

Normally – OFF Silicon Carbide Junction Transistor

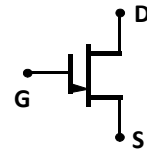
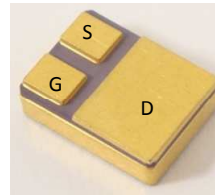
V_{DS}	=	650 V
$V_{DS(ON)}$	=	1.7 V
I_D	=	16 A
$R_{DS(ON)}$	=	105 mΩ

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	$T_C = 155\text{ °C}$	16	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}	$T_C = 25\text{ °C}$	27	W
Operating and Storage Temperature	T_j, T_{stg}		-55 to 250	°C

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

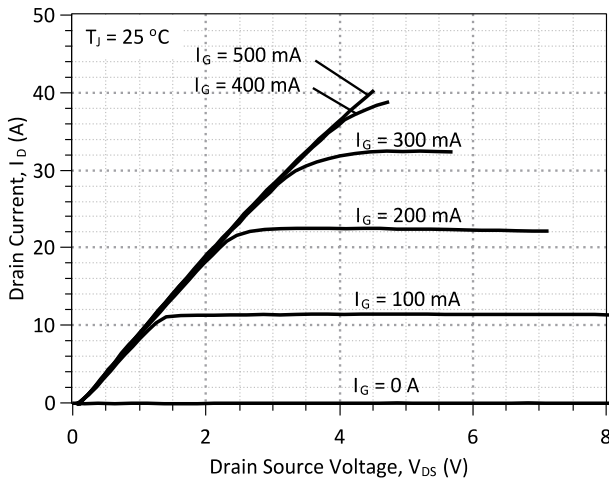
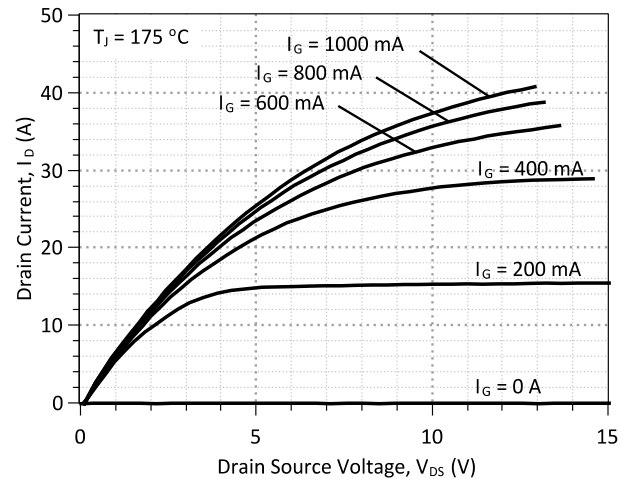
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	$V_{DS(ON)}$	$I_D = 16\text{ A}, I_G = 500\text{ mA}, T_j = 25\text{ °C}$		1.7		V
		$I_D = 16\text{ A}, I_G = 1000\text{ mA}, T_j = 175\text{ °C}$		2.7		
		$I_D = 16\text{ A}, I_G = 1000\text{ mA}, T_j = 250\text{ °C}$		4.3		
Drain – Source On Resistance	$R_{DS(ON)}$	$I_D = 16\text{ A}, I_G = 500\text{ mA}, T_j = 25\text{ °C}$		105		mΩ
		$I_D = 16\text{ A}, I_G = 1000\text{ mA}, T_j = 175\text{ °C}$		180		
		$I_D = 16\text{ A}, I_G = 1000\text{ mA}, T_j = 250\text{ °C}$		290		
Gate Forward Voltage	$V_{GS(FWD)}$	$I_G = 500\text{ mA}, T_j = 25\text{ °C}$ $I_G = 500\text{ mA}, T_j = 250\text{ °C}$		3 2.6		V
DC Current Gain	β	$V_{DS} = 5\text{ V}, I_D = 20\text{ A}, T_j = 25\text{ °C}$		115		
		$V_{DS} = 5\text{ V}, I_D = 20\text{ A}, T_j = 250\text{ °C}$		75		

Off Characteristics

Drain Leakage Current	I_{DSS}	$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 25\text{ °C}$		1		μA
		$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 175\text{ °C}$		7		
		$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 250\text{ °C}$		45		

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}	$V_{DS} = 35\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}, T_j = 25\text{ }^\circ\text{C}$		1534		pF
Output Capacitance	C_{oss}			157		pF
Reverse Transfer Capacitance	C_{rss}			157		pF
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 20\text{ A},$ $R_{G(on)} = R_{G(off)} = 22\ \Omega,$ $V_{GS} = -8/15\text{ V}, T_j = 175\text{ }^\circ\text{C}$ Refer to Figure 10 for gate drive current waveforms		5		ns
Rise Time	t_r			37		ns
Turn Off Delay Time	$t_{d(off)}$			68		ns
Fall Time	t_f			78		ns
Turn-On Energy Per Pulse	E_{on}			66		μJ
Turn-Off Energy Per Pulse	E_{off}		365		μJ	
Total Switching Energy	E_{ts}		431		μJ	
Turn On Delay Time	$t_{d(on)}$	$V_{DD} = 400\text{ V}, I_D = 20\text{ A},$ $R_{G(on)} = R_{G(off)} = 22\ \Omega,$ $V_{GS} = -8/15\text{ V}, T_j = 250\text{ }^\circ\text{C}$ Refer to Figure 10 for gate drive current waveforms		7		ns
Rise Time	t_r			38		ns
Turn Off Delay Time	$t_{d(off)}$			85		ns
Fall Time	t_f			86		ns
Turn-On Energy Per Pulse	E_{on}			64		μJ
Turn-Off Energy Per Pulse	E_{off}		395		μJ	
Total Switching Energy	E_{ts}		459		μJ	
Thermal Characteristics						
Thermal resistance, junction - case	$R_{th(jc)}$			0.6		$^\circ\text{C/W}$


Figure 1: Typical Output Characteristics at 25 °C

Figure 2: Typical Output Characteristics at 175 °C

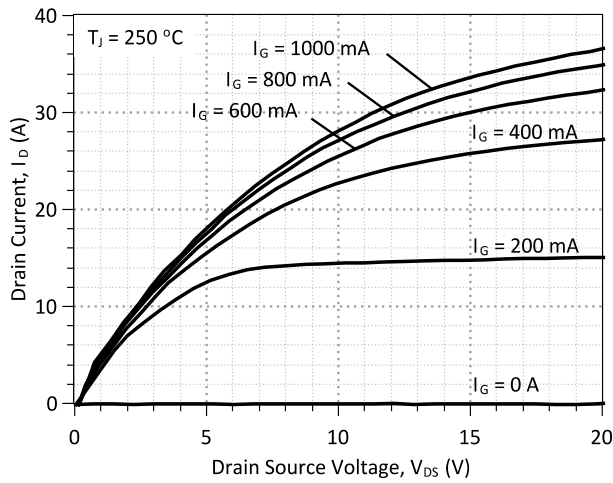


Figure 3: Typical Output Characteristics at 250 °C

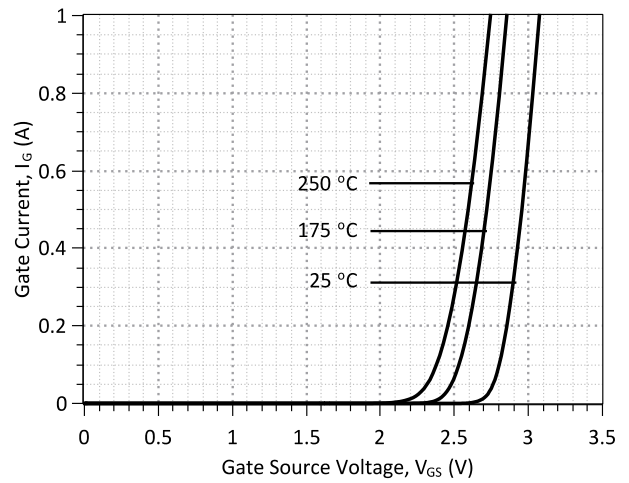


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

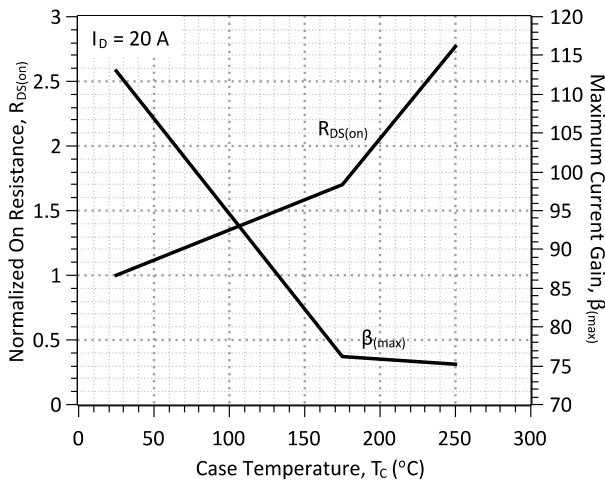


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

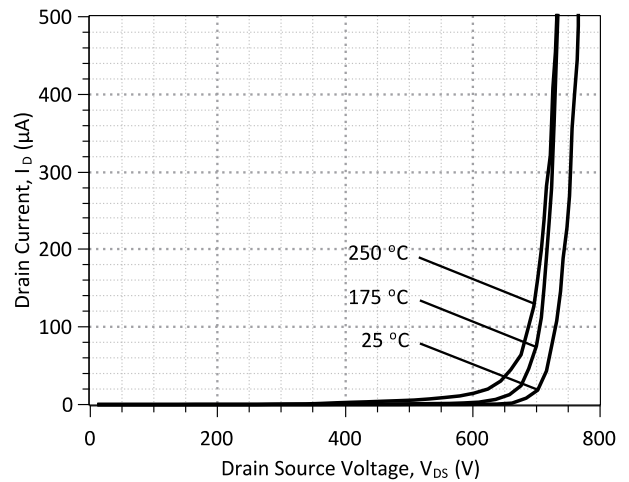


Figure 6: Typical Blocking Characteristics

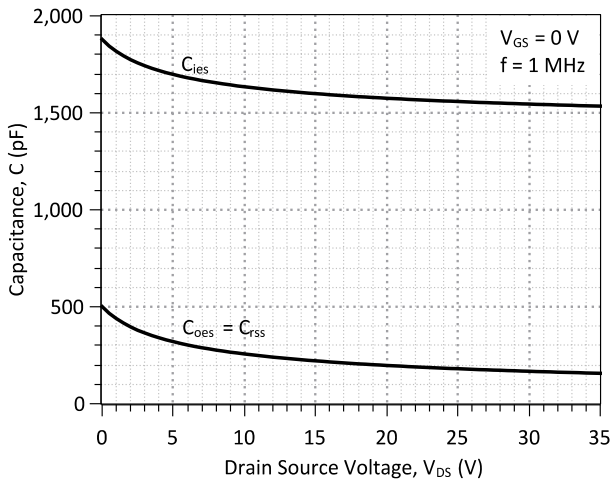


Figure 7: Typical Capacitance vs Drain-Source Voltage

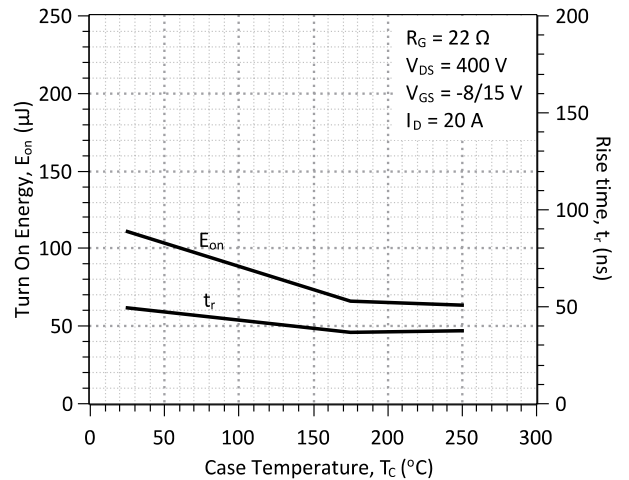


Figure 8: Typical Turn On Losses and Switching Times vs. Temperature

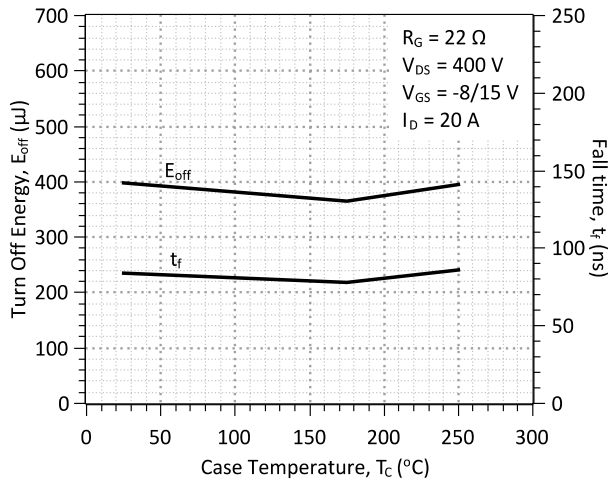


Figure 9: Typical Turn Off Energy Losses and Switching Times vs. Temperature

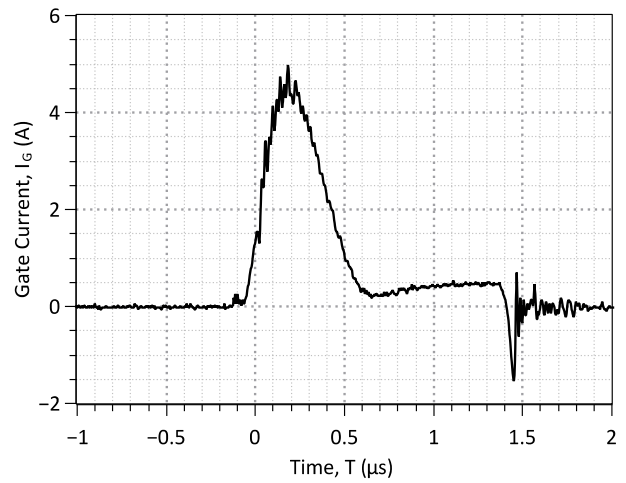
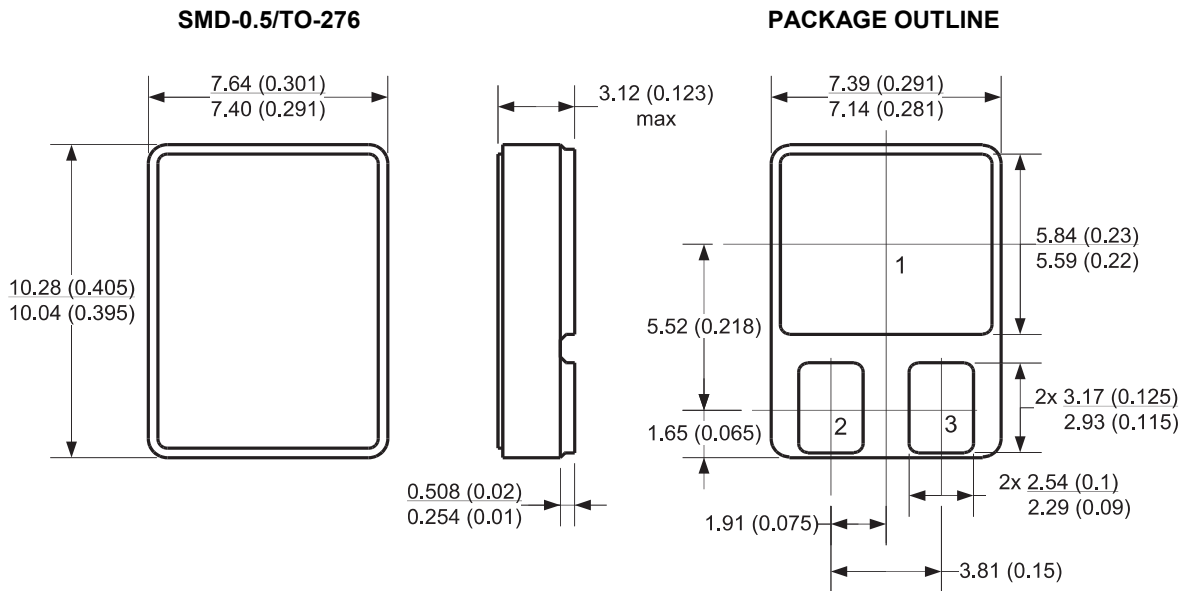


Figure 10: Typical Gate-Source Switching Waveforms

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
2012/08/24	0	Initial release	

Published by

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SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the 2N7640-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/sic-products/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 2N7640 NPN
+ IS      6.03E-47
+ ISE     1.72E-28
+ EG      3.2
+ BF      122
+ BR      0.55
+ IKF     300
+ NF      1
+ NE      1.868
+ RB      0.26
+ RE      0.088
+ RC      0.01
+ CJC     5.68E-10
+ VJC     2.978967839
+ MJC     0.466424924
+ CJE     1.72E-09
+ VJE     2.77859888
+ MJE     0.48415
+ XTI     3
+ XTB     -0.78
+ TRC1    7.00E-02
+ VCEO    800
+ ICRATING 15
+ MFG     GeneSiC_Semiconductor
*
*      End of 2N7640-GA SPICE Model
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