

## MG12200D-BN2MM



### Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E71639             |

### Features

- High short circuit capability, self limiting short circuit current
- IGBT<sup>3</sup> CHIP(Trench+Field Stop technology)
- $V_{CE(sat)}$  with positive temperature coefficient
- Fast switching and short tail current
- Free wheeling diodes with fast and soft reverse recovery
- Low switching losses

### Applications

- Medical applications
- High frequency switching application
- Motion/servo control
- UPS systems

### Module Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

| Symbol      | Parameters                 | Test Conditions  | Min | Typ  | Max | Unit             |
|-------------|----------------------------|------------------|-----|------|-----|------------------|
| $T_{J\max}$ | Max. Junction Temperature  |                  |     |      | 150 | $^\circ\text{C}$ |
| $T_{Jop}$   | Operating Temperature      |                  | -40 |      | 125 | $^\circ\text{C}$ |
| $T_{stg}$   | Storage Temperature        |                  | -40 |      | 125 | $^\circ\text{C}$ |
| $V_{isol}$  | Insulation Test Voltage    | AC, t=1min       |     | 3000 |     | V                |
| CTI         | Comparative Tracking Index |                  | 350 |      |     |                  |
| Torque      | Module-to-Sink             | Recommended (M6) | 3   |      | 5   | N·m              |
| Torque      | Module Electrodes          | Recommended (M6) | 2.5 |      | 5   | N·m              |
| Weight      |                            |                  |     | 320  |     | g                |

### Absolute Maximum Ratings ( $T_c = 25^\circ\text{C}$ , unless otherwise specified)

| Symbol       | Parameters                        | Test Conditions                                                   | Values   | Unit                 |
|--------------|-----------------------------------|-------------------------------------------------------------------|----------|----------------------|
| <b>IGBT</b>  |                                   |                                                                   |          |                      |
| $V_{CES}$    | Collector - Emitter Voltage       | $T_J = 25^\circ\text{C}$                                          | 1200     | V                    |
| $V_{GES}$    | Gate - Emitter Voltage            |                                                                   | $\pm 20$ | V                    |
| $I_C$        | DC Collector Current              | $T_c = 25^\circ\text{C}$                                          | 290      | A                    |
|              |                                   | $T_c = 80^\circ\text{C}$                                          | 200      | A                    |
| $I_{CM}$     | Repetitive Peak Collector Current | $t_p = 1\text{ms}$                                                | 400      | A                    |
| $P_{tot}$    | Power Dissipation Per IGBT        |                                                                   | 1050     | W                    |
| <b>Diode</b> |                                   |                                                                   |          |                      |
| $V_{RRM}$    | Repetitive Reverse Voltage        | $T_J = 25^\circ\text{C}$                                          | 1200     | V                    |
| $I_{F(AV)}$  | Average Forward Current           | $T_c = 25^\circ\text{C}$                                          | 290      | A                    |
|              |                                   | $T_c = 80^\circ\text{C}$                                          | 200      | A                    |
| $I_{FRM}$    | Repetitive Peak Forward Current   |                                                                   | 400      | A                    |
| $I^2t$       |                                   | $T_J = 125^\circ\text{C}$ , $t = 10\text{ms}$ , $V_R = 0\text{V}$ | 7750     | $\text{A}^2\text{s}$ |

Life Support Note:

#### Not Intended for Use in Life Support or Life Saving Applications

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

MG12200D-BN2MM

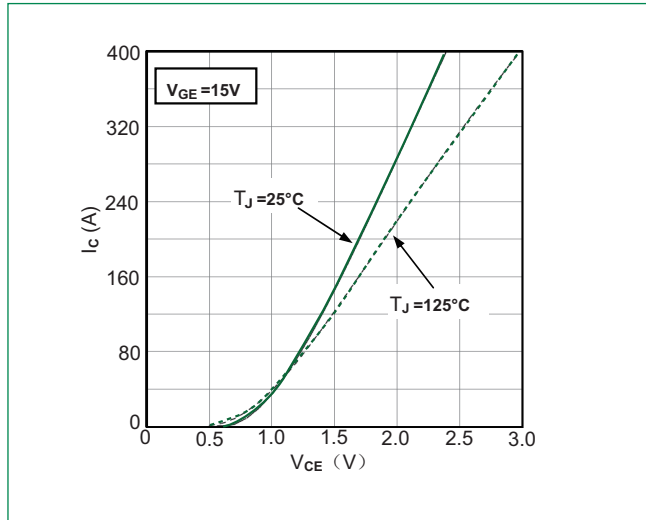
# Power Module

## 1200V 200A IGBT Module

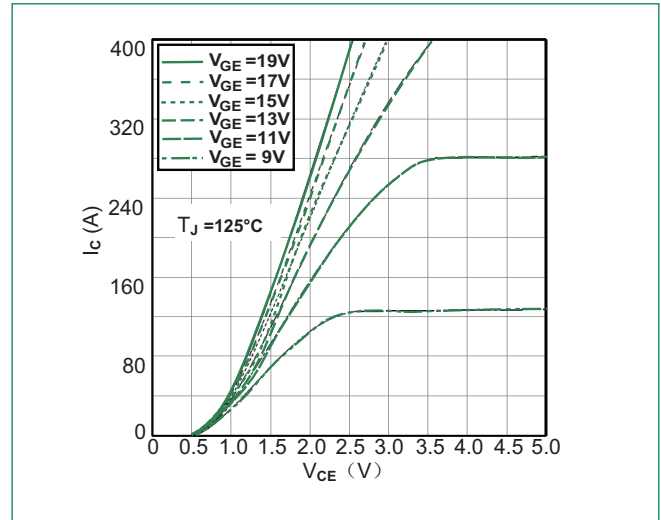
### Electrical and Thermal Specifications ( $T_c = 25^\circ\text{C}$ , unless otherwise specified)

| Symbol               | Parameters                                      | Test Conditions                                                                                                  |                       | Min  | Typ  | Max  | Unit |
|----------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------|------|------|------|------|
| IGBT                 |                                                 |                                                                                                                  |                       |      |      |      |      |
| V <sub>GE(th)</sub>  | Gate - Emitter Threshold Voltage                | V <sub>CE</sub> =V <sub>GE</sub> , I <sub>C</sub> =8mA                                                           |                       | 5.0  | 5.8  | 6.5  | V    |
| V <sub>CE(sat)</sub> | Collector - Emitter                             | I <sub>C</sub> =200A, V <sub>GE</sub> =15V, T <sub>J</sub> =25°C                                                 |                       |      | 1.7  |      | V    |
|                      | Saturation Voltage                              | I <sub>C</sub> =200A, V <sub>GE</sub> =15V, T <sub>J</sub> =125°C                                                |                       |      | 1.9  |      | V    |
| I <sub>ICES</sub>    | Collector Leakage Current                       | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>J</sub> =25°C                                                |                       |      |      | 1    | mA   |
|                      |                                                 | V <sub>CE</sub> =1200V, V <sub>GE</sub> =0V, T <sub>J</sub> =125°C                                               |                       |      |      | 5    | mA   |
| I <sub>GES</sub>     | Gate Leakage Current                            | V <sub>CE</sub> =0V, V <sub>GE</sub> =±15V, T <sub>J</sub> =125°C                                                |                       | -400 |      | 400  | nA   |
| R <sub>Gint</sub>    | Integrated Gate Resistor                        |                                                                                                                  |                       |      | 3.8  |      | Ω    |
| Q <sub>ge</sub>      | Gate Charge                                     | V <sub>CE</sub> =600V, I <sub>C</sub> =200A , V <sub>GE</sub> =±15V                                              |                       |      | 1.9  |      | μC   |
| C <sub>ies</sub>     | Input Capacitance                               | V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f =1MHz                                                               |                       |      | 14   |      | nF   |
| C <sub>res</sub>     | Reverse Transfer Capacitance                    |                                                                                                                  |                       |      | 0.5  |      | nF   |
| t <sub>d(on)</sub>   | Turn - on Delay Time                            | V <sub>CC</sub> =600V<br>I <sub>C</sub> =200A<br>R <sub>G</sub> =3.6Ω<br>V <sub>GE</sub> =±15V<br>Inductive Load | T <sub>J</sub> =25°C  |      | 160  |      | ns   |
|                      |                                                 |                                                                                                                  | T <sub>J</sub> =125°C |      | 170  |      | ns   |
| t <sub>r</sub>       | Rise Time                                       |                                                                                                                  | T <sub>J</sub> =25°C  |      | 40   |      | ns   |
|                      |                                                 |                                                                                                                  | T <sub>J</sub> =125°C |      | 45   |      | ns   |
| t <sub>d(off)</sub>  | Turn - off Delay Time                           |                                                                                                                  | T <sub>J</sub> =25°C  |      | 450  |      | ns   |
|                      |                                                 |                                                                                                                  | T <sub>J</sub> =125°C |      | 520  |      | ns   |
| t <sub>f</sub>       | Fall Time                                       |                                                                                                                  | T <sub>J</sub> =25°C  |      | 100  |      | ns   |
|                      |                                                 |                                                                                                                  | T <sub>J</sub> =125°C |      | 160  |      | ns   |
| E <sub>on</sub>      | Turn - on Energy                                |                                                                                                                  | T <sub>J</sub> =25°C  |      | 10   |      | mJ   |
|                      |                                                 |                                                                                                                  | T <sub>J</sub> =125°C |      | 15   |      | mJ   |
| E <sub>off</sub>     | Turn - off Energy                               |                                                                                                                  | T <sub>J</sub> =25°C  |      | 16.5 |      | mJ   |
|                      |                                                 |                                                                                                                  | T <sub>J</sub> =125°C |      | 25   |      | mJ   |
| I <sub>SC</sub>      | Short Circuit Current                           | t <sub>psc</sub> ≤10μS , V <sub>GE</sub> =15V, T <sub>J</sub> =125°C , V <sub>CC</sub> =900V                     |                       |      | 800  |      | A    |
| R <sub>thJC</sub>    | Junction-to-Case Thermal Resistance (Per IGBT)  |                                                                                                                  |                       |      |      | 0.12 | K/W  |
| Diode                |                                                 |                                                                                                                  |                       |      |      |      |      |
| V <sub>F</sub>       | Forward Voltage                                 | I <sub>F</sub> =200A, V <sub>GE</sub> =0V, T <sub>J</sub> =25°C                                                  |                       |      | 1.65 |      | V    |
|                      |                                                 | I <sub>F</sub> =200A, V <sub>GE</sub> =0V, T <sub>J</sub> =125°C                                                 |                       |      | 1.65 |      | V    |
| t <sub>RR</sub>      | Reverse Recovery Time                           | I <sub>F</sub> =200A, V <sub>R</sub> =600V<br>di <sub>F</sub> /dt=-4000A/μs<br>T <sub>J</sub> =125°C             |                       |      | 190  |      | ns   |
| I <sub>RRM</sub>     | Max. Reverse Recovery Current                   |                                                                                                                  |                       |      | 36   |      | A    |
| E <sub>rec</sub>     | Reverse Recovery Energy                         |                                                                                                                  |                       |      | 17   |      | mJ   |
| R <sub>thJCD</sub>   | Junction-to-Case Thermal Resistance (Per Diode) |                                                                                                                  |                       |      |      | 0.2  | K/W  |

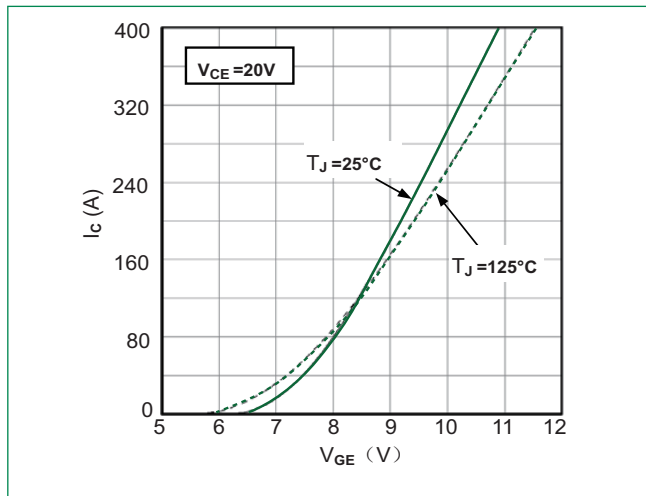
**Figure 1: Typical Output Characteristics**



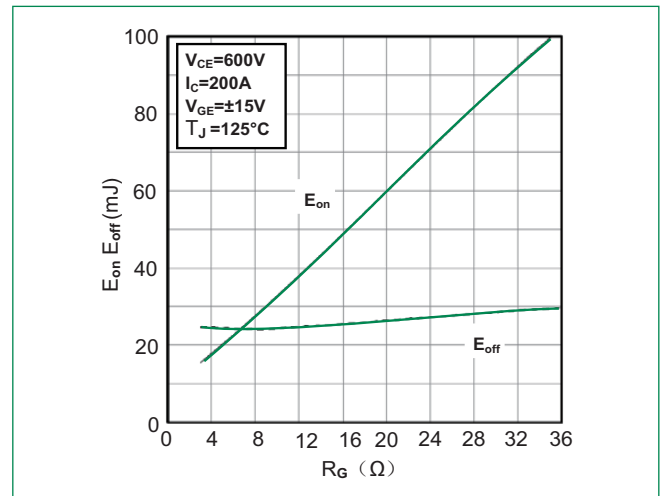
**Figure 2: Typical Output Characteristics**



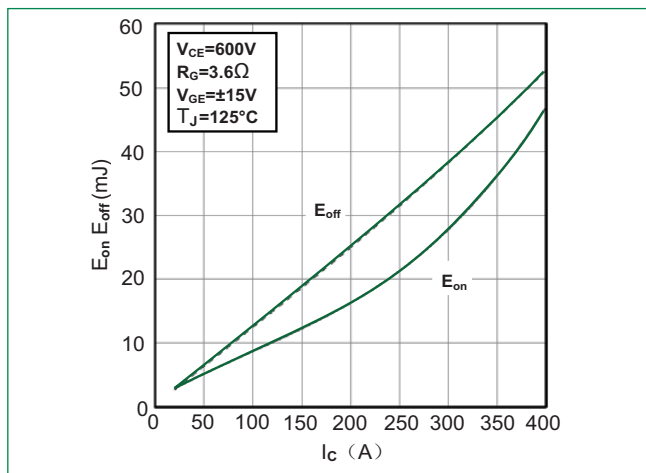
**Figure 3: Typical Transfer characteristics**



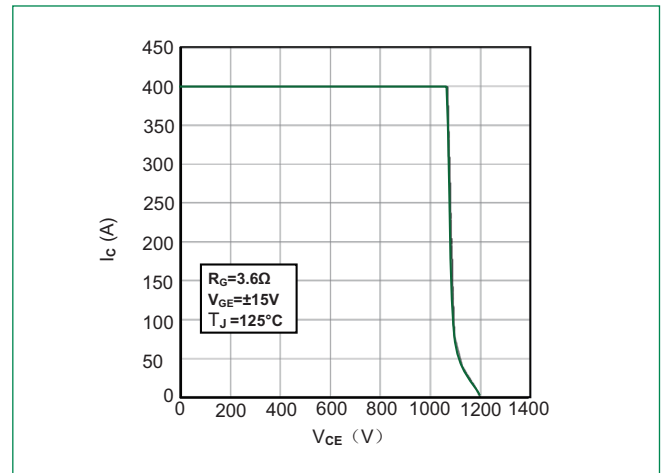
**Figure 4: Switching Energy vs. Gate Resistor**



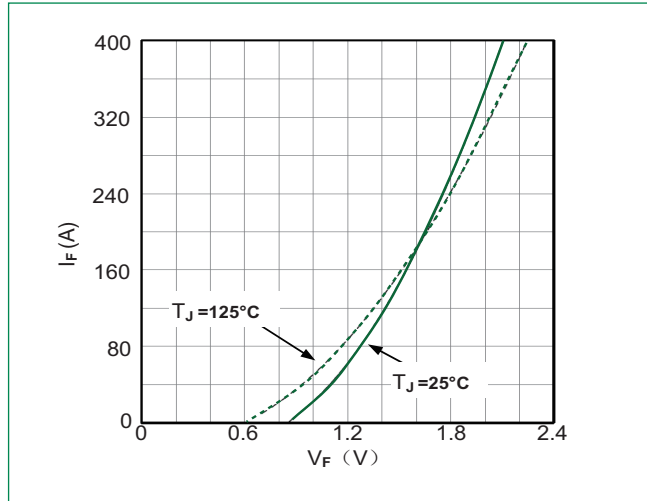
**Figure 5: Switching Energy vs. Collector Current**



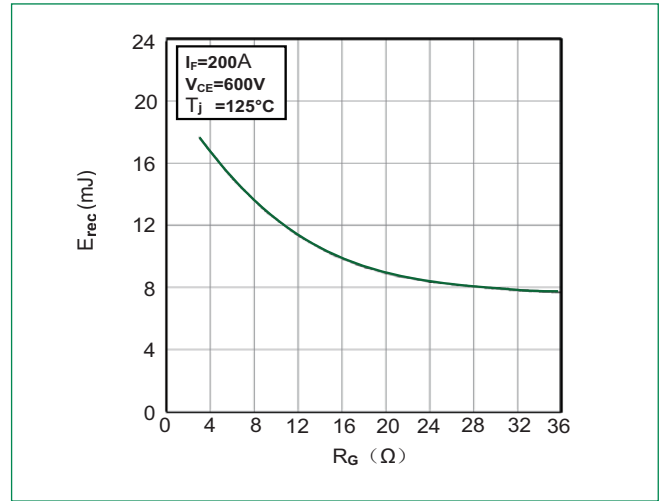
**Figure 6: Reverse Biased Safe Operating Area**



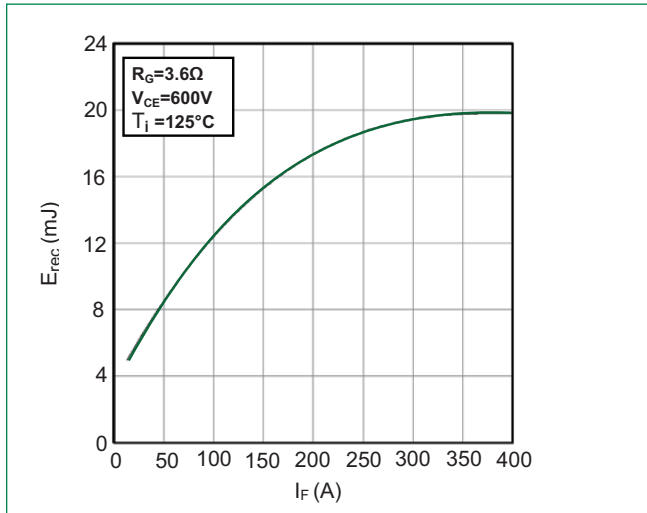
**Figure 7: Diode Forward Characteristics**



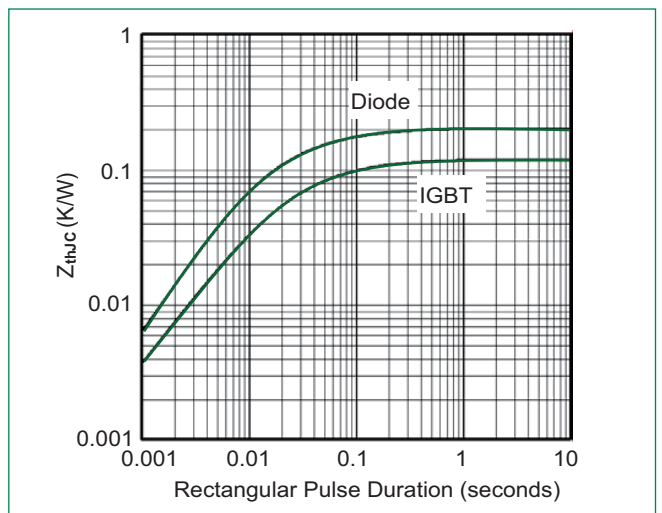
**Figure 8: Switching Energy vs. Gate Resistor**



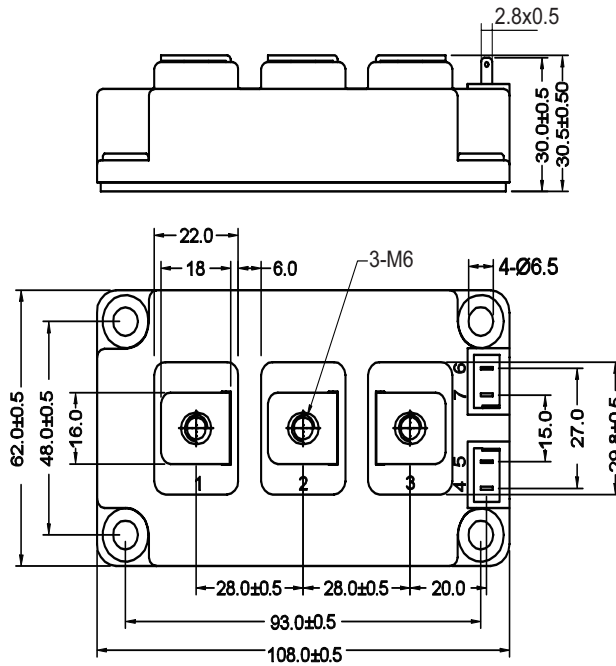
**Figure 9: Switching Energy vs. Forward Current**



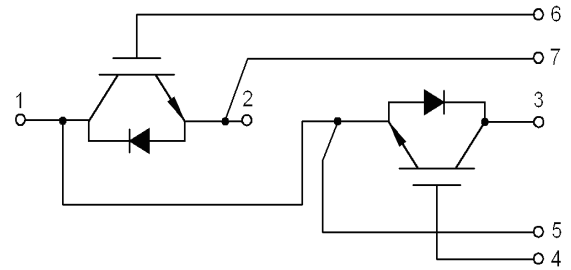
**Figure 10: Transient Thermal Impedance**



### Dimensions-Package D



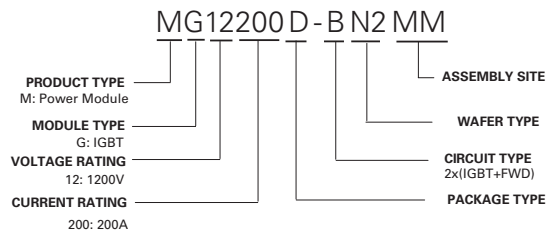
### Circuit Diagram



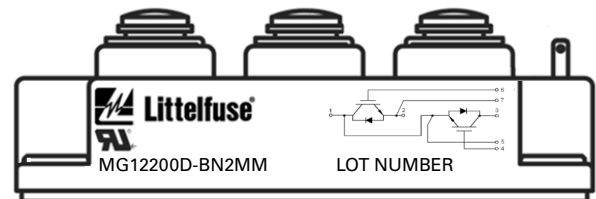
### Packing Options

| Part Number    | Marking        | Weight | Packing Mode | M.O.Q |
|----------------|----------------|--------|--------------|-------|
| MG12200D-BN2MM | MG12200D-BN2MM | 320g   | Bulk Pack    | 60    |

### Part Numbering System



### Part Marking System



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