

MITSUBISHI HVIGBT MODULES  
**CM1200DC-34N**

4th-Version HVIGBT (High Voltage Insulated Gate Bipolar Transistor) Modules

HIGH POWER SWITCHING USE  
 INSULATED TYPE

**CM1200DC-34N**



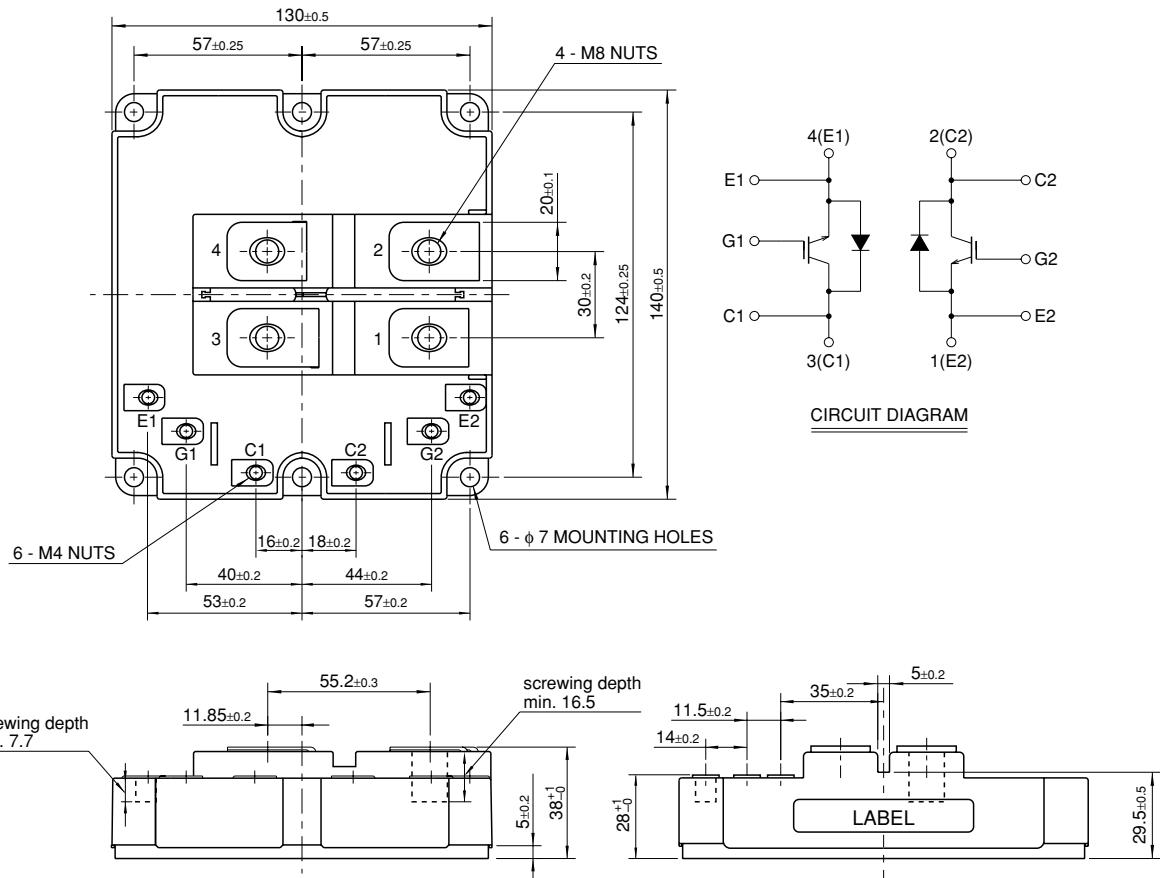
- Ic ..... 1200A
- VCES ..... 1700V
- Insulated Type
- 2-element in a Pack
- AISiC Baseplate
- Trench Gate IGBT : CSTBT™
- Soft Reverse Recovery Diode

**APPLICATION**

Traction drives, High Reliability Converters / Inverters, DC choppers

**OUTLINE DRAWING & CIRCUIT DIAGRAM**

Dimensions in mm



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Jul. 2005

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## MAXIMUM RATINGS

| Symbol                   | Item                              | Conditions  | Ratings    | Unit |
|--------------------------|-----------------------------------|---|------------|------|
| V <sub>CE</sub> S        | Collector-emitter voltage         | V <sub>GE</sub> = 0V, T <sub>j</sub> = 25°C   | 1700       | V    |
| V <sub>GE</sub> S        | Gate-emitter voltage              | V <sub>CE</sub> = 0V, T <sub>j</sub> = 25°C   | ±20        | V    |
| I <sub>C</sub>           | Collector current                 | T <sub>C</sub> = 75°C   | 1200       | A    |
| I <sub>CM</sub>          |                                   | Pulse (Note 1)  | 2400       | A    |
| I <sub>E</sub> (Note 2)  | Emitter current                   |   | 1200       | A    |
| I <sub>EM</sub> (Note 2) |                                   | Pulse (Note 1)  | 2400       | A    |
| P <sub>C</sub> (Note 3)  | Maximum power dissipation         | T <sub>C</sub> = 25°C, IGBT part  | 6500       | W    |
| T <sub>j</sub>           | Junction temperature              |   | -40 ~ +150 | °C   |
| T <sub>op</sub>          | Operating temperature             |   | -40 ~ +125 | °C   |
| T <sub>stg</sub>         | Storage temperature               |   | -40 ~ +125 | °C   |
| V <sub>iso</sub>         | Isolation voltage                 | RMS, sinusoidal, f = 60Hz, t = 1min.  | 4000       | V    |
| t <sub>p</sub> sc        | Maximum short circuit pulse width | V <sub>CC</sub> = 1200V, V <sub>CE</sub> ≤ 1700V, V <sub>GE</sub> = 15V<br>T <sub>j</sub> = 125°C | 10         | μs   |

## ELECTRICAL CHARACTERISTICS

| Symbol                    | Item                                 | Conditions   | Limits |      |      | Unit     |
|---------------------------|--------------------------------------|--|--------|------|------|----------|
|                           |                                      |  | Min    | Typ  | Max  |          |
| I <sub>CE</sub> S         | Collector cut-off current            | V <sub>CE</sub> = V <sub>CE</sub> S, V <sub>GE</sub> = 0V, T <sub>j</sub> = 25°C   | —      | —    | 4    | mA       |
| V <sub>GE(th)</sub>       | Gate-emitter threshold voltage       | I <sub>C</sub> = 120mA, V <sub>CE</sub> = 10V, T <sub>j</sub> = 25°C   | 6.0    | 7.0  | 8.0  | V        |
| I <sub>GE</sub> S         | Gate leakage current                 | V <sub>GE</sub> = V <sub>GE</sub> S, V <sub>CE</sub> = 0V, T <sub>j</sub> = 25°C   | —      | —    | 0.5  | μA       |
| V <sub>CE(sat)</sub>      | Collector-emitter saturation voltage | I <sub>C</sub> = 1200A, V <sub>GE</sub> = 15V, T <sub>j</sub> = 25°C (Note 4)  | —      | 2.15 | 2.80 | V        |
|                           |                                      | I <sub>C</sub> = 1200A, V <sub>GE</sub> = 15V, T <sub>j</sub> = 125°C (Note 4)   | —      | 2.40 | —    |          |
| C <sub>ies</sub>          | Input capacitance                    | V <sub>CE</sub> = 10V, f = 100kHz<br>V <sub>GE</sub> = 0V, T <sub>j</sub> = 25°C   | —      | 176  | —    | nF       |
| C <sub>oes</sub>          | Output capacitance                   |  | —      | 9.6  | —    | nF       |
| C <sub>res</sub>          | Reverse transfer capacitance         |  | —      | 2.8  | —    | nF       |
| Q <sub>g</sub>            | Total gate charge                    | V <sub>CC</sub> = 850V, I <sub>C</sub> = 1200A, V <sub>GE</sub> = 15V, T <sub>j</sub> = 25°C   | —      | 6.8  | —    | μC       |
| V <sub>EC</sub> (Note 2)  | Emitter-collector voltage            | I <sub>E</sub> = 1200A, V <sub>GE</sub> = 0V, T <sub>j</sub> = 25°C (Note 4)   | —      | 2.60 | 3.30 | V        |
|                           |                                      | I <sub>E</sub> = 1200A, V <sub>GE</sub> = 0V, T <sub>j</sub> = 125°C (Note 4)  | —      | 2.30 | —    |          |
| t <sub>d(on)</sub>        | Turn-on delay time                   | V <sub>CC</sub> = 850V, I <sub>C</sub> = 1200A, V <sub>GE</sub> = ±15V<br>R <sub>G(on)</sub> = 1.3Ω, T <sub>j</sub> = 125°C, L <sub>s</sub> = 150nH<br>Inductive load  | —      | 1.00 | —    | μs       |
| t <sub>r</sub>            | Turn-on rise time                    |  | —      | 0.40 | —    | μs       |
| E <sub>on</sub>           | Turn-on switching energy             | V <sub>CC</sub> = 850V, I <sub>C</sub> = 1200A, V <sub>GE</sub> = ±15V<br>R <sub>G(off)</sub> = 3.3Ω, T <sub>j</sub> = 125°C, L <sub>s</sub> = 150nH<br>Inductive load | —      | 380  | —    | mJ/pulse |
| t <sub>d(off)</sub>       | Turn-off delay time                  |  | —      | 1.20 | —    | μs       |
| t <sub>f</sub>            | Turn-off fall time                   | V <sub>CC</sub> = 850V, I <sub>C</sub> = 1200A, V <sub>GE</sub> = ±15V<br>R <sub>G(off)</sub> = 3.3Ω, T <sub>j</sub> = 125°C, L <sub>s</sub> = 150nH<br>Inductive load | —      | 0.30 | —    | μs       |
| E <sub>off</sub>          | Turn-off switching energy            |  | —      | 360  | —    | mJ/pulse |
| t <sub>rr</sub> (Note 2)  | Reverse recovery time                | V <sub>CC</sub> = 850V, I <sub>C</sub> = 1200A, V <sub>GE</sub> = ±15V   | —      | 1.00 | —    | μs       |
| I <sub>rr</sub> (Note 2)  | Reverse recovery current             | R <sub>G(on)</sub> = 1.3Ω, T <sub>j</sub> = 125°C, L <sub>s</sub> = 150nH  | —      | 560  | —    | A        |
| Q <sub>rr</sub> (Note 2)  | Reverse recovery charge              | Inductive load   | —      | 300  | —    | μC       |
| E <sub>rec</sub> (Note 2) | Reverse recovery energy              |  | —      | 220  | —    | mJ/pulse |

Note 1. Pulse width and repetition rate should be such that junction temperature (T<sub>j</sub>) does not exceed T<sub>op</sub>max rating (125°C).

2. The symbols represent characteristics of the anti-parallel, emitter to collector free-wheel diode (FWDi).

3. Junction temperature (T<sub>j</sub>) should not exceed T<sub>j</sub>max rating (150°C).

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

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**THERMAL CHARACTERISTICS**

| Symbol                | Item                       | Conditions  | Limits |      |      | Unit |
|-----------------------|----------------------------|---|--------|------|------|------|
|                       |                            |   | Min    | Typ  | Max  |      |
| R <sub>th(j-c)Q</sub> | Thermal resistance         | Junction to Case, IGBT part, 1/2 module                     | —      | —    | 19.0 | K/kW |
| R <sub>th(j-c)R</sub> |                            | Junction to Case, FWDi part, 1/2 module                     | —      | —    | 42.0 | K/kW |
| R <sub>th(c-f)</sub>  | Contact thermal resistance | Case to Fin, $\lambda_{grease} = 1W/m \cdot K$ , 1/2 module | —      | 16.0 | —    | K/kW |

**MECHANICAL CHARACTERISTICS**

| Symbol         | Item                            | Conditions                     | Limits |      |      | Unit |
|----------------|---------------------------------|--------------------------------|--------|------|------|------|
|                |                                 |                                | Min    | Typ  | Max  |      |
| M              | Mounting torque                 | M8 : Main terminals screw      | 7.0    | —    | 20.0 | N·m  |
|                |                                 | M6 : Mounting screw            | 3.0    | —    | 6.0  |      |
|                |                                 | M4 : Auxiliary terminals screw | 1.0    | —    | 3.0  |      |
| —              | Mass                            |                                | —      | 0.8  | —    | kg   |
| CTI            | Comparative tracking index      |                                | 600    | —    | —    | —    |
| d <sub>a</sub> | Clearance distance in air       |                                | 9.5    | —    | —    | mm   |
| d <sub>s</sub> | Creepage distance along surface |                                | 15.0   | —    | —    | mm   |
| LC-E(int)      | Internal inductance             | IGBT part                      | —      | 30   | —    | nH   |
| RC-E(int)      | Internal lead resistance        | T <sub>C</sub> = 25°C          | —      | 0.28 | —    | mΩ   |

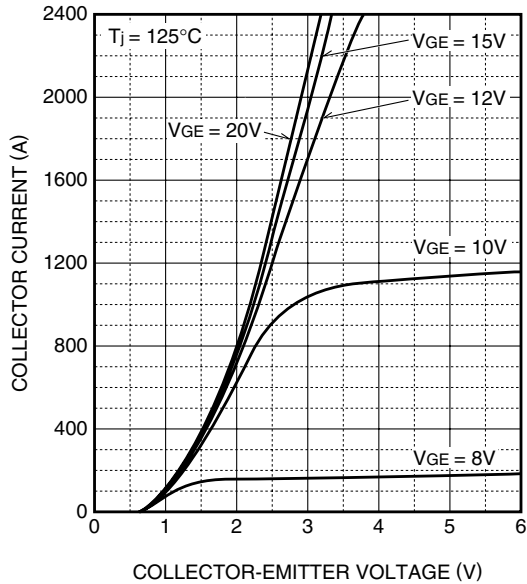
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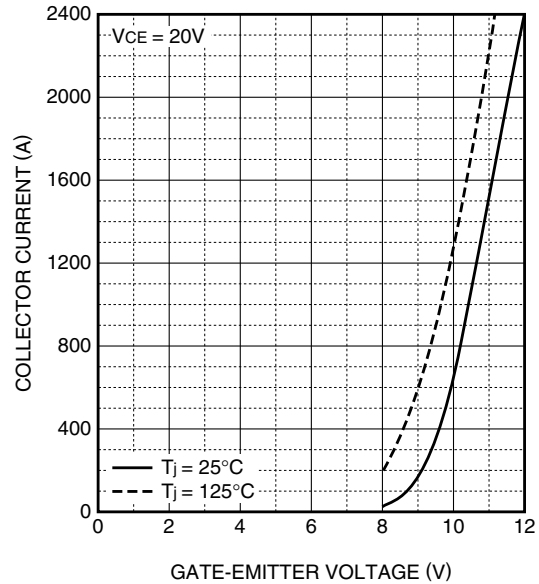
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## PERFORMANCE CURVES

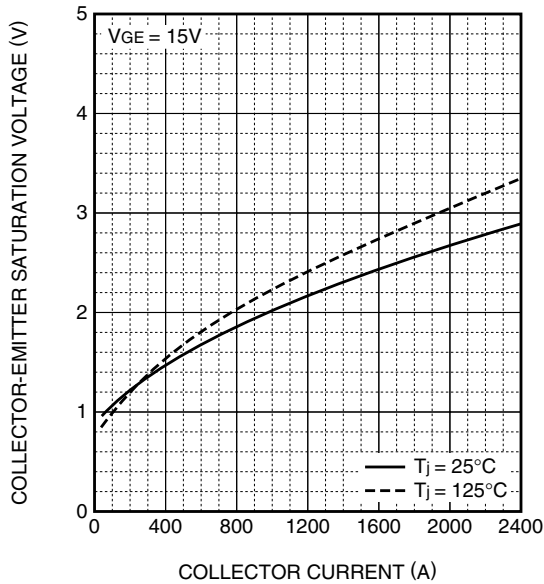
OUTPUT CHARACTERISTICS (TYPICAL)



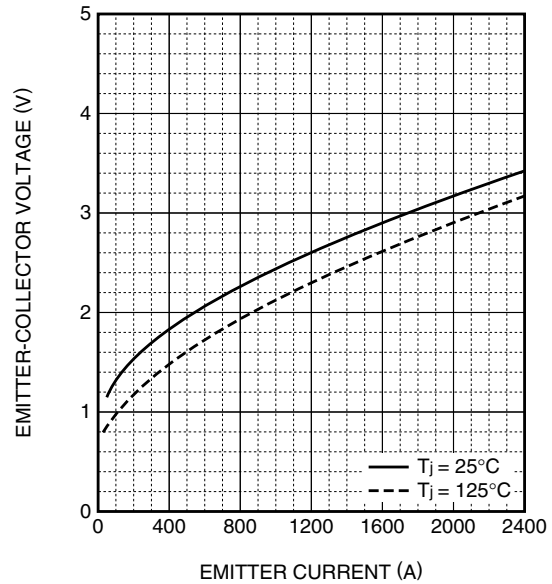
TRANSFER CHARACTERISTICS (TYPICAL)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



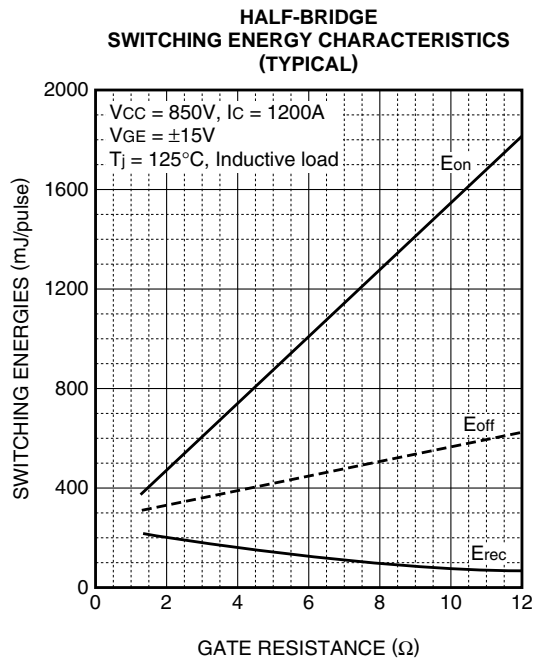
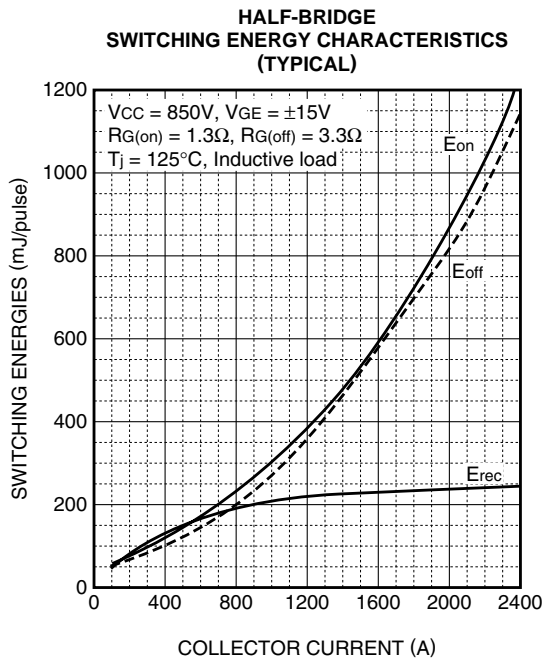
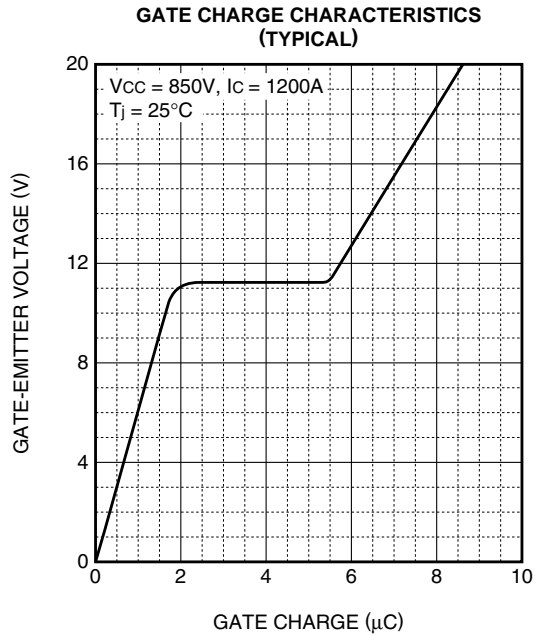
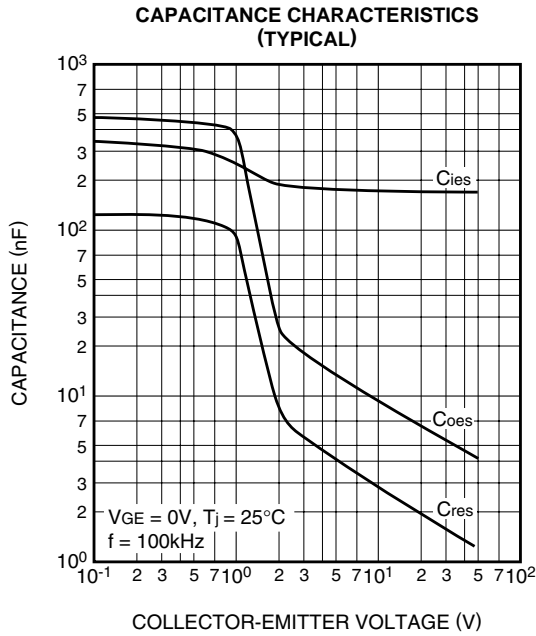
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



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