

MITSUBISHI IGBT MODULES

# CM400HU-24F

HIGH POWER SWITCHING USE

## CM400HU-24F



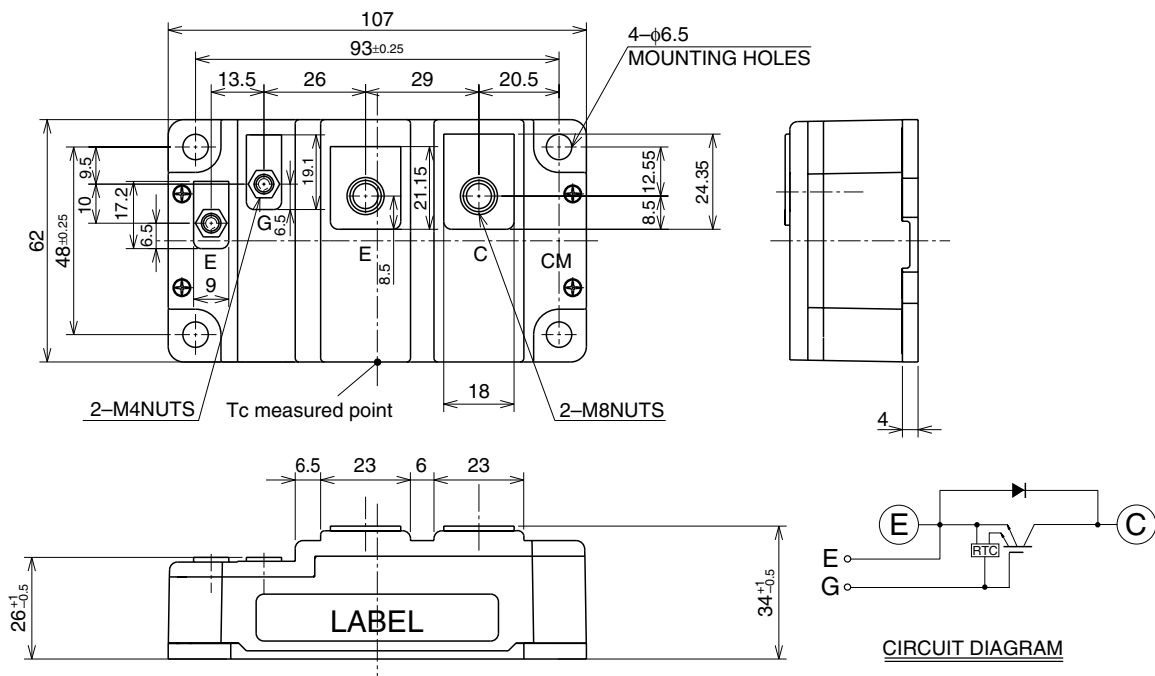
- Ic ..... 400A
- VCES ..... 1200V
- Insulated Type
- 1-elements in a pack

## APPLICATION

General purpose inverters & Servo controls, etc

## OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



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### MAXIMUM RATINGS (T<sub>j</sub> = 25°C, unless otherwise specified)

| Symbol                   | Parameter                     | Conditions                                     | Ratings    | Unit  |
|--------------------------|-------------------------------|------------------------------------------------|------------|-------|
| V <sub>CES</sub>         | Collector-emitter voltage     | G-E Short                                      | 1200       | V     |
| V <sub>GES</sub>         | Gate-emitter voltage          | C-E Short                                      | ±20        | V     |
| I <sub>C</sub>           | Collector current             | T <sub>C</sub> = 25°C                          | 400        | A     |
| I <sub>CM</sub>          |                               | Pulse (Note 2)                                 | 800        |       |
| I <sub>E</sub> (Note 1)  | Emitter current               | T <sub>C</sub> = 25°C                          | 400        | A     |
| I <sub>EM</sub> (Note 1) |                               | Pulse (Note 2)                                 | 800        |       |
| P <sub>C</sub> (Note 3)  | Maximum collector dissipation | T <sub>C</sub> = 25°C                          | 1600       | W     |
| T <sub>j</sub>           | Junction temperature          |                                                | −40 ~ +150 | °C    |
| T <sub>stg</sub>         | Storage temperature           |                                                | −40 ~ +125 | °C    |
| V <sub>iso</sub>         | Isolation voltage             | Terminals to base plate, f = 60Hz, AC 1 minute | 2500       | Vrms  |
| —                        | Torque strength               | Main terminals M8 screw                        | 8.8 ~ 10.8 | N • m |
|                          |                               | Mounting M6 screw                              | 3.5 ~ 4.5  | N • m |
|                          |                               | G(E) Terminal M4 screw                         | 1.3 ~ 1.7  | N • m |
| —                        | Weight                        | Typical value                                  | 450        | g     |

### ELECTRICAL CHARACTERISTICS (T<sub>j</sub> = 25°C, unless otherwise specified)

| Symbol                   | Parameter                            | Test conditions                                                                                                   | Limits                 |      |         | Unit |
|--------------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------|------|---------|------|
|                          |                                      |                                                                                                                   | Min.                   | Typ. | Max.    |      |
| I <sub>CES</sub>         | Collector cutoff current             | V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V                                                         | —                      | —    | 2       | mA   |
| V <sub>GE(th)</sub>      | Gate-emitter threshold voltage       | I <sub>C</sub> = 40mA, V <sub>CE</sub> = 10V                                                                      | 5                      | 6    | 7       | V    |
| I <sub>GES</sub>         | Gate leakage current                 | ±V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V                                                        | —                      | —    | 80      | μA   |
| V <sub>CE(sat)</sub>     | Collector-emitter saturation voltage | I <sub>C</sub> = 400A, V <sub>GE</sub> = 15V                                                                      | T <sub>j</sub> = 25°C  | 1.8  | 2.4     | V    |
|                          |                                      |                                                                                                                   | T <sub>j</sub> = 125°C | 1.9  | —       |      |
| C <sub>ies</sub>         | Input capacitance                    | V <sub>CE</sub> = 10V<br>V <sub>GE</sub> = 0V                                                                     | —                      | —    | 160     | nF   |
| C <sub>oes</sub>         | Output capacitance                   |                                                                                                                   | —                      | —    | 6.8     |      |
| C <sub>res</sub>         | Reverse transfer capacitance         |                                                                                                                   | —                      | —    | 4.0     |      |
| Q <sub>G</sub>           | Total gate charge                    | V <sub>CC</sub> = 600V, I <sub>C</sub> = 400A, V <sub>GE</sub> = 15V                                              | —                      | 4400 | —       | nC   |
| t <sub>d(on)</sub>       | Turn-on delay time                   | V <sub>CC</sub> = 600V, I <sub>C</sub> = 400A<br>V <sub>GE</sub> = ±15V<br>R <sub>G</sub> = 0.78Ω, Inductive load | —                      | —    | 300     | ns   |
| t <sub>r</sub>           | Turn-on rise time                    |                                                                                                                   | —                      | —    | 100     |      |
| t <sub>d(off)</sub>      | Turn-off delay time                  |                                                                                                                   | —                      | —    | 600     |      |
| t <sub>f</sub>           | Turn-off fall time                   |                                                                                                                   | —                      | —    | 300     |      |
| t <sub>rr</sub> (Note 1) | Reverse recovery time                |                                                                                                                   | —                      | —    | 350     | ns   |
| Q <sub>rr</sub> (Note 1) | Reverse recovery charge              | I <sub>E</sub> = 400A                                                                                             | —                      | 23.6 | —       | μC   |
| V <sub>EC</sub> (Note 1) | Emitter-collector voltage            | I <sub>E</sub> = 400A, V <sub>GE</sub> = 0V                                                                       | —                      | —    | 3.2     | V    |
| R <sub>th(j-c)Q</sub>    | Thermal resistance*1                 | IGBT part                                                                                                         | —                      | —    | 0.078   | K/W  |
| R <sub>th(j-c)R</sub>    |                                      | FWDi part                                                                                                         | —                      | —    | 0.09    |      |
| R <sub>th(c-f)</sub>     | Contact thermal resistance           | Case to heat sink, Thermal compound applied*2                                                                     | —                      | 0.02 | —       |      |
| R <sub>th(j-c)Q</sub>    | Thermal resistance                   | Case temperature measured point is just under the chips                                                           | —                      | —    | 0.045*3 |      |
| R <sub>G</sub>           | External gate resistance             |                                                                                                                   | 0.78                   | —    | 7.8     | Ω    |

Note 1. I<sub>E</sub>, V<sub>EC</sub>, t<sub>rr</sub>, Q<sub>rr</sub> & die/dt represent characteristics of the anti-parallel, emitter-collector free-wheel diode (FWDi).

2. Pulse width and repetition rate should be such that the device junction temperature (T<sub>j</sub>) does not exceed T<sub>jmax</sub> rating.

3. Junction temperature (T<sub>j</sub>) should not increase beyond 150°C.

4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

\*1 : Case temperature (T<sub>C</sub>) measured point is indicated in OUTLINE DRAWING.

\*2 : Typical value is measured by using thermally conductive grease of λ = 0.9[W/(m • K)].

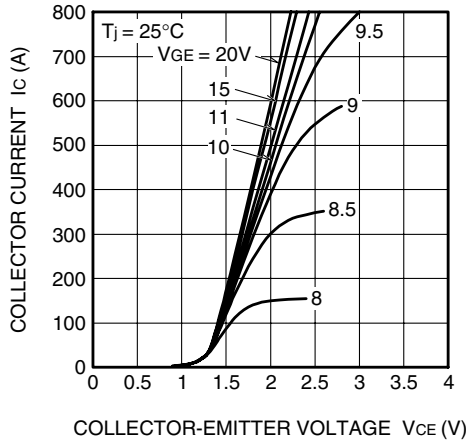
\*3 : If you use this value, R<sub>th(f-a)</sub> should be measured just under the chips.

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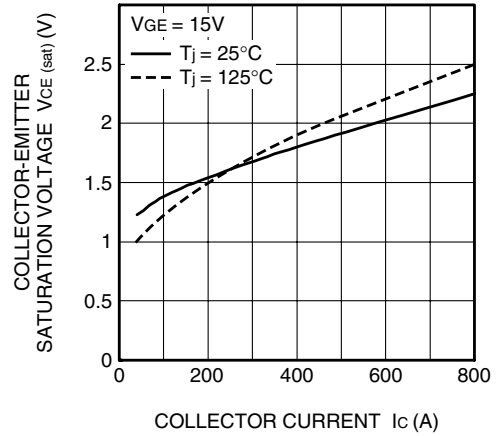
HIGH POWER SWITCHING USE

## PERFORMANCE CURVES

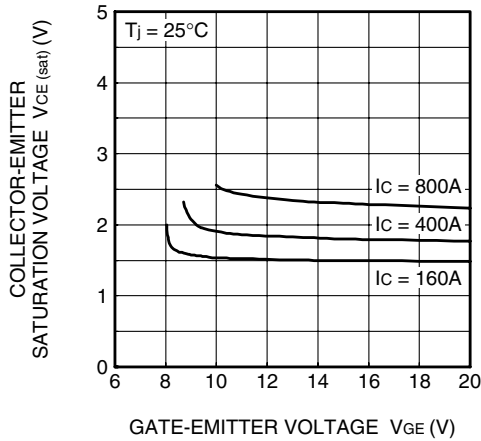
OUTPUT CHARACTERISTICS  
(TYPICAL)



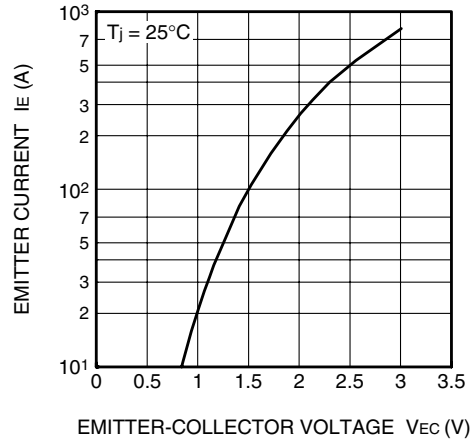
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



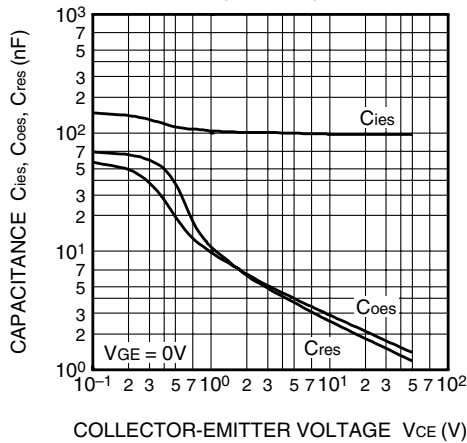
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



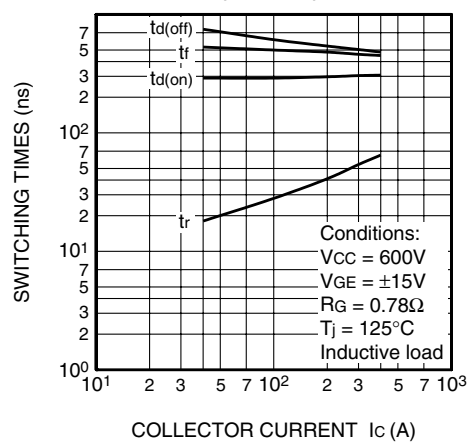
FREE-WHEEL DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



CAPACITANCE- $V_{ce}$   
CHARACTERISTICS  
(TYPICAL)



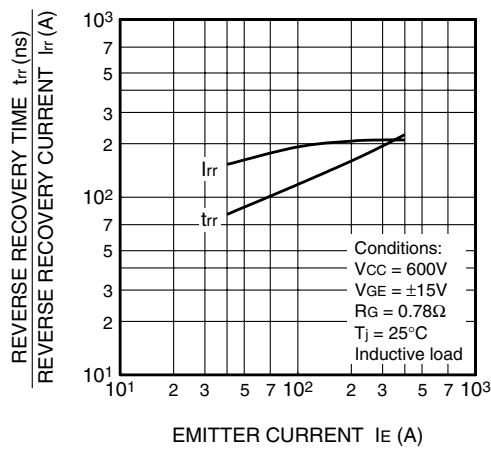
HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)



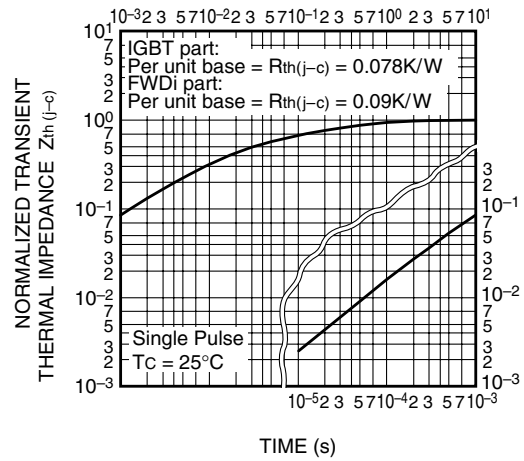
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**REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)**



**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT part & FWDi part)**



**GATE CHARGE  
CHARACTERISTICS  
(TYPICAL)**

