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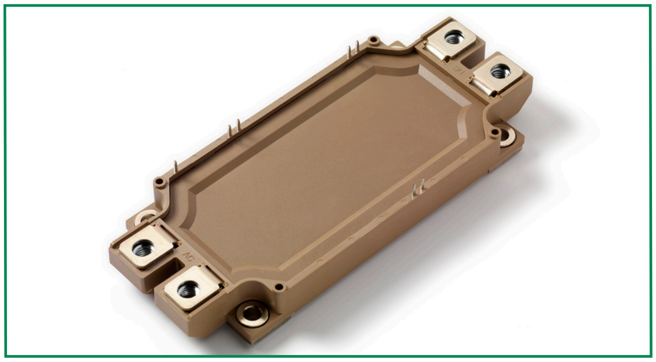
# IGBT Power Module

# 1200 V 600 A IGBT Module

## MG12600WB-BR2MM

RoHS



## Features

- Trench-gate field stop IGBT technology
- Low saturation voltage and positive temperature coefficient
- Fast switching and short tail current
- Free wheeling diodes with fast and soft reverse recovery
- Temperature sense included
- $T_{J\,max}$ = 175 °C

## Agency Approvals

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

## Applications

- Industrial and servo drives
- Solar inverters
- High-power converters
- UPS
- Welding
- RoHS compliant

## Module Characteristics ($T_C$ = 25 °C, unless otherwise specified)

| Symbol | Parameters | Test Conditions | Values | Unit |
|---|---|---|---|---|
| $T_{J\,max}$ | Max. Junction Temperature | | 175 | °C |
| $T_{J\,op}$ | Operating Temperature | | -40~150 | °C |
| $T_{stg}$ | Storage Temperature | | -40~125 | °C |
| $V_{isol}$ | Isolation Breakdown Voltage | AC, 50 Hz(R.M.S), t = 1 minute | 3000 | V |
| Torque | to heatsink | Recommended (M5) | 2.5~5 | N·m |
| | Iolerminal | Recommended (M6) | 3~5 | N·m |
| Weight | | | 350 | g |

## Absolute Maximum Ratings ($T_C$ = 25 °C, unless otherwise specified)

| Symbol | Parameters | Test Conditions | Values | Unit |
|---|---|---|---|---|
| IGBT | | | | |
| $V_{CES}$ | Collector Emitter Voltage | $T_J$ = 25 °C | 1200 | V |
| $V_{GES}$ | Gate Emitter Voltage | | ±20 | V |
| $I_C$ | DC Collector Current | $T_C$ = 25 °C | 750 | A |
| | | $T_C$ = 80 °C | 600 | A |
| $I_{CM}$ | Repetitive Peak Collector Current | $t_p$ = 1 ms | 1200 | A |
| $P_{tot}$ | Power Dissipation Per IGBT | | 2500 | W |
| **Diode** | | | | |
| $V_{RRM}$ | Repetitive Reverse Voltage | $T_J$ = 25 °C | 1200 | V |
| $I_{F(AV)}$ | Average Forward Current | $T_C$ = 25 °C | 600 | A |
| $I_{FRM}$ | Repetitive Peak Forward Current | $t_p$ = 1ms | 1200 | A |
| $I^2t$ | | $T_J$ = 125 °C, t = 10 ms, $V_R$ = 0 V | 45 | $KA^2s$ |

## Electrical and Thermal Specifications ($T_C$ = 25 °C, unless otherwise specified)

| Symbol | Parameters | | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| **IGBT** | | | | | | | | |
| $V_{GE(th)}$ | Gate Emitter Threshold Voltage | | $V_{CE} = V_{GE}$, $I_C$ = 24 mA | | 5.0 | 5.4 | 6.4 | V |
| $V_{CE(sat)}$ | Collector Emitter Saturation Voltage | chip | $I_C$ = 600 A, $V_{GE}$ = 15 V, $T_J$ = 25 °C | | | 1.7 | 2.15 | V |
| | | | $I_C$ = 600 A, $V_{GE}$ = 15 V, $T_J$ = 125 °C | | | 1.9 | | |
| | | terminal | $I_C$ = 600 A, $V_{GE}$ = 15 V, $T_J$ = 25 °C | | | 2.0 | 2.5 | V |
| | | | $I_C$ = 600 A, $V_{GE}$ = 15 V, $T_J$ = 125 °C | | | 2.4 | | |
| $I_{CES}$ | Collector Leakage Current | | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V, $T_J$ = 25 °C | | | | 100 | μA |
| | | | $V_{CE}$ = 1200 V, $V_{GE}$ = 0 V, $T_J$ = 125 °C | | | | 1 | mA |
| $I_{GES}$ | Gate Leakage Current | | $V_{CE}$ = 0 V, $V_{GE}$ = ±15 V, $T_J$ = 125 °C | | -400 | | 400 | nA |
| $R_{Gint}$ | Integrated Gate Resistor | | | | | 0.5 | | Ω |
| $Q_g$ | Gate Charge | | $V_{CE}$ = 600 V, $I_C$ = 600 A , $V_{GE}$ = ±15 V | | | 3.4 | | μC |
| $C_{ies}$ | Input Capacitance | | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, f = 1 MHz | | | 60.5 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | | | 1.8 | | nF |
| $t_{d(on)}$ | Turn-on Delay Time | | $V_{CC}$ = 600 V<br>$I_C$ = 600 A<br>$R_G$ = 5 Ω<br>$V_{GE}$ = ±15 V<br>Inductive Load | $T_J$ = 25 °C | | 250 | | ns |
| | | | | $T_J$ = 125 °C | | 280 | | ns |
| $t_r$ | Rise Time | | | $T_J$ = 25 °C | | 220 | | ns |
| | | | | $T_J$ = 125 °C | | 240 | | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | | $T_J$ = 25 °C | | 1000 | | ns |
| | | | | $T_J$ = 125 °C | | 1100 | | ns |
| $t_f$ | Fall Time | | | $T_J$ = 25 °C | | 170 | | ns |
| | | | | $T_J$ = 125 °C | | 190 | | ns |
| $E_{on}$ | Turn-on Energy | | | $T_J$ = 25 °C | | 20 | | mJ |
| | | | | $T_J$ = 125 °C | | 35 | | mJ |
| $E_{off}$ | Turn-off Energy | | | $T_J$ = 25 °C | | 105 | | mJ |
| | | | | $T_J$ = 125 °C | | 120 | | mJ |
| $I_{SC}$ | Short Circuit Current | | $t_{psc}$ ≤ 10 μS , $V_{GE}$ = 15 V; $T_J$ = 125 °C , $V_{CC}$ = 600 V | | | 2400 | | A |
| $R_{thJC}$ | Junction-to-Case Thermal Resistance (Per IGBT) | | | | | | 0.06 | K/W |
| **Diode** | | | | | | | | |
| $V_F$ | Forward Voltage | chip | $I_F$ = 600 A, $V_{GE}$ = 0 V, $T_J$ = 25 °C | | | 2.1 | 2.5 | V |
| | | | $I_F$ = 600 A, $V_{GE}$ = 0 V, $T_J$ = 125 °C | | | 2.2 | | V |
| $t_{RR}$ | Reverse Recovery Time | | $I_F$ = 600 A, $V_R$ = 600 V<br>$di_F/dt$ = -2700 A/μs<br>$T_J$ = 125 °C | | | 330 | | ns |
| $I_{RRM}$ | Max. Reverse Recovery Current | | | | | 305 | | A |
| $Q_{RR}$ | Reverse Recovery Charge | | | | | 96 | | μC |
| $E_{rec}$ | Reverse Recovery Energy | | | | | 42 | | mJ |
| $R_{thJCD}$ | Junction-to-Case Thermal Resistance (Per Diode) | | | | | | 0.1 | K/W |

## NTC Characteristics ($T_c$ = 25 °C, unless otherwise specified)

| Symbol | Parameters | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{25}$ | Resistance | $T_c$ = 25 °C | | 5 | | KΩ |
| $B_{25/50}$ | $R_2 = R_{25}$ exp $[B_{25/50}$ $(1/T_2$ - 1/((298, 15 K))] | | | 3375 | | K |

**Figure 1: Typical Output Characteristics IGBT Inverter**

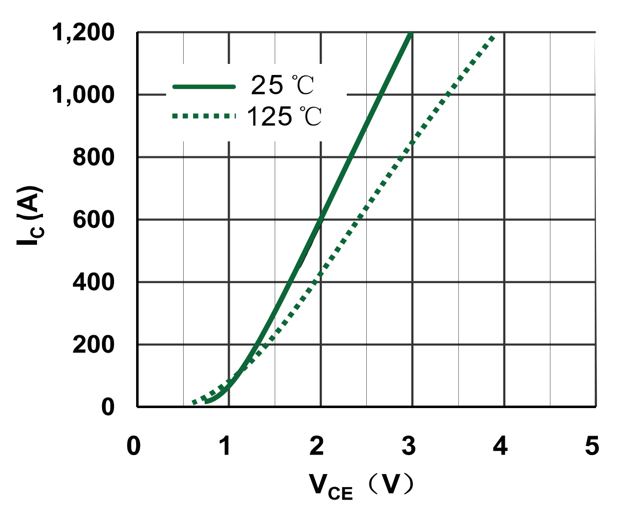



**Figure 2: Typical Output Characteristics IGBT Inverter**

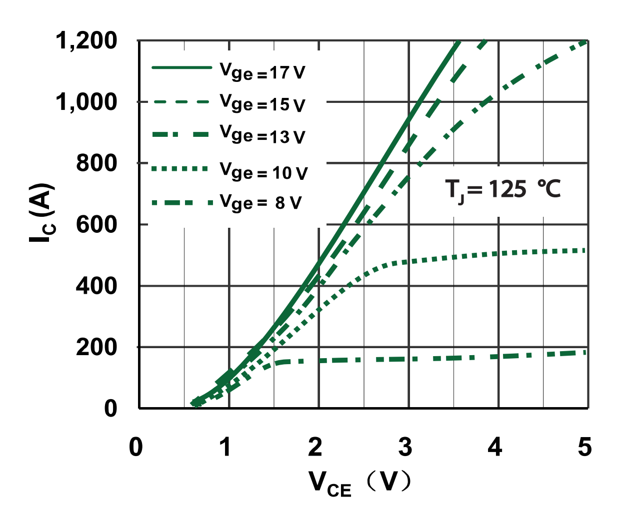



**Figure 3: Typical Transfer Characteristics IGBT Inverter**

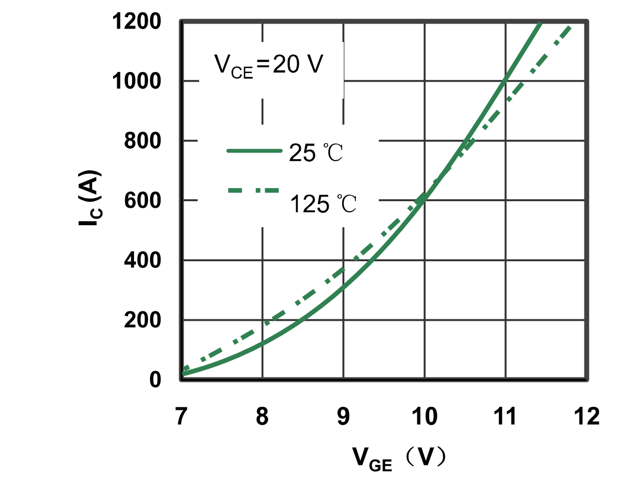



**Figure 4: Switching Energy vs. Gate Resistor IGBT Inverter**

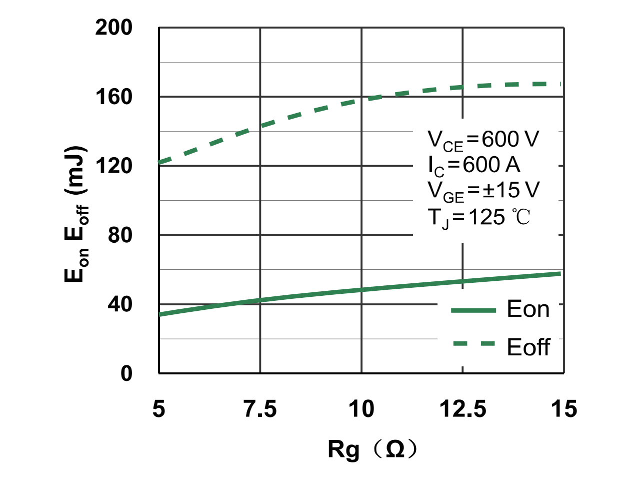



**Figure 5: Switching Energy vs. Collector Current IGBT Inverter**

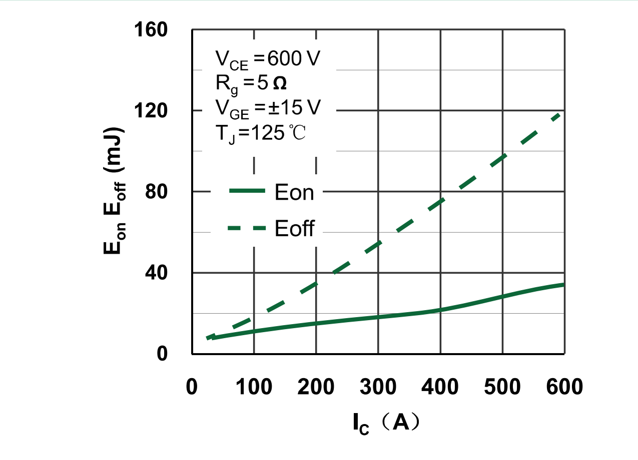



**Figure 6: Reverse Biased Safe Operating Area IGBT Inverter**

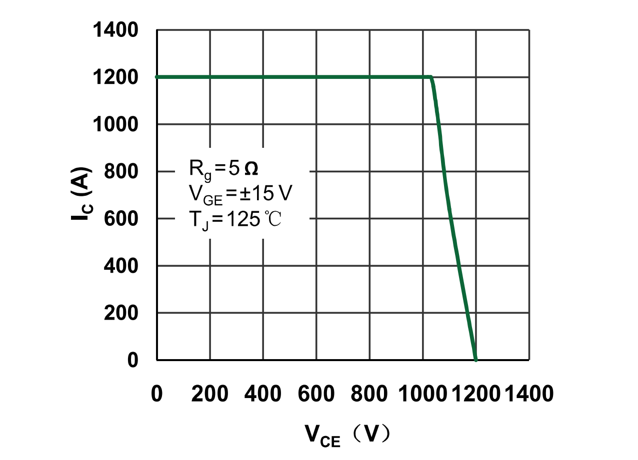


**Figure 7: Collector Current vs Case temperature IGBT -inverter**

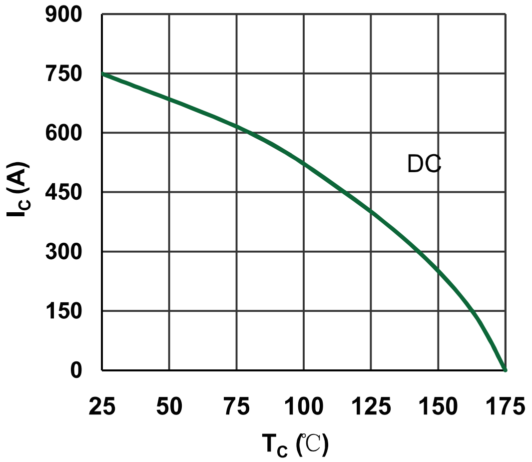



**Figure 8: Forward current vs Case temperature Diode -inverter**

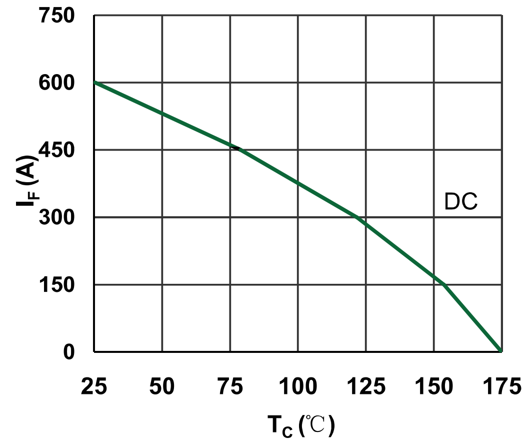



**Figure 9: Diode Forward Characteristics Diode -inverter**

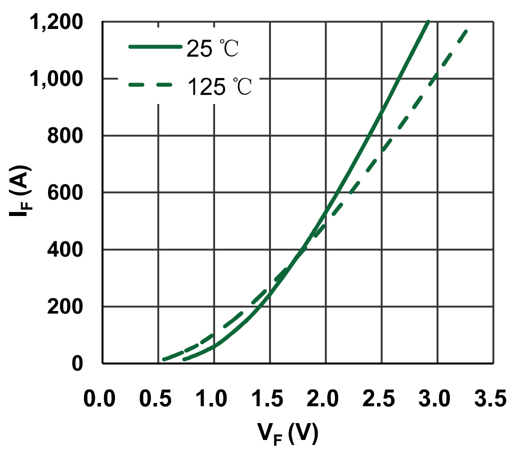



**Figure 10: Switching Energy vs Gate Resistor Diode -inverter**

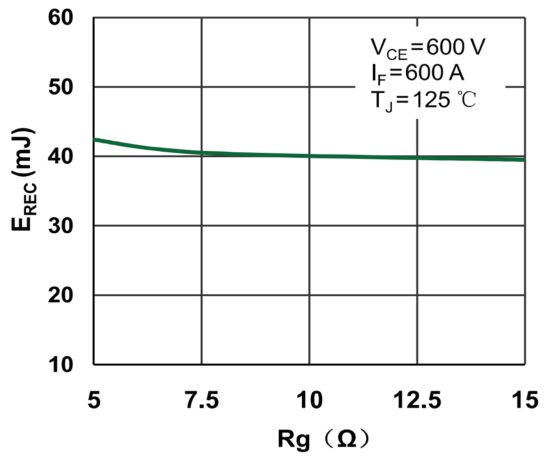



**Figure 11: Switching Energy vs Forward Current Diode-inverter**

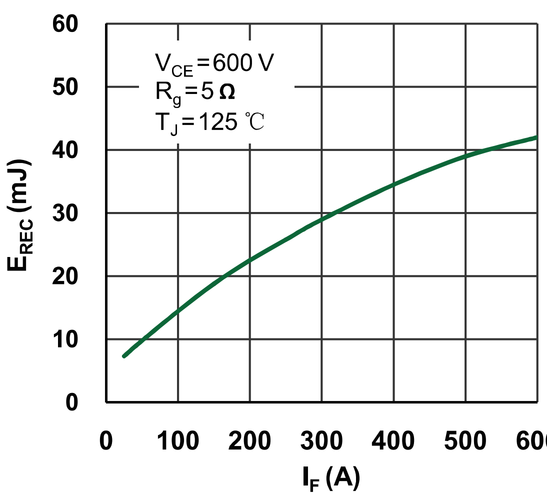
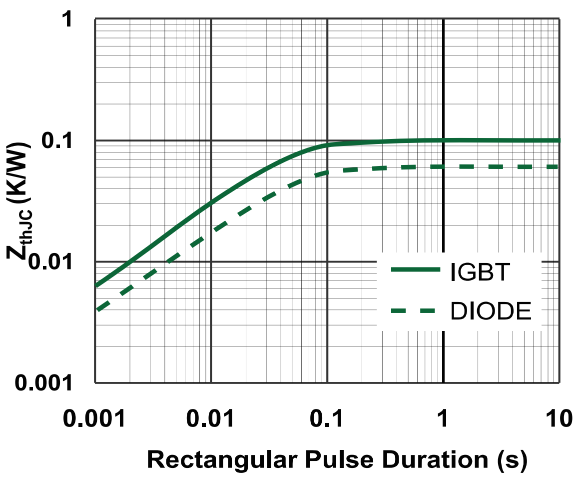
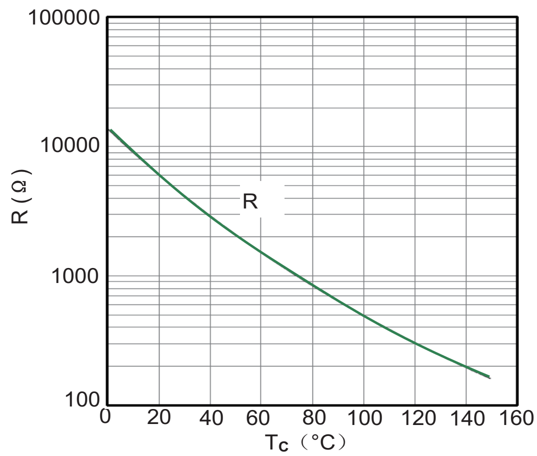


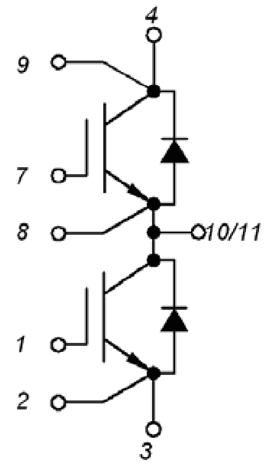

**Figure 12: Transient Thermal Impedance of Diode and IGBT -inverter**



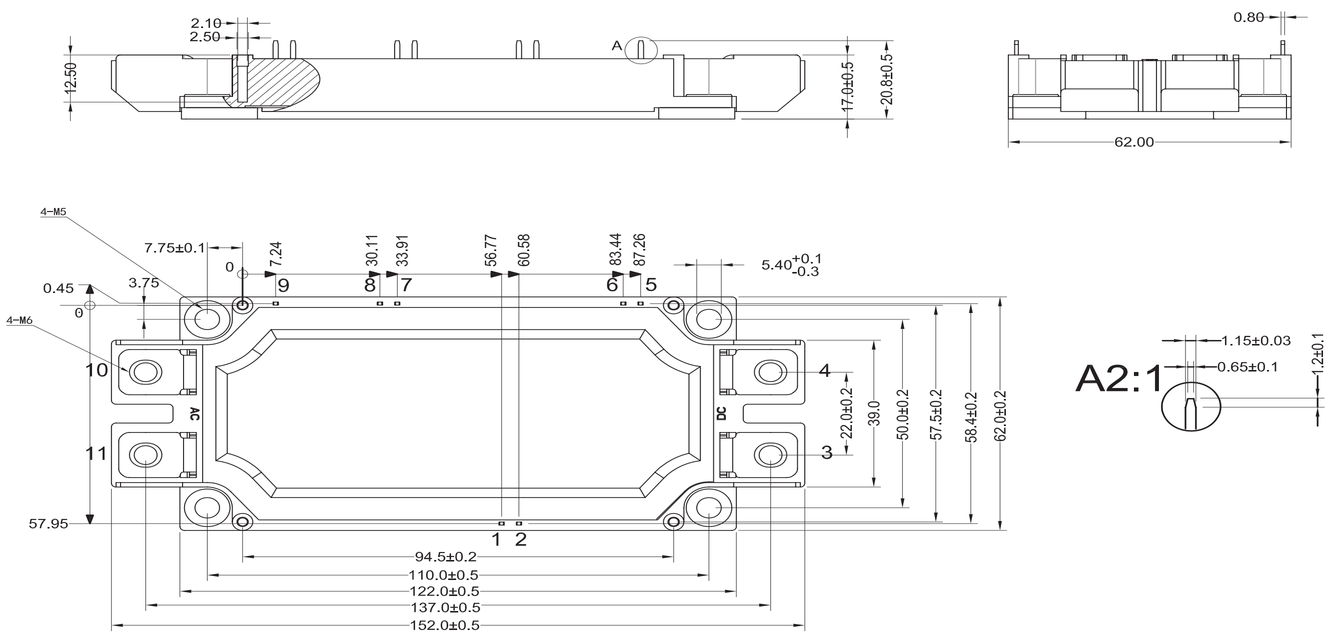
## Figure 13: NTC Characteristics




## Circuit Diagram




## Dimensions-Package WB

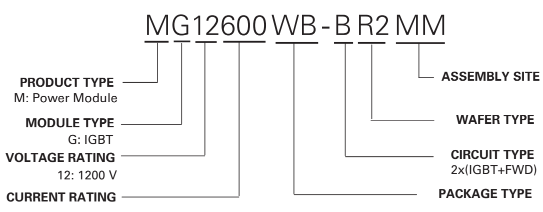



The foot pins are in gold / nickel coating

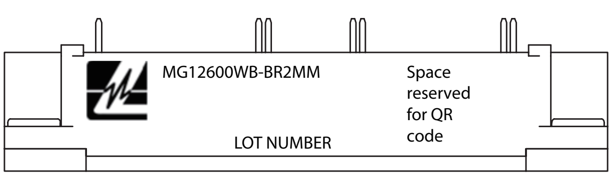
## Packing Options

| Part Number | Marking | Weight | Packing Mode | M.O.Q |
|---|---|---|---|---|
| MG12600WB-BR2MM | MG12600WB-BR2MM | 350 g | Bulk Pack | 60 |

## Part Numbering System




## Part Marking System






Revised:10/05/16