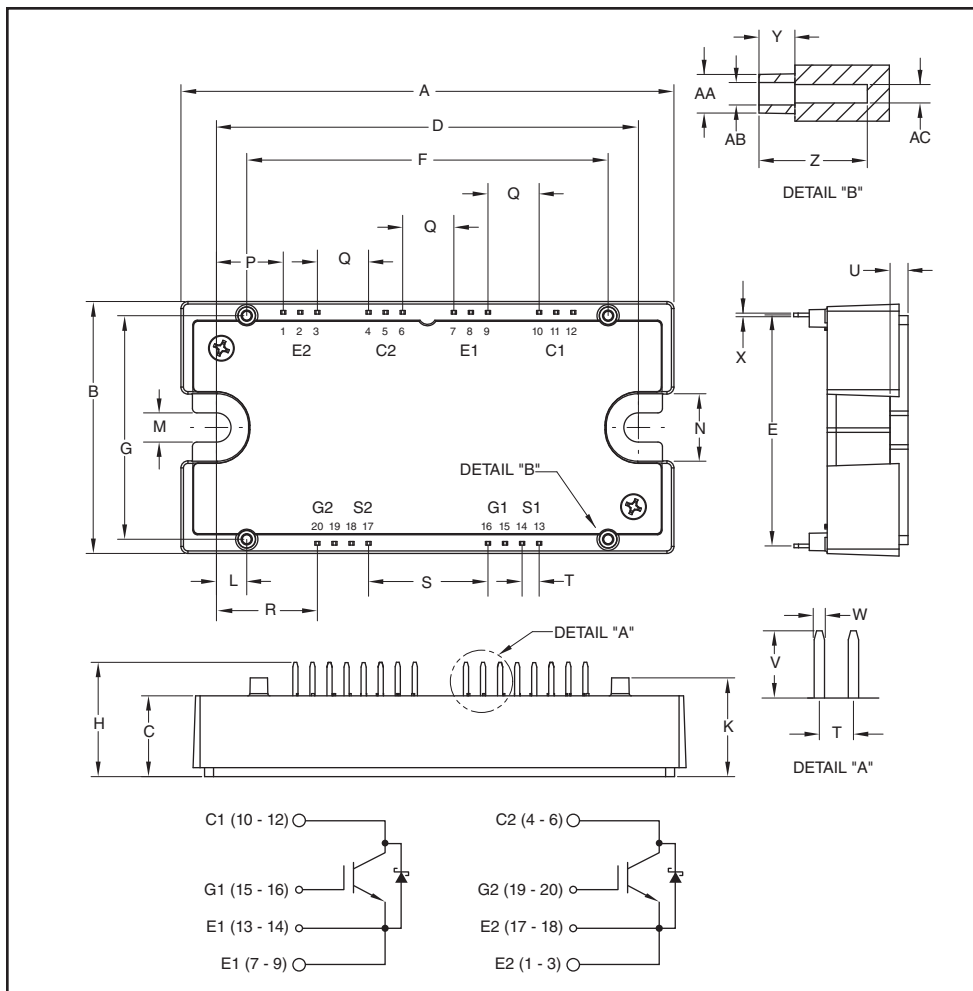


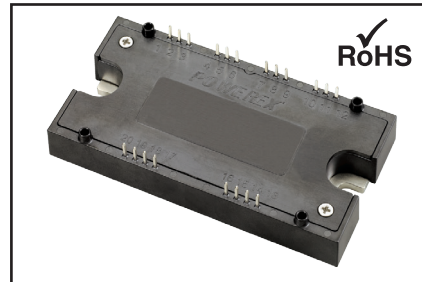
## Split Dual Si/SiC Hybrid IGBT Module 150 Amperes/1200 Volts



**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
- ☐ Copper 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

**QID1215005**
**Split Dual Si/SiC Hybrid IGBT Module**

150 Amperes/1200 Volts

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

| Ratings                                                                                   | Symbol    | QID1215003 | 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 ( $T_C = 25^\circ\text{C}$ )                                            | $I_C$     | 150*       | Amperes          |
| Peak Collector Current                                                                    | $I_{CM}$  | 300*       | Amperes          |
| Emitter Current** ( $T_C = 25^\circ\text{C}$ )                                            | $I_E$     | 150*       | Amperes          |
| Repetitive Peak Emitter Current ( $T_C = 25^\circ\text{C}$ )**                            | $I_{EM}$  | 300*       | Amperes          |
| Maximum Collector Dissipation ( $T_C = 25^\circ\text{C}$ , $T_j \leq 150^\circ\text{C}$ ) | $P_C$     | 960        | 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,  $T_j = 25^\circ\text{C}$  unless otherwise specified**

| Characteristics                      |                     | Symbol        | Test Conditions                                | Min. | Typ. | Max. | Units   |
|--------------------------------------|---------------------|---------------|------------------------------------------------|------|------|------|---------|
| Collector-Cutoff Current             |                     | $I_{CES}$     | $V_{CE} = V_{CES}, V_{GE} = 0V$                | —    | —    | 1.0  | mA      |
| Gate Leakage Current                 |                     | $I_{GES}$     | $V_{GE} = V_{GES}, V_{CE} = 0V$                | —    | —    | 0.5  | $\mu A$ |
| Gate-Emitter Threshold Voltage       |                     | $V_{GE(th)}$  | $I_C = 15mA, V_{CE} = 10V$                     | 4.5  | 6.0  | 7.5  | Volts   |
| Collector-Emitter Saturation Voltage |                     | $V_{CE(sat)}$ | $I_C = 150A, V_{GE} = 15V, T_j = 25^{\circ}C$  | —    | 5.0  | 6.5  | Volts   |
|                                      |                     |               | $I_C = 150A, V_{GE} = 15V, T_j = 125^{\circ}C$ | —    | 5.0  | —    | Volts   |
| Total Gate Charge                    |                     | $Q_G$         | $V_{CC} = 600V, I_C = 150A, V_{GE} = 15V$      | —    | 680  | —    | nC      |
| Input Capacitance                    |                     | $C_{ies}$     | $V_{CE} = 10V, V_{GE} = 0V$                    | —    | —    | 24   | nf      |
| Output Capacitance                   |                     | $C_{oes}$     |                                                | —    | —    | 2.0  | nf      |
| Reverse Transfer Capacitance         |                     | $C_{res}$     |                                                | —    | —    | 0.45 | nf      |
| Inductive                            | Turn-on Delay Time  | $t_{d(on)}$   | $V_{CC} = 600V, I_C = 150A,$                   | —    | —    | TBD  | ns      |
| Load                                 | Rise Time           | $t_r$         | $V_{GE1} = V_{GE2} = 15V,$                     | —    | —    | TBD  | ns      |
| Switch                               | Turn-off Delay Time | $t_{d(off)}$  | $R_G = 2.1\Omega,$                             | —    | —    | TBD  | ns      |
| Time                                 | 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).

**QID1215005****Split Dual Si/SiC Hybrid IGBT Module**

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

| Characteristics         | Symbol   | Test Conditions                                                                 | Min. | Typ. | Max. | Units |
|-------------------------|----------|---------------------------------------------------------------------------------|------|------|------|-------|
| Diode Forward Voltage   | $V_{FM}$ | $I_F = 150\text{A}$ , $V_{GE} = -5\text{V}$                                     | —    | 1.45 | 1.75 | Volts |
|                         |          | $I_F = 150\text{A}$ , $V_{GE} = -5\text{V}$ , $T_j = 175^\circ\text{C}$         | —    | 1.95 | 2.35 | Volts |
| Diode Reverse Current   | $I_R$    | $V_R = 1200\text{V}$                                                            | —    | 1.8  | 10   | mA    |
|                         |          | $V_R = 1200$ , $T_j = 175^\circ\text{C}$                                        | —    | 12   | 66.6 | mA    |
| Diode Capacitive Charge | $Q_C$    | $V_R = 1200\text{V}$ , $I_F = 150\text{A}$ , $di/dt = 2200\text{A}/\mu\text{s}$ | —    | 600  | —    | nC    |

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

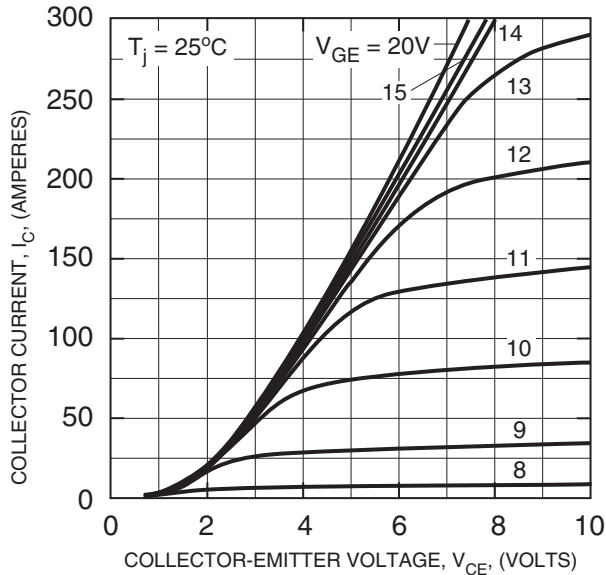
| Characteristics                      | Symbol         | Test Conditions                                                           | Min. | Typ. | Max. | Units                     |
|--------------------------------------|----------------|---------------------------------------------------------------------------|------|------|------|---------------------------|
| Thermal Resistance, Junction to Case | $R_{th(j-c)Q}$ | Per IGBT 1/2 Module,<br>$T_C$ Reference Point Under Chips                 | —    | —    | 0.13 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case | $R_{th(j-c)D}$ | Per FWDi 1/2 Module, $T_C$ Reference<br>$T_C$ Reference Point Under Chips | —    | —    | 0.25 | $^\circ\text{C}/\text{W}$ |
| 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                        |

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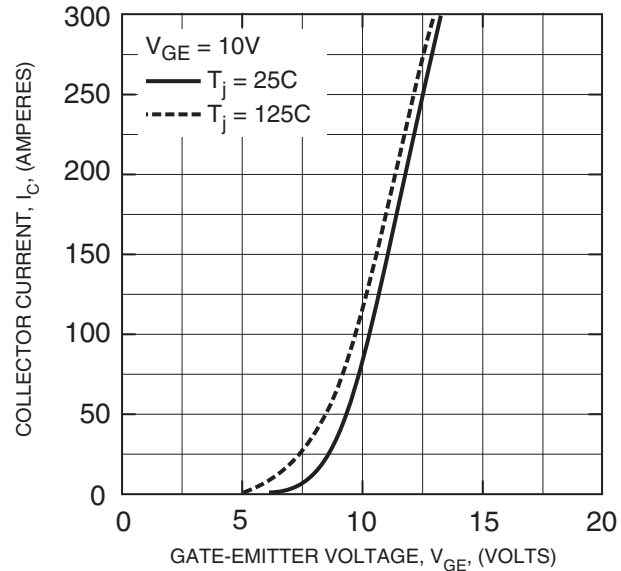
Split Dual Si/SiC Hybrid IGBT Module

150 Amperes/1200 Volts

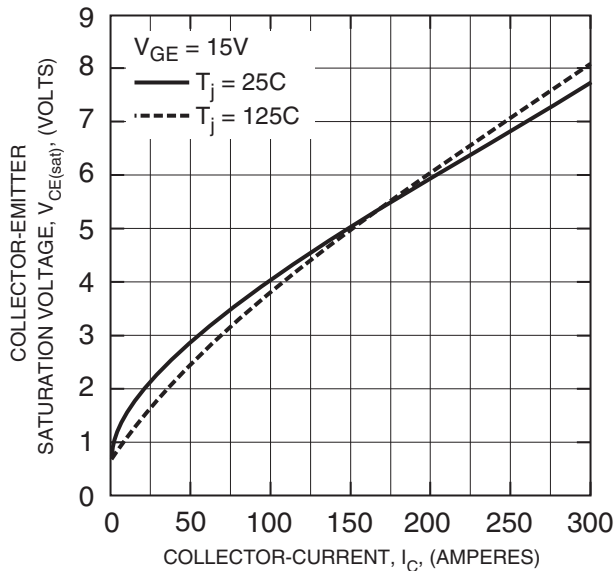
OUTPUT CHARACTERISTICS  
(TYPICAL)



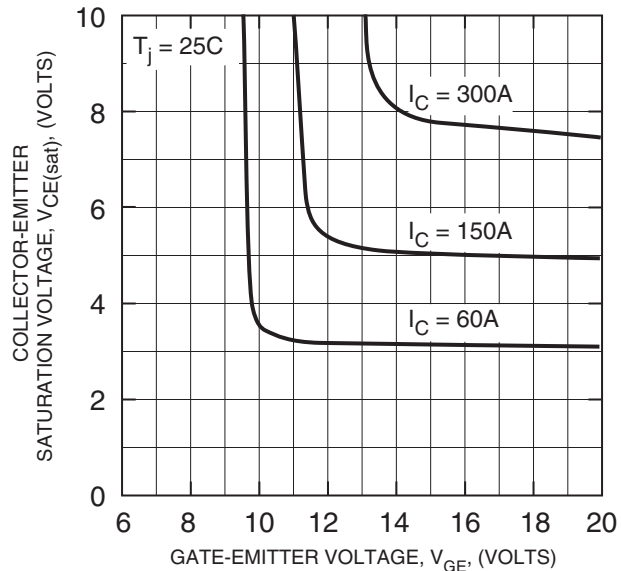
TRANSFER CHARACTERISTICS  
(TYPICAL)



COLLECTOR-EMITTER  
SATURATION VOLTAGE CHARACTERISTICS  
(TYPICAL)



COLLECTOR-EMITTER  
SATURATION VOLTAGE CHARACTERISTICS  
(TYPICAL)

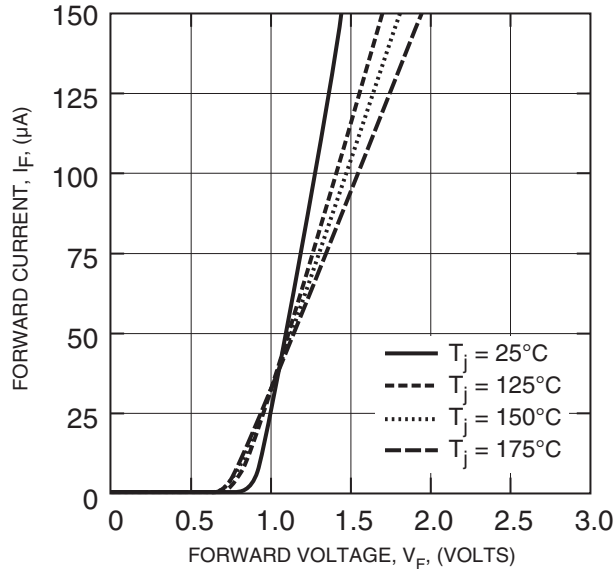


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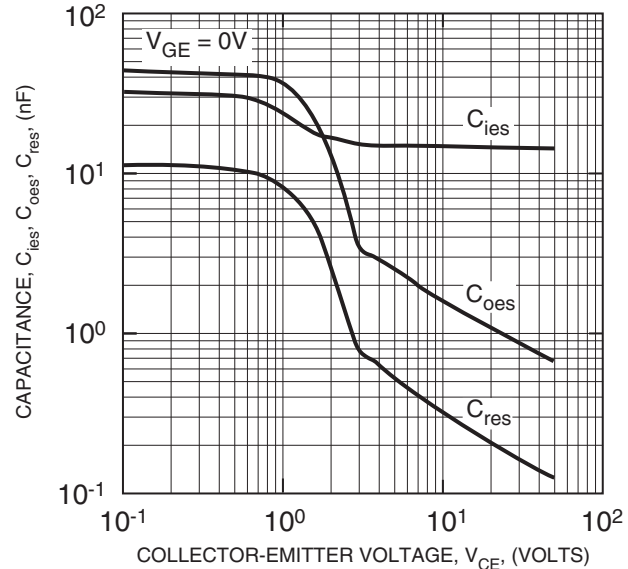
Split Dual Si/SiC Hybrid IGBT Module

150 Amperes/1200 Volts

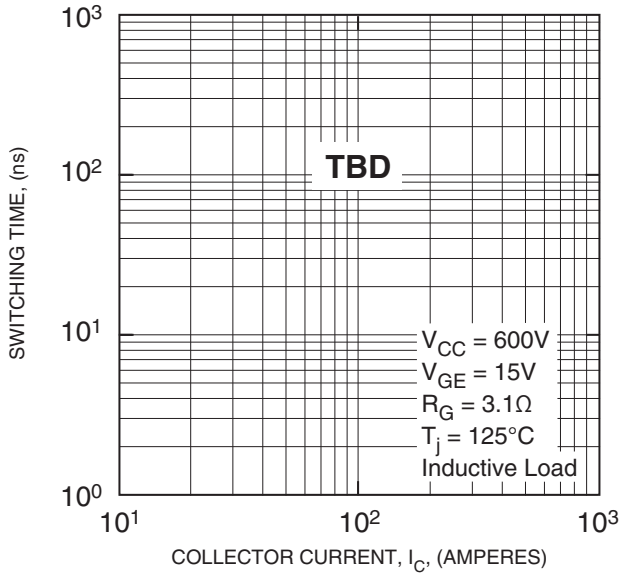
**FREE-WHEEL SCHOTTKY DIODE  
FORWARD CHARACTERISTICS  
(TYPICAL)**



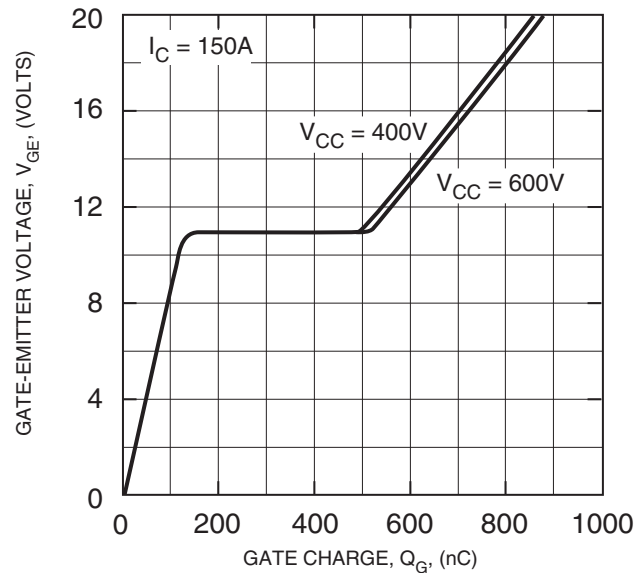
**CAPACITANCE VS.  $V_{CE}$   
(TYPICAL)**



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



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

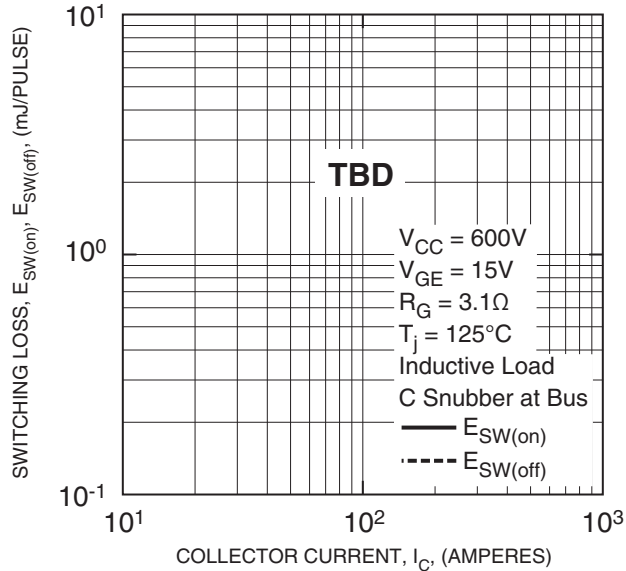


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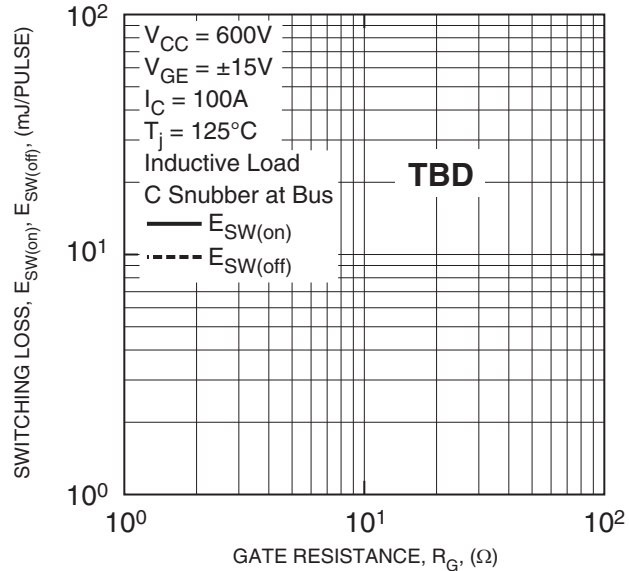
Split Dual Si/SiC Hybrid IGBT Module

150 Amperes/1200 Volts

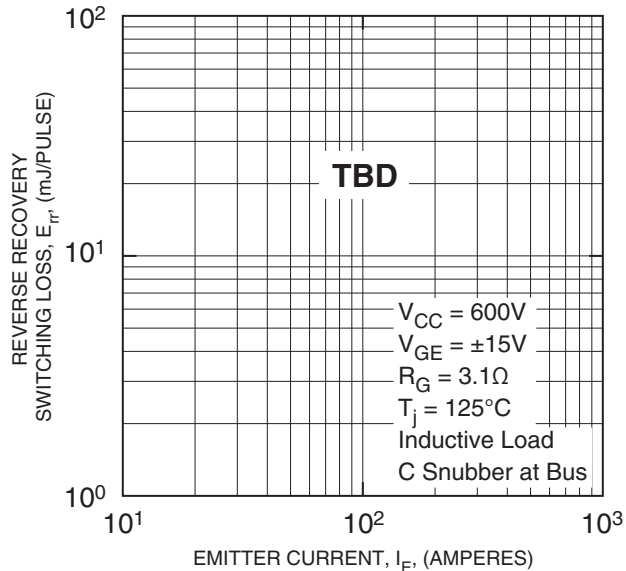
SWITCHING LOSS VS.  
COLLECTOR CURRENT  
(TYPICAL)



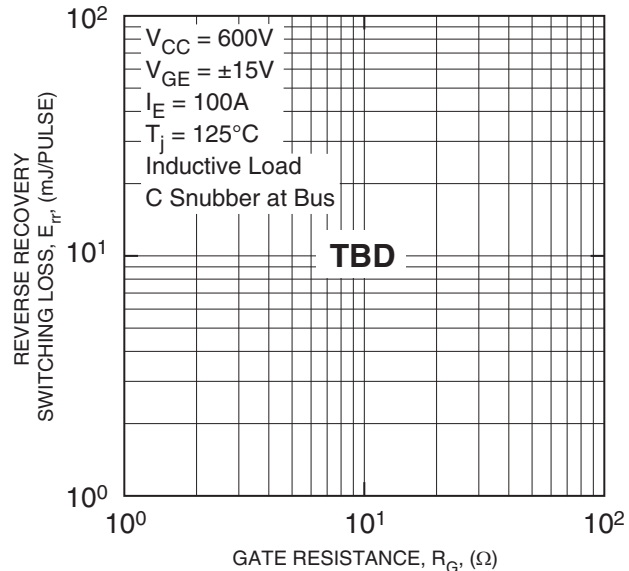
SWITCHING LOSS VS.  
GATE RESISTANCE  
(TYPICAL)



REVERSE RECOVERY SWITCHING LOSS VS.  
EMITTER CURRENT  
(TYPICAL)



REVERSE RECOVERY SWITCHING LOSS VS.  
GATE RESISTANCE  
(TYPICAL)



QID1215005

Split Dual Si/SiC Hybrid IGBT Module

150 Amperes/1200 Volts

