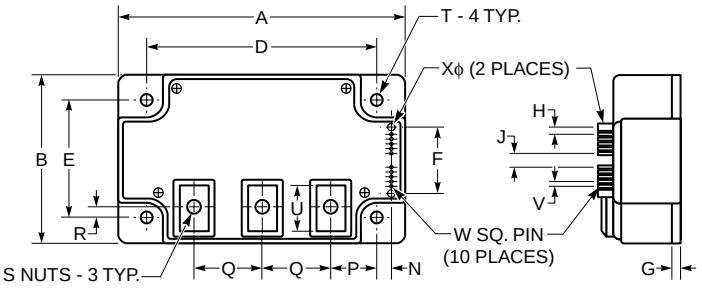
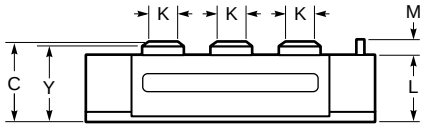
PM400DVA060

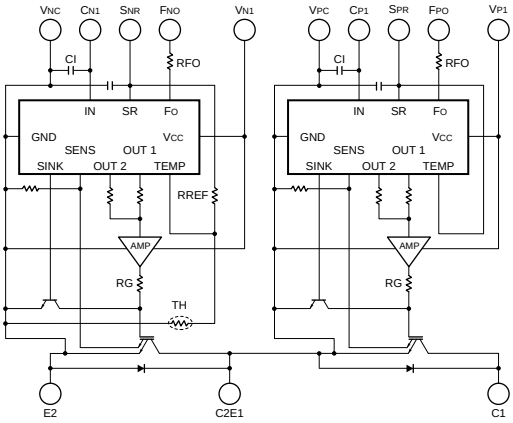
FLAT-BASE TYPE
INSULATED PACKAGE





TERMINAL CODE

1. V_{N1}	1. V_{P1}
2. S_{NR}	2. S_{PR}
3. C_{N1}	3. C_{P1}
4. V_{NC}	4. V_{PC}
5. F_{NO}	5. F_{PO}



Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.72	120.0
B	2.76	70.0
C	1.14 +0.04/-0.02	29.0 +1.0/-0.5
D	4.17±0.010	106.0±0.25
E	2.20±0.010	56.0±0.25
F	1.52	38.5
G	0.16	4.0
H	0.16	4.01
J	0.40	10.16
K	0.55	14.0
L	1.02	26.0
M	0.45	11.5

Dimensions	Inches	Millimeters
N	0.12	3.0
P	1.50	38.0
Q	0.98	25.0
R	0.37	9.3
S	M6 Metric	M6
T	0.26 Dia.	Dia. 6.5
U	0.72	18.3
V	0.10	2.54
W	0.025 SQ	0.64 SQ
X	0.14 Dia.	3.5 Dia.
Y	1.10	28.0

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 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. PM400DVA060 is a 600V, 400 Ampere Intelligent Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 10)
PM	400	60

MITSUBISHI ELECTRIC

PM400DVA060

FLAT-BASE TYPE
INSULATED PACKAGE

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, M6 Mounting Screws	—	3.92~5.88	N · m
Mounting Torque, M6 Main Terminal Screws	—	3.92~5.88	N · m
Module Weight (Typical)	—	510	Grams
Supply Voltage (Applied between C1-E2)	$V_{CC(surge)}$	500	Volts
Supply Voltage Protected by SC (V_D = 13.5 ~16.5V, Inverter Part, T_j = 125°C Start)	$V_{CC(prot.)}$	400	Volts
Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)	V_{iso}	2500	Vrms

Control Sector

Supply Voltage (Applied between V_{P1}-V_{PC}, V_{N1}-V_{NC})	V_D	20	Volts
Input Voltage (Applied between C_{P1}-V_{PC}, V_{N1}-V_{NC})	V_{CIN}	10	Volts
Fault Output Supply Voltage (Applied between F_{PO}-V_{PC}, F_{NO}-V_{NC})	V_{FO}	20	Volts
Fault Output Current (Sink Current at F_{PO}, F_{NO} Terminal)	I_{FO}	20	mA

IGBT Inverter Sector

Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 5V)	V_{CES}	600	Volts
Collector Current, (T_C = 25°C)	I_C	400	Amperes
Peak Collector Current, (T_C = 25°C)	I_{CP}	800	Amperes
Collector Dissipation (T_C = 25°C)	P_C	1033	Watts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Short Circuit Trip Level	SC	-20°C ≤ T_j ≤ 125°C, V_D = 15V	500	—	—	Amperes
Short Circuit Current Delay Time	$t_{off(SC)}$	V_D = 15V	—	10	—	µs
Over Temperature Protection	OT	Trip Level	111	118	125	°C
(V_D = 15V, Lower Arm)	OT_r	Reset Level	—	100	—	°C
Supply Circuit Under Voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
(-20°C ≤ T_j ≤ 125°C)	UV_r	Reset Level	—	12.5	—	Volts
Circuit Current	I_D	V_D = 15V, V_{CIN} = 5V, V_{N1}-V_{NC}	—	27	38	mA
		V_D = 15V, V_{CIN} = 5V, V_{P1}-V_{PC}	—	27	38	mA
Input ON Threshold Voltage	$V_{th(on)}$	Applied between	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{th(off)}$	C_{P1}-V_{PC}, C_{N1}-V_{NC}	1.7	2.0	2.3	Volts
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
SXR Terminal Output Voltage	V_{SXR}	T_j ≤ 125°C, R_{in} = 6.8kΩ (S_{PR}, S_{NR})	4.5	5.1	5.6	Volts

* Fault output is given only when the internal SC, OT, and UV protections circuits of either an upper-arm or a lower-arm device operate to protect it.

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector-Emitter Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, V_D = 15V, T_j = 25°C	—	—	1.0	mA
		$V_{CE} = V_{CES}$, V_D = 15V, T_j = 125°C	—	—	10.0	mA
FWDi Forward Voltage	V_{EC}	$-I_C$ = 400A, V_D = 15V, V_{CIN} = 5V	—	2.20	3.30	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 400A, Pulsed, T_j = 25°C	—	2.35	2.80	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 400A, Pulsed, T_j = 125°C	—	2.55	3.05	Volts
Inductive Load Switching Times	t_{on}	V_D = 15V, V_{CIN} = 0 ↔ 5V, V_{CC} = 300V, I_C = 400A, T_j = 125°C	0.4	0.8	2.1	µs
	t_{rr}		—	0.2	0.3	µs
	$t_{C(on)}$		—	0.3	1.1	µs
	t_{off}		—	1.8	2.9	µs
	$t_{C(off)}$		—	0.6	1.2	µs

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	Each Inverter IGBT	—	—	0.121	°C/Watt
	$R_{th(j-c)F}$	Each Inverter FWDi	—	—	0.18	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.081	°C/Watt

Recommended Conditions for Use

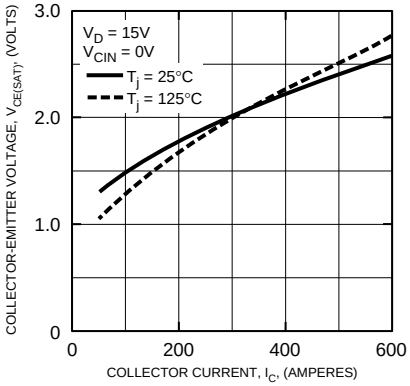
Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across C1-E2 Terminals	≤ 400	Volts
	$V_{CE(surge)}$	Applied across C1-E1, C2-E2 Terminals	≤ 500	Volts
	V_D	Applied between V_{P1}-V_{PC}, V_{N1}-V_{NC} *	15 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between C_{P1}-V_{PC}, C_{N1}-V_{NC}	≤ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$		≥ 4.0	Volts
Arm Shoot-Through Blocking Time	t_{DEAD}	For IPM's each Input Signal	≥ 3.0	µs

* With ripple satisfying the following conditions, dv/dt swing ≤ 5V/µs, Variation ≤ 2V peak to peak.

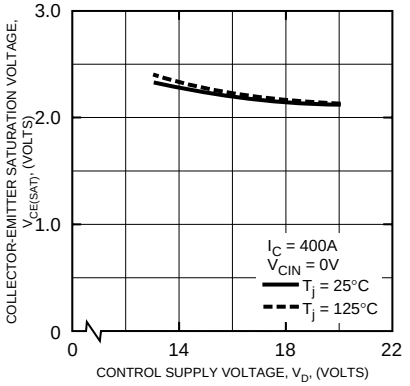
PM400DVA060

FLAT-BASE TYPE
INSULATED PACKAGE

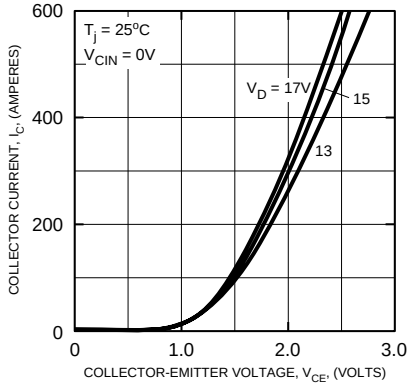
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



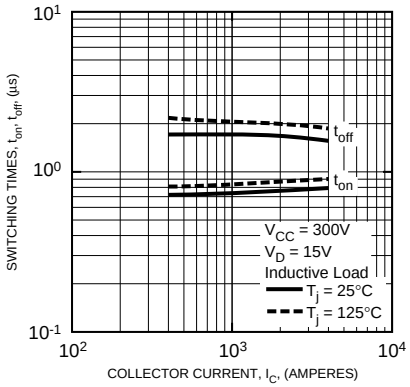
COLLECTOR-EMITTER SATURATON VOLTAGE CHARACTERISTICS (TYPICAL)



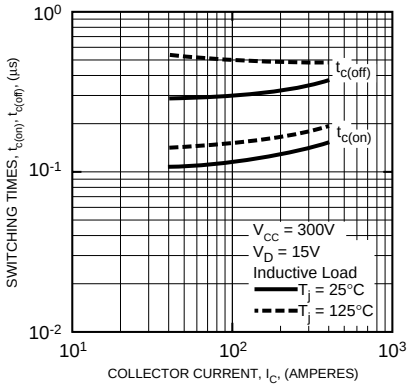
OUTPUT CHARACTERISTICS (TYPICAL)



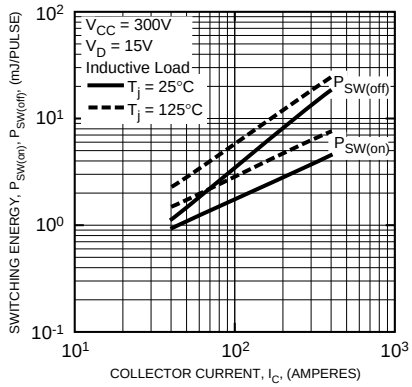
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



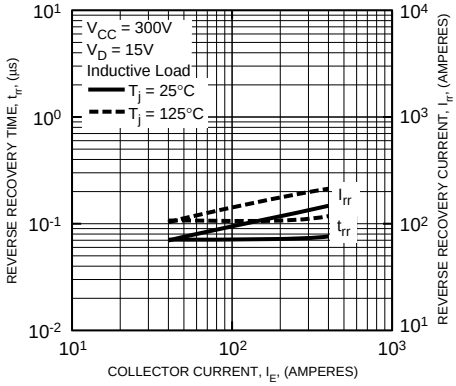
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



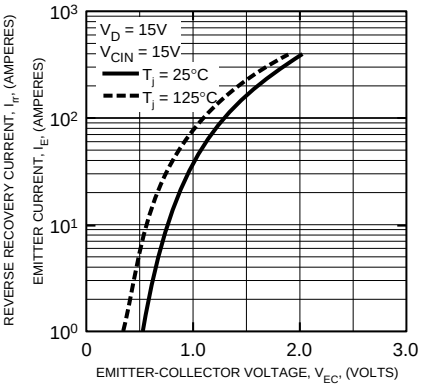
SWITCHING LOSS CHARACTERISTICS (TYPICAL)



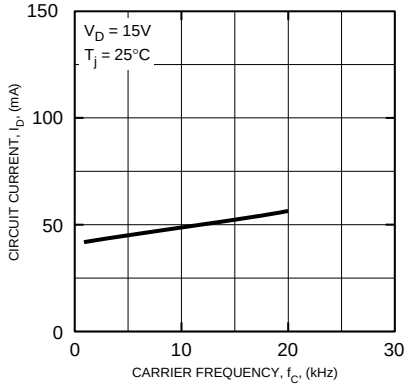
REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



DIODE FORWARD CHARACTERISTICS



CIRCUIT CURRENT VS. CARRIER FREQUENCY



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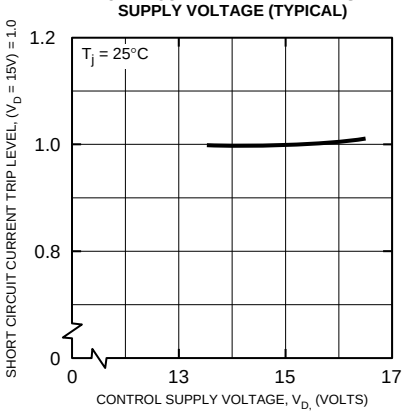
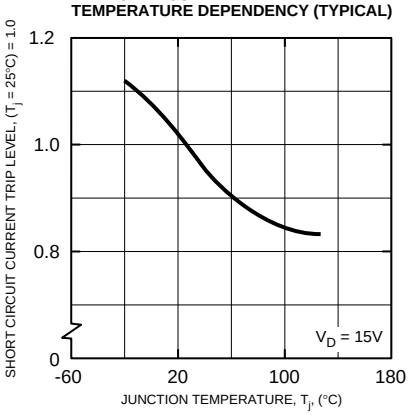
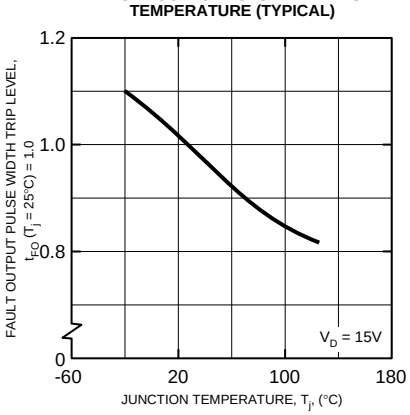
OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)



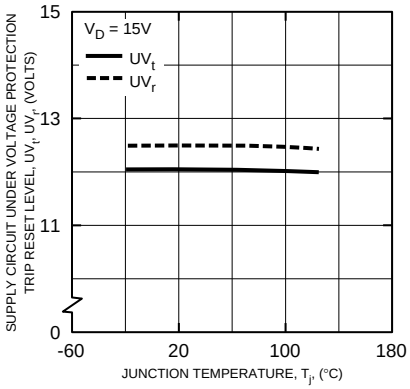
OVER CURRENT TRIP LEVEL TEMPERATURE DEPENDENCY (TYPICAL)



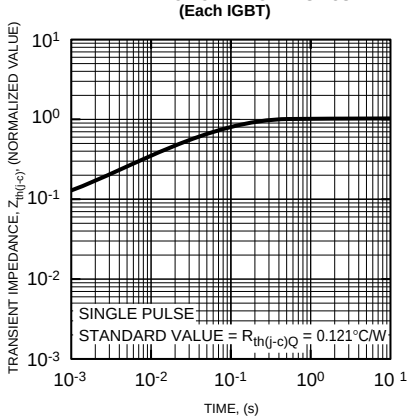
FAULT OUTPUT PULSE WIDTH VS. TEMPERATURE (TYPICAL)



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



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each FWDi)