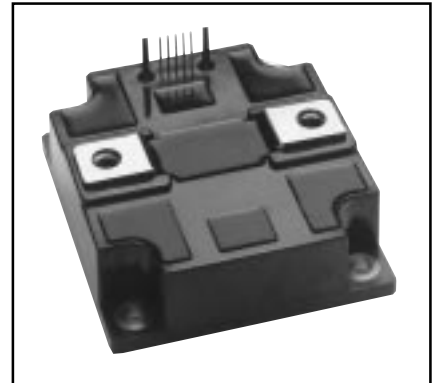
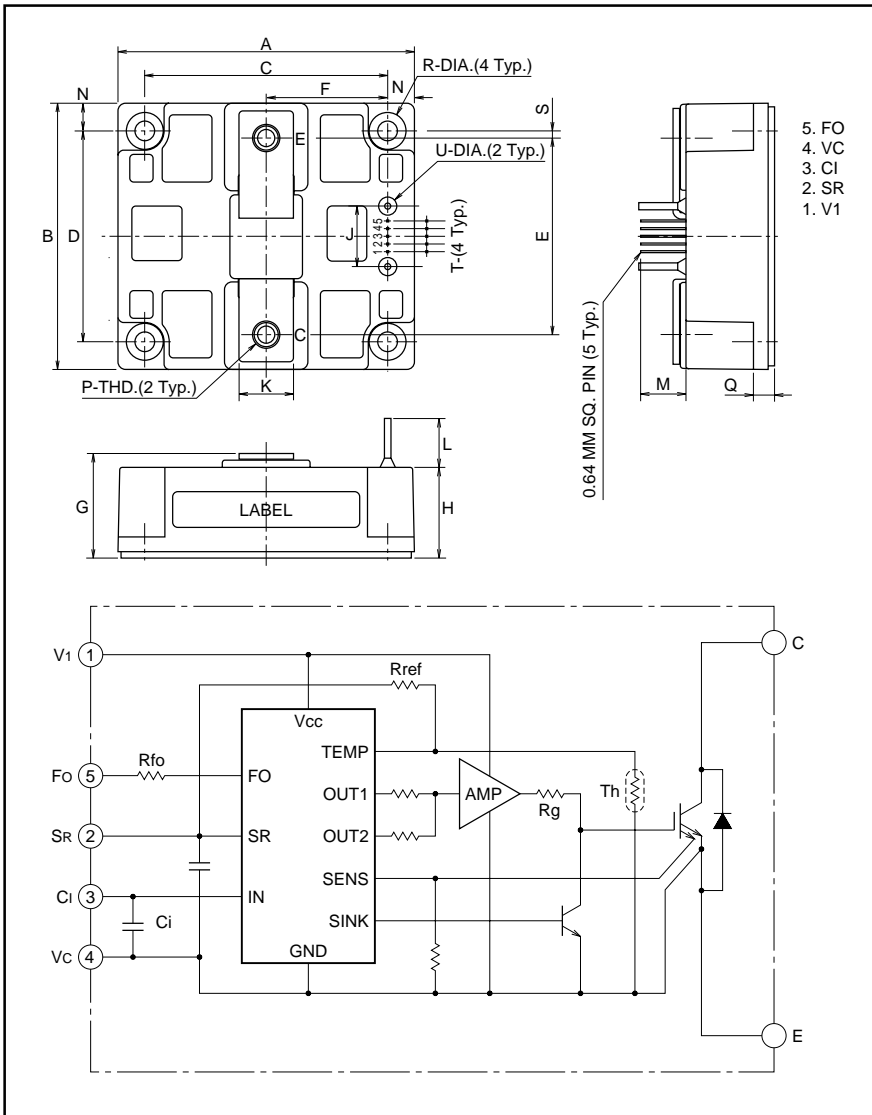


PM400HSA120

FLAT-BASE TYPE
INSULATED PACKAGE



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. PM400HSA120 is a 1200V, 400 Ampere Intelligent Power Module.

| Type | Current Rating Amperes | V _{CES} Volts (x 10) |
|------|---------------------------|----------------------------------|
| PM | 400 | 120 |

Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|------------------|----------------|
| A | 3.86 | 98.0 |
| B | 3.46 | 88.0 |
| C | 3.15±0.01 | 80.0±0.25 |
| D | 2.76±0.01 | 70.0±0.25 |
| E | 2.56 | 65.0 |
| F | 1.57 | 40.0 |
| G | 1.34 +0.04/-0.02 | 34.0 +1.0/-0.5 |
| H | 1.16 | 29.5 |
| J | 0.79 | 20.0 |
| K | 0.71 | 18.0 |

| Dimensions | Inches | Millimeters |
|------------|-----------|-------------|
| L | 0.63 | 16.0 |
| M | 0.59 | 15.0 |
| N | 0.35 | 9.0 |
| P | Metric M8 | M8 |
| Q | 0.28 | 7.0 |
| R | 0.26 Dia. | Dia. 6.5 |
| S | 0.10 | 2.5 |
| T | 0.100 | 2.54 |
| U | 0.08 Dia. | 2.0 Dia. |

PM400HSA120

FLAT-BASE TYPE
INSULATED PACKAGE

Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Ratings | Symbol | PM400HSA120 | Units |
|--|------------------------|-------------|---------------------------|
| Power Device Junction Temperature | T_j | -20 to 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to 125 | $^\circ\text{C}$ |
| Case Operating Temperature | T_C | -20 to 100 | $^\circ\text{C}$ |
| Mounting Torque, M6 Mounting Screws | — | 3.92~5.88 | $\text{N} \cdot \text{m}$ |
| Mounting Torque, M8 Main Terminal Screws | — | 8.83~10.8 | $\text{N} \cdot \text{m}$ |
| Module Weight (Typical) | — | 630 | Grams |
| Supply Voltage Protected by OC and SC ($V_D = 13.5 - 16.5\text{V}$, Inverter Part) | $V_{\text{CC(prot.)}}$ | 800 | Volts |
| Isolation Voltage (Main Terminal to Baseplate, AC 1 min.) | V_{iso} | 2500 | V_{rms} |

Control Sector

| | | | |
|--|------------------|----|-------|
| Supply Voltage (Applied between V_1 - V_C) | V_D | 20 | Volts |
| Input Voltage (Applied between C_1 - V_C) | V_{CIN} | 10 | Volts |
| Fault Output Supply Voltage (Applied between F_O - V_C) | V_{FO} | 20 | Volts |
| Fault Output Current (Fault Current of F_O Terminal) | I_{FO} | 20 | mA |

IGBT Inverter Sector

| | | | |
|---|------------------|------|---------|
| Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 5\text{V}$) | V_{CES} | 1200 | Volts |
| Collector Current, ($T_C = 25^\circ\text{C}$) | I_C | 400 | Amperes |
| Peak Collector Current, ($T_C = 25^\circ\text{C}$) | I_{CP} | 800 | Amperes |
| Collector Dissipation | P_C | 2315 | Watts |

Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|----------------------|---|------|------|------|------------------|
| Control Sector | | | | | | |
| Over Current Trip Level Inverter Part | OC | $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$ | 480 | 650 | — | Amperes |
| Short Circuit Trip Level Inverter Part | SC | $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $V_D = 15\text{V}$ | 650 | 930 | — | Amperes |
| Over Current Delay Time | $t_{\text{off(OC)}}$ | $V_D = 15\text{V}$ | — | 5 | — | μs |
| Over Temperature Protection | OT | Trip Level | 100 | 110 | 120 | $^\circ\text{C}$ |
| | OT_r | Reset Level | 85 | 95 | 105 | $^\circ\text{C}$ |
| 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_1 - V_C | 13.5 | 15 | 16.5 | Volts |
| Circuit Current | I_D | $V_D = 15\text{V}$, $V_{\text{CIN}} = 5\text{V}$, V_1 - V_C | — | 23 | 30 | mA |
| Input ON Threshold Voltage | $V_{\text{th(on)}}$ | Applied between C_1 - V_C | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{\text{th(off)}}$ | Applied between C_1 - V_C | 1.7 | 2.0 | 2.3 | Volts |
| PWM Input Frequency | f_{PWM} | 3- ϕ Sinusoidal | — | 15 | 20 | kHz |
| Fault Output Current | $I_{\text{FO(H)}}$ | $V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}$ | — | — | 0.01 | mA |
| | $I_{\text{FO(L)}}$ | $V_D = 15\text{V}$, $V_{\text{FO}} = 15\text{V}$ | — | 10 | 15 | mA |
| Minimum Fault Output Pulse Width | t_{FO} | $V_D = 15\text{V}$ | 1.0 | 1.8 | — | ms |
| SR Terminal Output Voltage | V_{SR} | $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $R_{\text{in}} = 6.8 \text{ k}\Omega$ | 4.5 | 5.1 | 5.6 | Volts |

PM400HSA120

FLAT-BASE TYPE
INSULATED PACKAGEElectrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------|--|------|------|------|---------------|
| IGBT Inverter Sector | | | | | | |
| Collector Cutoff Current | I_{CES} | $V_{CE} = V_{CES}, T_j = 25^\circ\text{C}$ | — | — | 1.0 | mA |
| | | $V_{CE} = V_{CES}, T_j = 125^\circ\text{C}$ | — | — | 10 | mA |
| Emitter-Collector Voltage | V_{EC} | $-I_C = 400\text{A}, V_D = 15\text{V}, V_{CIN} = 5\text{V}$ | — | 2.5 | 3.5 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 400\text{A},$ $T_j = 25^\circ\text{C}, \text{ Pulsed}$ | — | 2.3 | 3.2 | Volts |
| | | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 400\text{A},$ $T_j = 125^\circ\text{C}, \text{ Pulsed}$ | — | 2.1 | 2.9 | Volts |
| Inductive Load Switching Times | t_{on} | | 0.5 | 1.4 | 2.5 | μs |
| | t_{rr} | $V_D = 15\text{V}, V_{CIN} = 0 \leftrightarrow 5\text{V}$ | — | 0.2 | 0.4 | μs |
| | $t_{C(on)}$ | $V_{CC} = 600\text{V}, I_C = 400\text{A}$ | — | 0.4 | 1.0 | μs |
| | t_{off} | $T_j = 125^\circ\text{C}$ | — | 2.5 | 3.5 | μs |
| | $t_{C(off)}$ | | — | 0.6 | 1.1 | μs |

Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|-------------------------------------|----------------|---|------|------|-------|-----------------------|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | Each IGBT | — | — | 0.054 | $^\circ\text{C/Watt}$ |
| | $R_{th(j-c)F}$ | Each FWDi | — | — | 0.10 | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied | — | — | 0.038 | $^\circ\text{C/Watt}$ |

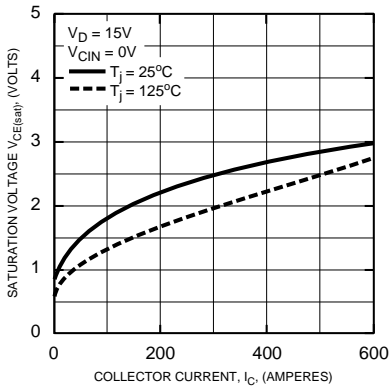
Recommended Conditions for Use

| Characteristic | Symbol | Condition | Value | Units |
|---------------------|----------------|--------------------------------|-------------------|---------------|
| Supply Voltage | V_{CC} | Applied across C1-E2 Terminals | 0 ~ 800 | Volts |
| | V_D | Applied between V_1 - V_C | 15 ± 1.5 | Volts |
| Input ON Voltage | $V_{CIN(on)}$ | Applied between C_1 - V_C | 0 ~ 0.8 | Volts |
| Input OFF Voltage | $V_{CIN(off)}$ | Applied between C_1 - V_C | $4.0 \sim V_{SR}$ | Volts |
| PWM Input Frequency | f_{PWM} | Using Application Circuit | 5 ~ 20 | kHz |
| Minimum Dead Time | t_{dead} | Input Signal | ≥ 3.5 | μs |

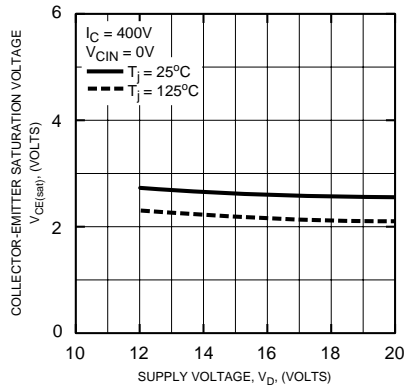
PM400HSA120

FLAT-BASE TYPE
INSULATED PACKAGE

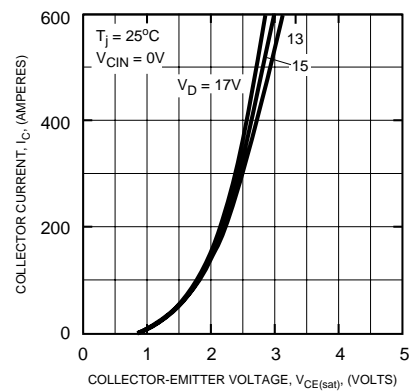
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



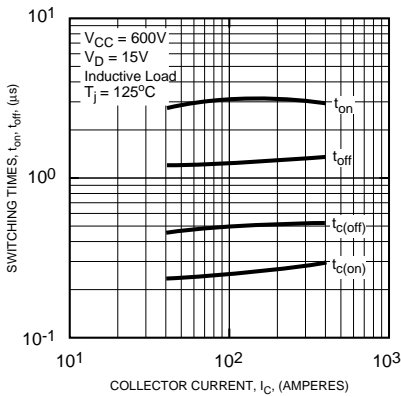
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



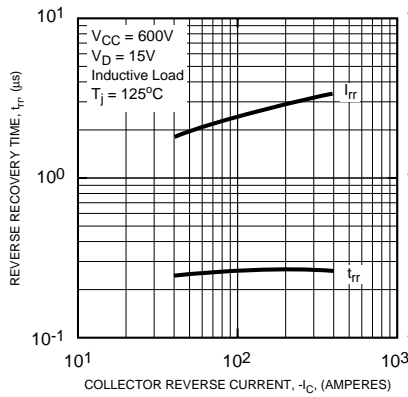
OUTPUT CHARACTERISTICS (TYPICAL)



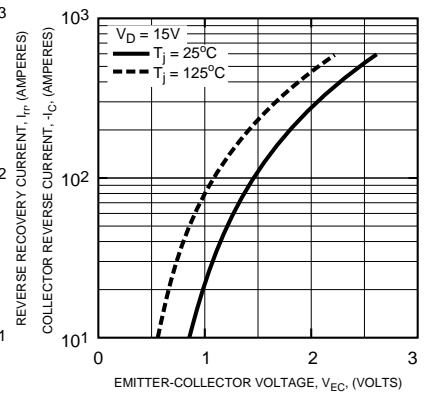
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



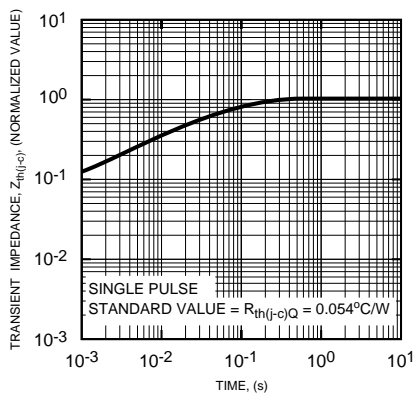
REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



DIODE FORWARD CHARACTERISTICS



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (Each FWDi)

