

## High Temperature Silicon Carbide Power Schottky Diode

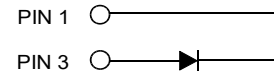
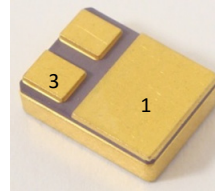
|                                  |   |              |
|----------------------------------|---|--------------|
| $V_{RRM}$                        | = | <b>650 V</b> |
| $I_F$ ( $T_C=25^\circ\text{C}$ ) | = | <b>14 A</b>  |
| $Q_C$                            | = | <b>20 nC</b> |

### Features

- 650 V Schottky rectifier
- 210 °C maximum operating temperature
- Zero reverse recovery charge
- Superior surge current capability
- Positive temperature coefficient of  $V_F$
- Temperature independent switching behavior
- Lowest figure of merit  $Q_C/I_F$
- Available screened to Mil-PRF-19500

### Package

- RoHS Compliant



### Advantages

- High temperature operation
- Improved circuit efficiency (Lower overall cost)
- Low switching losses
- Ease of paralleling devices without thermal runaway
- Smaller heat sink requirements
- Industry's lowest reverse recovery charge
- Industry's lowest device capacitance
- Ideal for output switching of power supplies
- Best in class reverse leakage current at operating temperature

### Applications

- Down Hole Oil Drilling
- Geothermal Instrumentation
- Solenoid Actuators
- General Purpose High-Temperature Switching
- Amplifiers
- Solar Inverters
- Switched-Mode Power Supply (SMPS)
- Power Factor Correction (PFC)

### Maximum Ratings at $T_j = 210^\circ\text{C}$ , unless otherwise specified

| Parameter  | Symbol         | Conditions   | Values |            | Unit                 |
|--|----------------|--|--------|------------|----------------------|
|  |                |  | min.   | typ.       |                      |
| Repetitive peak reverse voltage                      | $V_{RRM}$      |  |        | 650        | V                    |
| Continuous forward current                           | $I_F$          | $T_C = 25^\circ\text{C}$                           |        | 8          | A                    |
| Continuous forward current                           | $I_F$          | $T_C \leq 190^\circ\text{C}$                       |        | 4.3        | A                    |
| RMS forward current                                  | $I_{F(RMS)}$   | $T_C \leq 190^\circ\text{C}$                       |        | 8          | A                    |
| Surge non-repetitive forward current, Half Sine Wave | $I_{F,SM}$     | $T_C = 25^\circ\text{C}$ , $t_p = 10\text{ ms}$    |        | 32         | A                    |
| Non-repetitive peak forward current                  | $I_{F,max}$    | $T_C = 25^\circ\text{C}$ , $t_p = 10\ \mu\text{s}$ |        | 120        | A                    |
| $I^2t$ value   | $\int I^2 dt$  | $T_C = 25^\circ\text{C}$ , $t_p = 10\text{ ms}$    |        | 5          | $\text{A}^2\text{S}$ |
| Power dissipation                                    | $P_{tot}$      | $T_C = 25^\circ\text{C}$                           |        | 163        | W                    |
| Operating and storage temperature                    | $T_j, T_{stg}$ |  |        | -55 to 210 | $^\circ\text{C}$     |

### Electrical Characteristics at $T_j = 210^\circ\text{C}$ , unless otherwise specified

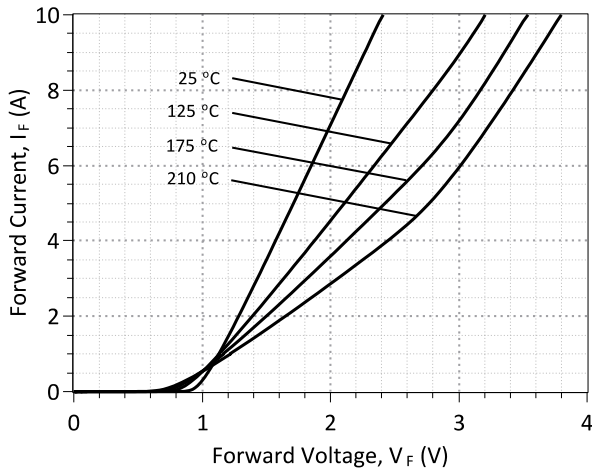
| Parameter               | Symbol | Conditions  | Values |      |      | Unit          |
|-------------------------|--------|---|--------|------|------|---------------|
|                         |        |   | min.   | typ. | max. |               |
| Diode forward voltage   | $V_F$  | $I_F = 5\text{ A}$ , $T_j = 25^\circ\text{C}$   |        | 1.7  |      | V             |
|                         |        | $I_F = 5\text{ A}$ , $T_j = 210^\circ\text{C}$  |        | 2.9  |      |               |
| Reverse current         | $I_R$  | $V_R = 650\text{ V}$ , $T_j = 25^\circ\text{C}$   |        | 1    | 5    | $\mu\text{A}$ |
|                         |        | $V_R = 650\text{ V}$ , $T_j = 210^\circ\text{C}$  |        | 10   | 100  |               |
| Total capacitive charge | $Q_C$  | $I_F \leq I_{F,MAX}$<br>$dI_F/dt = 200\text{ A}/\mu\text{s}$<br>$T_j = 210^\circ\text{C}$ |        | 20   |      | nC            |
| Switching time          | $t_s$  | $V_R = 400\text{ V}$  |        | < 25 |      | ns            |
| Total capacitance       | C      | $V_R = 1\text{ V}$ , $f = 1\text{ MHz}$ , $T_j = 25^\circ\text{C}$                        |        | 274  |      | pF            |
|                         |        | $V_R = 400\text{ V}$ , $f = 1\text{ MHz}$ , $T_j = 25^\circ\text{C}$                      |        | 31   |      |               |
|                         |        | $V_R = 650\text{ V}$ , $f = 1\text{ MHz}$ , $T_j = 25^\circ\text{C}$                      |        | 29   |      |               |

### Thermal Characteristics

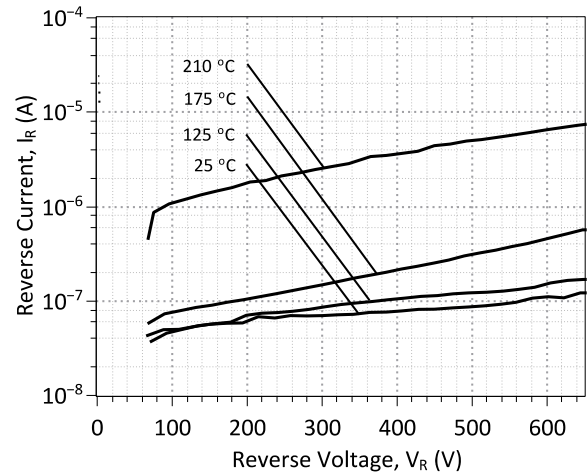
|                                     |            |      |                           |
|-------------------------------------|------------|------|---------------------------|
| Thermal resistance, junction - case | $R_{thJC}$ | 1.38 | $^\circ\text{C}/\text{W}$ |
|-------------------------------------|------------|------|---------------------------|

### Mechanical Properties

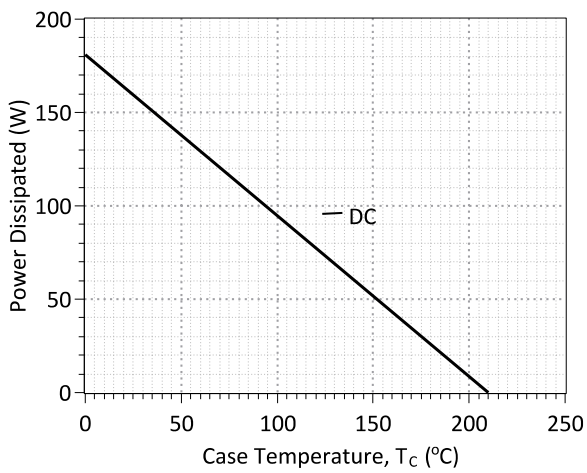
|                 |   |     |    |
|-----------------|---|-----|----|
| Mounting torque | M | 0.6 | Nm |
|-----------------|---|-----|----|



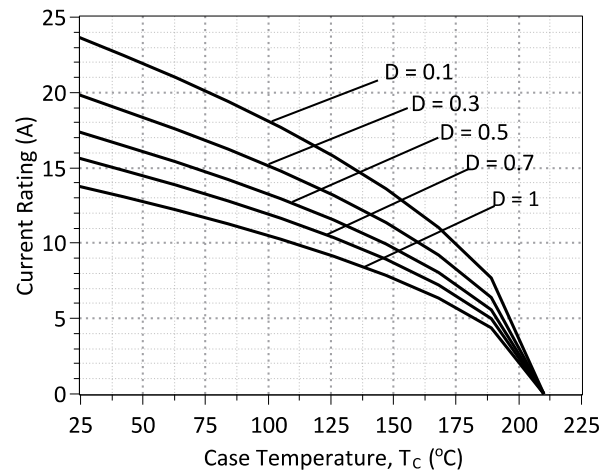
**Figure 1: Typical Forward Characteristics**



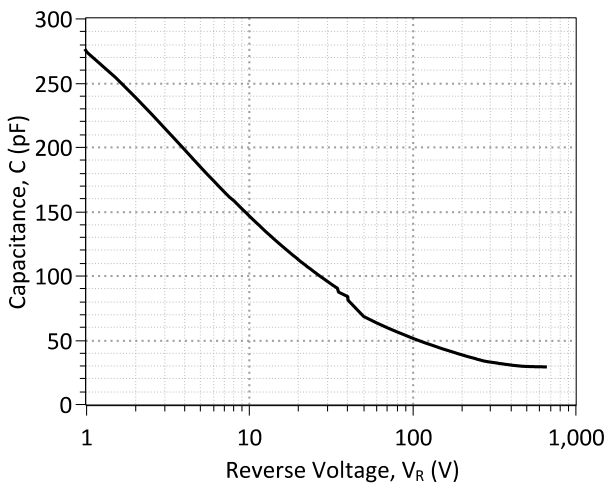
**Figure 2: Typical Reverse Characteristics**



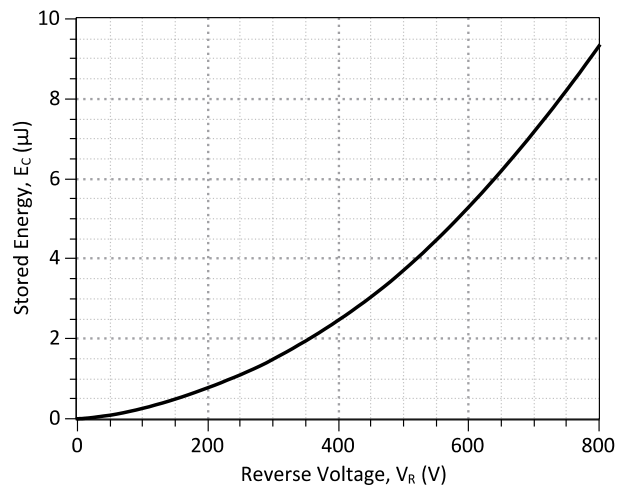
**Figure 3: Power Derating Curve**



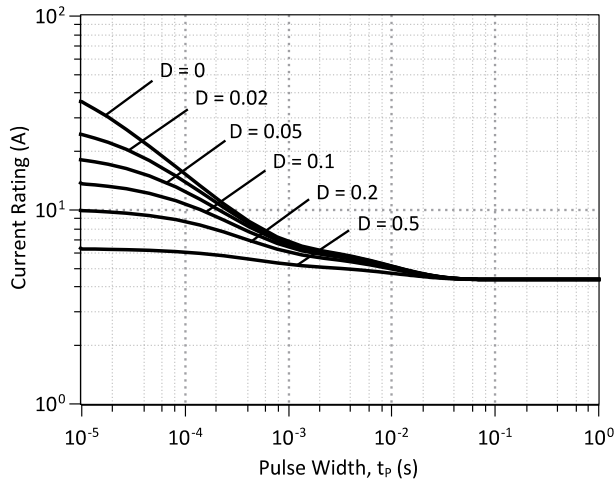
**Figure 4: Current Derating Curves ( $D = t_p/T$ ,  $t_p = 400 \mu s$ )  
(Considering worst case  $Z_{th}$  conditions)**



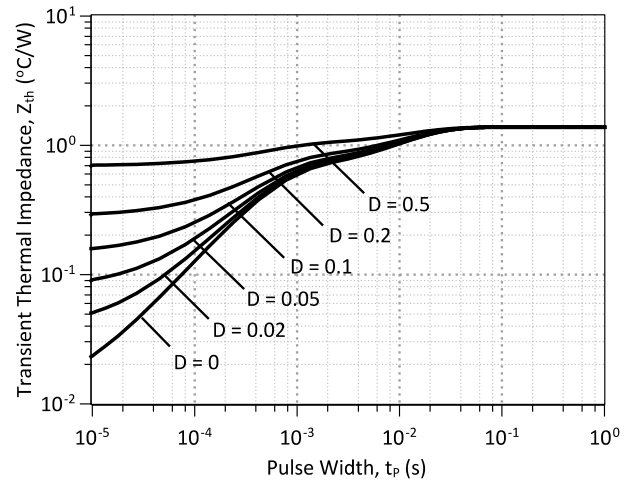
**Figure 5: Typical Junction Capacitance vs Reverse Voltage Characteristics**



**Figure 6: Typical Capacitive Energy vs Reverse Voltage Characteristics**

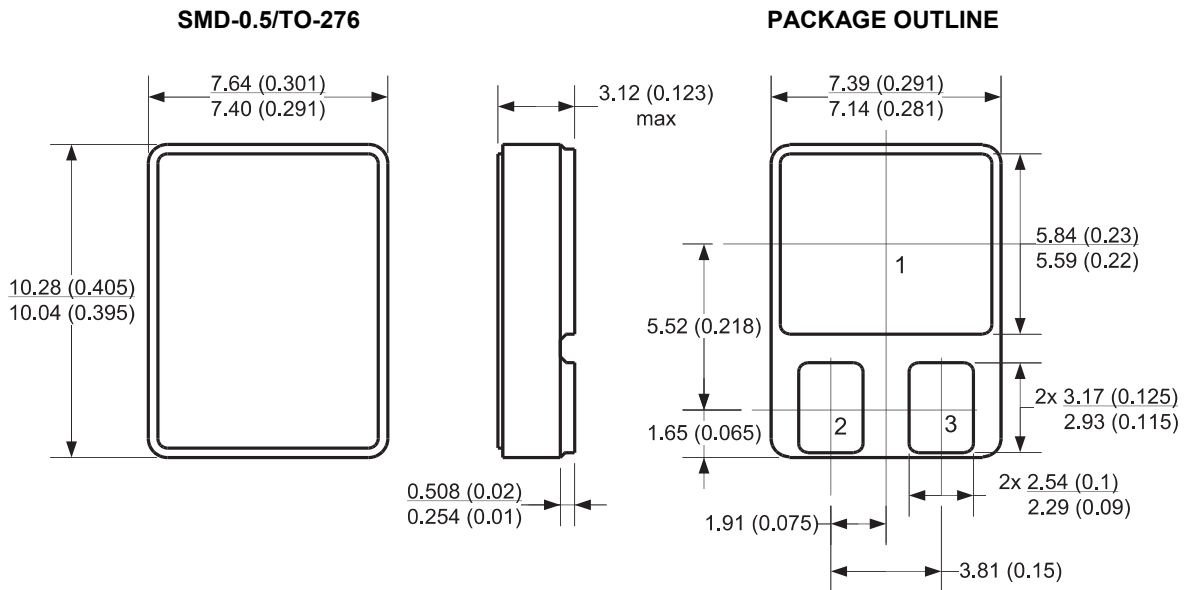


**Figure 7: Current vs Pulse Duration Curves at  $T_c = 190\text{ }^\circ\text{C}$**



**Figure 8: Transient Thermal Impedance**

**Package Dimensions:**



**NOTE**

1. CONTROLLED DIMENSION IS INCH. DIMENSION IN BRACKET IS MILLIMETER.
2. DIMENSIONS DO NOT INCLUDE END FLASH, MOLD FLASH, MATERIAL PROTRUSIONS

**Revision History**

| Date       | Revision | Comments                           | Supersedes |
|------------|----------|------------------------------------|------------|
| 2014/08/26 | 1        | Updated Electrical Characteristics |            |
| 2012/04/24 | 0        | Initial release                    |            |
|            |          |                                    |            |

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## SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the 1N8033-GA device.

```
*      MODEL OF GeneSiC Semiconductor Inc.
*
*      $Revision:   1.0           $
*      $Date:      05-SEP-2013   $
*
*      GeneSiC Semiconductor Inc.
*      43670 Trade Center Place Ste. 155
*      Dulles, VA 20166
*      http://www.genesicsemi.com/index.php/hit-sic/schottky
*
*      COPYRIGHT (C) 2013 GeneSiC Semiconductor Inc.
*      ALL RIGHTS RESERVED
*
*      These models are provided "AS IS, WHERE IS, AND WITH NO WARRANTY
*      OF ANY KIND EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED
*      TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A
*      PARTICULAR PURPOSE."
*      Models accurate up to 2 times rated drain current.
*
*      Start of 1N8033-GA SPICE Model
*
.SUBCKT 1N8033 ANODE KATHODE
D1 ANODE KATHODE 1N8033_25C; Call the Schottky Diode Model
D2 ANODE KATHODE 1N8033_PIN; Call the PiN Diode Model
.MODEL 1N8033_25C D
+ IS      1.99E-17      RS      0.12463
+ N       1            IKF     569.082
+ EG      1.2          XTI     3
+ TRS1    0.0035       TRS2    3.87E-05
+ CJO     3.38E-10     VJ      0.41772
+ M       1.5479       FC      0.5
+ TT      1.00E-10     BV      650
+ IBV     1.00E-03     VPK     650
+ IAVE    5            TYPE    SiC_Schottky
+ MFG     GeneSiC_Semiconductor
.MODEL 1N8033_PIN D
+ IS      1.33E-10     RS      0.31147
+ N       5            IKF     0
+ EG      3.23         XTI     -10
+ FC      0.5          TT      0
+ BV      650          IBV     1.00E-03
+ VPK     650          IAVE    5
+ TYPE    SiC_PiN
.ENDS
*
*      End of 1N8033-GA SPICE Model
```

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