, T_j = 125°C	—	1.9	2.6	Volts
Inductive Load Switching Times	t_{on}	V_D = 15V, V_{CIN} = 0 ↔ 15V V_{CC} = 300V, I_C = 20A T_j = 125°C	0.3	0.6	1.5	µs
	t_{rr}		—	0.12	0.3	µs
	$t_{C(on)}$		—	0.2	0.8	µs
	t_{off}		—	1.5	2.3	µs
	$t_{C(off)}$		—	0.5	1.5	µs

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	Each IGBT	—	—	2.2	°C/Watt
	$R_{th(j-c)F}$	Each FWDi	—	—	4.5	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.083	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	0 ~ 400	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 · V_N · W_N-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	≥ 2.0	µs

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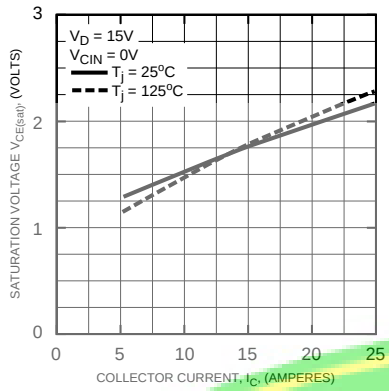
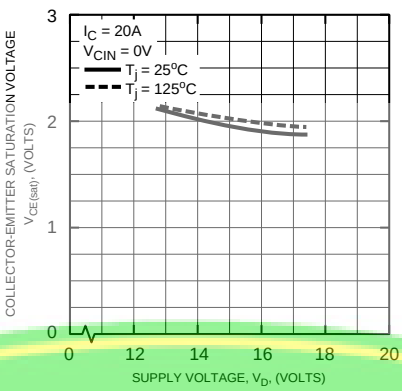
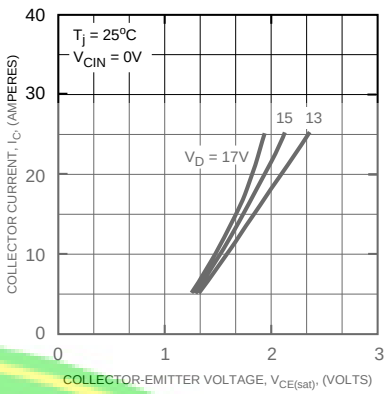
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



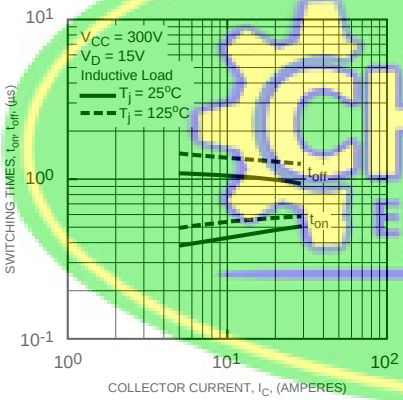
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



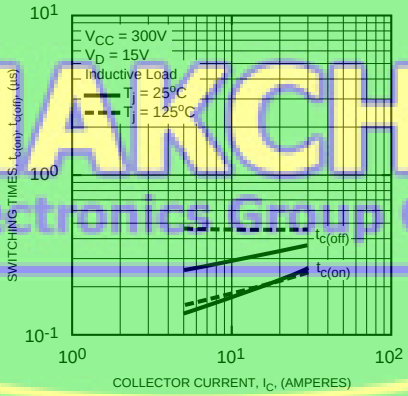
OUTPUT CHARACTERISTICS (TYPICAL)



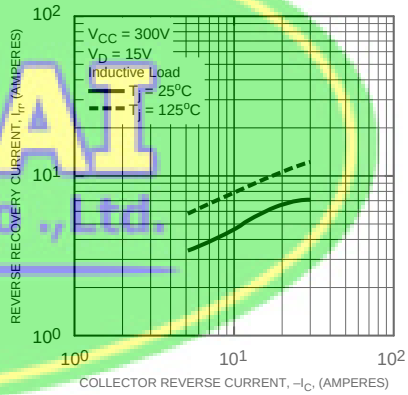
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



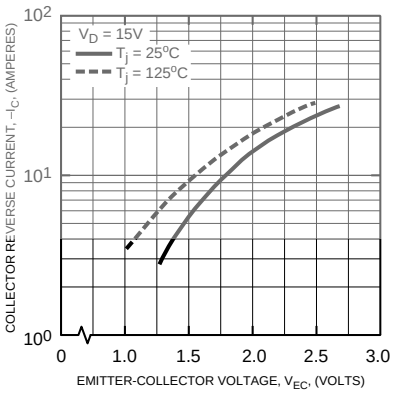
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



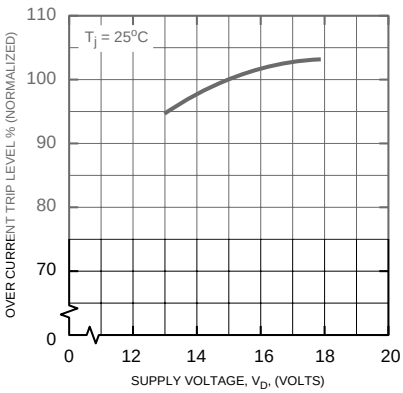
REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



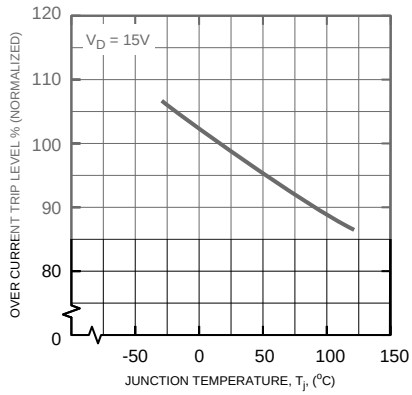
DIODE FORWARD CHARACTERISTICS



OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)



OVER CURRENT TRIP LEVEL TEMPERATURE DEPENDENCY (TYPICAL)



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FLAT-BASE TYPE
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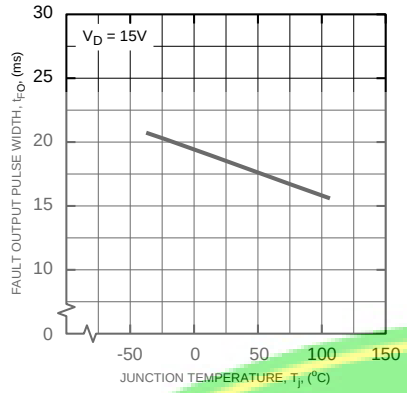
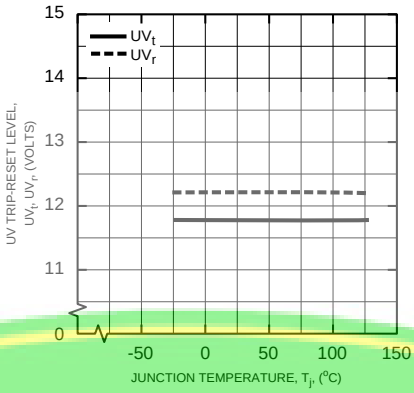
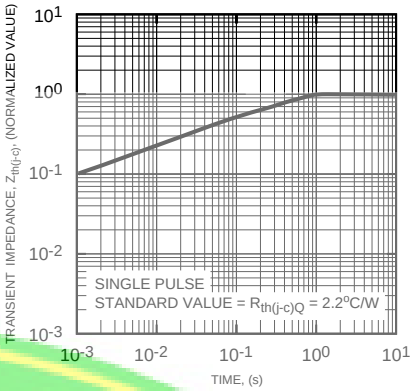
FAULT OUTPUT PULSE WIDTH VS. TEMPERATURE (TYPICAL)



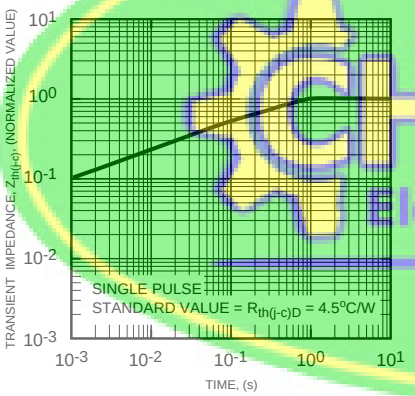
CONTROL SUPPLY VOLTAGE TRIP-RESET LEVEL TEMPERATURE DEPENDENCY (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each FWDi)



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