

MITSUBISHI IGBT MODULES  
**CM50TL-24NF**

HIGH POWER SWITCHING USE

**CM50TL-24NF**



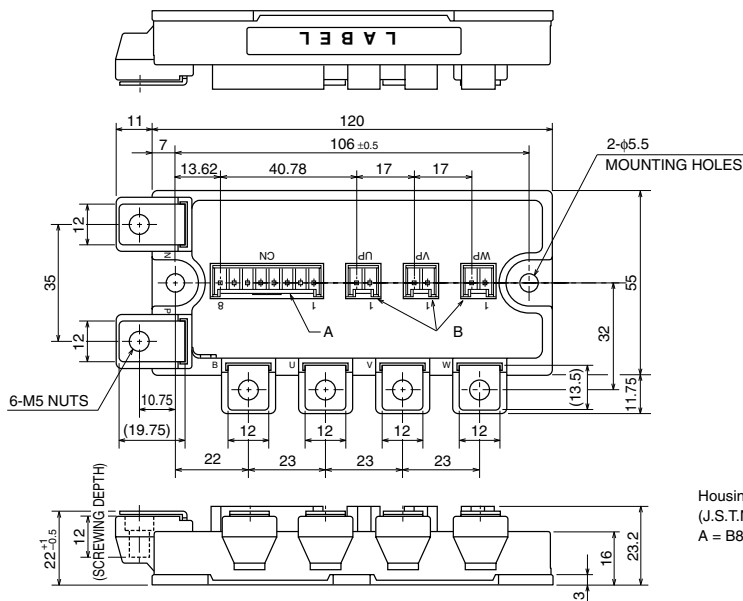
- IC ..... 50A
- VCES ..... 1200V
- Insulated Type
- 6-elements in a pack

**APPLICATION**

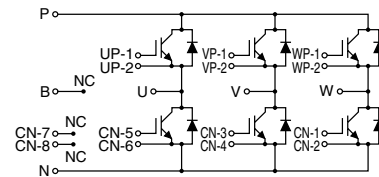
AC drive inverters & Servo controls, etc

**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**

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

| Symbol                   | Parameter                     | Conditions                                     | Ratings    | Unit  |
|--------------------------|-------------------------------|--|------------|-------|
| V <sub>CE</sub> S        | Collector-emitter voltage     | G-E Short                                      | 1200       | V     |
| V <sub>GE</sub> S        | Gate-emitter voltage          | C-E Short                                      | ±20        | V     |
| I <sub>C</sub>           | Collector current             | DC, T <sub>c</sub> = 94°C <sup>*1</sup>        | 50         | A     |
| I <sub>CM</sub>          |                               | Pulse (Note 2)                                 | 100        | A     |
| I <sub>E</sub> (Note 1)  | Emitter current               |  | 50         | A     |
| I <sub>EM</sub> (Note 1) |                               | Pulse (Note 2)                                 | 100        | A     |
| P <sub>C</sub> (Note 3)  | Maximum collector dissipation | T <sub>c</sub> = 25°C                          | 390        | 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 M5 screw                        | 2.5 ~ 3.5  | N • m |
| —                        |                               | Mounting M5 screw                              | 2.5 ~ 3.5  | N • m |
| —                        | Weight                        | Typical value                                  | 350        | 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>CE</sub> S, V <sub>GE</sub> = 0V   | —      | —                            | 1    | mA   |
| V <sub>GE(th)</sub>      | Gate-emitter threshold voltage       | I <sub>C</sub> = 5.0mA, 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> = 50A, V <sub>GE</sub> = 15V   | —      | T <sub>j</sub> = 25°C<br>2.1 | 3.0  | V    |
|                          |                                      | T <sub>j</sub> = 125°C<br>2.4   |        | —                            |      |      |
| C <sub>ies</sub>         | Input capacitance                    | V <sub>CE</sub> = 10V<br>V <sub>GE</sub> = 0V   | —      | —                            | 8.5  | nF   |
| C <sub>oes</sub>         | Output capacitance                   |   | —      | —                            | 0.75 | nF   |
| C <sub>res</sub>         | Reverse transfer capacitance         |   | —      | —                            | 0.17 | nF   |
| Q <sub>G</sub>           | Total gate charge                    | V <sub>CC</sub> = 600V, I <sub>C</sub> = 50A, V <sub>GE</sub> = 15V   | —      | 250                          | —    | nC   |
| t <sub>d(on)</sub>       | Turn-on delay time                   | V <sub>CC</sub> = 600V, I <sub>C</sub> = 50A<br>V <sub>GE</sub> = ±15V<br>R <sub>G</sub> = 6.3Ω, Inductive load<br>I <sub>E</sub> = 50A | —      | —                            | 100  | ns   |
| t <sub>r</sub>           | Turn-on rise time                    |   | —      | —                            | 50   | ns   |
| t <sub>d(off)</sub>      | Turn-off delay time                  |   | —      | —                            | 300  | ns   |
| t <sub>f</sub>           | Turn-off fall time                   |   | —      | —                            | 350  | ns   |
| t <sub>rr</sub> (Note 1) | Reverse recovery time                |   | —      | —                            | 100  | ns   |
| Q <sub>rr</sub> (Note 1) | Reverse recovery charge              | —   | 2      | —                            | µC   |      |
| V <sub>EC</sub> (Note 1) | Emitter-collector voltage            | I <sub>E</sub> = 50A, V <sub>GE</sub> = 0V  | —      | —                            | 3.8  | V    |
| R <sub>th(j-c)Q</sub>    | Thermal resistance                   | IGBT part (1/6 module) <sup>*1</sup>  | —      | —                            | 0.32 | K/W  |
| R <sub>th(j-c)R</sub>    |                                      | FWDi part (1/6 module) <sup>*1</sup>  | —      | —                            | 0.43 | K/W  |
| R <sub>th(c-f)</sub>     | Contact thermal resistance           | Case to heat sink, Thermal compound Applied (1/6 module) <sup>*2</sup>  | —      | 0.085                        | —    | K/W  |
| R <sub>G</sub>           | External gate resistance             |   | 6.3    | —                            | 96   | Ω    |

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

If you use this value, R<sub>th(t-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.

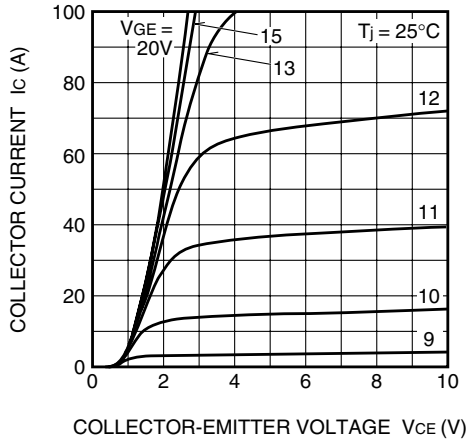
4. Pulse width and repetition rate should be such as to cause negligible temperature rise.

# CM50TL-24NF

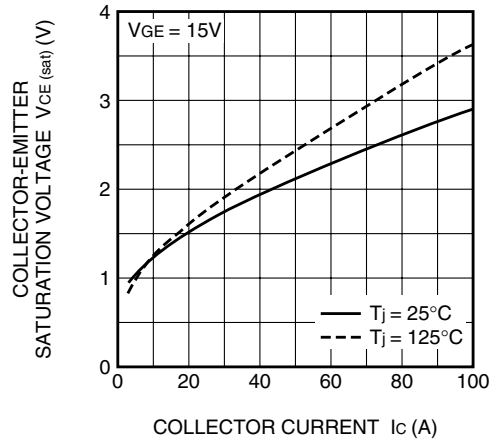
HIGH POWER SWITCHING USE

## PERFORMANCE CURVES

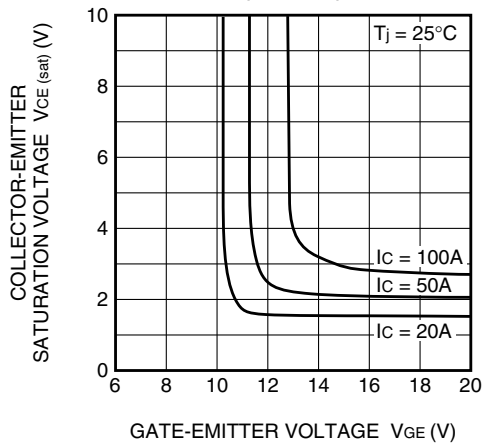
**OUTPUT CHARACTERISTICS (TYPICAL)**



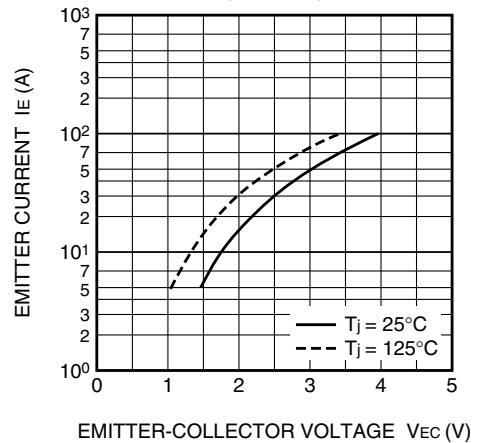
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



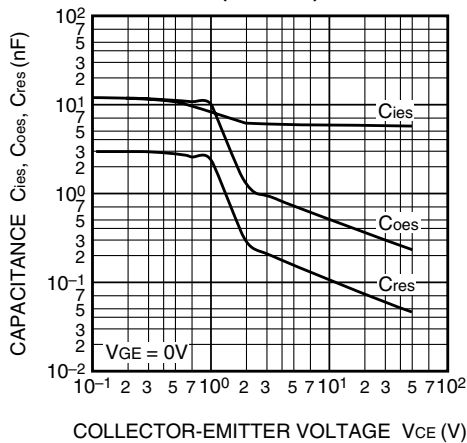
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



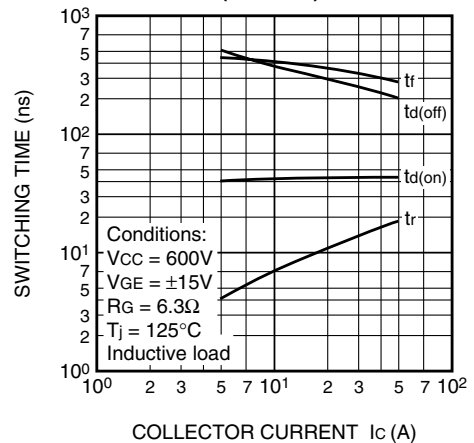
**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)**



**CAPACITANCE-VCE CHARACTERISTICS (TYPICAL)**



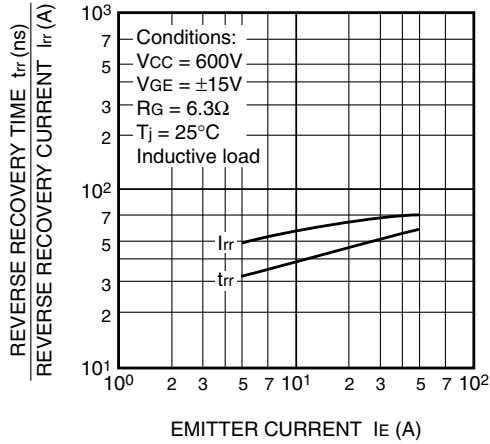
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



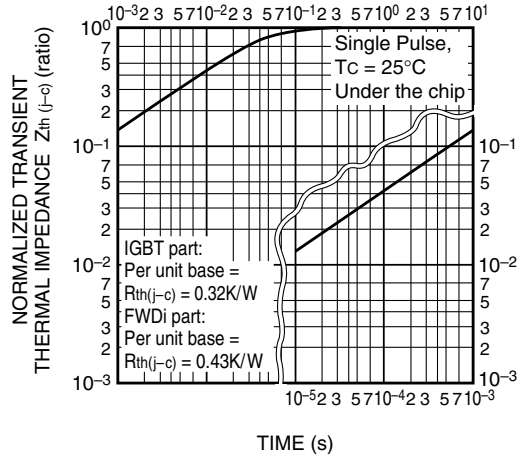
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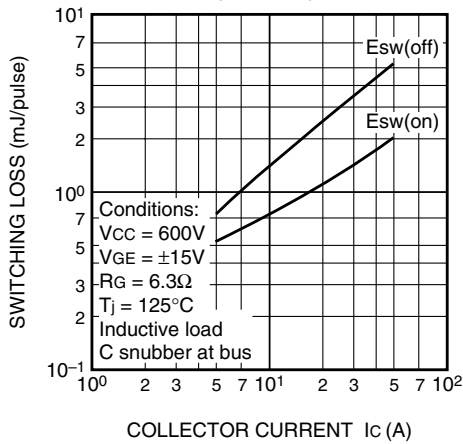
REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)



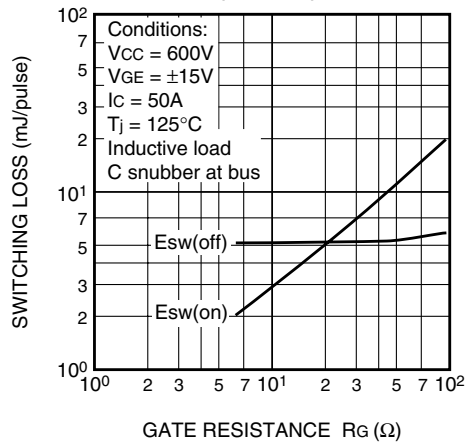
TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT part & FWDi part)



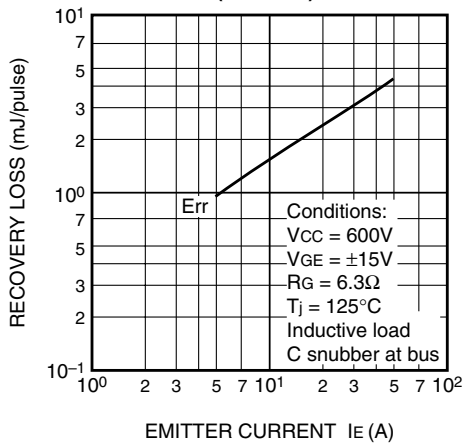
SWITCHING LOSS vs. COLLECTOR CURRENT (TYPICAL)



SWITCHING LOSS vs. GATE RESISTANCE (TYPICAL)



RECOVERY LOSS vs. IE (TYPICAL)



RECOVERY LOSS vs. GATE RESISTANCE (TYPICAL)

