

# MITSUBISHI IGBT MODULES

## CM200RL-24NF

HIGH POWER SWITCHING USE

### CM200RL-24NF



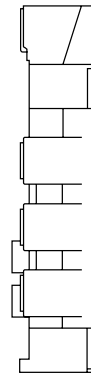
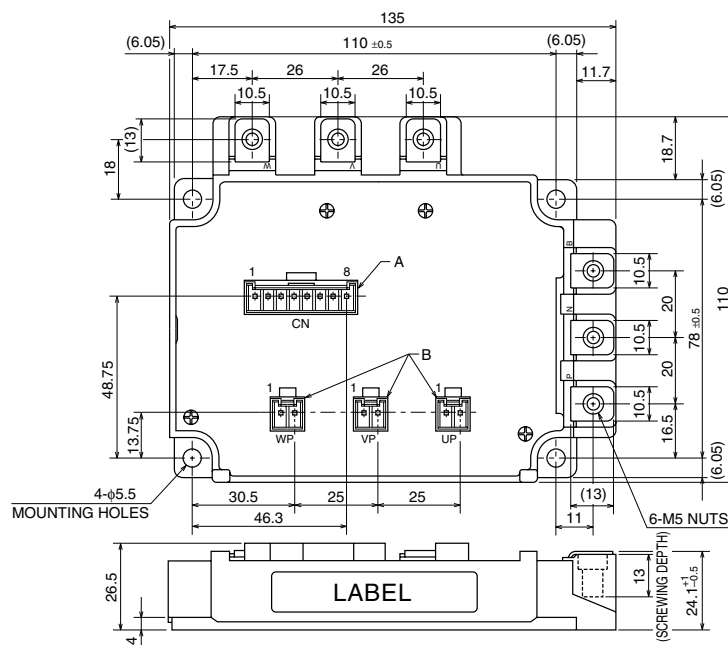
- Ic .....200A
- VCES ..... 1200V
- Insulated Type
- 7-elements in a pack

### APPLICATION

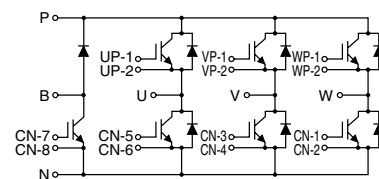
AC drive inverters & Servo controls, etc

### OUTLINE DRAWING & CIRCUIT DIAGRAM

Dimensions in mm



Housing Type of A and B  
(J.S.T.Mfg.Co.Ltd)  
A = B8P-VH-FB-B, B = B2P-VH-FB-B



CIRCUIT DIAGRAM

# CM200RL-24NF

## HIGH POWER SWITCHING USE

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

#### INVERTER PART

| 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             | DC, T <sub>c</sub> = 72°C <sup>*1</sup> | 200     | A    |
| I <sub>CM</sub>          |                               | Pulse (Note 2)                          | 400     | A    |
| I <sub>E</sub> (Note 1)  | Emitter current               |                                         | 200     | A    |
| I <sub>EM</sub> (Note 1) |                               | Pulse (Note 2)                          | 400     | A    |
| P <sub>C</sub> (Note 3)  | Maximum collector dissipation | T <sub>c</sub> = 25°C                   | 1160    | W    |

#### BRAKE PART

| 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               | DC, T <sub>c</sub> = 80°C <sup>*1</sup> | 100     | A    |
| I <sub>CM</sub>         |                                 | Pulse (Note 2)                          | 200     | A    |
| P <sub>C</sub> (Note 3) | Maximum collector dissipation   | T <sub>c</sub> = 25°C                   | 620     | W    |
| V <sub>RRM</sub>        | Repetitive peak reverse voltage | Clamp diode part                        | 1200    | V    |
| I <sub>FM</sub>         | Forward current                 | Clamp diode part                        | 100     | A    |

#### (COMMON RATING)

| Symbol           | Parameter            | Conditions                                     | Ratings    | Unit             |
|------------------|----------------------|------------------------------------------------|------------|------------------|
| 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       | V <sub>rms</sub> |
| —                | Torque strength      | Main terminals M5 screw                        | 2.5 ~ 3.5  | N • m            |
| —                |                      | Mounting M5 screw                              | 2.5 ~ 3.5  | N • m            |
| —                | Weight               | Typical value                                  | 750        | g                |

# CM200RL-24NF

## HIGH POWER SWITCHING USE

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

#### INVERTER PART

| Symbol                   | Parameter                            | Test conditions                                                      | Limits |       |      | Unit |
|--------------------------|--------------------------------------|----------------------------------------------------------------------|--------|-------|------|------|
|                          |                                      |                                                                      | Min.   | Typ.  | Max. |      |
| IC <sub>ES</sub>         | Collector cutoff current             | V <sub>CE</sub> = V <sub>CE</sub> S, V <sub>GE</sub> = 0V            | —      | —     | 1    | mA   |
| V <sub>GE(th)</sub>      | Gate-emitter threshold voltage       | I <sub>C</sub> = 20mA, V <sub>CE</sub> = 10V                         | 6      | 7     | 8    | V    |
| I <sub>GES</sub>         | Gate leakage current                 | ±V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V           | —      | —     | 0.5  | μA   |
| V <sub>CE(sat)</sub>     | Collector-emitter saturation voltage | I <sub>C</sub> = 200A, V <sub>GE</sub> = 15V                         | —      | 2.1   | 3.1  | V    |
|                          |                                      | T <sub>j</sub> = 25°C<br>T <sub>j</sub> = 125°C                      | —      | 2.4   | —    |      |
| C <sub>ies</sub>         | Input capacitance                    | V <sub>CE</sub> = 10V                                                | —      | —     | 35   | nF   |
| C <sub>oes</sub>         | Output capacitance                   | V <sub>GE</sub> = 0V                                                 | —      | —     | 3    | nF   |
| C <sub>res</sub>         | Reverse transfer capacitance         |                                                                      | —      | —     | 0.68 | nF   |
| Q <sub>G</sub>           | Total gate charge                    | V <sub>CC</sub> = 600V, I <sub>C</sub> = 200A, V <sub>GE</sub> = 15V | —      | 1000  | —    | nC   |
| t <sub>d(on)</sub>       | Turn-on delay time                   |                                                                      | —      | —     | 130  | ns   |
| t <sub>r</sub>           | Turn-on rise time                    | V <sub>CC</sub> = 600V, I <sub>C</sub> = 200A                        | —      | —     | 70   | ns   |
| t <sub>d(off)</sub>      | Turn-off delay time                  | V <sub>GE</sub> = ±15V                                               | —      | —     | 400  | ns   |
| t <sub>f</sub>           | Turn-off fall time                   | R <sub>G</sub> = 1.6Ω, Inductive load                                | —      | —     | 350  | ns   |
| t <sub>rr</sub> (Note 1) | Reverse recovery time                | I <sub>E</sub> = 200A                                                | —      | —     | 150  | ns   |
| Q <sub>rr</sub> (Note 1) | Reverse recovery charge              |                                                                      | —      | 9     | —    | μC   |
| V <sub>EC</sub> (Note 1) | Emitter-collector voltage            | I <sub>E</sub> = 200A, V <sub>GE</sub> = 0V                          | —      | —     | 3.8  | V    |
| R <sub>th(j-c)Q</sub>    | Thermal resistance                   | IGBT part (1/6 module)*1                                             | —      | —     | 0.11 | K/W  |
| R <sub>th(j-c)R</sub>    |                                      | FWDi part (1/6 module)*1                                             | —      | —     | 0.17 | K/W  |
| R <sub>th(c-f)</sub>     | Contact thermal resistance           | Case to heat sink, Thermal compound Applied (1/6 module)*2           | —      | 0.051 | —    | K/W  |
| R <sub>G</sub>           | External gate resistance             |                                                                      | 1.6    | —     | 21   | Ω    |

#### BRAKE PART

| Symbol                | Parameter                            | Test conditions                                                      | Limits |      |      | Unit |
|-----------------------|--------------------------------------|----------------------------------------------------------------------|--------|------|------|------|
|                       |                                      |                                                                      | Min.   | Typ. | Max. |      |
| IC <sub>ES</sub>      | Collector cutoff current             | V <sub>CE</sub> = V <sub>CE</sub> S, V <sub>GE</sub> = 0V            | —      | —    | 1    | mA   |
| V <sub>GE(th)</sub>   | Gate-emitter threshold voltage       | I <sub>C</sub> = 10mA, V <sub>CE</sub> = 10V                         | 6      | 7    | 8    | V    |
| I <sub>GES</sub>      | Gate leakage current                 | ±V <sub>GE</sub> = V <sub>GES</sub> , V <sub>CE</sub> = 0V           | —      | —    | 0.5  | μA   |
| V <sub>CE(sat)</sub>  | Collector-emitter saturation voltage | I <sub>C</sub> = 100A, V <sub>GE</sub> = 15V                         | —      | 2.1  | 3.0  | V    |
|                       |                                      | T <sub>j</sub> = 25°C<br>T <sub>j</sub> = 125°C                      | —      | 2.4  | —    |      |
| C <sub>ies</sub>      | Input capacitance                    | V <sub>CE</sub> = 10V                                                | —      | —    | 17.5 | nF   |
| C <sub>oes</sub>      | Output capacitance                   | V <sub>GE</sub> = 0V                                                 | —      | —    | 1.5  | nF   |
| C <sub>res</sub>      | Reverse transfer capacitance         |                                                                      | —      | —    | 0.34 | nF   |
| Q <sub>G</sub>        | Total gate charge                    | V <sub>CC</sub> = 600V, I <sub>C</sub> = 100A, V <sub>GE</sub> = 15V | —      | 500  | —    | nC   |
| V <sub>FM</sub>       | Forward voltage drop                 | I <sub>F</sub> = 100A                                                | —      | —    | 3.8  | V    |
| R <sub>th(j-c)Q</sub> | Thermal resistance                   | IGBT part*1                                                          | —      | —    | 0.20 | K/W  |
| R <sub>th(j-c)R</sub> |                                      | Clamp diode part*1                                                   | —      | —    | 0.28 | K/W  |
| R <sub>G</sub>        | External gate resistance             |                                                                      | 3.1    | —    | 31   | Ω    |

\*1 : Case temperature (T<sub>c</sub>) measured point is just under the chips.

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

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

Note 1. I<sub>E</sub>, V<sub>EC</sub>, t<sub>rr</sub> & Q<sub>rr</sub> 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.

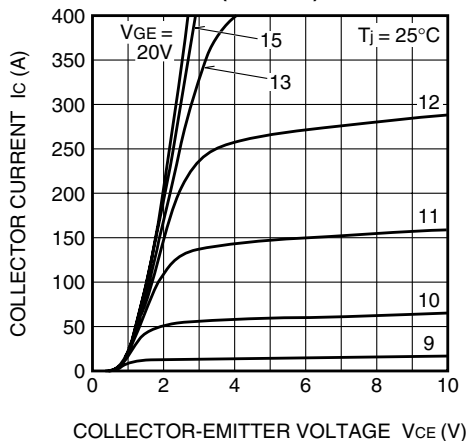
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

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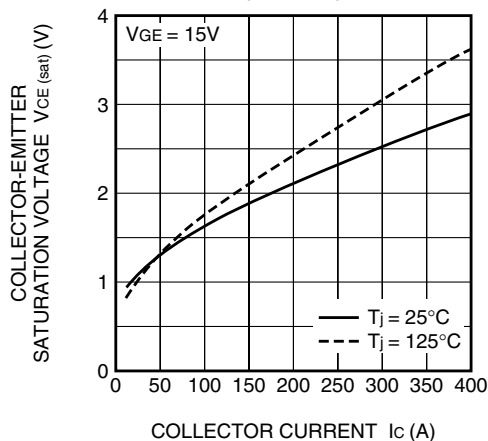
HIGH POWER SWITCHING USE

## PERFORMANCE CURVES

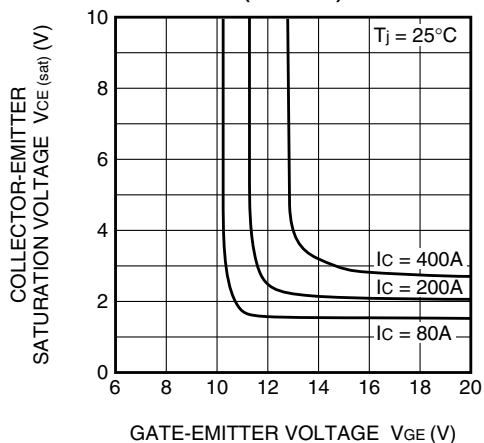
OUTPUT CHARACTERISTICS  
(TYPICAL)



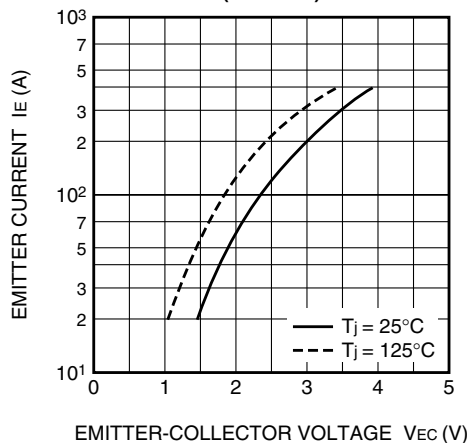
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



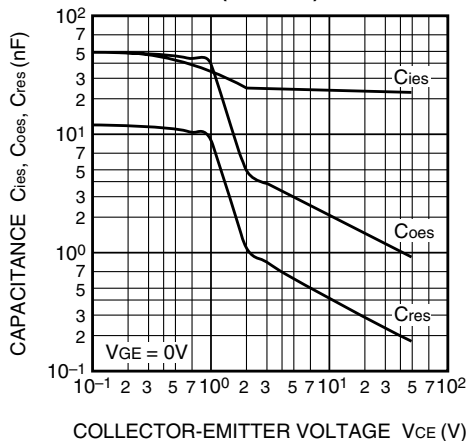
COLLECTOR-EMITTER SATURATION  
VOLTAGE CHARACTERISTICS  
(TYPICAL)



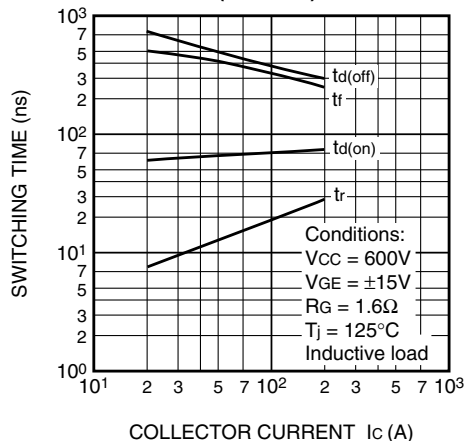
FREE-WHEEL DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)



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



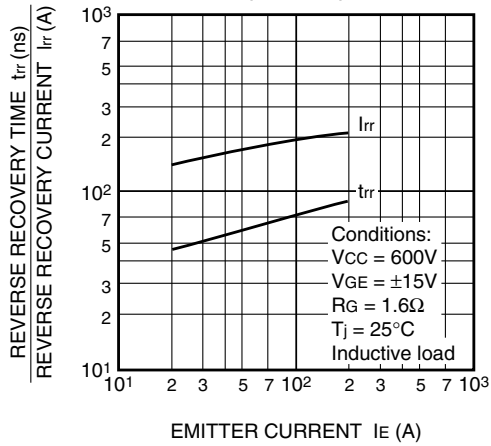
HALF-BRIDGE  
SWITCHING CHARACTERISTICS  
(TYPICAL)



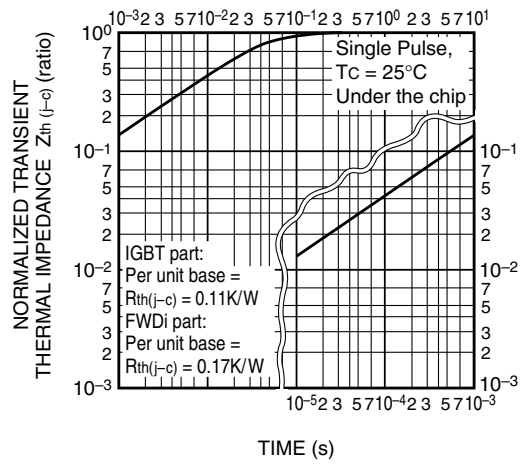
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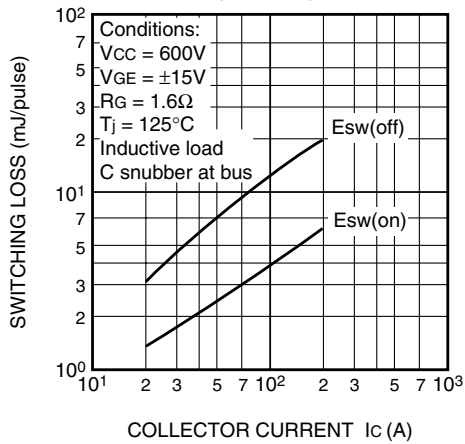
**REVERSE RECOVERY CHARACTERISTICS  
OF FREE-WHEEL DIODE  
(TYPICAL)**



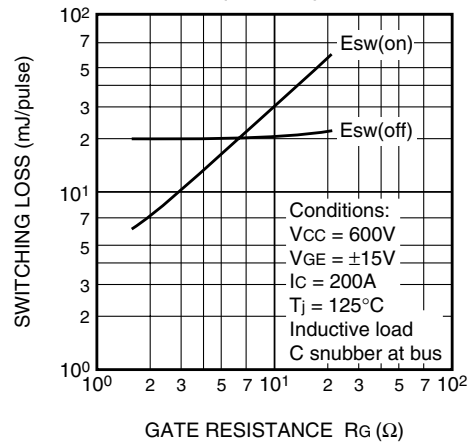
**TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT part & FWDi part)**



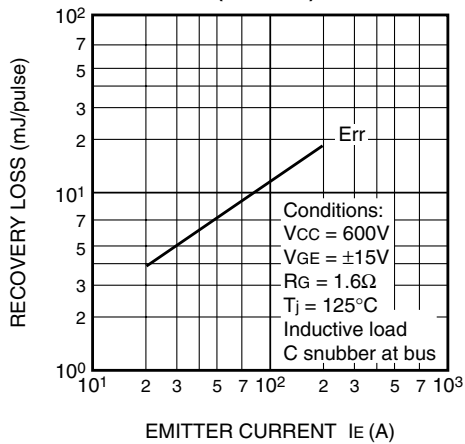
**SWITCHING LOSS vs.  
COLLECTOR CURRENT  
(TYPICAL)**



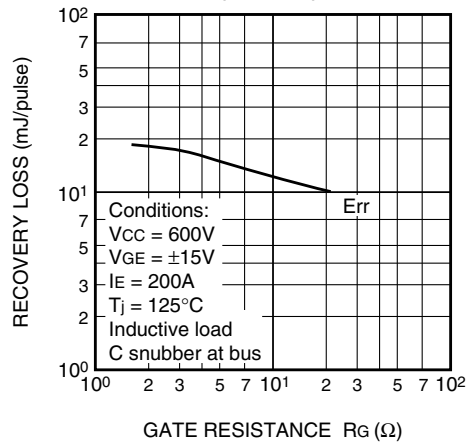
**SWITCHING LOSS vs.  
GATE RESISTANCE  
(TYPICAL)**



**RECOVERY LOSS vs. Ie  
(TYPICAL)**



**RECOVERY LOSS vs.  
GATE RESISTANCE  
(TYPICAL)**



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