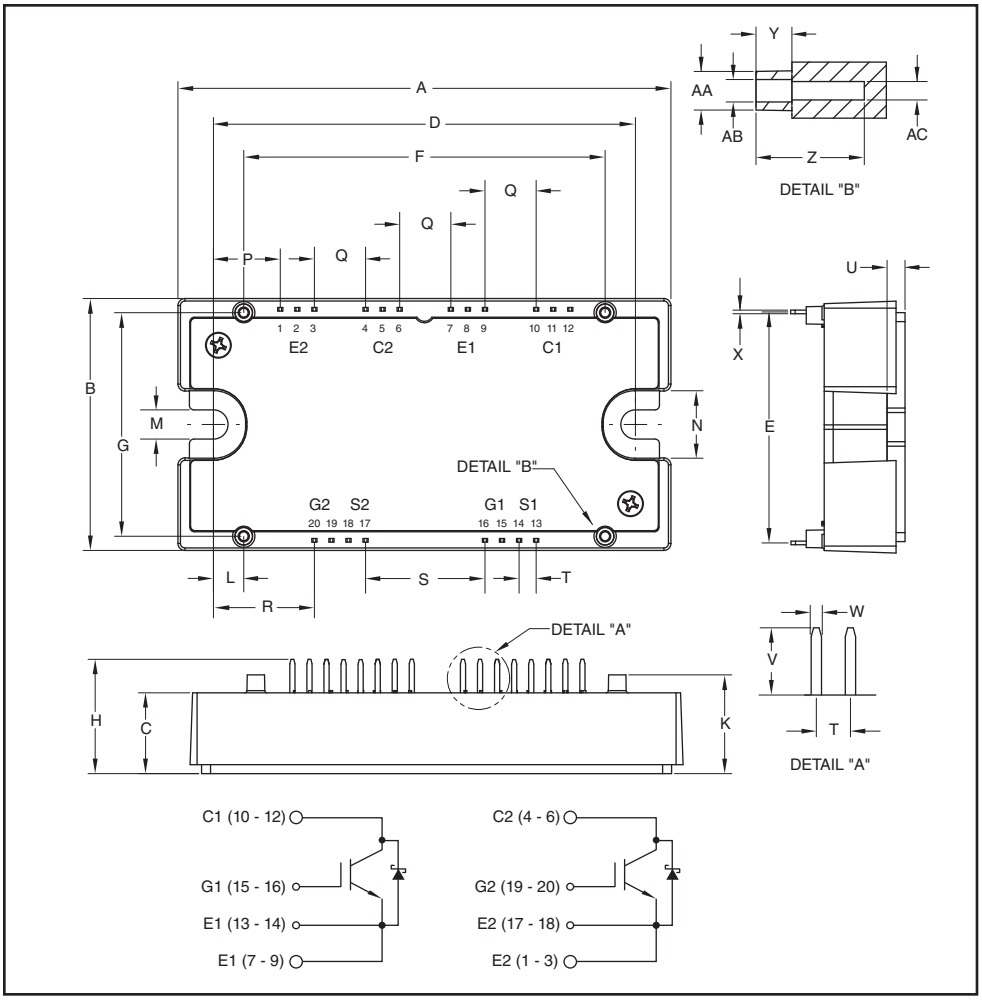
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

# QID1210005

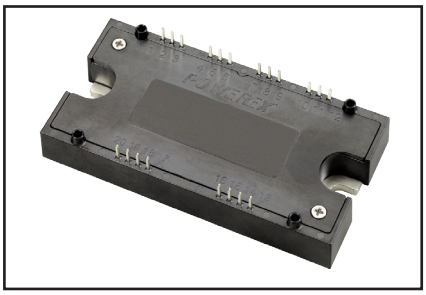
## Split Dual Si/SiC Hybrid IGBT Module
### 100 Amperes/1200 Volts




**Outline Drawing and Circuit Diagram**

| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 4.32 | 109.8 |
| B | 2.21 | 56.1 |
| C | 0.71 | 18.0 |
| D | 3.70±0.02 | 94.0±0.5 |
| E | 2.026 | 51.46 |
| F | 3.17 | 80.5 |
| G | 1.96 | 49.8 |
| H | 1.00 | 25.5 |
| K | 0.87 | 22.0 |
| L | 0.266 | 6.75 |
| M | 0.26 | 6.5 |
| N | 0.59 | 15.0 |
| P | 0.586 | 14.89 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| Q | 0.449 | 11.40 |
| R | 0.885 | 22.49 |
| S | 1.047 | 26.6 |
| T | 0.15 | 3.80 |
| U | 0.16 | 4.0 |
| V | 0.30 | 7.5 |
| W | 0.045 | 1.15 |
| X | 0.03 | 0.8 |
| Y | 0.16 | 4.0 |
| Z | 0.47 | 12.1 |
| AA | 0.17 Dia. | 4.3 Dia. |
| AB | 0.10 Dia. | 2.5 Dia. |
| AC | 0.08 Dia. | 2.1 Dia. |



**Description:**
Powerex IGBT Modules are designed for use in high frequency applications; upwards of 30 kHz for hard switching applications and 80 kHz for soft switching applications. Each module consists of two IGBT Transistors with each transistor having a reverse-connected super-fast recovery free-wheel silicon carbide Schottky diode. All components and interconnects are isolated from the heat sinking baseplate, offering simplified system assembly and thermal management.

**Features:**
- ☐ Low $E_{SW(off)}$
- ☐ Aluminum Nitride Isolation
- ☐ **Discrete Super-Fast Recovery Free-Wheel Silicon Carbide Schottky Diode**
- ☐ Low Internal Inductance
- ☐ 2 Individual Switches per Module
- ☐ Isolated Baseplate for Easy Heat Sinking
- ☐ Copper Baseplate

**Applications:**
- ☐ Energy Saving Power Systems such as:
  Fans; Pumps; Consumer Appliances
- ☐ High Frequency Type Power Systems such as:
  UPS; High Speed Motor Drives; Induction Heating; Welder; Robotics
- ☐ High Temperature Power Systems such as:
  Power Electronics in Electric Vehicle and Aviation Systems

***QID1210005***
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## Absolute Maximum Ratings, $T_j$ = 25°C unless otherwise specified

| Ratings | Symbol | QID1210005 | Units |
|---|---|---|---|
| Junction Temperature | $T_j$ | –40 to 150 | °C |
| Storage Temperature | $T_{stg}$ | –40 to 150 | °C |
| Collector-Emitter Voltage (G-E Short) | $V_{CES}$ | 1200 | Volts |
| Gate-Emitter Voltage (C-E Short) | $V_{GES}$ | ±20 | Volts |
| Collector Current ($T_C$ = 25°C) | $I_C$ | 100* | Amperes |
| Peak Collector Current | $I_{CM}$ | 200* | Amperes |
| Emitter Current** ($T_C$ = 25°C) | $I_E$ | 80* | Amperes |
| Repetitive Peak Emitter Current ($T_C$ = 25°C, $t_p$ = 10ms, Half Sine Pulse)** | $I_{EM}$ | 455* | Amperes |
| Maximum Collector Dissipation ($T_C$ = 25°C, $T_j \leq$ 150°C) | $P_C$ | 730 | Watts |
| Mounting Torque, M6 Mounting | — | 40 | in-lb |
| Weight | — | 270 | Grams |
| Isolation Voltage (Main Terminal to Baseplate, AC 1 min.) | $V_{ISO}$ | 2500 | Volts |

## IGBT Electrical Characteristics, $T_j$ = 25°C unless otherwise specified

| Characteristics | | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Collector-Cutoff Current | | $I_{CES}$ | $V_{CE} = V_{CES}$, $V_{GE}$ = 0V | — | — | 1.0 | mA |
| Gate Leakage Current | | $I_{GES}$ | $V_{GE} = V_{GES}$, $V_{CE}$ = 0V | — | — | 0.5 | µA |
| Gate-Emitter Threshold Voltage | | $V_{GE(th)}$ | $I_C$ = 10mA, $V_{CE}$ = 10V | 4.5 | 6.0 | 7.5 | Volts |
| Collector-Emitter Saturation Voltage | | $V_{CE(sat)}$ | $I_C$ = 100A, $V_{GE}$ = 15V, $T_j$ = 25°C | — | 5.0 | 6.5 | Volts |
| | | | $I_C$ = 100A, $V_{GE}$ = 15V, $T_j$ = 125°C | — | 5.0 | — | Volts |
| Total Gate Charge | | $Q_G$ | $V_{CC}$ = 600V, $I_C$ = 100A, $V_{GE}$ = 15V | — | 450 | — | nC |
| Input Capacitance | | $C_{ies}$ | $V_{CE}$ = 10V, $V_{GE}$ = 0V | — | — | 16 | nf |
| Output Capacitance | | $C_{oes}$ | | — | — | 1.3 | nf |
| Reverse Transfer Capacitance | | $C_{res}$ | | — | — | 0.3 | nf |
| Inductive | Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$ = 600V, $I_C$ = 100A, | — | — | TBD | ns |
| Load | Rise Time | $t_r$ | $V_{GE1} = V_{GE2}$ = 15V, | — | — | TBD | ns |
| Switch | Turn-off Delay Time | $t_{d(off)}$ | $R_G$ = 3.1Ω, | — | — | TBD | ns |
| | TimeFall Time | $t_f$ | Inductive Load Switching Operation | — | — | TBD | ns |

* Pulse width and repetition rate should be such that device junction temperature ($T_j$) does not exceed $T_{j(max)}$ rating.
**Represents characteristics of the anti-parallel, emitter-to-collector silicon carbide Schottky diode (FWDi).

***QID1210005***
***Split Dual Si/SiC Hybrid IGBT Module***
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## Reverse Schottky Diode Characteristics, $T_j$ = 25 °C unless otherwise specified

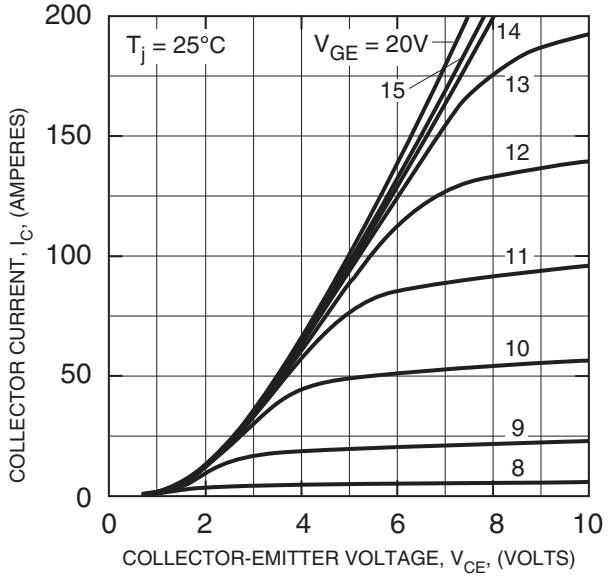
| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Diode Forward Voltage | $V_{FM}$ | $I_F$ = 80A, $V_{GS}$ = -5V | — | 1.6 | 2.0 | Volts |
| | | $I_F$ = 80A, $V_{GS}$ = -5V, $T_j$ = 175°C | — | 2.5 | 3.2 | Volts |
| Diode Reverse Current | $I_R$ | $V_R$ = 1200V | — | 140 | 800 | µA |
| | | $V_R$ = 1200, $T_j$ = 150°C | — | 260 | 1600 | µA |
| Diode Capacitive Charge | $Q_C$ | $V_R$ = 1200V, $I_F$ = 80A, di/dt = 800A/µs | — | 520 | — | nC |

## Thermal and Mechanical Characteristics, $T_j$ = 25 °C unless otherwise specified

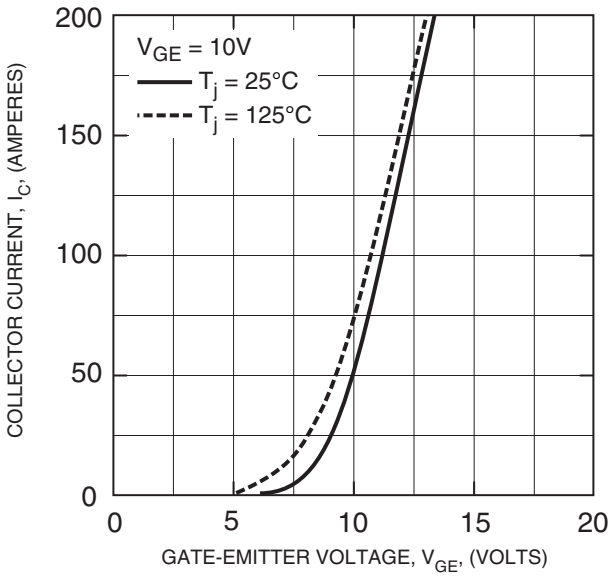
| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{th(j-c)}Q$ | Per IGBT 1/2 Module, $T_C$ Reference Point Under Chips | — | — | 0.17 | °C/W |
| Thermal Resistance, Junction to Case | $R_{th(j-c)}D$ | Per FWDi 1/2 Module, $T_C$ Reference $T_C$ Reference Point Under Chips | — | — | 0.304 | °C/W |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Per 1/2 Module, Thermal Grease Applied | — | 0.04 | — | °C/W |
| External Gate Resistance | $R_G$ | | 3.1 | — | 31 | Ω |
| Internal Inductance | $L_{int}$ | IGBT Part | — | 10 | — | nH |

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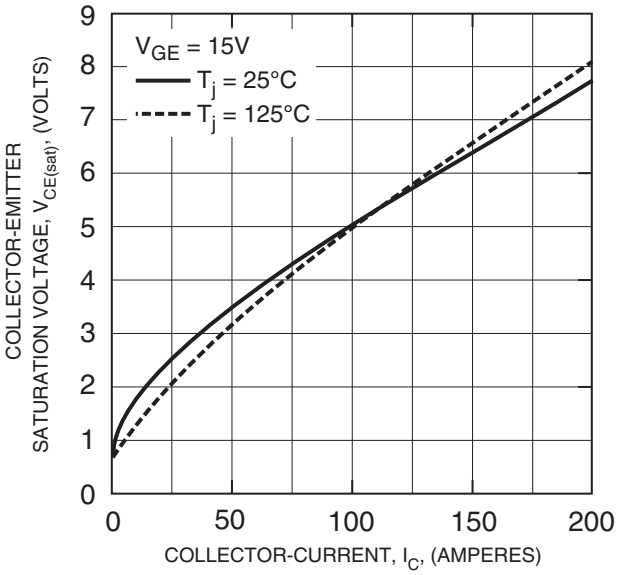
**OUTPUT CHARACTERISTICS (TYPICAL)**



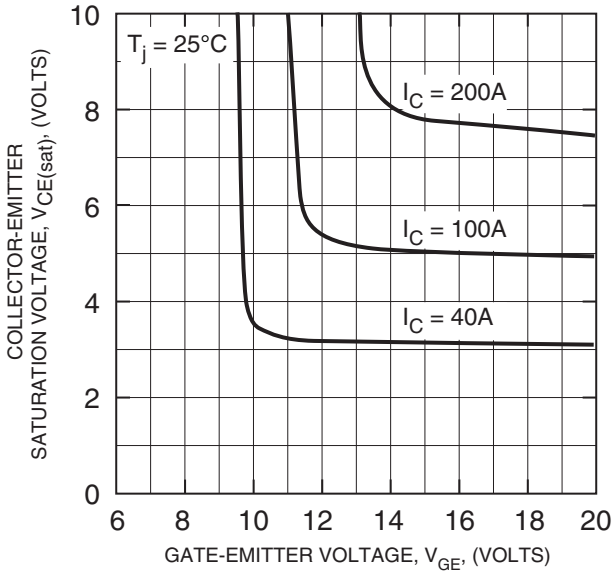

**TRANSFER CHARACTERISTICS (TYPICAL)**




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

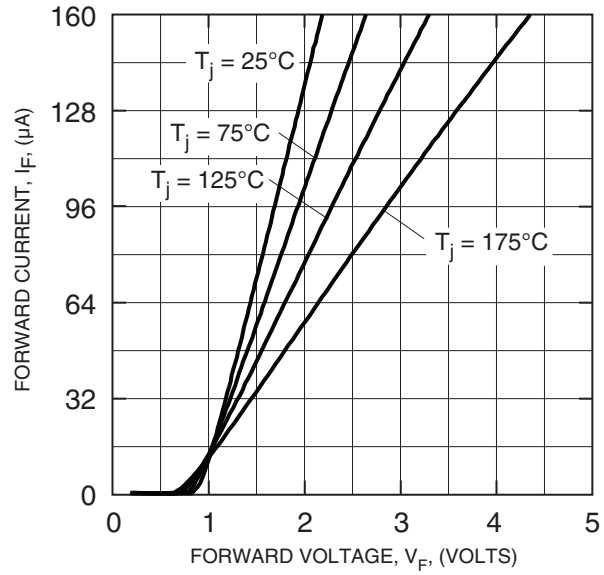



**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**

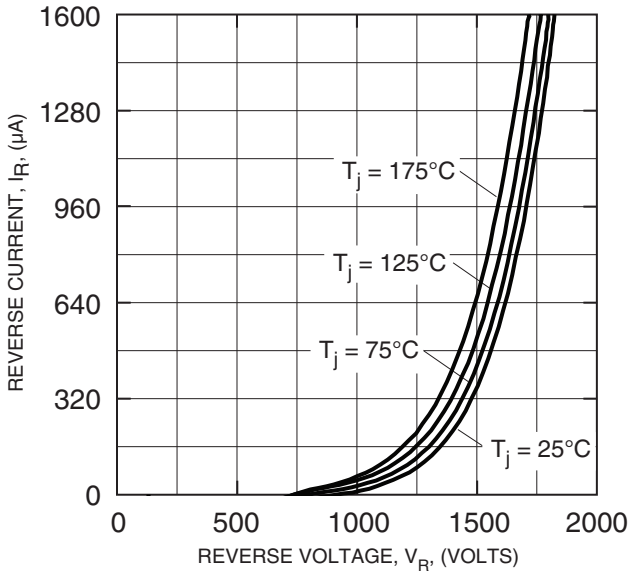


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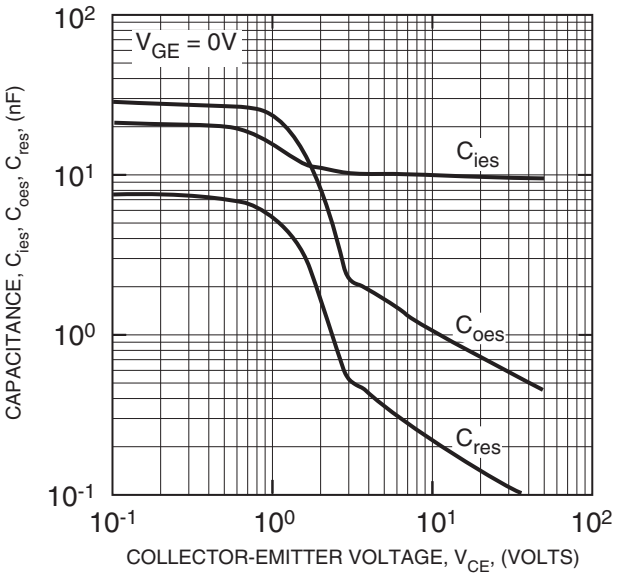
**FREE-WHEEL SCHOTTKY DIODE FORWARD CHARACTERISTICS (TYPICAL)**



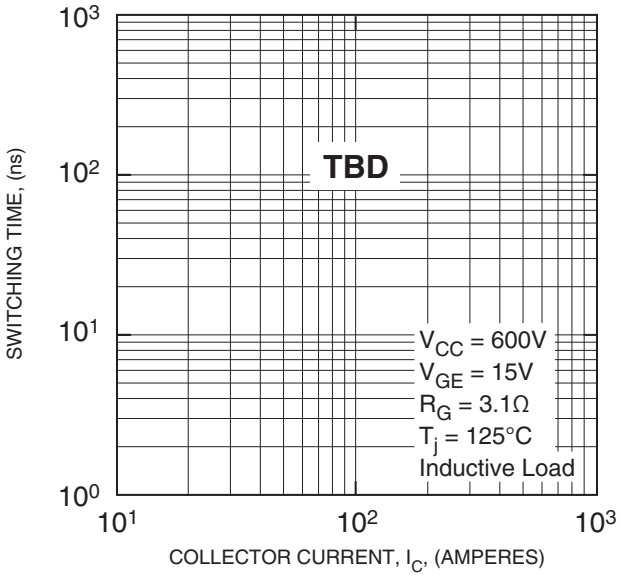

**FREE-WHEEL SCHOTTKY DIODE REVERSE CHARACTERISTICS (TYPICAL)**




**CAPACITANCE VS. $V_{CE}$ (TYPICAL)**

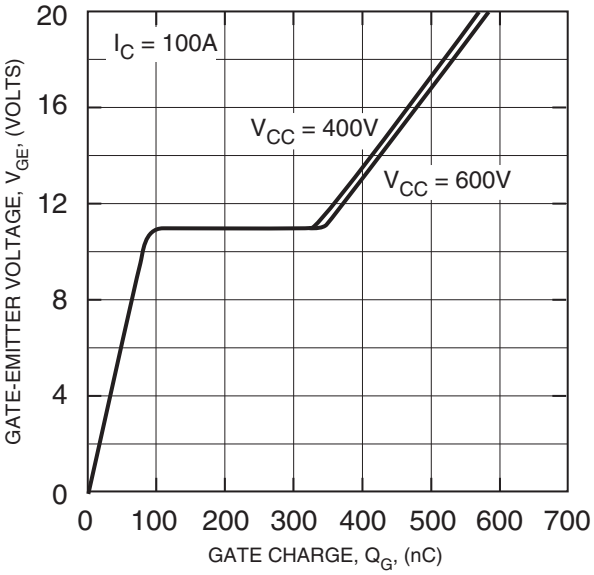



**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**

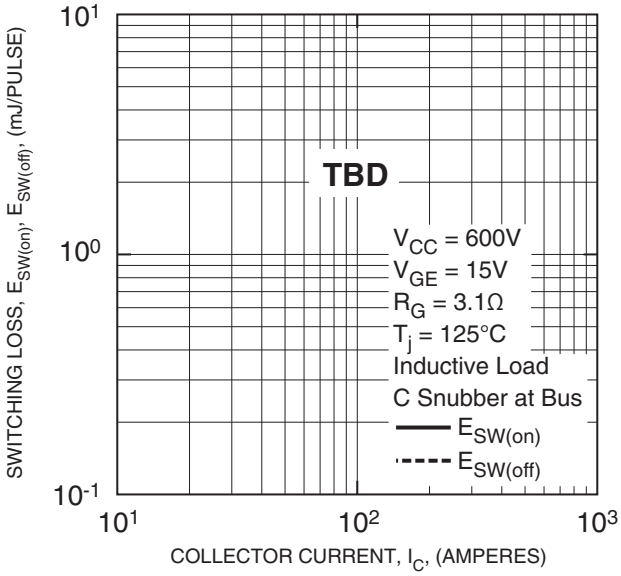


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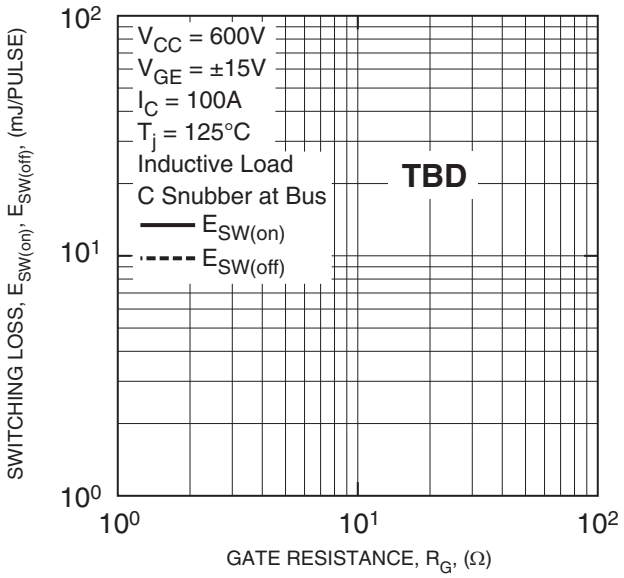
**GATE CHARGE VS. $V_{GE}$**



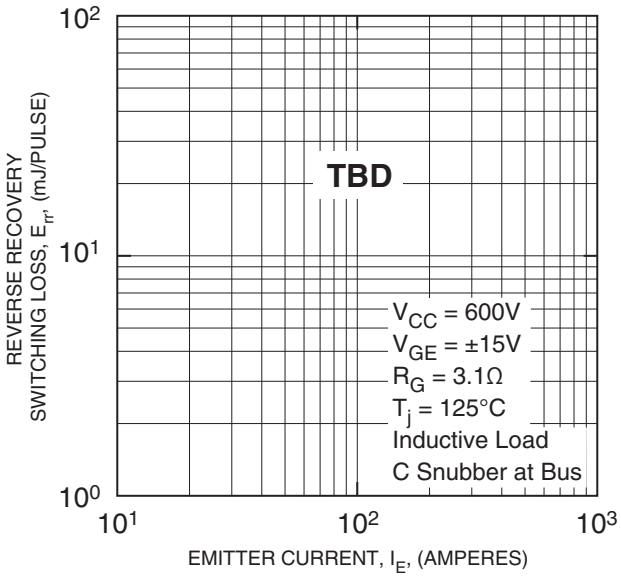

**SWITCHING LOSS VS. COLLECTOR CURRENT (TYPICAL)**




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

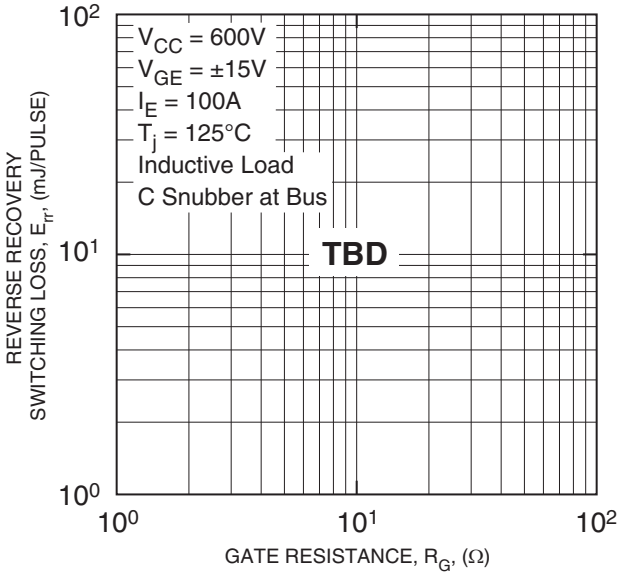



**REVERSE RECOVERY SWITCHING LOSS VS. EMITTER CURRENT (TYPICAL)**



***QID1210005***
***Split Dual Si/SiC Hybrid IGBT Module***
*100 Amperes/1200 Volts*

**REVERSE RECOVERY SWITCHING LOSS VS. GATE RESISTANCE (TYPICAL)**




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

