

Normally – OFF Silicon Carbide Junction Transistor

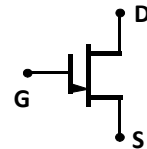
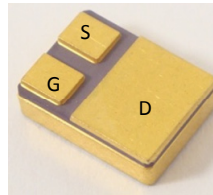
V_{DS}	=	650 V
$V_{DS(ON)}$	=	1.4 V
I_D	=	8 A
$R_{DS(ON)}$	=	180 mΩ

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 $T_j = 250\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values	Unit
Drain – Source Voltage	V_{DS}	$V_{GS} = 0\text{ V}$	650	V
Continuous Drain Current	I_D	$T_C = 158\text{ °C}$	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}	$T_C = 25\text{ °C}$	11	W
Operating and Storage Temperature	T_j, T_{stg}		-55 to 250	°C

Electrical Characteristics at $T_j = 250\text{ °C}$, unless otherwise specified

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

Off Characteristics

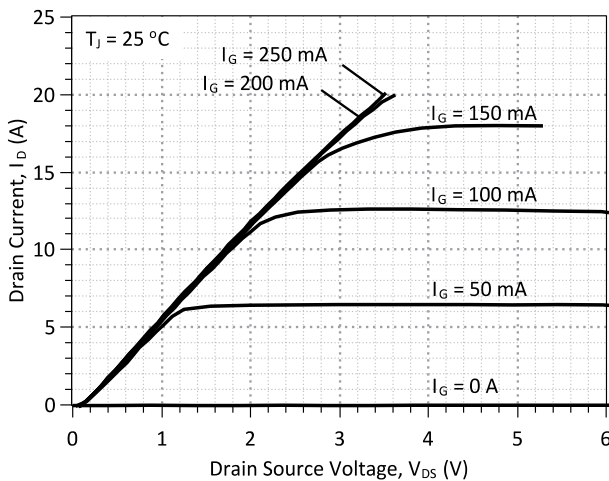
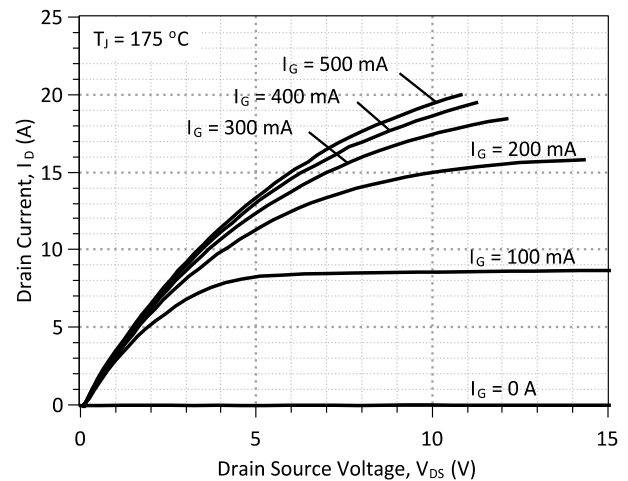
Drain Leakage Current	I_{DSS}	$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 25\text{ °C}$	10	100	μA
		$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 175\text{ °C}$	40	400	
		$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 250\text{ °C}$	100	600	

Electrical Characteristics at $T_j = 250\text{ }^\circ\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic Characteristics						
Input Capacitance	C_{iss}	$V_{DS} = 35\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}, T_{vj} = 25\text{ }^\circ\text{C}$		720		pF
Output Capacitance	C_{oss}			88		pF
Reverse Transfer Capacitance	C_{rss}			88		pF
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 10\text{ A},$ $R_{G(on)} = R_{G(off)} = 32\ \Omega,$ $V_{GS} = -8/15\text{ V}, T_j = 175\text{ }^\circ\text{C}$ 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	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 10\text{ A},$ $R_{G(on)} = R_{G(off)} = 32\ \Omega,$ $V_{GS} = -8/15\text{ V}, T_j = 250\text{ }^\circ\text{C}$ 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	$R_{th(jc)}$	1	$^\circ\text{C/W}$
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Figure 1: Typical Output Characteristics at 25 °C

Figure 2: Typical Output Characteristics at 175 °C

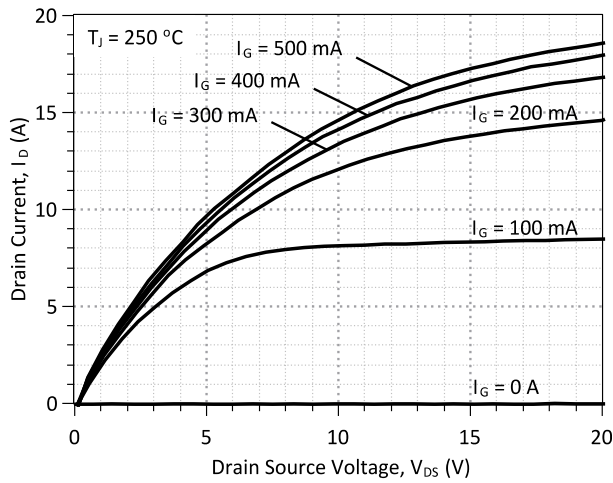


Figure 3: Typical Output Characteristics at 250 °C

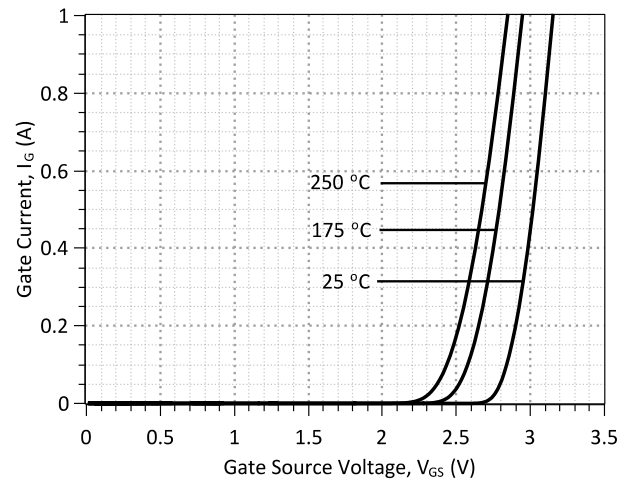


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

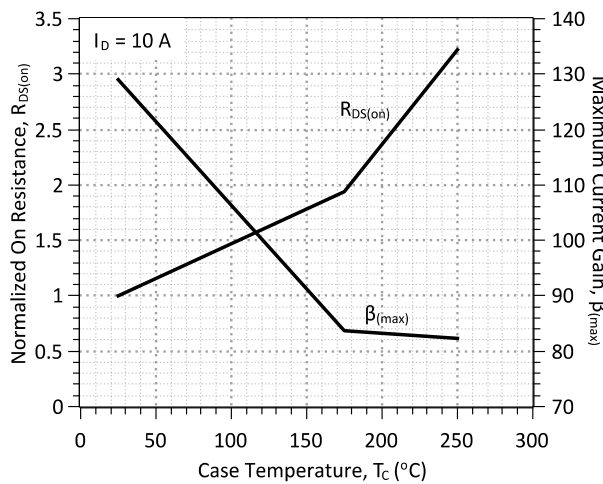


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

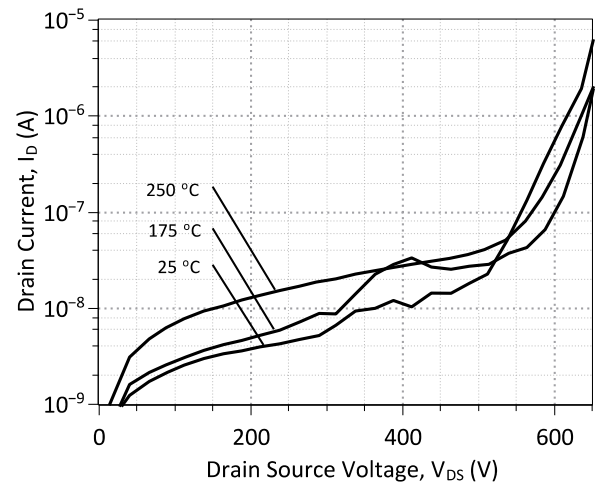


Figure 6: Typical Blocking Characteristics

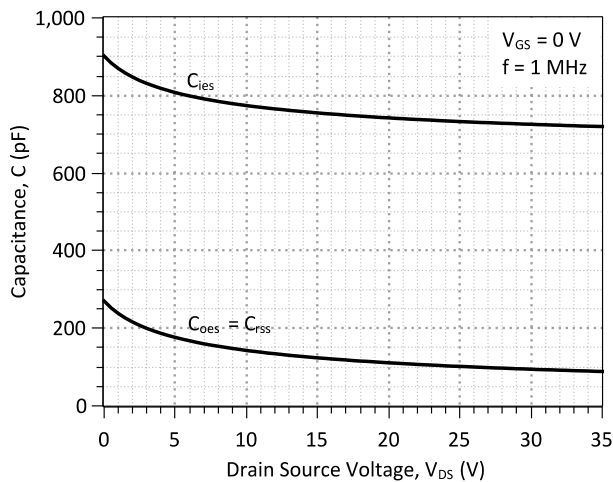


Figure 7: Typical Capacitance vs Drain-Source Voltage

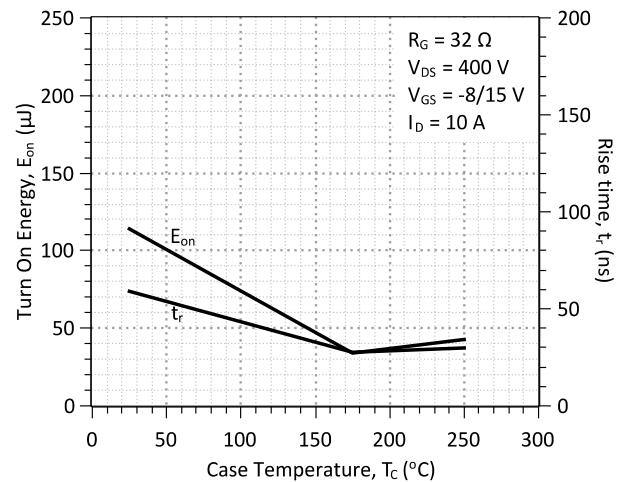


Figure 8: Typical Turn On Energy Losses and Switching Times vs. Temperature

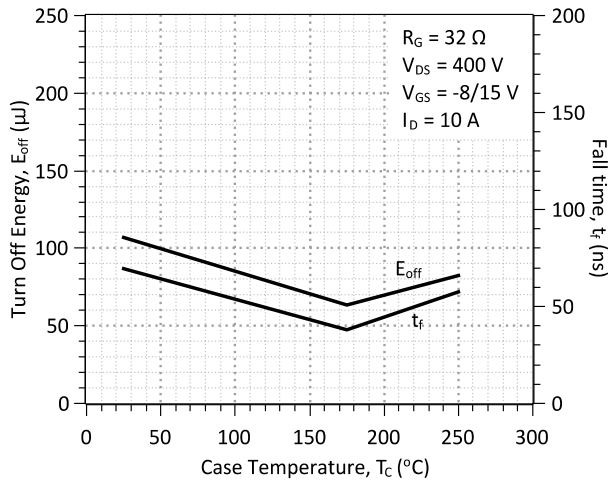


Figure 9: Typical Turn Off Energy Losses and Switching Times vs. Temperature

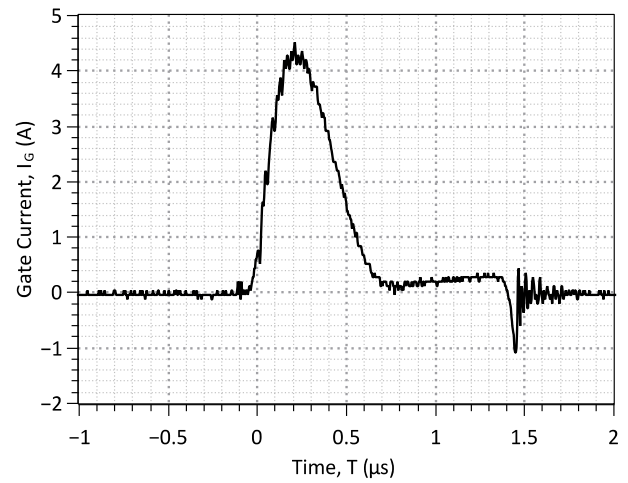
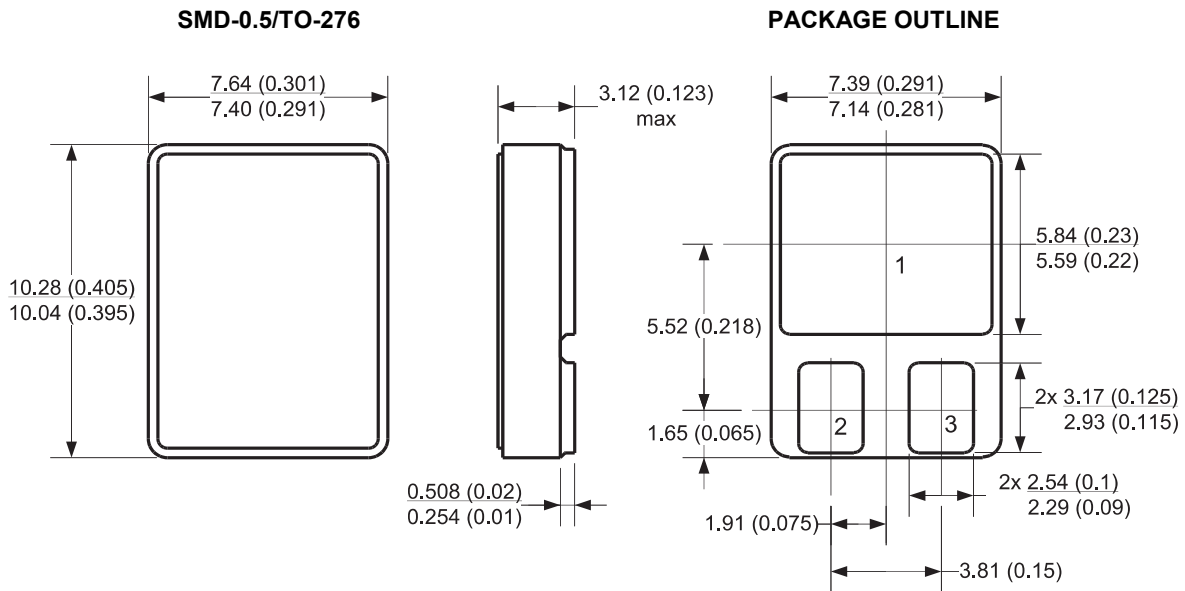


Figure 10: Typical Gate-Source Switching Waveforms

Package Dimensions:



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	

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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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