

## Normally – OFF Silicon Carbide Super Junction Transistor

$V_{DS}$	=	<b>650 V</b>
$V_{DS(ON)}$	=	<b>1.7 V</b>
$I_D$	=	<b>4 A</b>
$R_{DS(ON)}$	=	<b>415 mΩ</b>

### Features

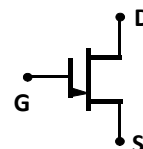
- 250 °C maximum operating temperature
- Temperature independent switching performance
- Electrically isolated base-plate
- Gate oxide free SiC switch
- Suitable for connecting an anti-parallel diode
- Positive temperature coefficient for easy paralleling
- Low gate charge
- Low intrinsic capacitance

### 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	$I_D$	$T_C = 165\text{ °C}$	4	A
Gate Peak Current	$I_{GM}$		5	A
Reverse Gate – Source Voltage	$V_{GS}$		200	V
Reverse Drain – Source Voltage	$V_{DS}$		40	V
Power Dissipation	$P_{tot}$	$T_C = 25\text{ °C}$	7	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	$V_{DS(ON)}$	$I_D = 4\text{ A}, I_G = 100\text{ mA}, T_J = 25\text{ }^{\circ}\text{C}$		1.7		V
		$I_D = 4\text{ A}, I_G = 250\text{ mA}, T_J = 175\text{ }^{\circ}\text{C}$		3.2		
		$I_D = 4\text{ A}, I_G = 250\text{ mA}, T_J = 250\text{ }^{\circ}\text{C}$		4.7		
Drain – Source On Resistance	$R_{DS(ON)}$	$I_D = 4\text{ A}, I_G = 100\text{ mA}, T_J = 25\text{ }^{\circ}\text{C}$		415		mΩ
		$I_D = 4\text{ A}, I_G = 250\text{ mA}, T_J = 175\text{ }^{\circ}\text{C}$		820		
		$I_D = 4\text{ A}, I_G = 250\text{ mA}, T_J = 250\text{ }^{\circ}\text{C}$		1310		
Gate Forward Voltage	$V_{GS(FWD)}$	$I_G = 500\text{ mA}, T_J = 25\text{ }^{\circ}\text{C}$		3.3		V
		$I_G = 500\text{ mA}, T_J = 250\text{ }^{\circ}\text{C}$		3.2		
DC Current Gain	$\beta$	$V_{DS} = 5\text{ V}, I_D = 5\text{ A}, T_J = 25\text{ }^{\circ}\text{C}$		120		
		$V_{DS} = 5\text{ V}, I_D = 5\text{ A}, T_J = 250\text{ }^{\circ}\text{C}$		85		

### Off Characteristics

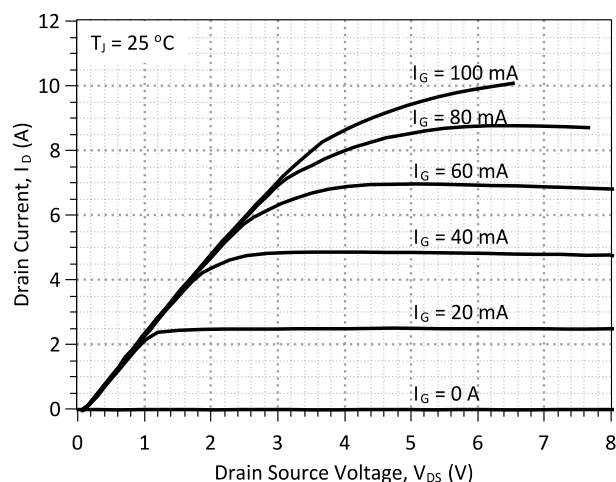
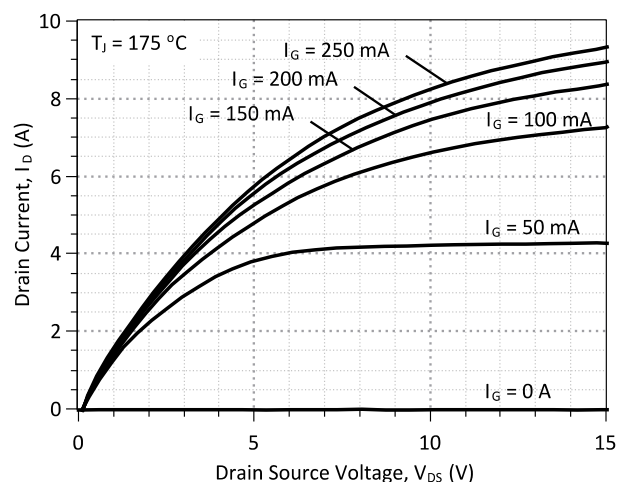
Drain Leakage Current	$I_{DSS}$	$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 25\text{ °C}$	7		nA
		$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 175\text{ °C}$	25		
		$V_R = 650\text{ V}, V_{GS} = 0\text{ V}, T_j = 250\text{ °C}$	105		

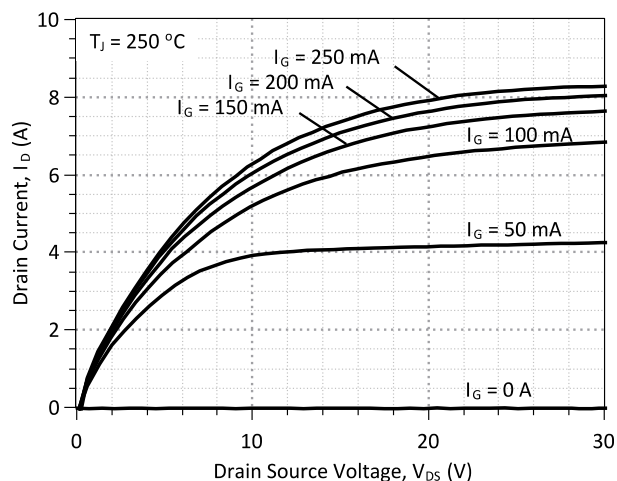
**Electrical Characteristics at  $T_j = 250^\circ\text{C}$ , unless otherwise specified**

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Dynamic Characteristics						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 35 V, V <sub>GS</sub> = 0 V, f = 1 MHz, T <sub>vj</sub> = 25 °C		324		pF
Output Capacitance	C <sub>oss</sub>			45		pF
Reverse Transfer Capacitance	C <sub>rss</sub>			45		pF
Switching Characteristics						
Turn On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 5 A, R <sub>G(on)</sub> = R <sub>G(off)</sub> = 44 Ω, V <sub>GS</sub> = -8/15 V ,T <sub>J</sub> = 175 °C Refer to Figure 10 for gate drive current waveforms		5		ns
Rise Time	t <sub>r</sub>			15		ns
Turn Off Delay Time	t <sub>d(off)</sub>			74		ns
Fall Time	t <sub>f</sub>			14		ns
Turn-On Energy Per Pulse	E <sub>on</sub>			24		μJ
Turn-Off Energy Per Pulse	E <sub>off</sub>	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 5 A, R <sub>G(on)</sub> = R <sub>G(off)</sub> = 44 Ω, V <sub>GS</sub> = -8/15 V ,T <sub>J</sub> = 250 °C Refer to Figure 10 for gate drive current waveforms		7		μJ
Total Switching Energy	E <sub>ts</sub>			31		μJ
Turn On Delay Time	t <sub>d(on)</sub>			9		ns
Rise Time	t <sub>r</sub>			24		ns
Turn Off Delay Time	t <sub>d(off)</sub>			114		ns
Fall Time	t <sub>f</sub>			17		ns
Turn-On Energy Per Pulse	E <sub>on</sub>			54		μJ
Turn-Off Energy Per Pulse	E <sub>off</sub>			10		μJ
Total Switching Energy	E <sub>te</sub>			64		μJ

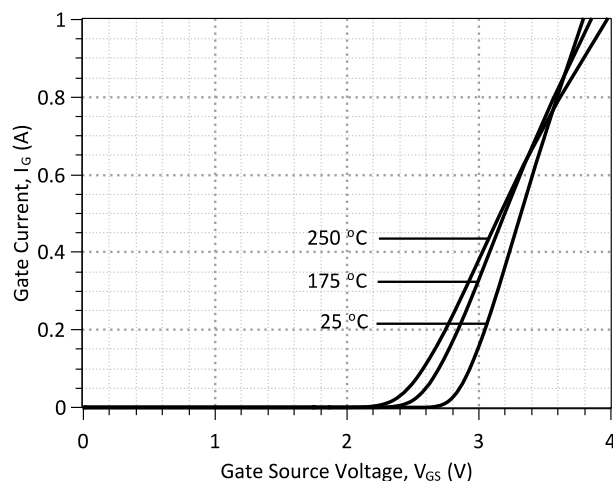
**Thermal Characteristics**

Thermal resistance, junction - case	$R_{thJC}$	4.2	$^\circ\text{C/W}$
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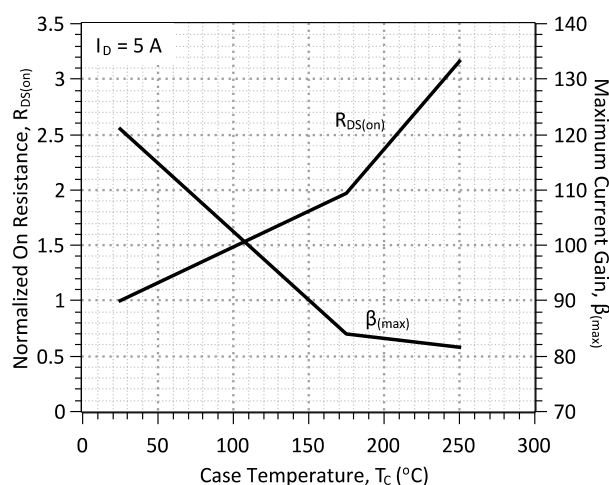

**Figure 1: Typical Output Characteristics at 25 °C**

**Figure 2: Typical Output Characteristics at 175 °C**



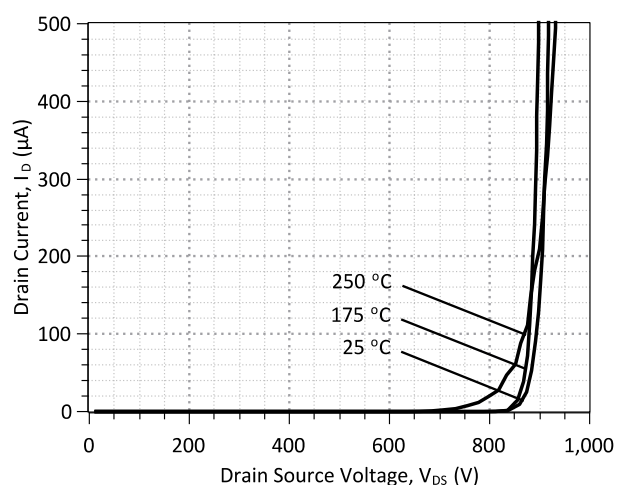
**Figure 3: Typical Output Characteristics at 250 °C**



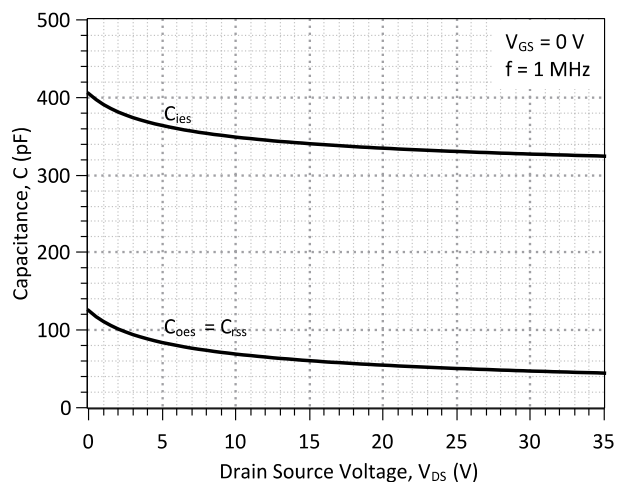
**Figure 4: Typical Gate Source I-V Characteristics vs. Temperature**



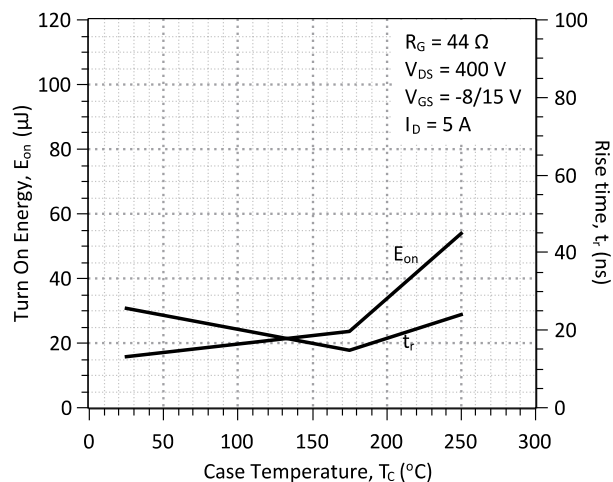
**Figure 5: Normalized On-Resistance and Current Gain vs. Temperature**



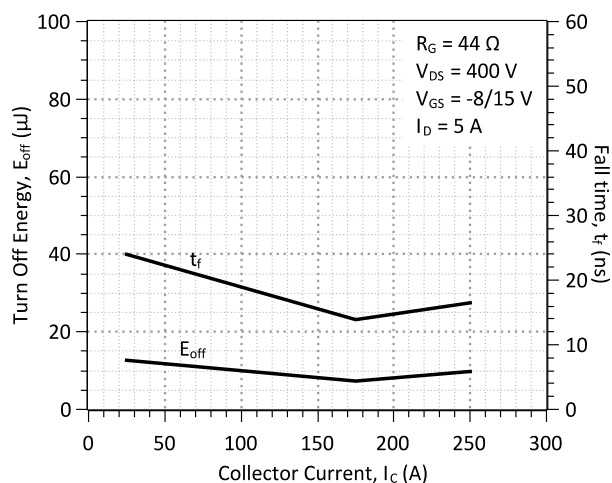
**Figure 6: Typical Blocking Characteristics**



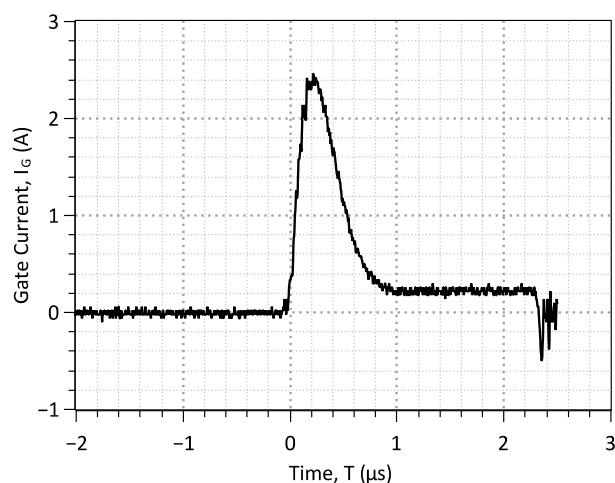
**Figure 7: Typical Capacitance vs Drain-Source Voltage**



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



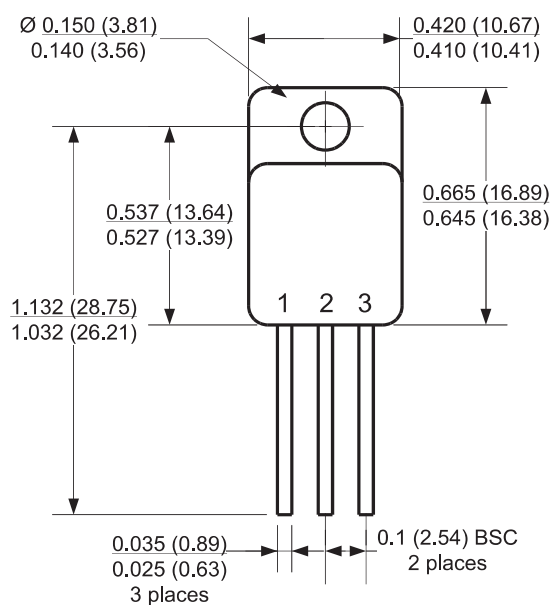
**Figure 9: Typical Turn Off Energy Losses and Switching Times vs. Temperature**



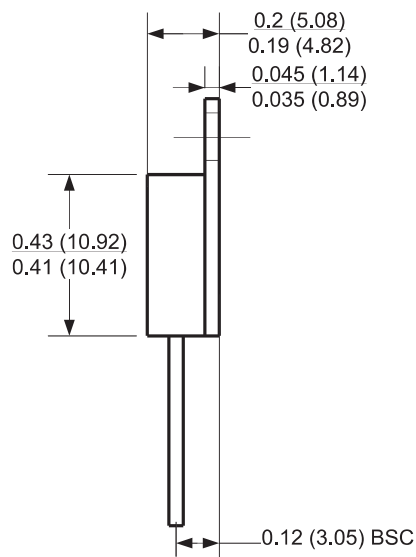
**Figure 10: Typical Gate-Source Switching Waveforms**

### 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
2012/08/24	0	Initial release	

## Published by

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