Normally – OFF Silicon Carbide Junction Transistor
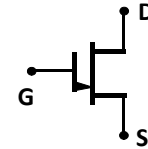
V_{DS}	=	650 V
$V_{DS(ON)}$	=	1.7 V
I_D	=	4 A
$R_{DS(ON)}$	=	415 mΩ

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 °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 = 165 °C	4	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	7	W
Operating and Storage Temperature	T_j, T_{stg}		-55 to 250	°C

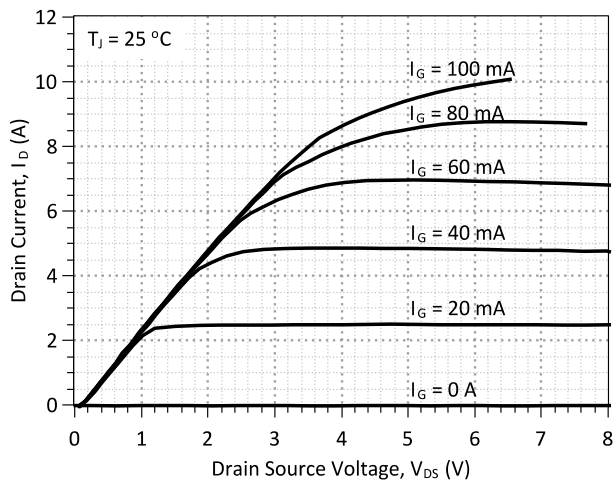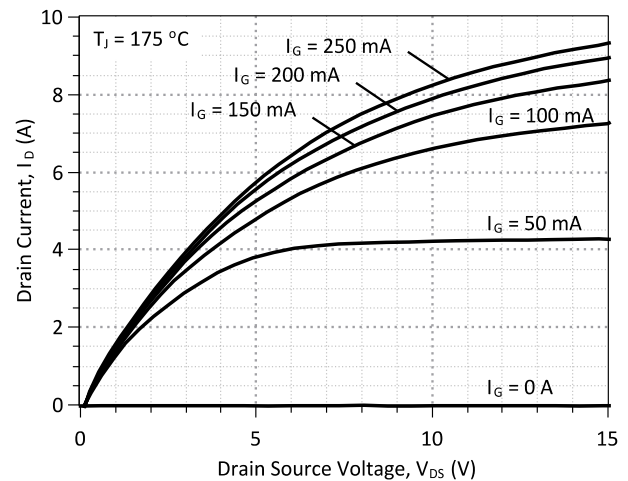## Electrical Characteristics at T_j = 250 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	$V_{DS(ON)}$	I_D = 4 A, I_G = 100 mA, T_j = 25 °C		1.7		V
		I_D = 4 A, I_G = 250 mA, T_j = 175 °C		3.2		
		I_D = 4 A, I_G = 250 mA, T_j = 250 °C		4.7		
Drain – Source On Resistance	$R_{DS(ON)}$	I_D = 4 A, I_G = 100 mA, T_j = 25 °C		415		mΩ
		I_D = 4 A, I_G = 250 mA, T_j = 175 °C		820		
		I_D = 4 A, I_G = 250 mA, T_j = 250 °C		1310		
Gate Forward Voltage	$V_{GS(FWD)}$	I_G = 500 mA, T_j = 25 °C		3.3		V
		I_G = 500 mA, T_j = 250 °C		3.2		
DC Current Gain	β	V_{DS} = 5 V, I_D = 5 A, T_j = 25 °C		120		
		V_{DS} = 5 V, I_D = 5 A, T_j = 250 °C		85		
Off Characteristics						
Drain Leakage Current	I_{DSS}	V_R = 650 V, V_{GS} = 0 V, T_j = 25 °C		7		nA
		V_R = 650 V, V_{GS} = 0 V, T_j = 175 °C		25		
		V_R = 650 V, V_{GS} = 0 V, T_j = 250 °C		105		

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

Parameter	Symbol	Conditions	Values min.	Values typ.	Values max.	Unit
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{DS} = 35 V, V_{GS} = 0 V, f = 1 MHz, T_{vj} = 25 °C		324		pF
Output Capacitance	C_{oss}			45		pF
Reverse Transfer Capacitance	C_{rss}			45		pF
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 400 V, I_D = 5 A, $R_{G(on)}$ = $R_{G(off)}$ = 44 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			15		ns
Turn Off Delay Time	$t_{d(off)}$			74		ns
Fall Time	t_f			14		ns
Turn-On Energy Per Pulse	E_{on}			24		µJ
Turn-Off Energy Per Pulse	E_{off}			7		µJ
Total Switching Energy	E_{ts}			31		µJ
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 400 V, I_D = 5 A, $R_{G(on)}$ = $R_{G(off)}$ = 44 Ω, V_{GS} = -8/15 V ,T_j = 250 °C Refer to Figure 10 for gate drive current waveforms		9		ns
Rise Time	t_r			24		ns
Turn Off Delay Time	$t_{d(off)}$			114		ns
Fall Time	t_f			17		ns
Turn-On Energy Per Pulse	E_{on}			54		µJ
Turn-Off Energy Per Pulse	E_{off}			10		µJ
Total Switching Energy	E_{ts}			64		µJ

Thermal Characteristics

Parameter	Symbol	Conditions	Values min.	Values typ.	Values max.	Unit
Thermal resistance, junction - case	R_{thJC}			4.2		°C/W

Figure 1: Typical Output Characteristics at 25 °C

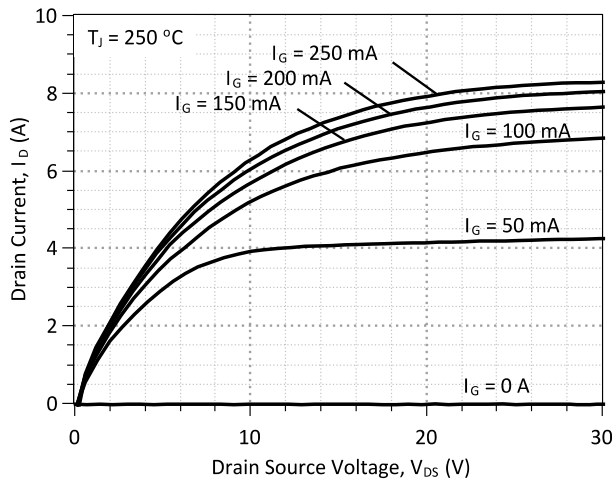Figure 2: Typical Output Characteristics at 175 °C

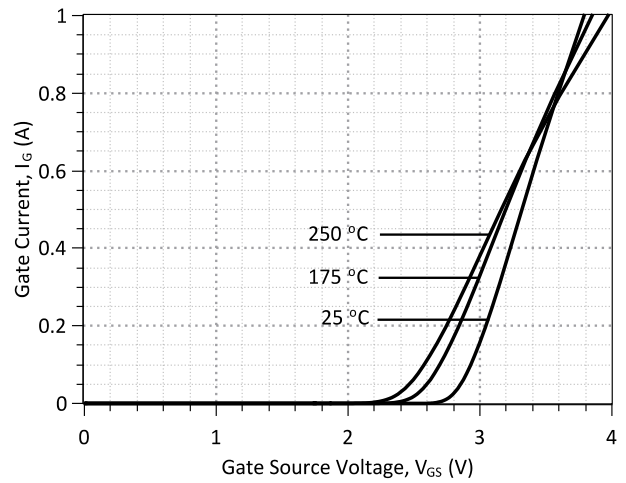**Figure 3: Typical Output Characteristics at 250 °C**

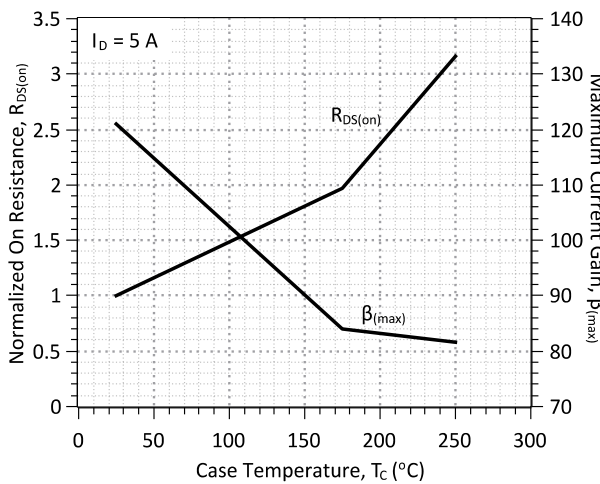**Figure 4: Typical Gate Source I-V Characteristics vs. Temperature**

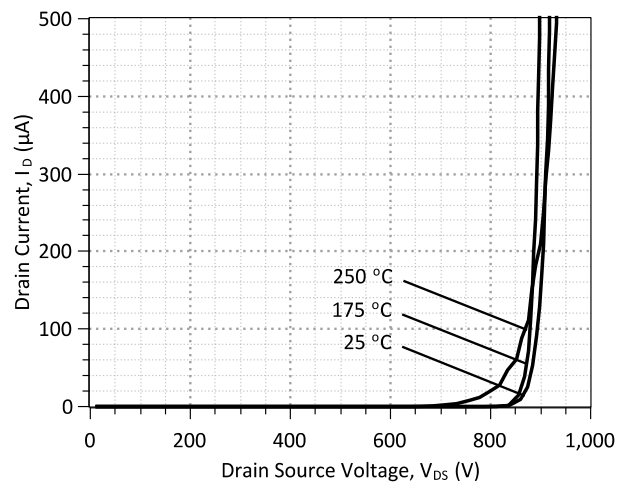**Figure 5: Normalized On-Resistance and Current Gain vs. Temperature**
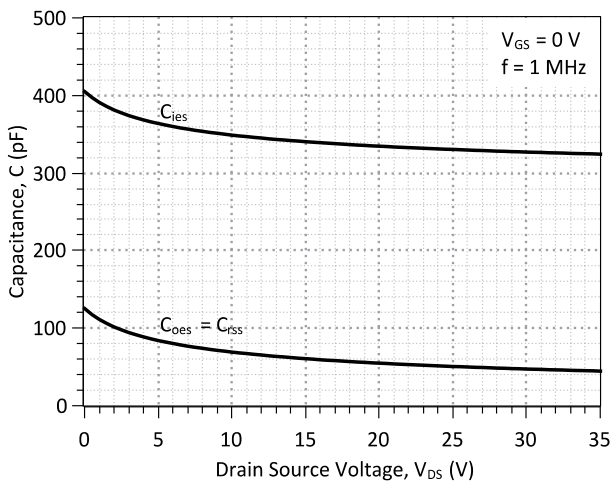

Figure 6: Typical Blocking Characteristics

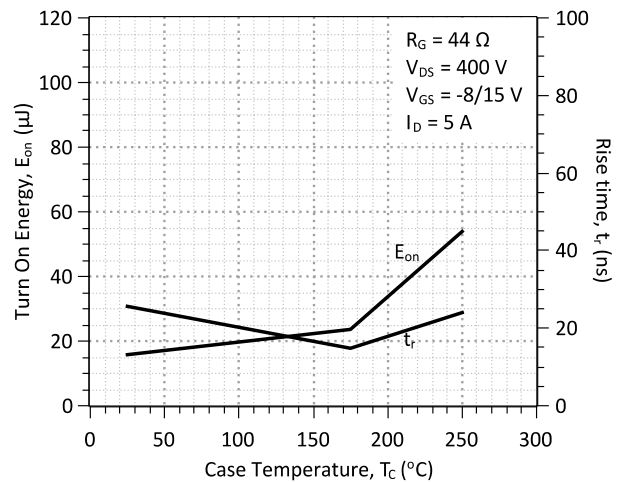**Figure 7: Typical Capacitance vs Drain-Source Voltage**

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

$R_G = 44\ \Omega$
$V_{DS} = 400\ V$
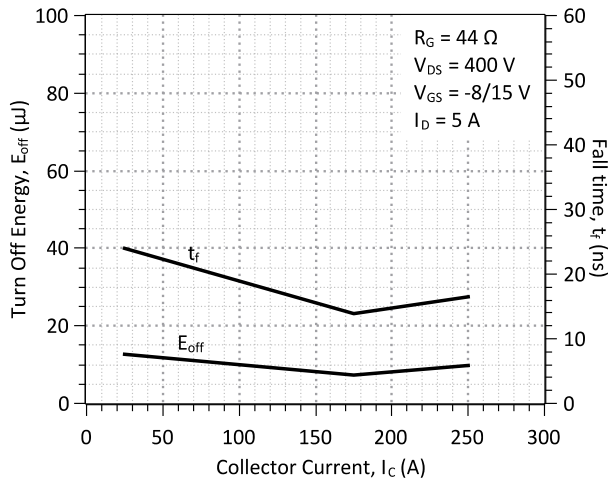$V_{GS} = -8/15\ V$
$I_D = 5\ A$

t_f

E_off

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**

Ø 0.150 (3.81)
0.140 (3.56)

0.420 (10.67)
0.410 (10.41)

0.537 (13.64)
0.527 (13.39)

0.665 (16.89)
0.645 (16.38)

1.132 (28.75)
1.032 (26.21)

1 2 3

0.035 (0.89)
0.025 (0.63)
3 places

0.1 (2.54) BSC
2 places

0.2 (5.08)
0.19 (4.82)

0.045 (1.14)
0.035 (0.89)

0.43 (10.92)
0.41 (10.41)

0.12 (3.05) BSC

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	

SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the 2N7635-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 2N7635 NPN
+ IS       1.22E-47
+ ISE      3.91E-27
+ EG       3.23
+ BF       110
+ BR       0.55
+ IKF      999
+ NF       1
+ NE       2.022
+ RB       0.26
+ RE       0.231
+ RC       0.16
+ CJC      1.37E-10
+ VJC      3.173990516
+ MJC      0.436428533
+ CJE      3.36E-10
+ VJE      2.944816511
+ MJE      0.493905327
+ XTI      3
+ XTB      -0.45
+ TRC1     1.50E-02
+ VCEO     800
+ ICRATING 4
+ MFG      GeneSiC_Semiconductor
*
* End of 2N7635-GA SPICE Model
```