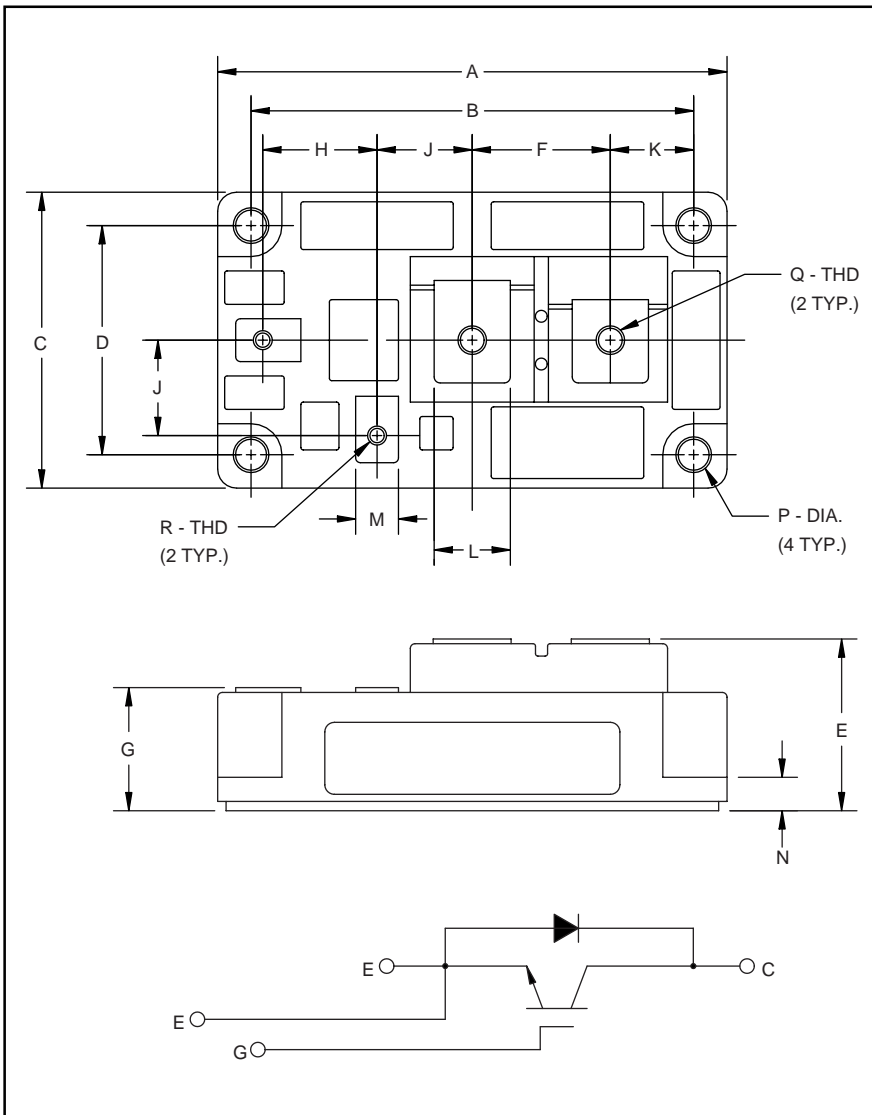


MITSUBISHI IGBT MODULES

CM400HA-28H

HIGH POWER SWITCHING USE
INSULATED TYPE



Description:

Mitsubishi IGBT Modules are designed for use in switching applications. Each module consists of one IGBT in a single configuration with a reverse-connected super-fast recovery free-wheel diode. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

Features:

- Low Drive Power
- Low $V_{CE(sat)}$
- Discrete Super-Fast Recovery Free-Wheel Diode
- High Frequency Operation
- Isolated Baseplate for Easy Heat Sinking

Applications:

- AC Motor Control
- Motion/Servo Control
- UPS
- Welding Power Supplies

Ordering Information:

Example: Select the complete part module number you desire from the table below -i.e. CM400HA-28H is a 1400V (V_{CES}), 400 Ampere Single IGBT Module.

| Type | Current Rating Amperes | V_{CES} Volts (x 50) |
|------|---------------------------|---------------------------|
| CM | 400 | 28 |

Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|-----------------|---------------|
| A | 4.21 | 107.0 |
| B | 3.661±0.01 | 93.0±0.25 |
| C | 2.44 | 62.0 |
| D | 1.89±0.01 | 48.0±0.25 |
| E | 1.42+0.04/-0.02 | 36.0+1.0/-0.5 |
| F | 1.14 | 29.0 |
| G | 1.02+0.04/-0.2 | 25.8+1.0/-0.5 |
| H | 0.94 | 24.0 |

| Dimensions | Inches | Millimeters |
|------------|-----------|-------------|
| J | 0.79 | 20.0 |
| K | 0.69 | 17.5 |
| L | 0.63 | 16.0 |
| M | 0.35 | 9.0 |
| N | 0.28 | 7.0 |
| P | 0.26 Dia. | Dia. 6.5 |
| Q | M6 Metric | M6 |
| R | M4 Metric | M4 |

CM400HA-28H

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

| Ratings | Symbol | CM400HA-28H | Units |
|--|-----------|-------------|------------------|
| Junction Temperature | T_j | -40 to 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to 125 | $^\circ\text{C}$ |
| Collector-Emitter Voltage (G-E SHORT) | V_{CES} | 1400 | Volts |
| Gate-Emitter Voltage (C-E SHORT) | V_{GES} | ± 20 | Volts |
| Collector Current ($T_C = 25^\circ\text{C}$) | I_C | 400 | Amperes |
| Peak Collector Current ($T_j \leq 150^\circ\text{C}$) | I_{CM} | 800* | Amperes |
| Emitter Current** ($T_C = 25^\circ\text{C}$) | I_E | 400 | Amperes |
| Peak Emitter Current** | I_{EM} | 800* | Amperes |
| Maximum Collector Dissipation ($T_C = 25^\circ\text{C}$) | P_c | 2800 | Watts |
| Mounting Torque, M6 Terminal | - | 1.96 ~ 2.94 | N · m |
| Mounting Torque, M6 Mounting | - | 1.96 ~ 2.94 | N · m |
| Mounting Torque, M4 Terminal | - | 0.98 ~ 1.47 | N · m |
| Weight | - | 400 | Grams |
| Isolation Voltage (Main Terminal to Baseplate, AC 1 min.) | V_{iso} | 2500 | Vrms |

*Pulse width and repetition rate should be such that the device junction temperature (T_j) does not exceed $T_{j(max)}$ rating.

**Represents characteristics of the anti-parallel, emitter-to-collector free-wheel diode (FWDi).

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------|--|------|------|-------|---------------|
| Collector-Cutoff Current | I_{CES} | $V_{CE} = V_{CES}, V_{GE} = 0V$ | - | - | 2.0 | mA |
| Gate Leakage Current | I_{GES} | $V_{GE} = V_{GES}, V_{CE} = 0V$ | - | - | 0.5 | μA |
| Gate-Emitter Threshold Voltage | $V_{GE(th)}$ | $I_C = 40\text{mA}, V_{CE} = 10V$ | 5.0 | 6.5 | 8.0 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C = 400\text{A}, V_{GE} = 15V$ | - | 3.1 | 4.2** | Volts |
| | | $I_C = 400\text{A}, V_{GE} = 15V, T_j = 150^\circ\text{C}$ | - | 2.95 | - | Volts |
| Total Gate Charge | Q_G | $V_{CC} = 800V, I_C = 400\text{A}, V_{GE} = 15V$ | - | 2040 | - | nC |
| Emitter-Collector Voltage | V_{EC} | $I_E = 400\text{A}, V_{GE} = 0V$ | - | - | 3.8 | Volts |

** Pulse width and repetition rate should be such that device junction temperature rise is negligible.

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

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|-------------------------------|---------------------|--|------|------|------|---------------|
| Input Capacitance | C_{ies} | | - | - | 80 | nF |
| Output Capacitance | C_{oes} | $V_{GE} = 0V, V_{CE} = 10V$ | - | - | 28 | nF |
| Reverse Transfer Capacitance | C_{res} | | - | - | 16 | nF |
| Resistive | Turn-on Delay Time | $V_{CC} = 800V, I_C = 400\text{A},$ $V_{GE1} = V_{GE2} = 15V, R_G = 0.78\Omega$ | - | - | 300 | ns |
| | Load | | | | | |
| Switching | Turn-off Delay Time | $V_{CC} = 800V, I_C = 400\text{A},$ $V_{GE1} = V_{GE2} = 15V, R_G = 0.78\Omega$ | - | - | 350 | ns |
| | Times | | | | | |
| Diode Reverse Recovery Time | t_{rr} | $I_E = 400\text{A}, di_E/dt = -800\text{A}/\mu\text{s}$ | - | - | 300 | ns |
| Diode Reverse Recovery Charge | Q_{rr} | $I_E = 400\text{A}, di_E/dt = -800\text{A}/\mu\text{s}$ | - | 4.0 | - | μC |

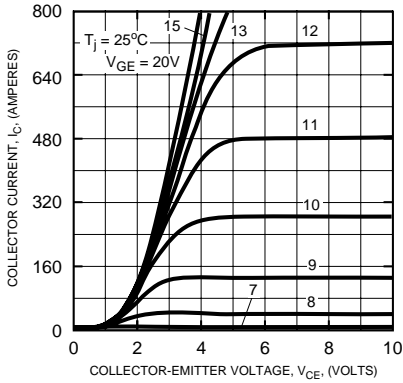
Thermal and Mechanical Characteristics, $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|---------------|------------------------------------|------|------|-------|---------------------------|
| Thermal Resistance, Junction to Case | $R_{th(j-c)}$ | Per IGBT | - | - | 0.045 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case | $R_{th(j-c)}$ | Per FWDi | - | - | 0.09 | $^\circ\text{C}/\text{W}$ |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Per Module, Thermal Grease Applied | - | - | 0.040 | $^\circ\text{C}/\text{W}$ |

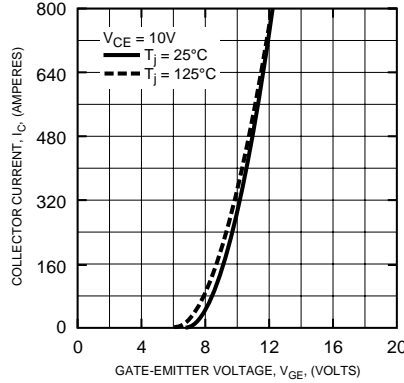
CM400HA-28H

HIGH POWER SWITCHING USE
INSULATED TYPE

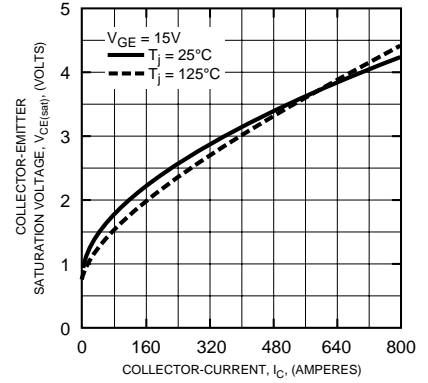
OUTPUT CHARACTERISTICS
(TYPICAL)



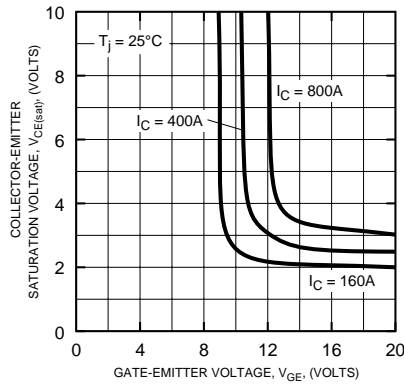
TRANSFER CHARACTERISTICS
(TYPICAL)



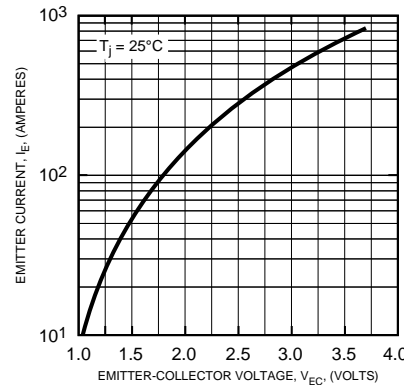
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS
(TYPICAL)



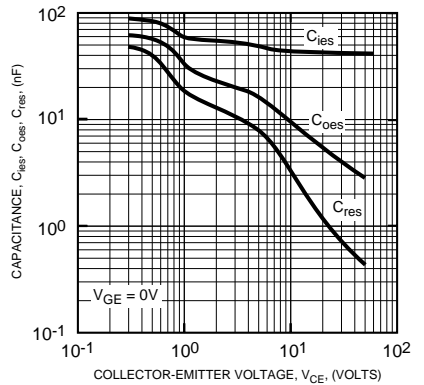
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS
(TYPICAL)



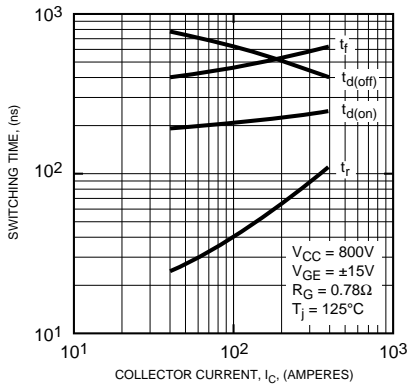
FREE-WHEEL DIODE FORWARD CHARACTERISTICS
(TYPICAL)



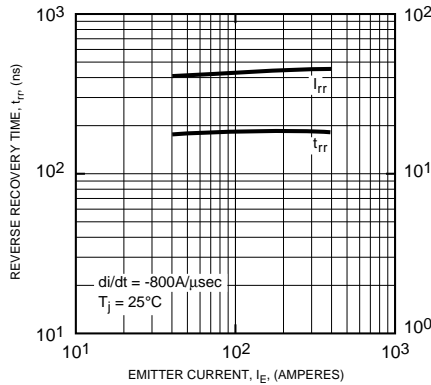
CAPACITANCE VS. V_{CE}
(TYPICAL)



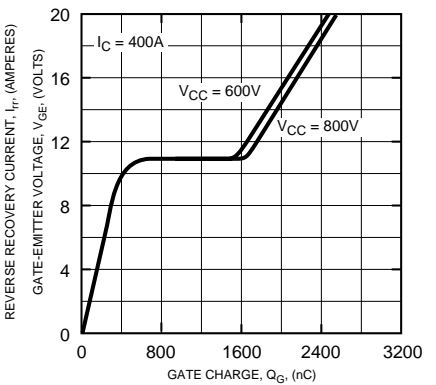
HALF-BRIDGE SWITCHING CHARACTERISTICS
(TYPICAL)



REVERSE RECOVERY CHARACTERISTICS
(TYPICAL)



GATE CHARGE, V_{GE}



CM400HA-28H

HIGH POWER SWITCHING USE
INSULATED TYPE

