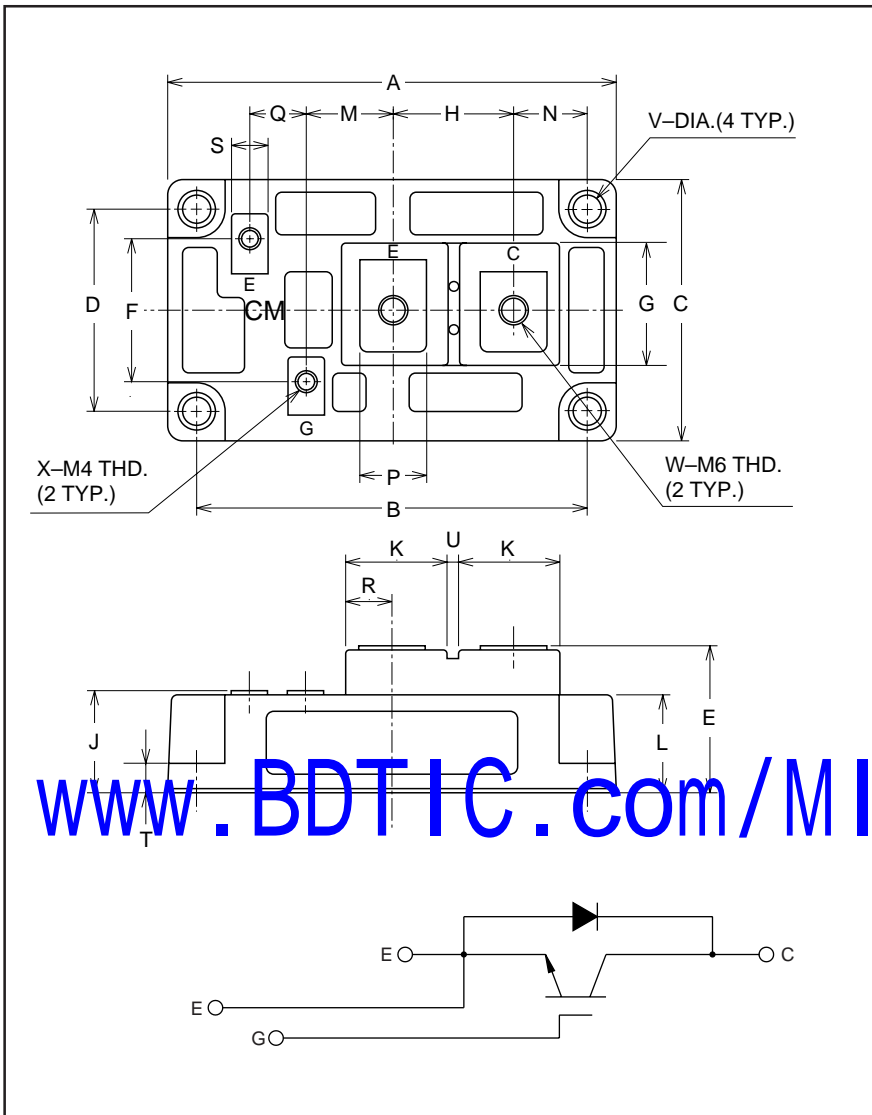


MITSUBISHI IGBT MODULES

CM400HA-12H

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-12H is a 600V (V_{CES}), 400 Ampere Single IGBT Module.

| Type | Current Rating Amperes | V_{CES} Volts (x 50) |
|------|---------------------------|---------------------------|
| CM | 400 | 12 |

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 Max. | 36.0 Max. |
| F | 1.34 | 34.0 |
| G | 1.18 | 30.0 |
| H | 1.14 | 29.0 |
| J | 0.98 Max. | 25.0 Max. |
| K | 0.94 | 24.0 |
| L | 0.93 | 23.5 |

| Dimensions | Inches | Millimeters |
|------------|-----------|-------------|
| M | 0.83 | 21.0 |
| N | 0.69 | 17.5 |
| P | 0.63 | 16.0 |
| Q | 0.51 | 13.0 |
| R | 0.43 | 11.0 |
| S | 0.35 | 9.0 |
| T | 0.28 | 7.0 |
| U | 0.12 | 3.0 |
| V | 0.26 Dia. | Dia. 6.5 |
| W | M6 Metric | M6 |
| X | M4 Metric | M4 |

CM400HA-12H

HIGH POWER SWITCHING USE
INSULATED TYPEAbsolute Maximum Ratings, $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

| | Symbol | Ratings | 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} | 600 | 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 | 1500 | Watts |
| Mounting Torque, M6 Main 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 $T_{j(\text{max})}$ 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_{CS} | $V_{\text{CE}} = V_{\text{CES}}, V_{\text{GE}} = 0\text{V}$ | – | – | 1.0 | mA |
| Gate Leakage Current | I_{GES} | $V_{\text{GE}} = V_{\text{GES}}, V_{\text{CE}} = 10\text{V}$ | – | – | 0.5 | μA |
| Gate-Emitter Threshold Voltage | $V_{\text{GE(th)}}$ | $I_c = 400\text{mA}, V_{\text{CE}} = 10\text{V}$ | 4.5 | 6.0 | 7.5 | Volts |
| Collector-Emitter Saturation Voltage | $V_{\text{CE(sat)}}$ | $I_c = 400\text{A}, V_{\text{GE}} = 15\text{V}$ | – | 2.1 | 2.8** | Volts |
| | | $I_c = 400\text{A}, V_{\text{GE}} = 15\text{V}, T_j = 150^\circ\text{C}$ | – | 2.15 | – | Volts |
| Total Gate Charge | Q_G | $V_{\text{CC}} = 400\text{V}, I_c = 400\text{A}, V_{\text{GE}} = 15\text{V}$ | – | 1200 | – | nC |
| Emitter-Collector Voltage | V_{EC} | $I_E = 400\text{A}, V_{\text{GE}} = 0\text{V}$ | – | – | 2.8 | 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} | | – | – | 40 | nF | |
| Output Capacitance | C_{oes} | $V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = 10\text{V}$ | – | – | 14 | nF | |
| Reverse Transfer Capacitance | C_{res} | | – | – | 8 | nF | |
| Resistive | Turn-on Delay Time | $t_{\text{d(on)}}$ | – | – | 350 | ns | |
| | | | | | | | Load |
| Switching | Turn-off Delay Time | $t_{\text{d(off)}}$ | – | – | 350 | ns | |
| | | | | | | | Times |
| Diode Reverse Recovery Time | t_{rr} | $I_E = 400\text{A}, di_E/dt = -800\text{A}/\mu\text{s}$ | – | – | 110 | ns | |
| Diode Reverse Recovery Charge | Q_{rr} | $I_E = 400\text{A}, di_E/dt = -800\text{A}/\mu\text{s}$ | – | 1.08 | – | μC | |

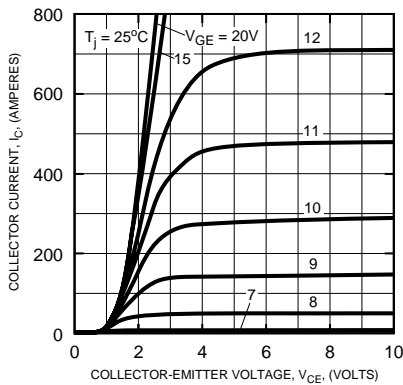
Thermal and Mechanical Characteristics, $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|----------------------|------------------------------------|------|------|-------|---------------------------|
| Thermal Resistance, Junction to Case | $R_{\text{th(j-c)}}$ | Per IGBT | – | – | 0.085 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case | $R_{\text{th(j-c)}}$ | Per FWDi | – | – | 0.18 | $^\circ\text{C}/\text{W}$ |
| Contact Thermal Resistance | $R_{\text{th(c-f)}}$ | Per Module, Thermal Grease Applied | – | – | 0.040 | $^\circ\text{C}/\text{W}$ |

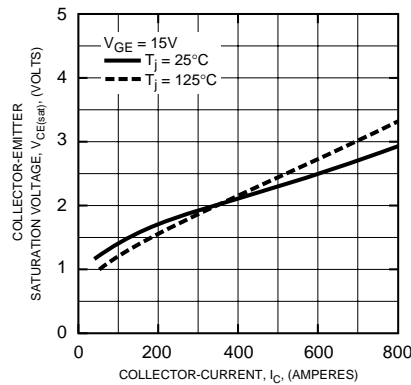
CM400HA-12H

HIGH POWER SWITCHING USE
INSULATED TYPE

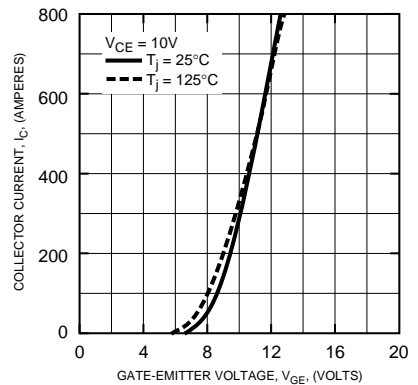
OUTPUT CHARACTERISTICS (TYPICAL)



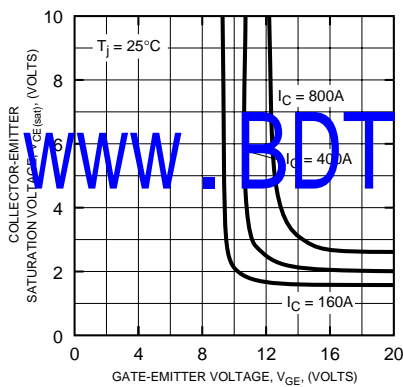
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



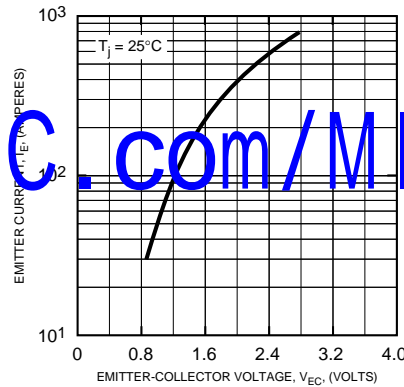
TRANSFER CHARACTERISTICS (TYPICAL)



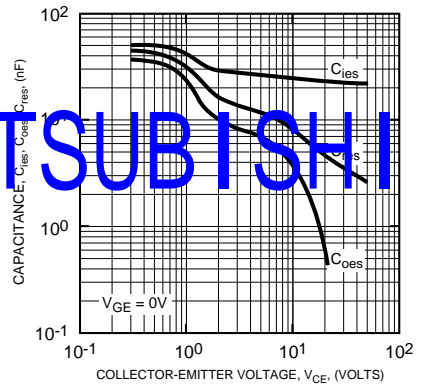
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



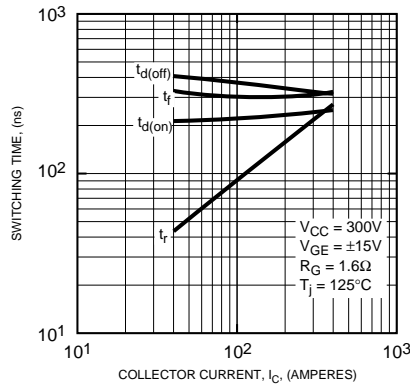
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



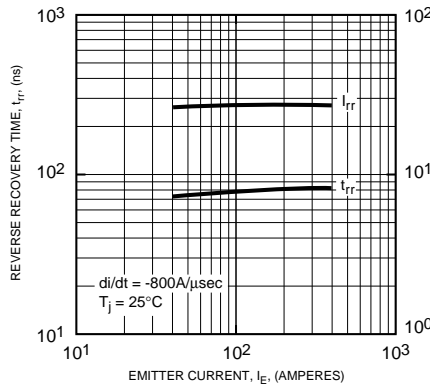
CAPACITANCE VS. V_{CE} (TYPICAL)



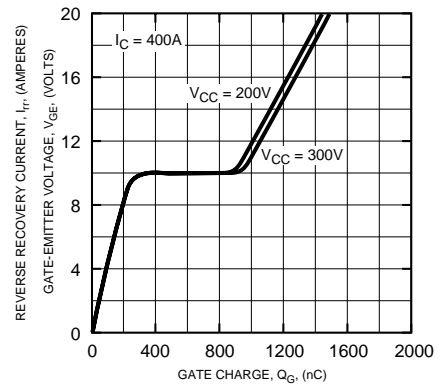
HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (TYPICAL)

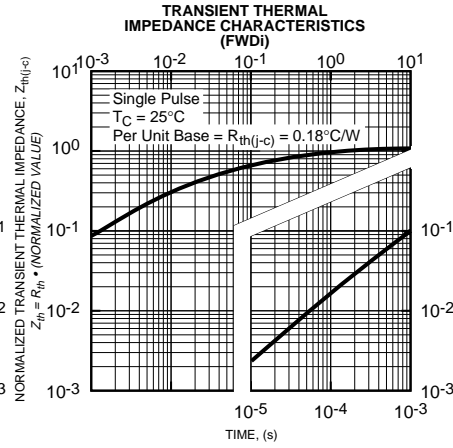
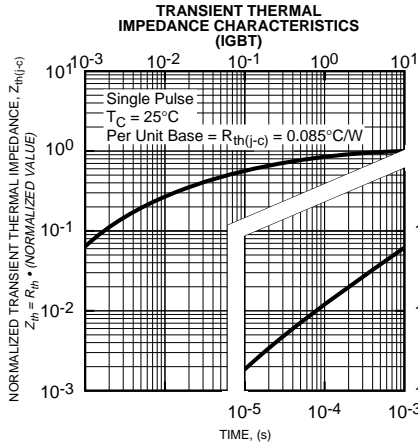


GATE CHARGE, V_{GE}



CM400HA-12H

HIGH POWER SWITCHING USE
INSULATED TYPE



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