

Normally – OFF Silicon Carbide Junction Transistor

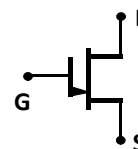
V_{DS}	=	650 V
$V_{DS(ON)}$	=	1.6 V
I_D	=	15 A
$R_{DS(ON)}$	=	110 mΩ

Features

- 250 °C maximum operating temperature
- Temperature independent switching performance
- Electrically isolated base-plate
- 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



TO – 257 (Isolated Base-plate 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	$T_C = 155\text{ °C}$	15	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}	$T_C = 25\text{ °C}$	22	W
Operating and Storage Temperature	T_J, T_{stg}		-55 to 250	°C

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

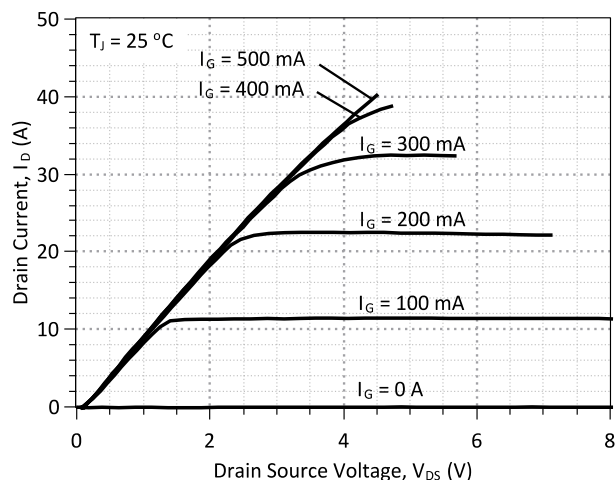
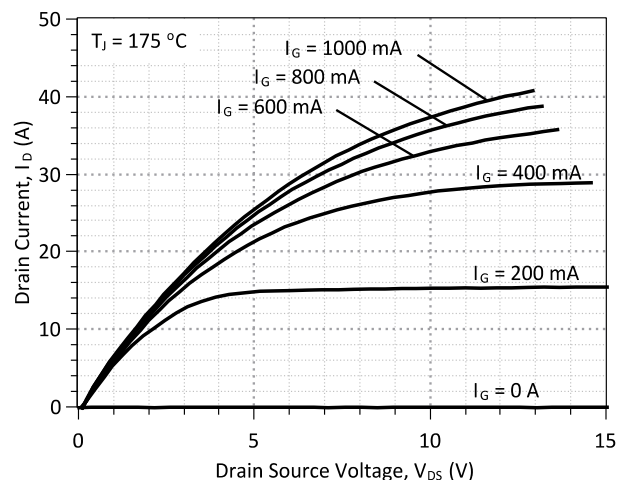
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	V _{DS(ON)}	I _D = 15 A, I _G = 500 mA, T _J = 25 °C		1.6	2.2	V
		I _D = 15 A, I _G = 1000 mA, T _J = 175 °C		2.5	3.3	
		I _D = 15 A, I _G = 1000 mA, T _J = 250 °C		4.0	4.8	
Drain – Source On Resistance	R _{DS(ON)}	I _D = 15 A, I _G = 500 mA, T _J = 25 °C		110		mΩ
		I _D = 15 A, I _G = 1000 mA, T _J = 175 °C		170		
		I _D = 15 A, I _G = 1000 mA, T _J = 250 °C		270		
Gate Forward Voltage	V _{GS(FWD)}	I _G = 500 mA, T _J = 25 °C		3		V
		I _G = 500 mA, T _J = 250 °C		2.6		
DC Current Gain	β	V _{DS} = 5 V, I _D = 20 A, T _J = 25 °C	80	110		
		V _{DS} = 5 V, I _D = 20 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 $T_J = 250^\circ\text{C}$, 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		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 V, I _D = 20 A, R _{G(on)} = R _{G(off)} = 22 Ω, V _{GS} = -8/15 V ,T _J = 175 °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}	V _{DD} = 400 V, I _D = 10 A, R _{G(on)} = R _{G(off)} = 22 Ω, V _{GS} = -8/15 V ,T _J = 250 °C Refer to Figure 10 for gate drive current waveforms		365		μJ
Total Switching Energy	E _{ts}			431		μJ
Turn On Delay Time	t _{d(on)}			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_{thJC}	1.4	$^\circ\text{C/W}$
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Figure 1: Typical Output Characteristics at 25 °C

Figure 2: Typical Output Characteristics at 175 °C

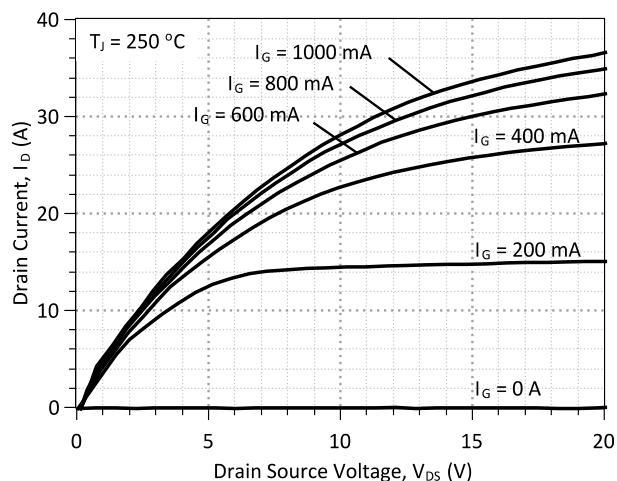


Figure 3: Typical Output Characteristics at 250 °C

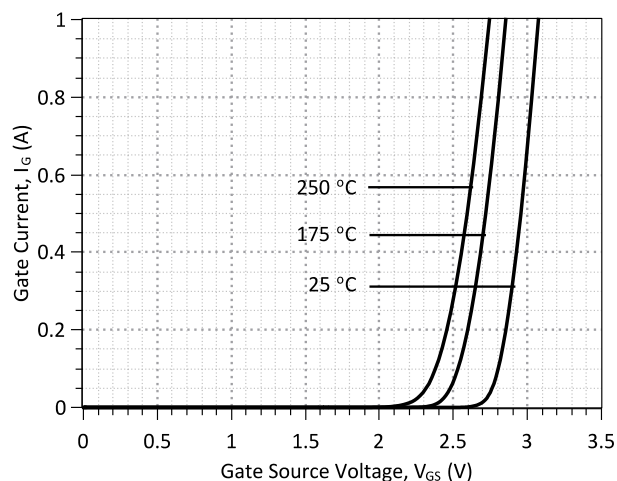


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

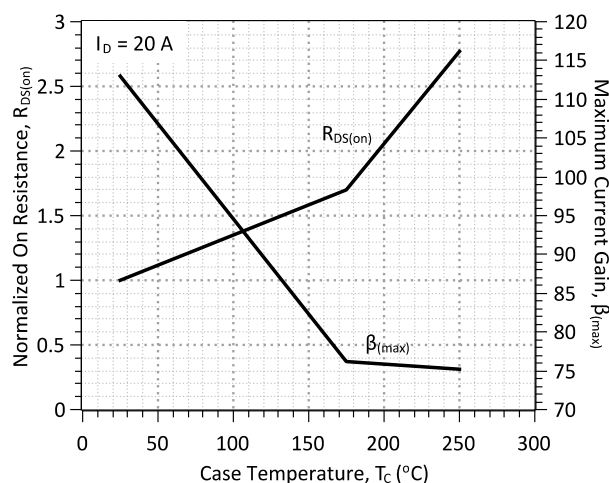


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

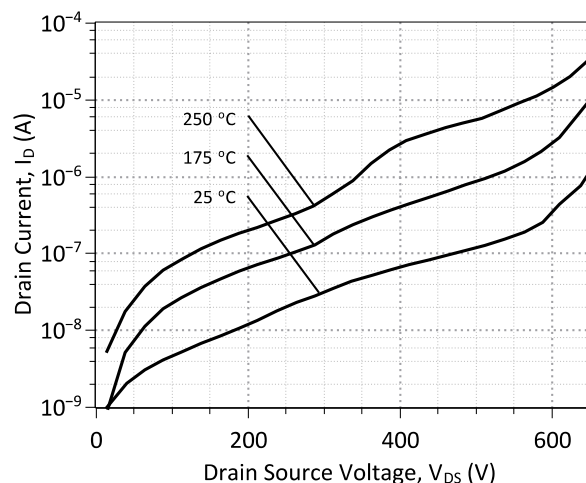


Figure 6: Typical Blocking Characteristics

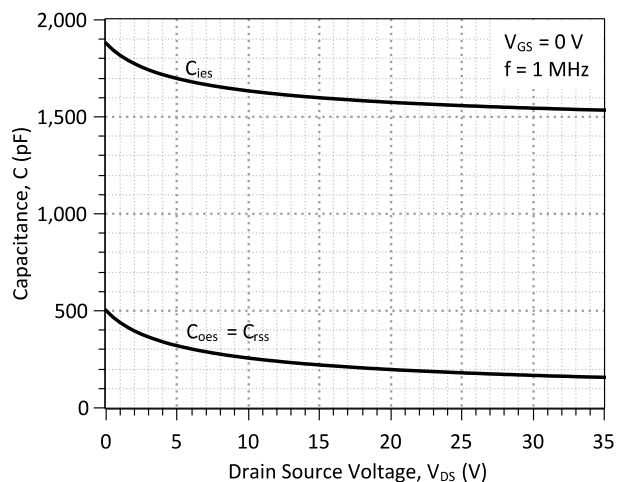


Figure 7: Typical Capacitance vs Drain-Source Voltage

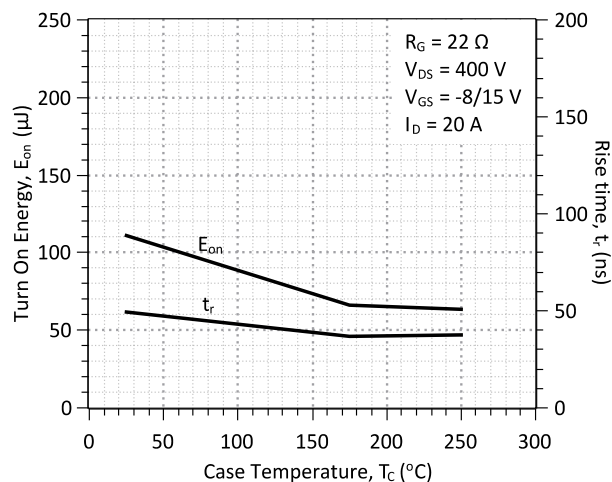


Figure 8: Typical Turn On Energy Losses and Switching Times vs. Temperature

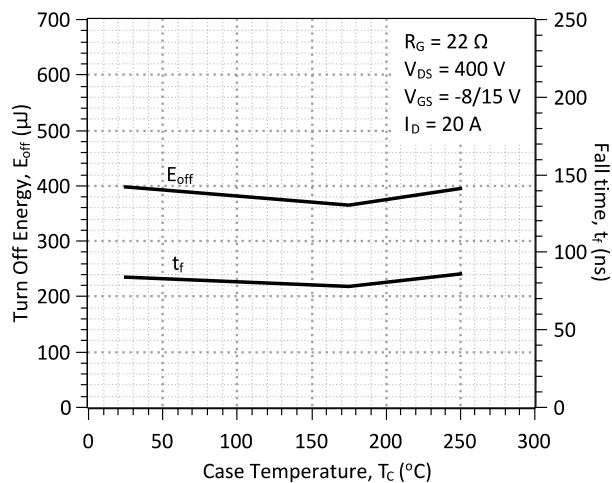


Figure 9: Typical Turn Off Energy Losses and Switching Times vs. Temperature

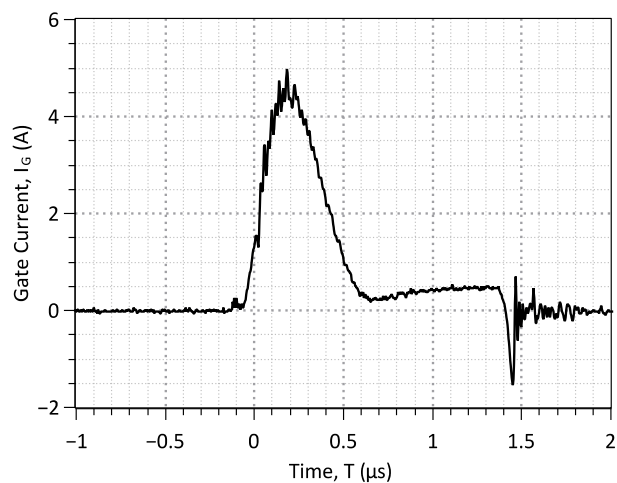
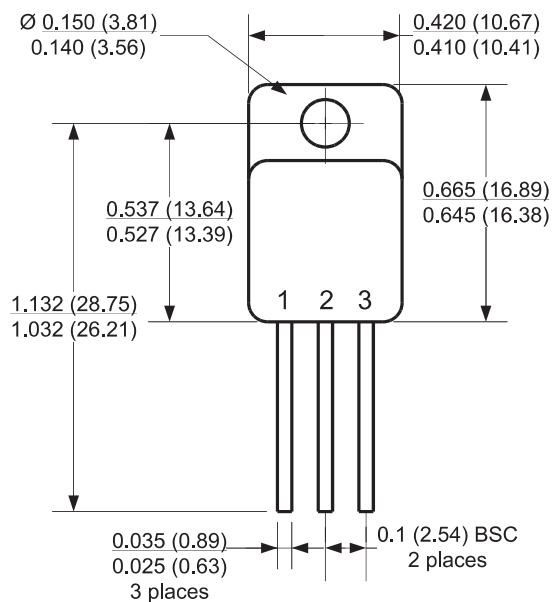


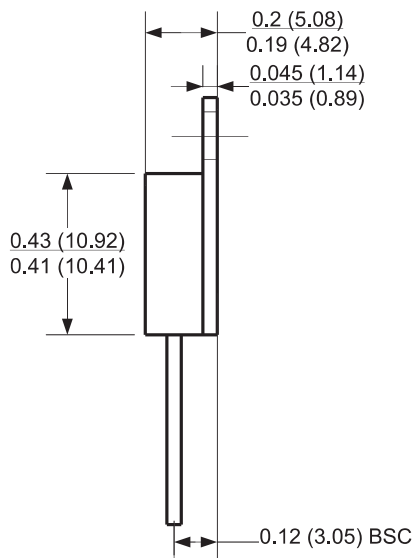
Figure 10: Typical Gate-Source Switching Waveforms

Package Dimensions:

TO-257



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.
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SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the 2N7639-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 2N7639 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    650
+ ICRATING 15
+ MFG      GeneSiC_Semiconductor
*
*      End of 2N7639-GA SPICE Model
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