

Normally – OFF Silicon Carbide Junction Transistor

| | | |
|--------------|---|---------------|
| V_{DS} | = | 650 V |
| $V_{DS(ON)}$ | = | 1.2 V |
| I_D | = | 7 A |
| $R_{DS(ON)}$ | = | 170 mΩ |

Features

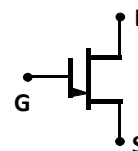
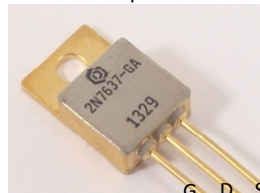
- 250 °C maximum operating temperature
- Temperature independent switching performance
- Electrically isolated base-plate
- Gate oxide free SiC switch
- Suitable for connecting an anti-parallel diode
- Positive temperature coefficient for easy paralleling
- Low gate charge
- Low intrinsic capacitance

Advantages

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

Package

- RoHS Compliant



TO – 257 (Isolated Base-plate Hermetic Package)

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 | $T_C = 158\text{ °C}$ | 7 | 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} | $T_C = 25\text{ °C}$ | 8 | 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 | $V_{DS(ON)}$ | $I_D = 7\text{ A}, I_G = 250\text{ mA}, T_J = 25\text{ }^{\circ}\text{C}$ | | 1.2 | 2.0 | V |
| | | $I_D = 7\text{ A}, I_G = 500\text{ mA}, T_J = 175\text{ }^{\circ}\text{C}$ | | 2.2 | 3.0 | |
| | | $I_D = 7\text{ A}, I_G = 500\text{ mA}, T_J = 250\text{ }^{\circ}\text{C}$ | | 3.1 | 4.0 | |
| Drain – Source On Resistance | $R_{DS(ON)}$ | $I_D = 7\text{ A}, I_G = 250\text{ mA}, T_J = 25\text{ }^{\circ}\text{C}$ | | 170 | | mΩ |
| | | $I_D = 7\text{ A}, I_G = 500\text{ mA}, T_J = 175\text{ }^{\circ}\text{C}$ | | 320 | | |
| | | $I_D = 7\text{ A}, I_G = 500\text{ mA}, T_J = 250\text{ }^{\circ}\text{C}$ | | 450 | | |
| Gate Forward Voltage | $V_{GS(FWD)}$ | $I_G = 500\text{ mA}, T_J = 25\text{ }^{\circ}\text{C}$ | | 3 | | V |
| | | $I_G = 500\text{ mA}, T_J = 250\text{ }^{\circ}\text{C}$ | | 2.7 | | |
| DC Current Gain | β | $V_{DS} = 5\text{ V}, I_D = 10\text{ A}, T_J = 25\text{ }^{\circ}\text{C}$ | 80 | 110 | | |
| | | $V_{DS} = 5\text{ V}, I_D = 10\text{ A}, T_J = 250\text{ }^{\circ}\text{C}$ | 50 | 80 | | |

Off Characteristics

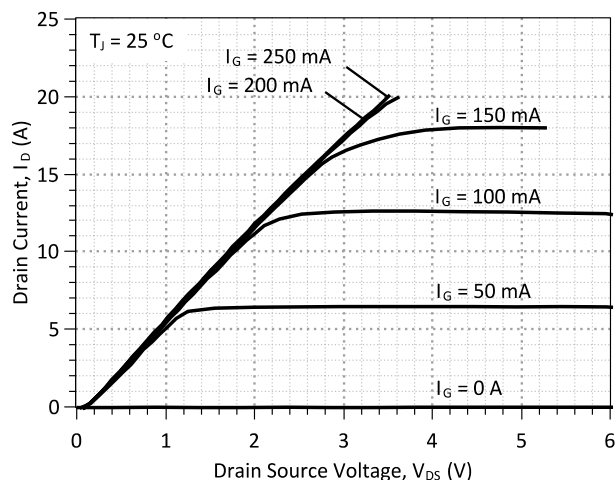
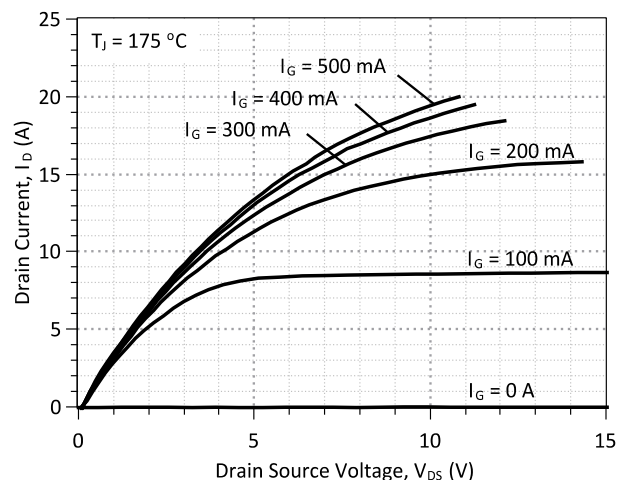
| | | | | | |
|-----------------------|-----------|--|-----|-----|---------------|
| Drain Leakage Current | I_{DSS} | $V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 25\text{ °C}$ | 10 | 100 | μA |
| | | $V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 175\text{ °C}$ | 40 | 400 | |
| | | $V_R = 650\text{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

Electrical Characteristics at $T_J = 250^\circ\text{C}$, 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 | | 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 °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} | V _{DD} = 400 V, I _D = 10 A, R _{G(on)} = R _{G(off)} = 32 Ω, V _{GS} = -8/15 V ,T _J = 250 °C Refer to Figure 10 for gate drive current waveforms | | 64 | | μJ |
| Total Switching Energy | E _{ts} | | | 98 | | μJ |
| Turn On Delay Time | t _{d(on)} | | | 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} | 2.5 | $^\circ\text{C/W}$ |
|-------------------------------------|------------|-----|--------------------|


Figure 1: Typical Output Characteristics at 25°C

Figure 2: Typical Output Characteristics at 175°C

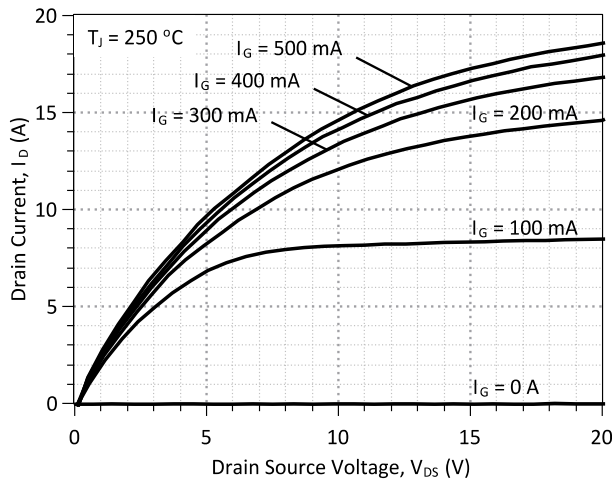


Figure 3: Typical Output Characteristics at 250 °C

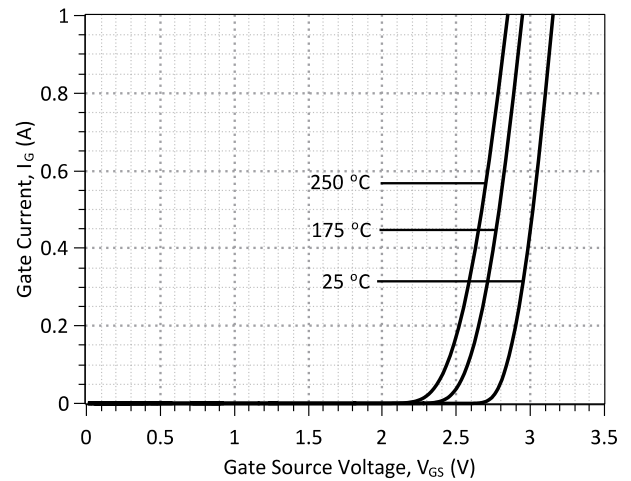


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

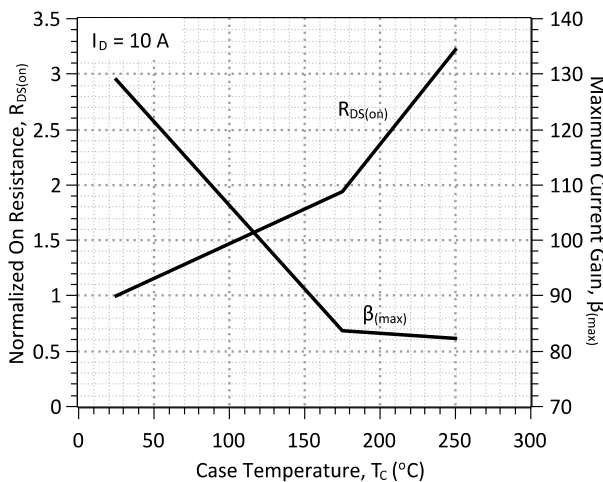


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

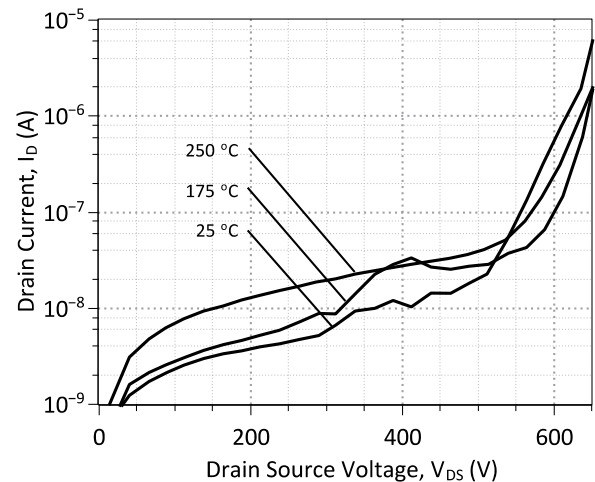


Figure 6: Typical Blocking Characteristics

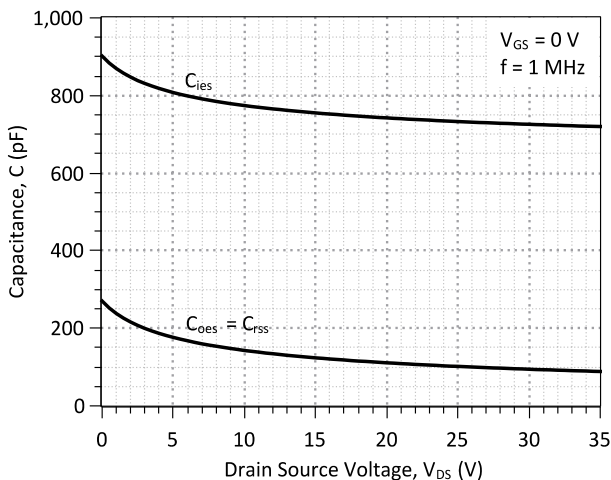


Figure 7: Typical Capacitance vs Drain-Source Voltage

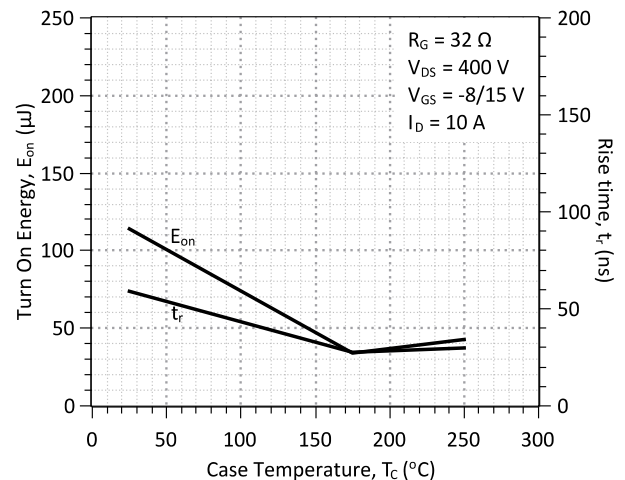
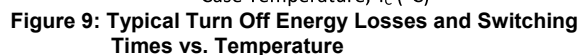


Figure 8: Typical Turn On Energy Losses and Switching Times vs. Temperature



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 2N7637-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 2N7637 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 2N7637-GA SPICE Model
```