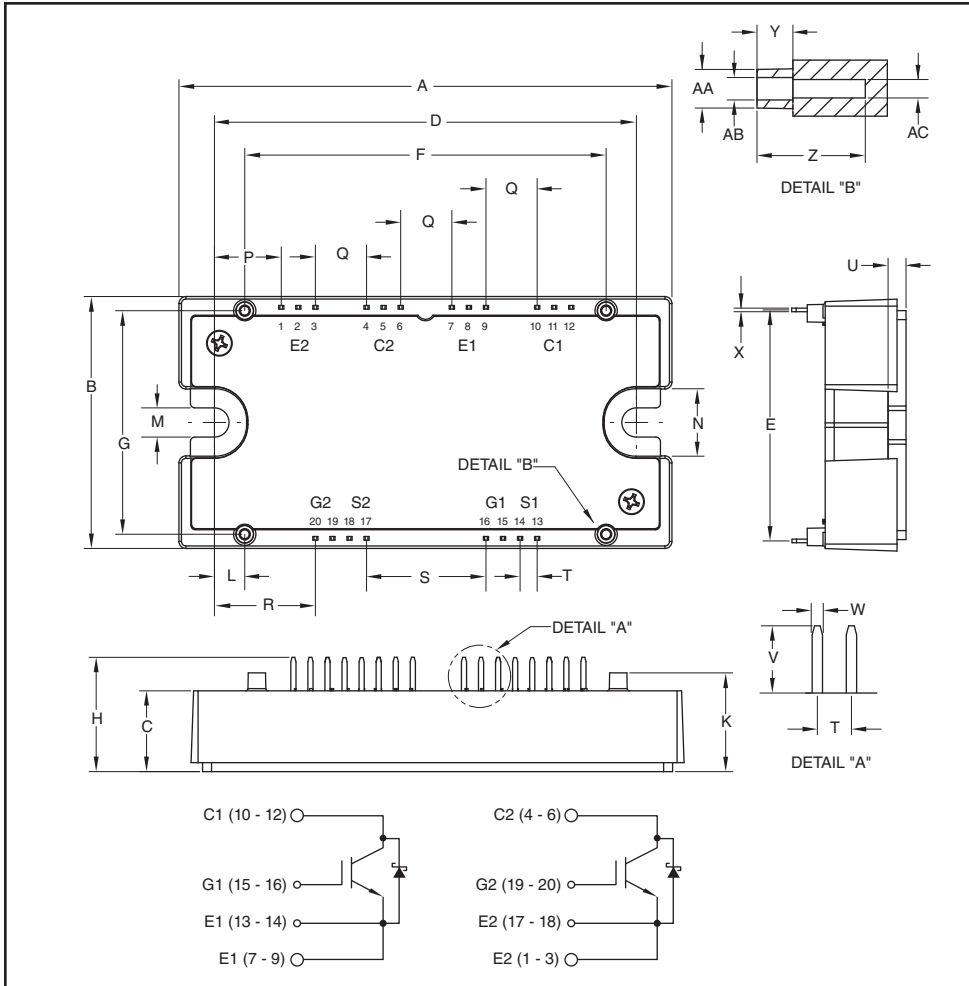


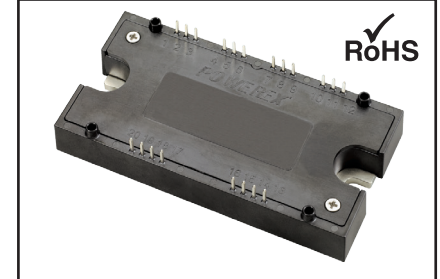
## Split Dual Si/SiC Hybrid IGBT Module 100 Amperes/1200 Volts



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 ESW(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
- AlSiC Baseplate
- RoHS Compliant

### 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

**QID1210006**  
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**Absolute Maximum Ratings,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

| Ratings   | Symbol    | QID1210006 | Units            |
|---|-----------|------------|------------------|
| Junction Temperature  | $T_j$     | -40 to 150 | $^\circ\text{C}$ |
| Storage Temperature   | $T_{stg}$ | -40 to 150 | $^\circ\text{C}$ |
| Collector-Emitter Voltage (G-E Short)   | $V_{CES}$ | 1200       | Volts            |
| Gate-Emitter Voltage (C-E Short)  | $V_{GES}$ | $\pm 20$   | Volts            |
| Collector Current ( $T_C = 25^\circ\text{C}$ )  | $I_C$     | 100*       | Amperes          |
| Peak Collector Current  | $I_{CM}$  | 200*       | Amperes          |
| Emitter Current** ( $T_C = 25^\circ\text{C}$ )  | $I_E$     | 80*        | Amperes          |
| Repetitive Peak Emitter Current ( $T_C = 25^\circ\text{C}$ , $t_p = 10\text{ms}$ , Half Sine Pulse)** | $I_{EM}$  | 455*       | Amperes          |
| Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ , $T_j \leq 150^\circ\text{C}$ )             | $P_C$     | 570        | Watts            |
| Mounting Torque, M6 Mounting  | —         | 40         | in-lb            |
| Weight  | —         | 130        | Grams            |
| Isolation Voltage (Main Terminal to Baseplate, AC 1 min.)   | $V_{ISO}$ | 2500       | Volts            |

**IGBT Electrical Characteristics,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

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

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**Reverse Schottky Diode Characteristics,  $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified**

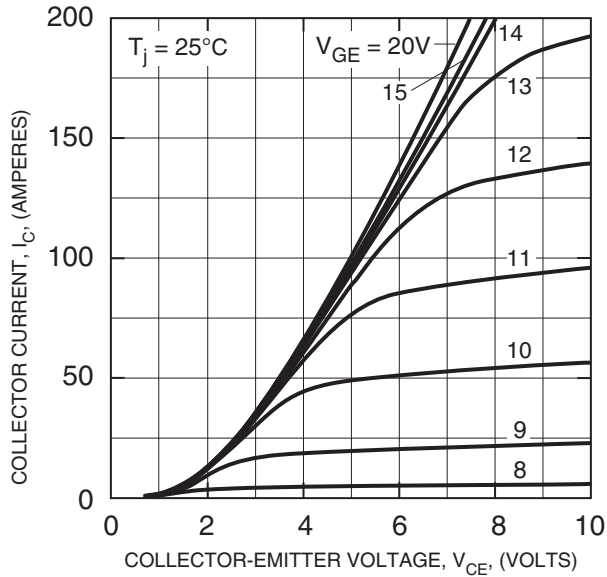
| Characteristics         | Symbol   | Test Conditions   | Min. | Typ. | Max. | Units         |
|-------------------------|----------|---|------|------|------|---------------|
| Diode Forward Voltage   | $V_{FM}$ | $I_F = 80\text{A}, V_{GS} = -5\text{V}$                                 | —    | 1.6 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

**Thermal and Mechanical Characteristics,  $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified**

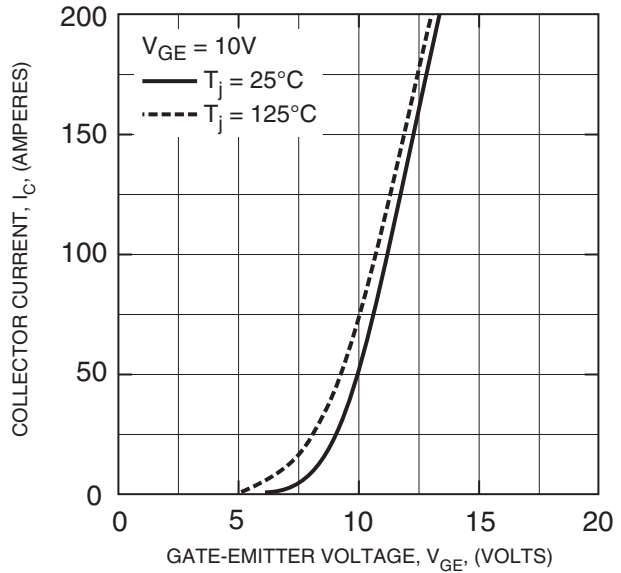
| Characteristics                      | Symbol         | Test Conditions                        | Min. | Typ. | Max.  | Units                     |
|--------------------------------------|----------------|--|------|------|-------|---------------------------|
| Thermal Resistance, Junction to Case | $R_{th(j-c)Q}$ | Per IGBT 1/2 Module,                   | —    | —    | 0.217 | $^\circ\text{C}/\text{W}$ |
|                                      |                | $T_C$ Reference Point Under Chips      |      |      |       |                           |
| Thermal Resistance, Junction to Case | $R_{th(j-c)D}$ | Per FWDi 1/2 Module, $T_C$ Reference   | —    | —    | 0.368 | $^\circ\text{C}/\text{W}$ |
|                                      |                | $T_C$ Reference Point Under Chips      |      |      |       |                           |
| Contact Thermal Resistance           | $R_{th(c-f)}$  | Per 1/2 Module, Thermal Grease Applied | —    | 0.04 | —     | $^\circ\text{C}/\text{W}$ |
| External Gate Resistance             | $R_G$          |  | 3.1  | —    | 31    | $\Omega$                  |
| Internal Inductance                  | $L_{int}$      | IGBT Part                              | —    | 10   | —     | nH                        |

**QID1210006**  
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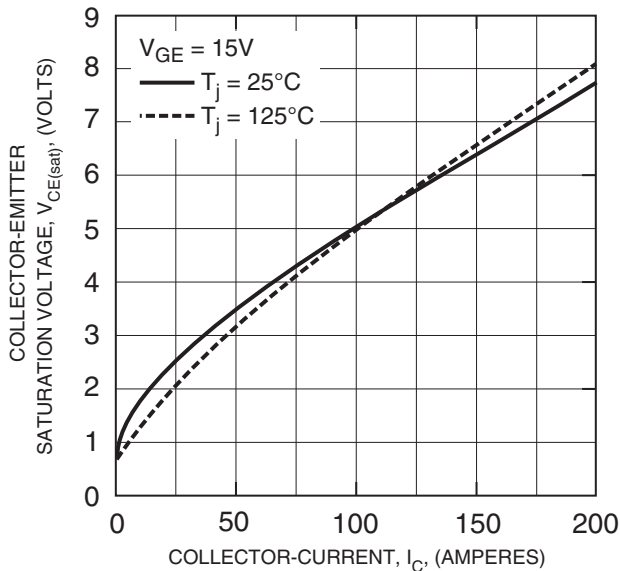
**OUTPUT CHARACTERISTICS (TYPICAL)**



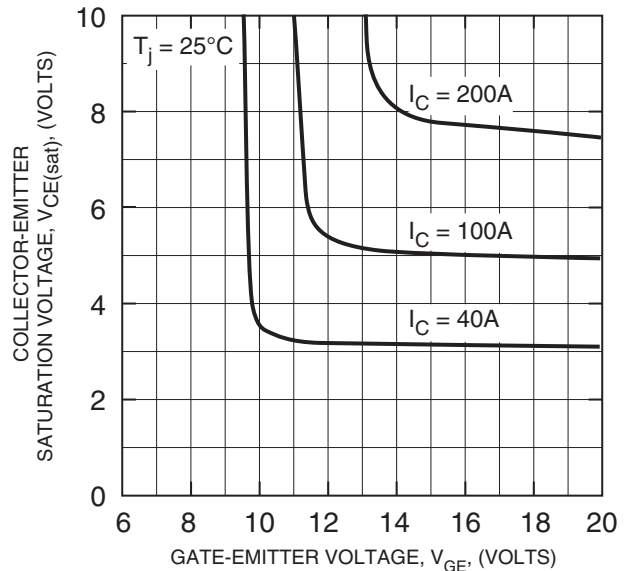
**TRANSFER CHARACTERISTICS (TYPICAL)**



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

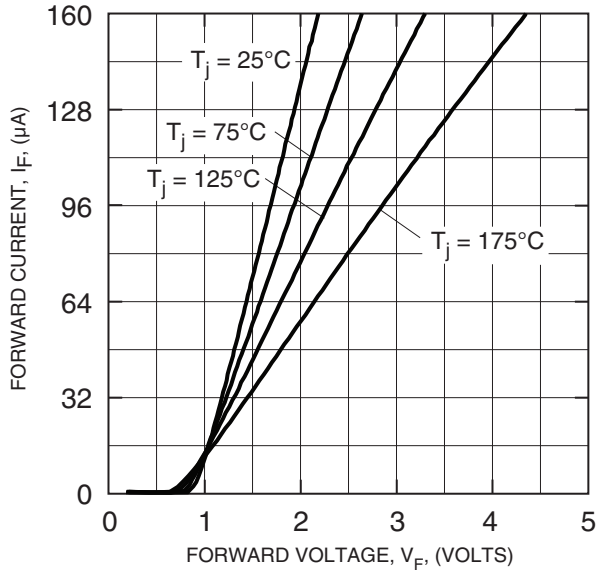


**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**

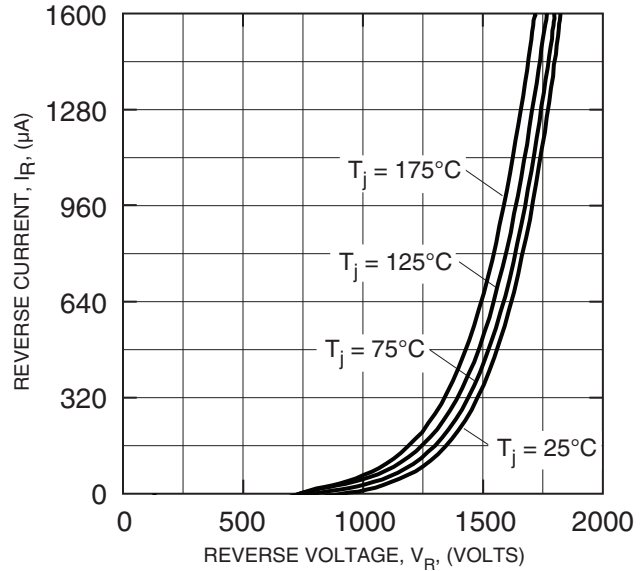


**QID1210006**  
**Split Dual Si/SiC Hybrid IGBT Module**  
 100 Amperes/1200 Volts

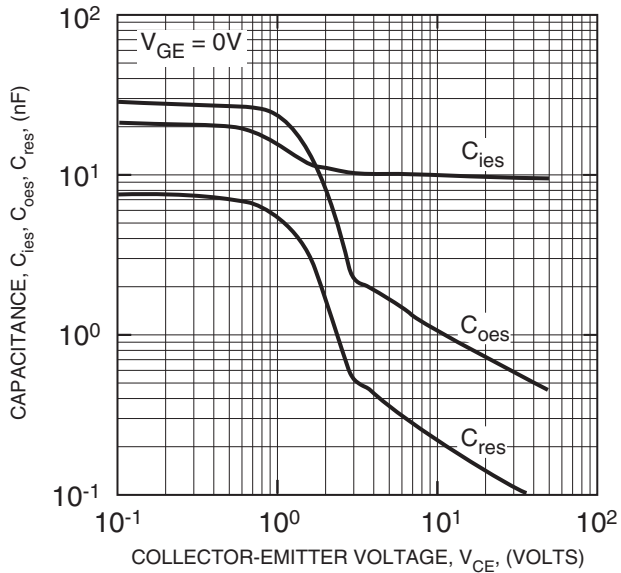
**FREE-WHEEL SCHOTTKY DIODE FORWARD CHARACTERISTICS (TYPICAL)**



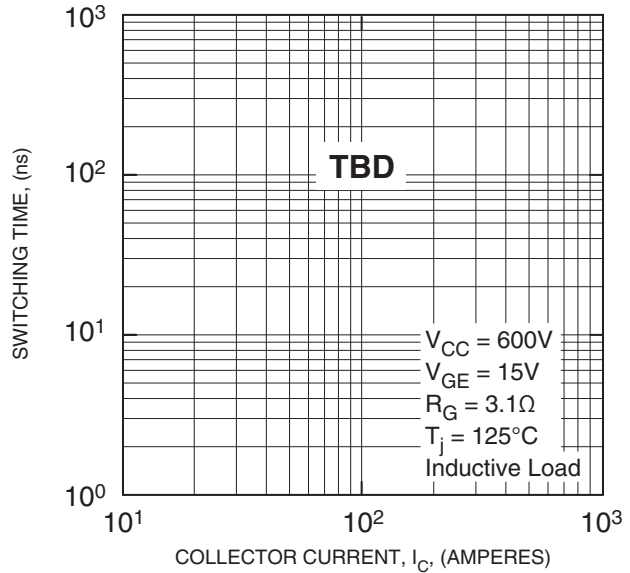
**FREE-WHEEL SCHOTTKY DIODE REVERSE CHARACTERISTICS (TYPICAL)**



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



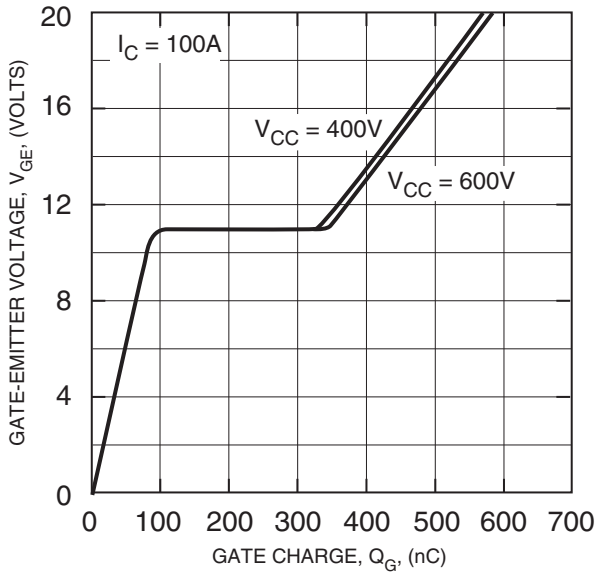
**HALF-BRIDGE SWITCHING CHARACTERISTICS (TYPICAL)**



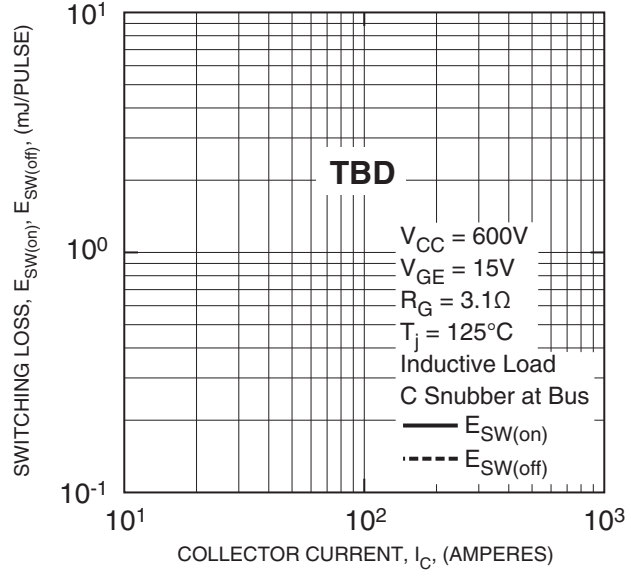
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**QID1210006**  
**Split Dual Si/SiC Hybrid IGBT Module**  
 100 Amperes/1200 Volts

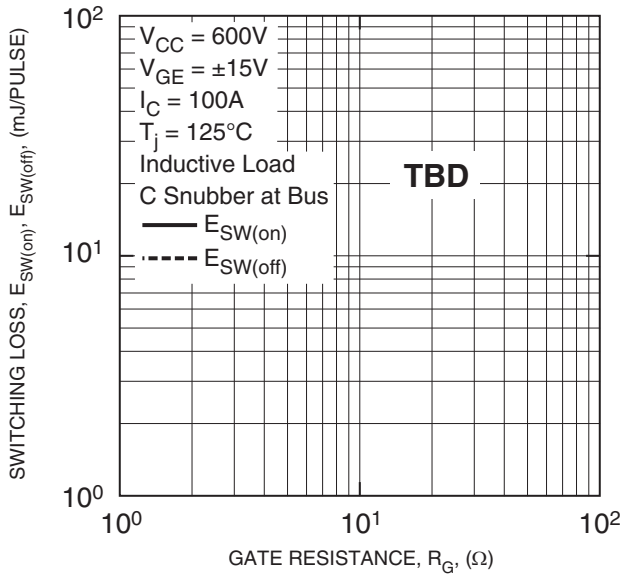
**GATE CHARGE VS.  $V_{GE}$**



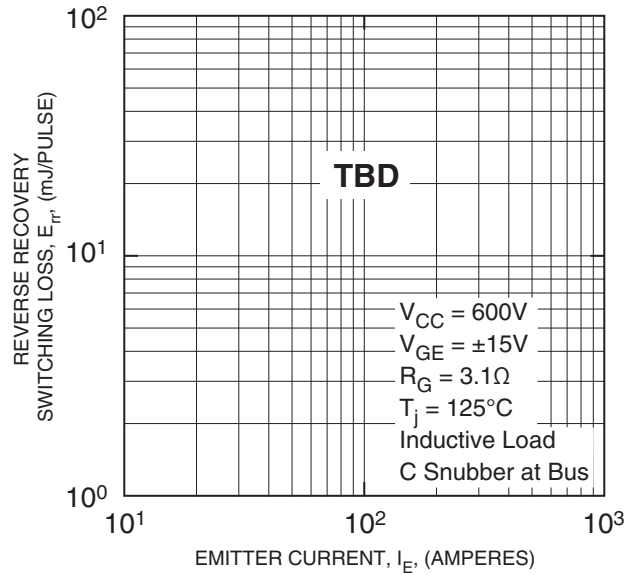
**SWITCHING LOSS VS. COLLECTOR CURRENT (TYPICAL)**



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



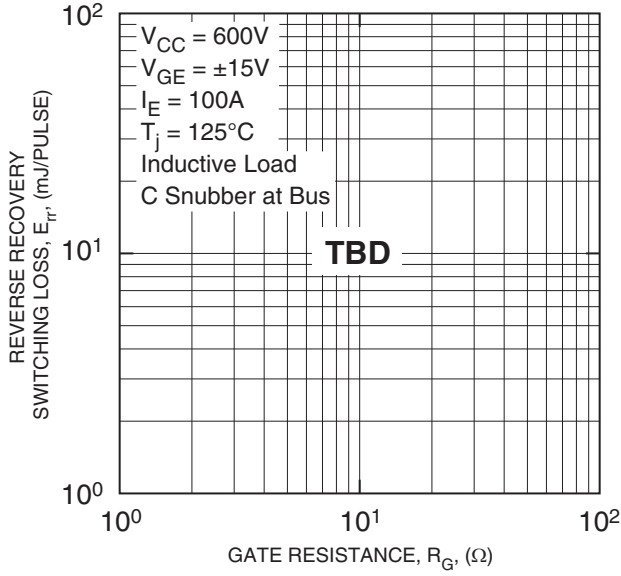
**REVERSE RECOVERY SWITCHING LOSS VS. EMITTER CURRENT (TYPICAL)**



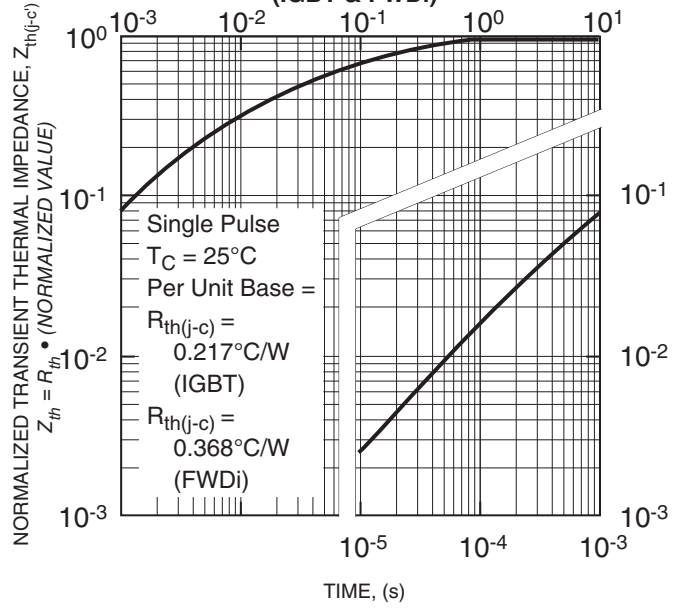
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**QID1210006**  
**Split Dual Si/SiC Hybrid IGBT Module**  
 100 Amperes/1200 Volts

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



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



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