

Normally – OFF Silicon Carbide Junction Transistor

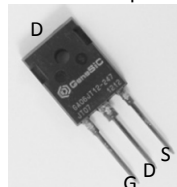
$-V_{DS}$	=	1200 V
$V_{DS(ON)}$	=	1.3 V
I_D	=	6 A
$R_{DS(ON)}$	=	220 mΩ

Features

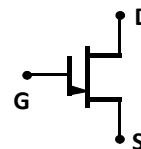
- 175 °C maximum operating temperature
- Temperature independent switching performance
- Gate oxide free SiC switch
- Suitable for connecting an anti-parallel diode
- Positive temperature coefficient for easy paralleling
- Low gate charge
- Low intrinsic capacitance

Package

- RoHS Compliant



TO-247AB



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 unless otherwise specified

Parameter	Symbol	Conditions	Values	Unit
Drain – Source Voltage	V_{DS}	$V_{GS} = 0\text{ V}$	1200	V
Continuous Drain Current	I_D	$T_{C,MAX} = 90\text{ °C}$	6	A
Gate Peak Current	I_{GM}		5	A
Turn-Off Safe Operating Area	RBSOA	$T_{VJ} = 175\text{ °C}$, $I_G = 1\text{ A}$, Clamped Inductive Load	$I_{D,max} = 6$ @ $V_{DS} \leq V_{DSmax}$	A
Short Circuit Safe Operating Area	SCSOA	$T_{VJ} = 175\text{ °C}$, $I_G = 1\text{ A}$, $V_{DS} = 800\text{ V}$, Non Repetitive	20	μs
Reverse Gate – Source Voltage	V_{SG}		30	V
Reverse Drain – Source Voltage	V_{SD}		40	V
Power Dissipation	P_{tot}	$T_C = 25\text{ °C}$	146	W
Storage Temperature	T_{stg}		-55 to 175	°C

Electrical Characteristics at $T_J = 175\text{ °C}$, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	V _{DS(ON)}	I _D = 6 A, I _G = 500 mA, T _J = 25 °C		1.3		V
		I _D = 6 A, I _G = 1000 mA, T _J = 125 °C		1.7		
		I _D = 6 A, I _G = 1000 mA, T _J = 175 °C		2.2		
Drain – Source On Resistance	R _{DS(ON)}	I _D = 6 A, I _G = 500 mA, T _J = 25 °C		220		mΩ
		I _D = 6 A, I _G = 1000 mA, T _J = 125 °C		280		
		I _D = 6 A, I _G = 1000 mA, T _J = 175 °C		370		
Gate Forward Voltage	V _{GS(FWD)}	I _G = 500 mA, T _J = 25 °C		3.1		V
		I _G = 500 mA, T _J = 175 °C		2.9		
DC Current Gain	β	V _{DS} = 5 V, I _D = 6 A, T _J = 25 °C		58		
		V _{DS} = 5 V, I _D = 6 A, T _J = 175 °C		33		
Off Characteristics						
Drain Leakage Current	I _{DSS}	V _R = 1100 V, V _{GS} = 0 V, T _J = 25 °C		300		nA
		V _R = 1100 V, V _{GS} = 0 V, T _J = 125 °C		350		
		V _R = 1100 V, V _{GS} = 0 V, T _J = 175 °C		450		
Gate Leakage Current	I _{SG}	V _{SG} = 20 V, T _J = 25 °C		20		nA

Electrical Characteristics at $T_J = 175\text{ }^{\circ}\text{C}$, unless otherwise specified

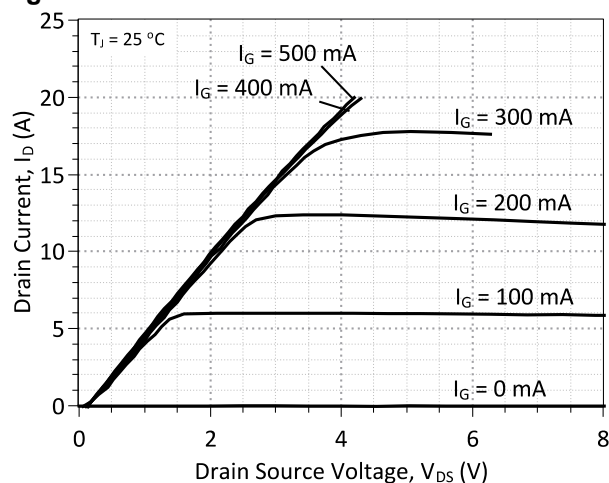
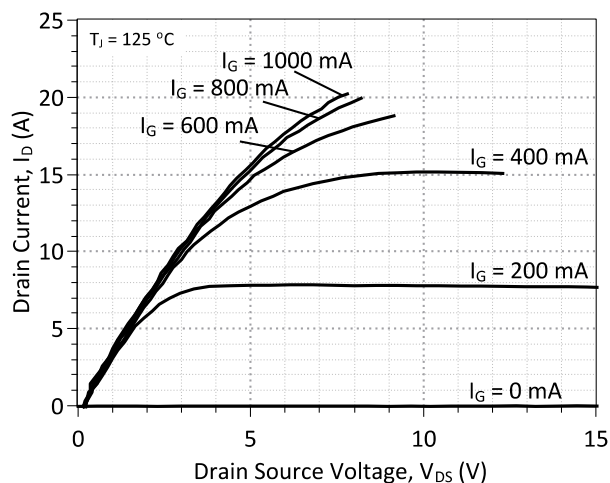
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Capacitance Characteristics						
Gate-Source Capacitance	C_{GS}	$V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		660		pF
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}$, $V_D = 1\text{ V}$, $f = 1\text{ MHz}$		900		pF
Reverse Transfer/Output Capacitance	C_{RSS}/C_{OSS}	$V_D = 1\text{ V}$, $f = 1\text{ MHz}$		240		pF

Switching Characteristics

Turn On Delay Time	$t_{d(on)}$	$T_J = 25\text{ }^{\circ}\text{C}$, $V_{DD} = 800\text{ V}$, $I_D = 6\text{ A}$, "Option #1" Gate Drive $R_{G(on)} = R_{G(off)} = 1.5\text{ }\Omega$, $C_G = 9\text{ nF}$ $V_{GH} = 20\text{ V}$, $V_{GL} = 6\text{ V}$, $V_{EE} = -5\text{ V}$ $L = 1.05\text{ mH}$, FWD = GB05SLT12, Refer to Figure 15 for gate current waveform		13		ns
Rise Time, Drain Current	t_r			7		ns
Turn Off Delay Time	$t_{d(off)}$			54		ns
Fall Time, Drain Current	t_f			51		ns
Turn-On Energy Per Pulse	E_{on}			175		μJ
Turn-Off Energy Per Pulse	E_{off}	$T_J = 175\text{ }^{\circ}\text{C}$, $V_{DD} = 800\text{ V}$, $I_D = 6\text{ A}$, "Option #1" Gate Drive $R_{G(on)} = R_{G(off)} = 1.5\text{ }\Omega$, $C_G = 9\text{ nF}$ $V_{GH} = 20\text{ V}$, $V_{GL} = 6\text{ V}$, $V_{EE} = -5\text{ V}$ $L = 1.05\text{ mH}$, FWD = GB05SLT12, Refer to Figure 15 for gate current waveform		44		μJ
Total Switching Energy	E_{ts}			219		μJ
Turn On Delay Time	$t_{d(on)}$			11		ns
Rise Time, Drain Current	t_r			8		ns
Turn Off Delay Time	$t_{d(off)}$			79		ns
Fall Time, Drain Current	t_f			45		ns
Turn-On Energy Per Pulse	E_{on}			159		μJ
Turn-Off Energy Per Pulse	E_{off}			55		μJ
Total Switching Energy	E_{ts}			214		μJ

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	1.03	$^{\circ}\text{C/W}$
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Figures

Figure 1: Typical Output Characteristics at 25 °C

Figure 2: Typical Output Characteristics at 125 °C

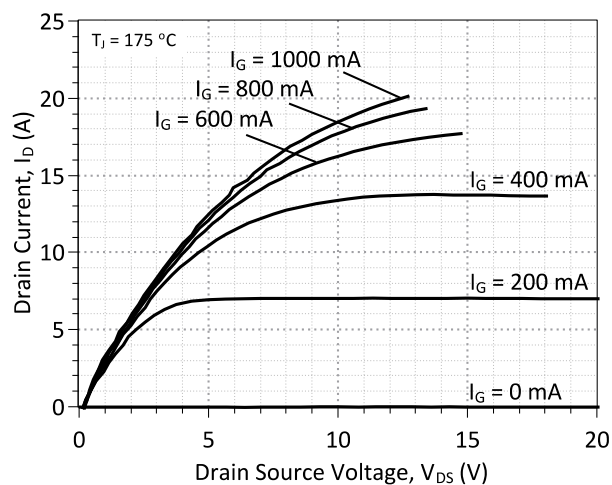


Figure 3: Typical Output Characteristics at 175 °C

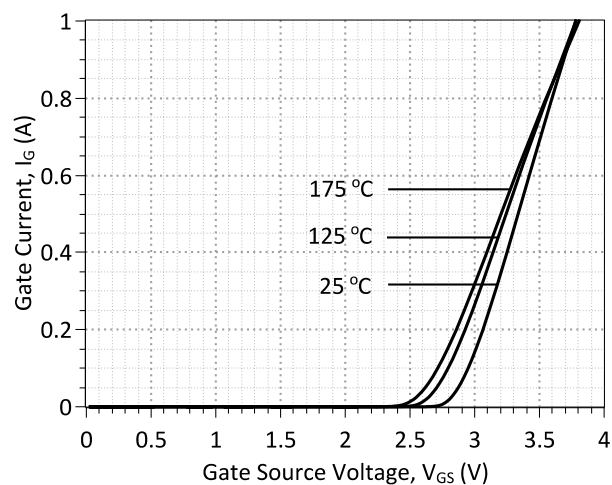


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

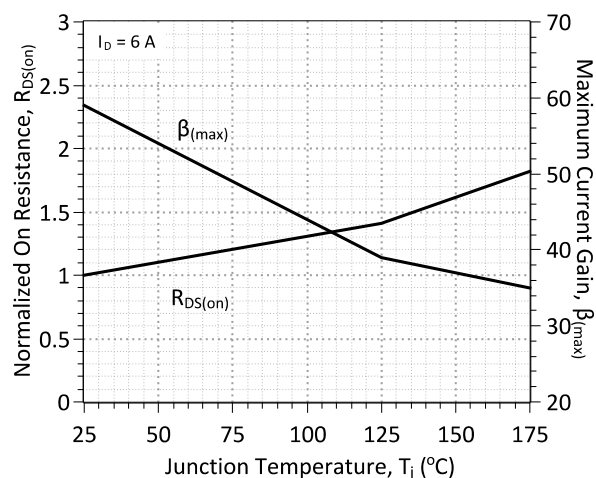


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

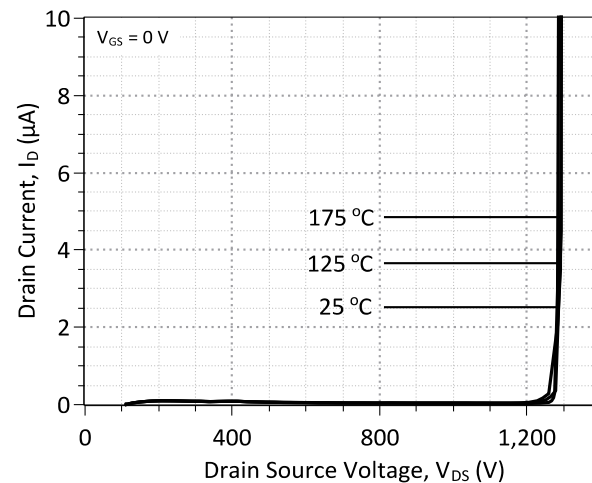


Figure 6: Typical Blocking Characteristics

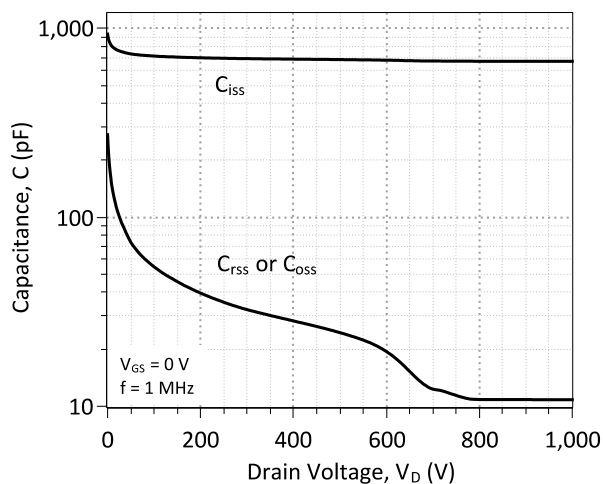


Figure 7: Capacitance Characteristics

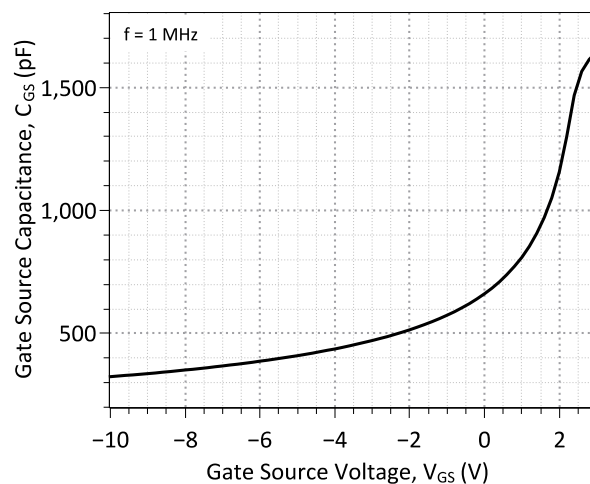


Figure 8: Capacitance Characteristics

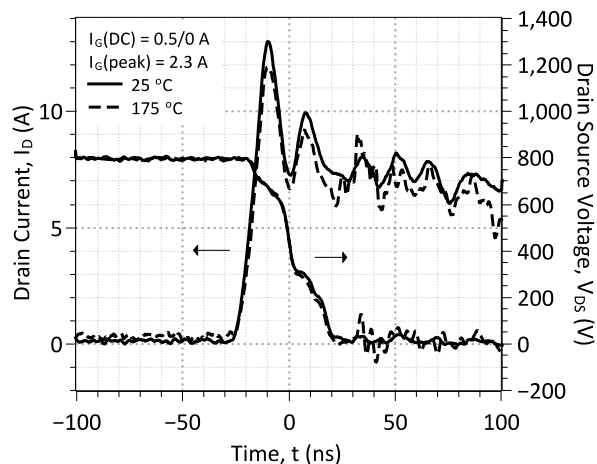


Figure 9: Typical Hard-switched Turn On Waveforms

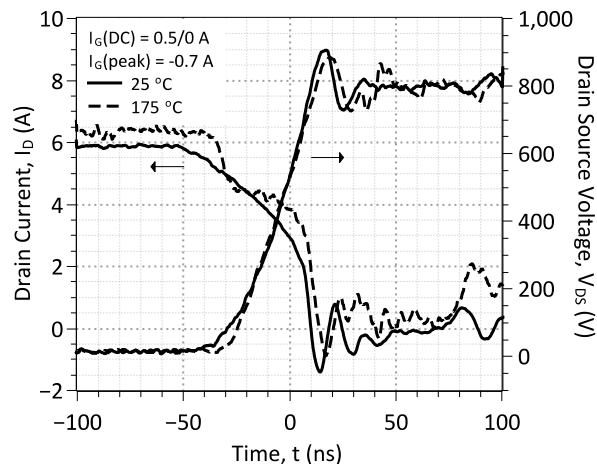


Figure 10: Typical Hard-switched Turn Off Waveforms

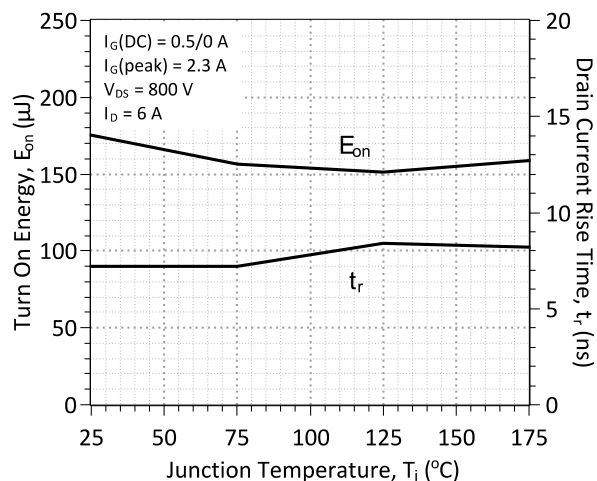


Figure 11: Typical Turn On Energy Losses and Switching Times vs. Temperature

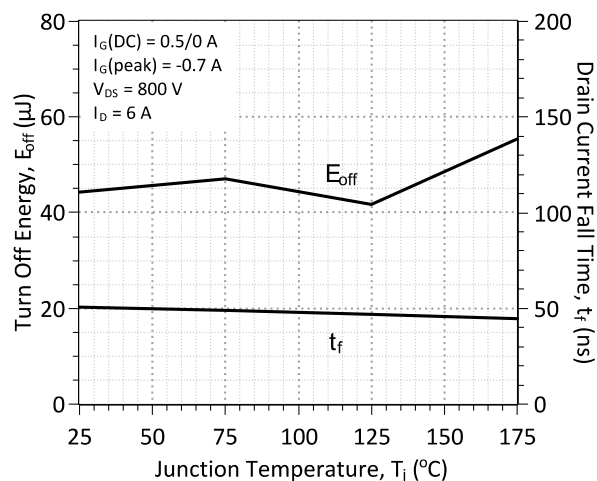


Figure 12: Typical Turn Off Energy Losses and Switching Times vs. Temperature

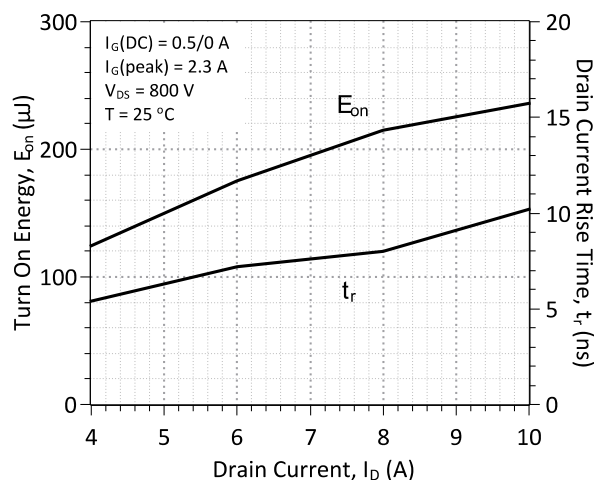


Figure 13: Typical Turn On Energy Losses vs. Drain Current

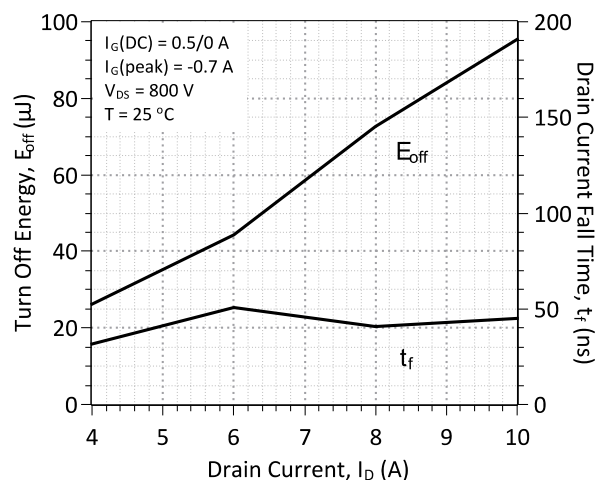


Figure 14: Typical Turn Off Energy Losses vs. Drain Current

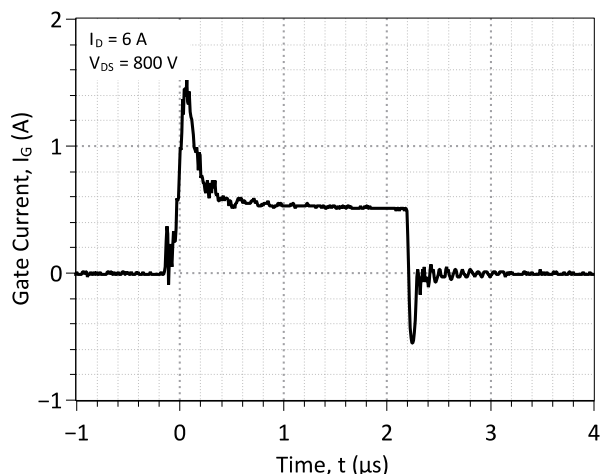


Figure 15: Typical Gate Current Waveform

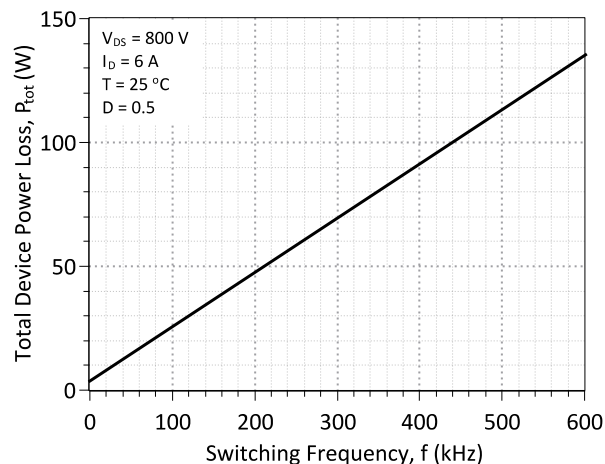


Figure 16: Typical Hard Switched Device Power Loss vs. Switching Frequency¹

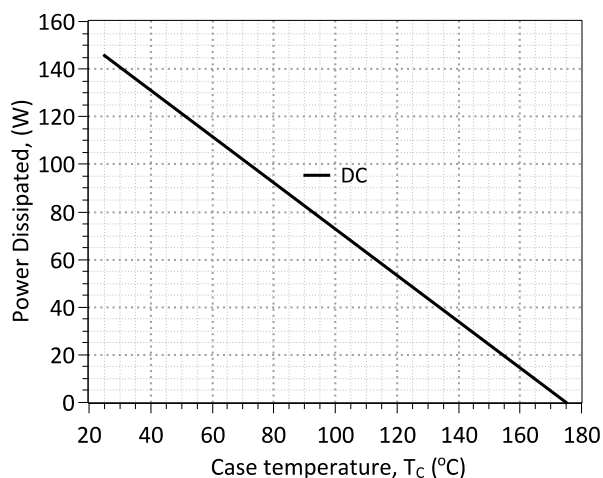


Figure 17: Power Derating Curve

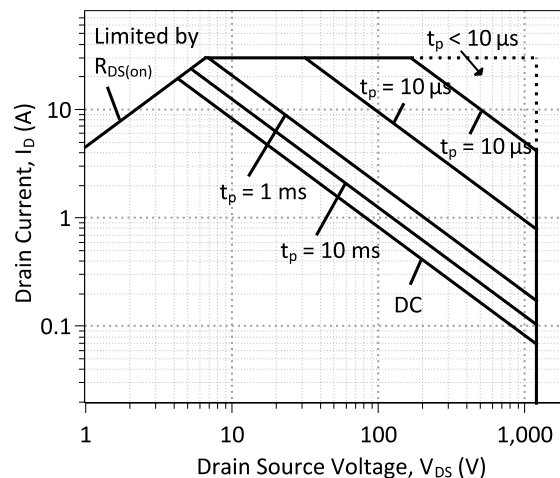


Figure 18: Forward Bias Safe Operating Area

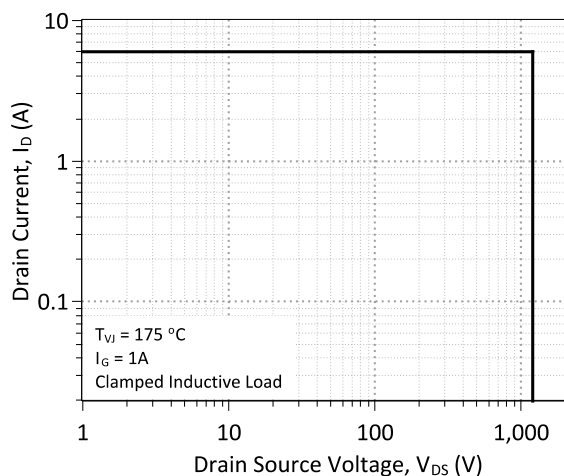


Figure 19: Turn-Off Safe Operating Area

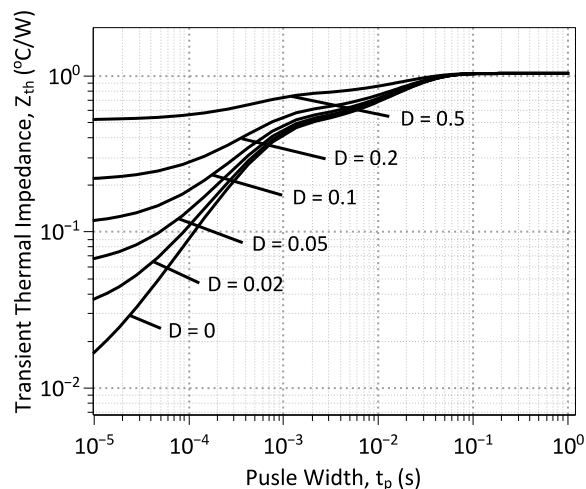


Figure 20: Transient Thermal Impedance

¹ – Representative values based on device switching energy loss. Actual losses will depend on gate drive conditions, device load, and circuit topology.

Gate Drive Technique (Option #1)

To drive the GA06JT12-247 with the lowest gate drive losses, please refer to the dual voltage source gate drive configuration described in Application Note AN-10B (<http://www.genesicsemi.com/index.php/references/notes>).

Gate Drive Technique (Option #2)

The GA06JT12-247 can be effectively driven using the IXYS IXDN614 / IXDD614 non-inverting gate driver IC or a comparable product. A typical gate driver configuration along with component values using this driver is offered below. Additional information is available in GeneSiC Application Note AN-10A and from the manufacturer at www.ixys.com.

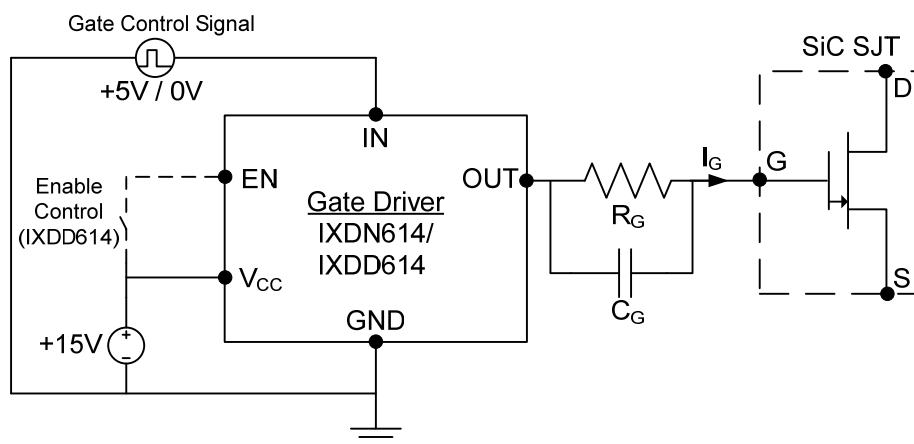
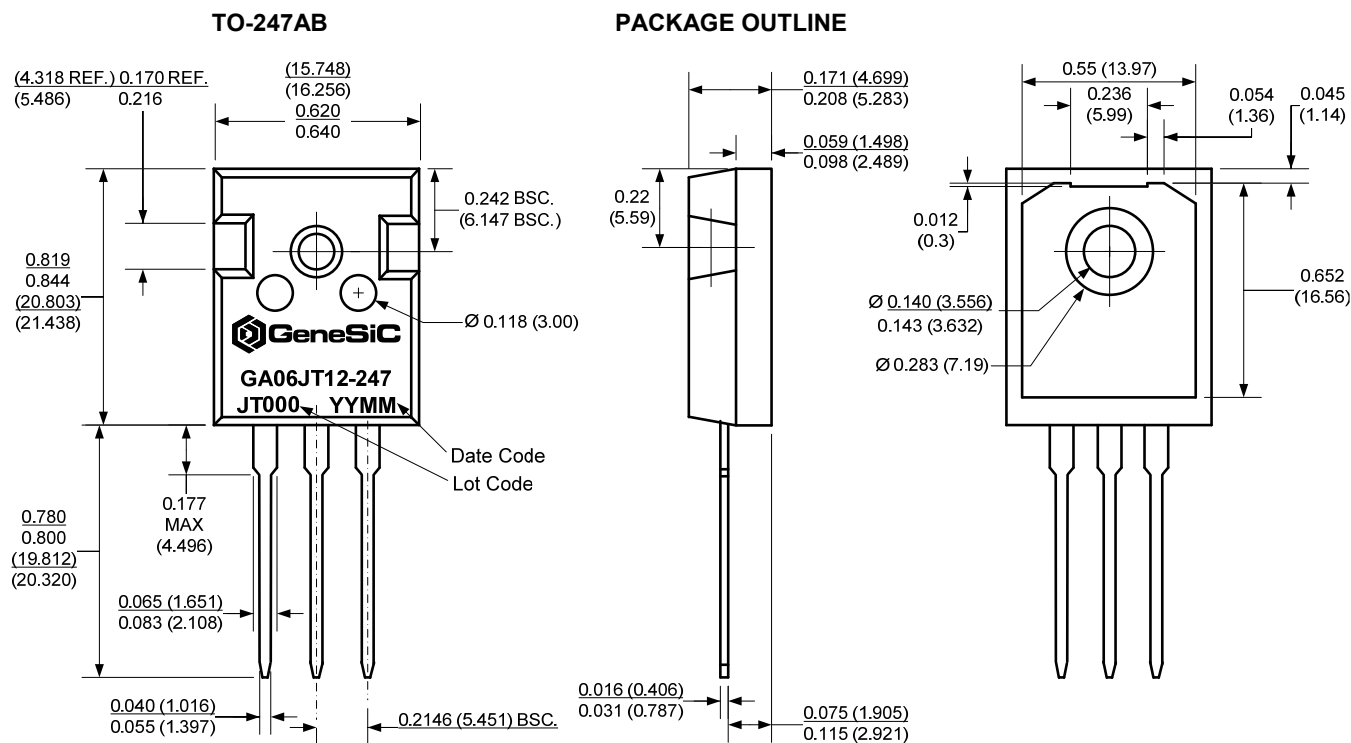


Figure 21: Gate Diver Configuration (Option #2)

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Option #1 Gate Drive Conditions (IXDD614/IXDN614)						
Supply Voltage, High Side Driver	V _{CC}	V _{GH}	15	20	30	V
Supply Voltage, Low Side Driver	V _{CC}	V _{GL}	5	6		V
Off State Voltage, Both Drivers	GND	V _{EE}		-5	0	V
Gate Control Input Signal, Low	IN		-5.0	0	0.8	V
Gate Control Input Signal, High	IN		4	5.0	V _{CC} +0.3	V
Enable, Low	EN	IXDD614 Only			1/3*V _{CC}	V
Enable, High	EN	IXDD614 Only	2/3*V _{CC}			V
Output Voltage, Low	V _{OUT}				0.025	V
Output Voltage, High	V _{OUT}		V _{CC} -0.025			V
Output Current, Peak	I _{OUT}	Package Limited			14	A
Output Current, Continuous	I _{OUT}			0.5	4.0	A
Passive Gate Components						
Gate Resistance	R _G	V _{GL} = 6.0 V, I _G ≈ 0.5 A		1.6	5	Ω
Gate Capacitance	C _G	V _{GH} = 20 V, I _{G,pk} ≈ 2.0 A	5	9		nF

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
2013/08/23	3	Updated Switching Characteristics	
2013/06/24	2	Updated Electrical Characteristics	
2013/02/21	1	Revised Electrical Characteristics	
2012/11/30	0	Initial Release	

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SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the GA06JT12 SJT device.

```
*      MODEL OF GeneSiC Semiconductor Inc.
*
*      $Revision:   1.0           $
*      $Date:      26-AUG-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 GA06JT12 NPN
+ IS      5.08E-47
+ ISE     1.26E-28
+ EG      3.2
+ BF      58.31
+ BR      0.55
+ IKF     200
+ NF      1
+ NE      1.892
+ RB      0.26
+ RE      0.1039
+ RC      0.06188
+ CJC     2.73E-10
+ VJC     3.04
+ MJC     0.448
+ CJE     6.86E-10
+ VJE     2.89
+ MJE     0.466
+ XTI     3
+ XTB     -1.33
+ TRC1    1.90E-2
+ VCEO    1200
+ ICRATING 6
+ MFG     GeneSiC_Semiconductor
*
*  End of GA06JT12 SPICE Model
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