Normally – OFF Silicon Carbide Junction Transistor

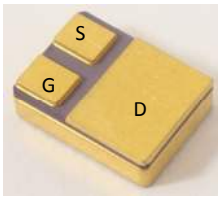
V_{DS}	=	650 V
$V_{DS(ON)}$	=	1.4 V
I_D	=	8 A
$R_{DS(ON)}$	=	180 mΩ

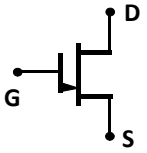
Features

- 250 °C maximum operating temperature
- Temperature independent switching performance
- Gate oxide free SiC switch
- Suitable for connecting an anti-parallel diode
- Positive temperature coefficient for easy paralleling
- Low gate charge
- Low intrinsic capacitance

Package

- RoHS Compliant





SMD0.5 / TO – 276 (Hermetic Package)

Advantages

- Low switching losses
- Higher efficiency
- High temperature operation
- High short circuit withstand capability

Applications

- Down Hole Oil Drilling, Geothermal Instrumentation
- Hybrid Electric Vehicles (HEV)
- Solar Inverters
- Switched-Mode Power Supply (SMPS)
- Power Factor Correction (PFC)
- Induction Heating
- Uninterruptible Power Supply (UPS)
- Motor Drives

Maximum Ratings at T_j = 250 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values	Unit
Drain – Source Voltage	V_{DS}	V_{GS} = 0 V	650	V
Continuous Drain Current	I_D	T_C = 158 °C	8	A
Gate Peak Current	I_{GM}		5	A
Reverse Gate – Source Voltage	V_{GS}		30	V
Reverse Drain – Source Voltage	V_{DS}		40	V
Power Dissipation	P_{tot}	T_C = 25 °C	11	W
Operating and Storage Temperature	T_j, T_{stg}		-55 to 250	°C

Electrical Characteristics at T_j = 250 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values min.	Values typ.	Values max.	Unit
On Characteristics						
Drain – Source On Voltage	$V_{DS(ON)}$	I_D = 8 A, I_G = 250 mA, T_j = 25 °C		1.4	2.1	V
		I_D = 8 A, I_G = 500 mA, T_j = 175 °C		2.6	3.7	
		I_D = 8 A, I_G = 500 mA, T_j = 250 °C		3.9	4.8	
Drain – Source On Resistance	$R_{DS(ON)}$	I_D = 8 A, I_G = 250 mA, T_j = 25 °C		180		mΩ
		I_D = 8 A, I_G = 500 mA, T_j = 175 °C		330		
		I_D = 8 A, I_G = 500 mA, T_j = 250 °C		490		
Gate Forward Voltage	$V_{GS(FWD)}$	I_G = 500 mA, T_j = 25 °C		3		V
		I_G = 500 mA, T_j = 250 °C		2.7		
DC Current Gain	β	V_{DS} = 5 V, I_D = 10 A, T_j = 25 °C	80	110		
		V_{DS} = 5 V, I_D = 10 A, T_j = 250 °C	50	80		
Off Characteristics						
Drain Leakage Current	I_{DSS}	V_R = 650 V, V_{GS} = 0 V, T_j = 25 °C		10	100	μA
		V_R = 650 V, V_{GS} = 0 V, T_j = 175 °C		40	400	
		V_R = 650 V, V_{GS} = 0 V, T_j = 250 °C		100	600	

Electrical Characteristics at T_j = 250 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{DS} = 35 V, V_{GS} = 0 V, f = 1 MHz, T_{vj} = 25 °C		720		pF
Output Capacitance	C_{oss}			88		pF
Reverse Transfer Capacitance	C_{rss}			88		pF
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 400 V, I_D = 10 A, $R_{G(on)}$ = $R_{G(off)}$ = 32 Ω, V_{GS} = -8/15 V ,T_j = 175 ºC Refer to Figure 10 for gate drive current waveforms		11		ns
Rise Time	t_r			28		ns
Turn Off Delay Time	$t_{d(off)}$			76		ns
Fall Time	t_f			38		ns
Turn-On Energy Per Pulse	E_{on}			34		µJ
Turn-Off Energy Per Pulse	E_{off}			64		µJ
Total Switching Energy	E_{ts}			98		µJ
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 400 V, I_D = 10 A, $R_{G(on)}$ = $R_{G(off)}$ = 32 Ω, V_{GS} = -8/15 V ,T_j = 250 ºC Refer to Figure 10 for gate drive current waveforms		12		ns
Rise Time	t_r			30		ns
Turn Off Delay Time	$t_{d(off)}$			73		ns
Fall Time	t_f			58		ns
Turn-On Energy Per Pulse	E_{on}			43		µJ
Turn-Off Energy Per Pulse	E_{off}			82		µJ
Total Switching Energy	E_{ts}			125		µJ
Thermal Characteristics						
Thermal resistance, junction - case	R_{thJC}			1		°C/W

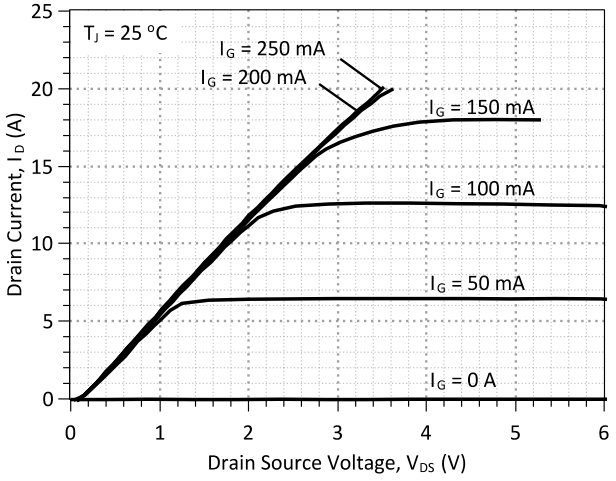


Figure 1: Typical Output Characteristics at 25 °C

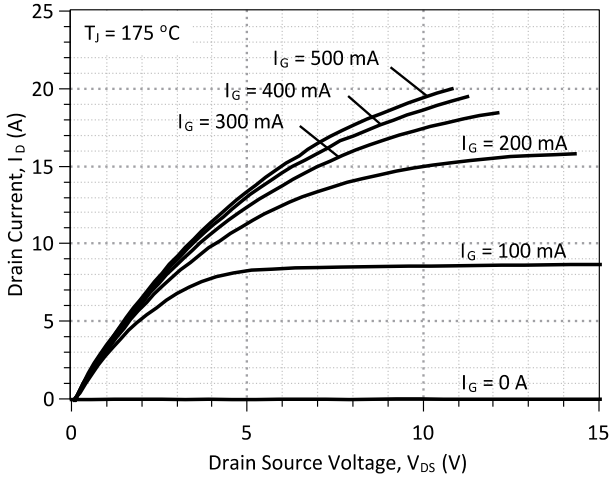


Figure 2: Typical Output Characteristics at 175 °C

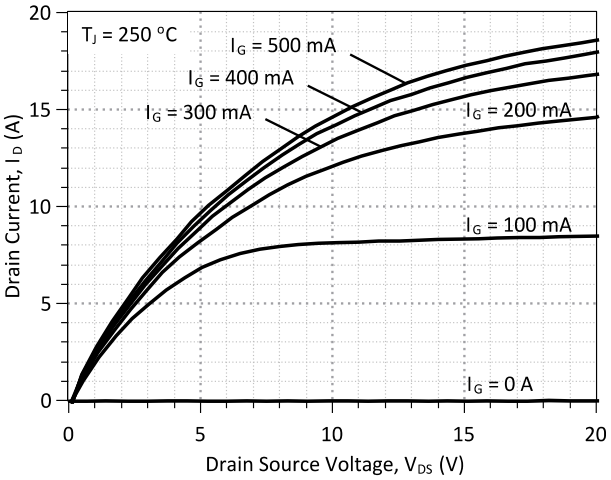


Figure 3: Typical Output Characteristics at 250 °C

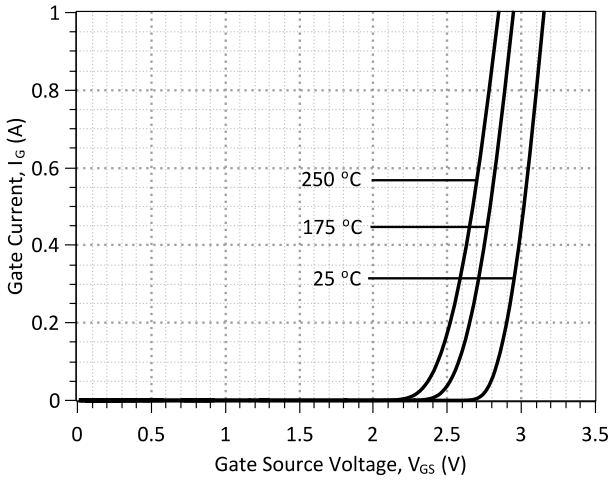


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

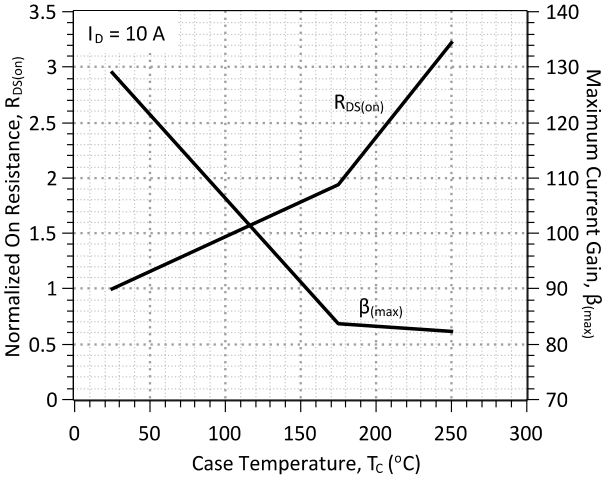


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

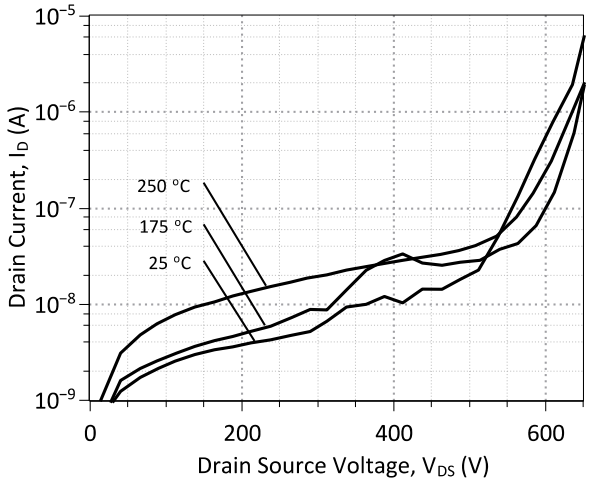


Figure 6: Typical Blocking Characteristics

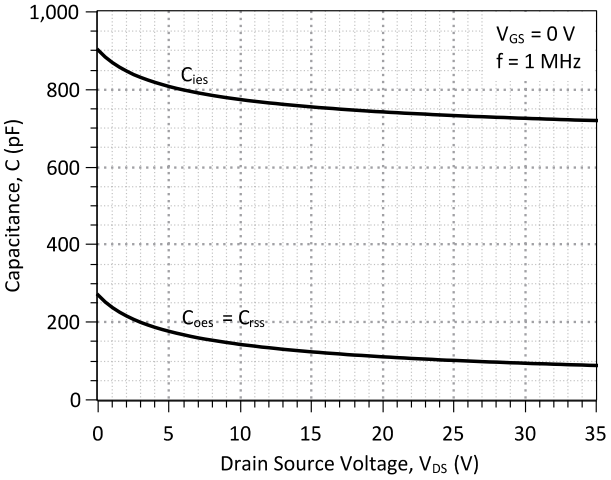


Figure 7: Typical Capacitance vs Drain-Source Voltage

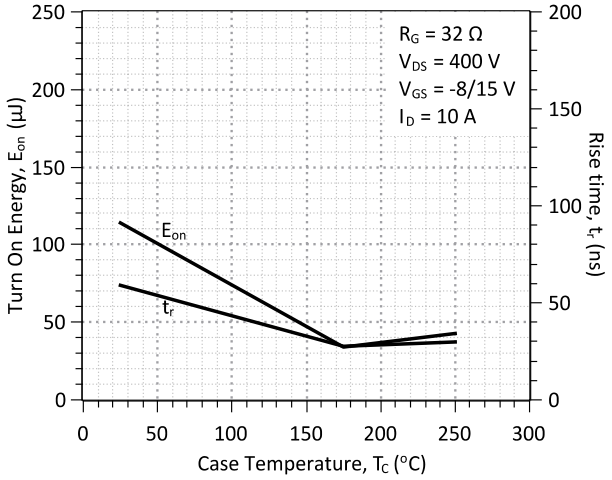


Figure 8: Typical Turn On Energy Losses and Switching Times vs. Temperature

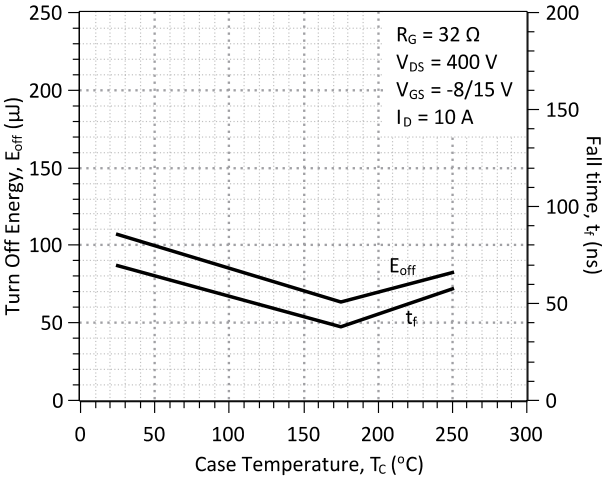


Figure 9: Typical Turn Off Energy Losses and Switching Times vs. Temperature

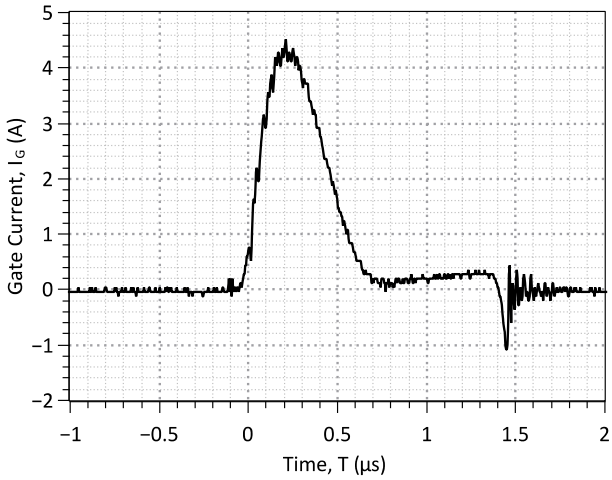
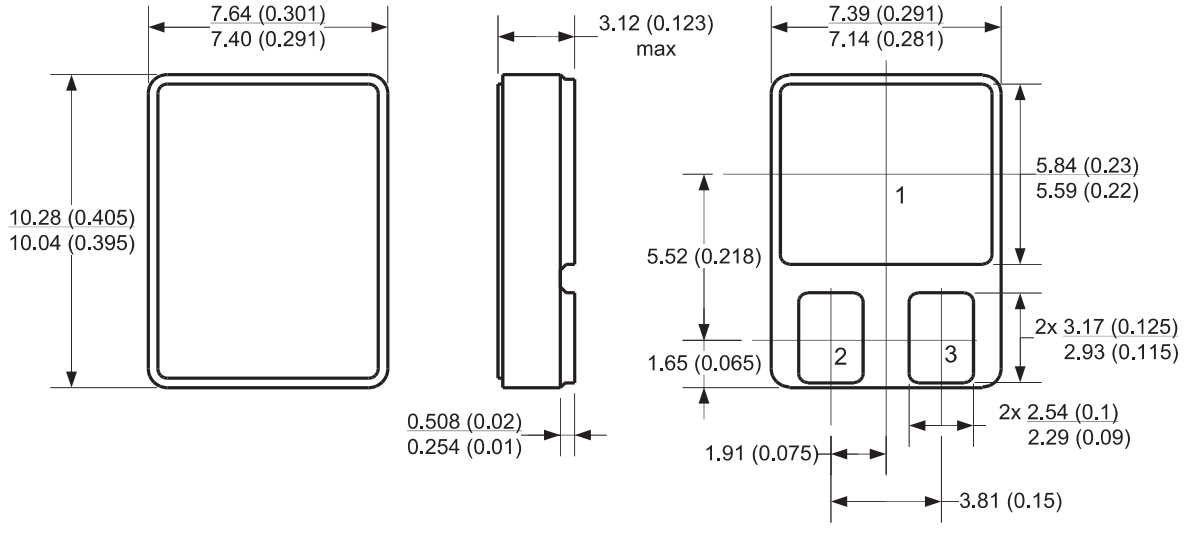


Figure 10: Typical Gate-Source Switching Waveforms

Package Dimensions:

SMD-0.5/TO-276 **PACKAGE OUTLINE**



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
2013/11/18	1	Updated Electrical Characteristics	
2012/08/24	0	Initial release	

Published by
GeneSiC Semiconductor, Inc.
43670 Trade Center Place Suite 155
Dulles, VA 20166

SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the 2N7638-GA device.

```
*     MODEL OF GeneSiC Semiconductor Inc.
*
*     $Revision:   1.0           $
*     $Date:   06-SEP-2013       $
*
*     GeneSiC Semiconductor Inc.
*     43670 Trade Center Place Ste. 155
*     Dulles, VA 20166
*     http://www.genesicsemi.com/index.php/hit-sic/sjt
*
*     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.
*
.model 2N7638 NPN
+ IS       3.73E-46
+ ISE      5.50E-28
+ EG       3.2
+ BF       103
+ BR       0.55
+ IKF      900
+ NF       1
+ NE       2.021
+ RB       0.26
+ RE       0.1
+ RC       0.09
+ CJC      2.77E-10
+ VJC      3.023103628
+ MJC      0.460762158
+ CJE      8.23E-10
+ VJE      2.945448229
+ MJE      0.498044294
+ XTI      3
+ XTB      -0.35
+ TRC1     1.20E-02
+ VCEO     650
+ ICRATING 8
+ MFG      GeneSiC_Semiconductor
*
* End of 2N7638-GA SPICE Model
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