

Normally – OFF Silicon Carbide Junction Transistor

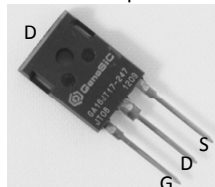
V_{DS}	=	1700 V
$V_{DS(ON)}$	=	1.7 V
I_D	=	16 A
$R_{DS(ON)}$	=	110 mΩ

Features

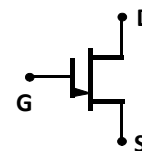
- 175 °C maximum operating temperature
- Temperature independent switching performance
- Gate oxide free SiC switch
- Suitable for connecting an anti-parallel diode
- Positive temperature coefficient for easy paralleling
- Low gate charge
- Low intrinsic capacitance

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}	$V_{GS} = 0\text{ V}$	1700	V
Continuous Drain Current	I_D	$T_{C,MAX} = 90\text{ °C}$	16	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	$I_{D,max} = 16$ @ $V_{DS} \leq V_{DSmax}$	A
Short Circuit Safe Operating Area	SCSOA	$T_{VJ} = 175\text{ °C}$, $I_G = 1\text{ A}$, $V_{DS} = 1200\text{ V}$, Non Repetitive	20	μs
Reverse Gate – Source Voltage	V_{SG}		30	V
Reverse Drain – Source Voltage	V_{SD}		40	V
Power Dissipation	P_{tot}	$T_C = 25\text{ °C}$	234	W
Storage Temperature	T_{stg}		-55 to 175	°C

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

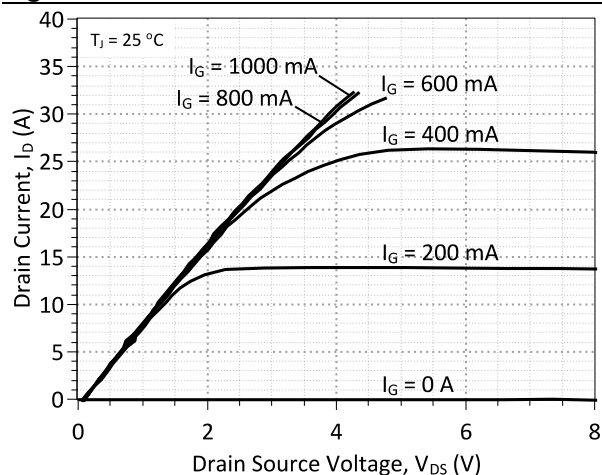
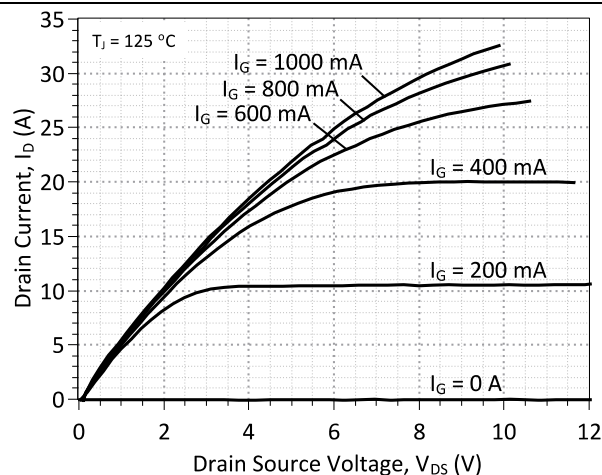
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	V _{DS(ON)}	I _D = 16 A, I _G = 1000 mA, T _J = 25 °C		1.7	2.0	V
		I _D = 16 A, I _G = 1000 mA, T _J = 125 °C		3.3	4.0	
		I _D = 16 A, I _G = 1000 mA, T _J = 175 °C		4.5	5.5	
Drain – Source On Resistance	R _{DS(ON)}	I _D = 16 A, I _G = 1000 mA, T _J = 25 °C		110		mΩ
		I _D = 16 A, I _G = 1000 mA, T _J = 125 °C		210		
		I _D = 16 A, I _G = 1000 mA, T _J = 175 °C		280		
Gate Forward Voltage	V _{GS(FWD)}	I _G = 500 mA, T _J = 25 °C		3.0		V
		I _G = 500 mA, T _J = 175 °C		2.7		
DC Current Gain	β	V _{DS} = 5 V, I _D = 16 A, T _J = 25 °C	50	65		
		V _{DS} = 5 V, I _D = 16 A, T _J = 175 °C		45		
Off Characteristics						
Drain Leakage Current	I _{DSS}	V _R = 1700 V, V _{GS} = 0 V, T _J = 25 °C		0.2	10	μA
		V _R = 1700 V, V _{GS} = 0 V, T _J = 125 °C		0.5	50	
		V _R = 1700 V, V _{GS} = 0 V, T _J = 175 °C		2.0	100	
Gate Leakage Current	I _{SG}	V _{SG} = 20 V, T _J = 25 °C		20		nA

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Capacitance Characteristics						
Gate-Source Capacitance	C_{GS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1730		pF
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, V_D = 1\text{ V}, f = 1\text{ MHz}$		2225		pF
Reverse Transfer/Output Capacitance	C_{RSS}/C_{OSS}	$V_D = 1\text{ V}, f = 1\text{ MHz}$		495		pF
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	$V_{DD} = 1100\text{ V}, I_D = 16\text{ A},$ $R_{G(on)} = R_{G(off)} = 22\ \Omega,$ $V_{GS} = -8/15\text{ V}, L = 1.1\text{ mH},$ FWD = GB20SLT12, $T_j = 25\text{ }^{\circ}\text{C}$ Refer to Figure 11 for gate current waveform		17		ns
Rise Time	t_r			14		ns
Turn Off Delay Time	$t_{d(off)}$			48		ns
Fall Time	t_f			46		ns
Turn-On Energy Per Pulse	E_{on}			781		μJ
Turn-Off Energy Per Pulse	E_{off}	$V_{DD} = 1100\text{ V}, I_D = 16\text{ A},$ $R_{G(on)} = R_{G(off)} = 22\ \Omega,$ $V_{GS} = -8/15\text{ V}, L = 1.1\text{ mH},$ FWD = GB20SLT12, $T_j = 175\text{ }^{\circ}\text{C}$ Refer to Figure 11 for gate current waveform		188		μJ
Total Switching Energy	E_{is}			969		μJ
Turn On Delay Time	$t_{d(on)}$			9		
Rise Time	t_r			22		ns
Turn Off Delay Time	$t_{d(off)}$			55		ns
Fall Time	t_f			41		ns
Turn-On Energy Per Pulse	E_{on}			794		μJ
Turn-Off Energy Per Pulse	E_{off}			118		μJ
Total Switching Energy	E_{is}			912		μJ

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	0.64	$^\circ\text{C/W}$
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Figures

Figure 1: Typical Output Characteristics at 25°C

Figure 2: Typical Output Characteristics at 125°C

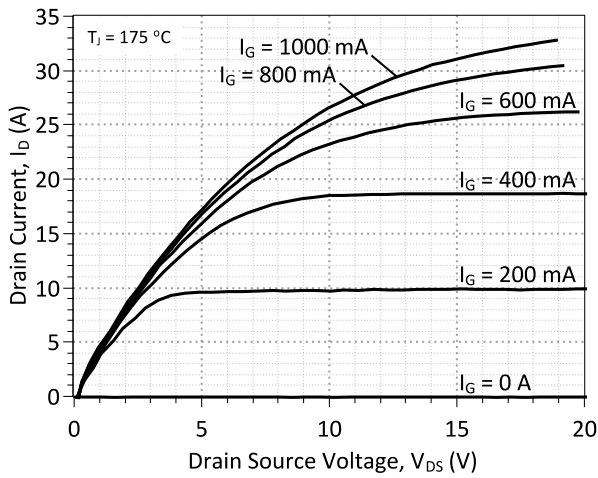


Figure 3: Typical Output Characteristics at 175 °C

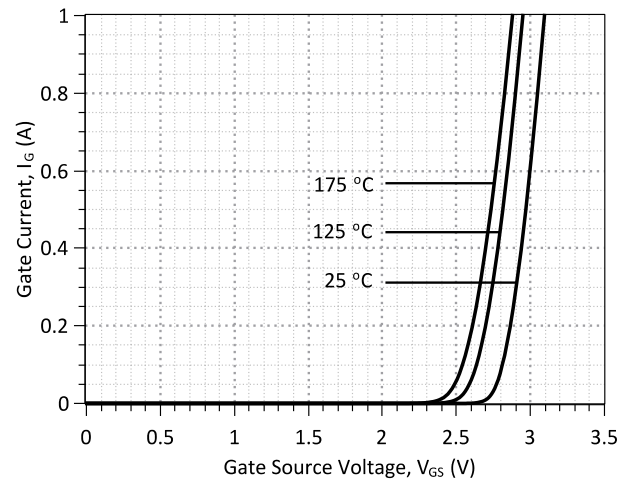


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

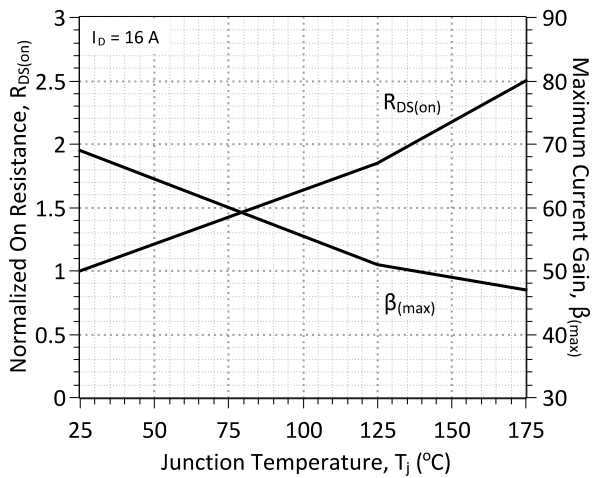


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

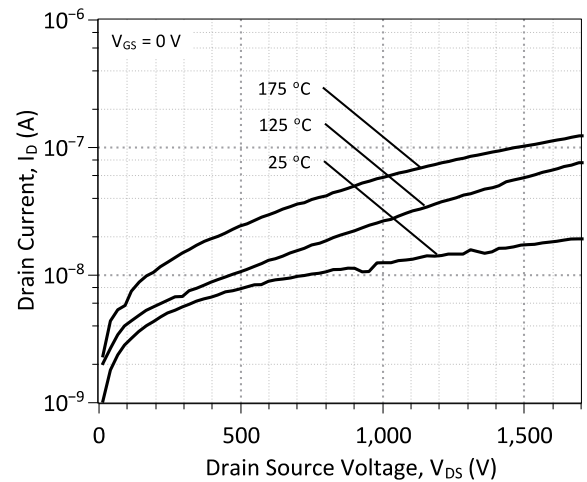


Figure 6: Typical Blocking Characteristics

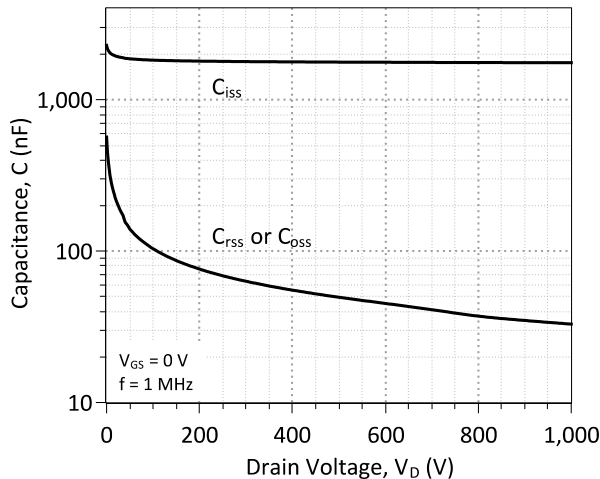


Figure 7: Capacitance Characteristics

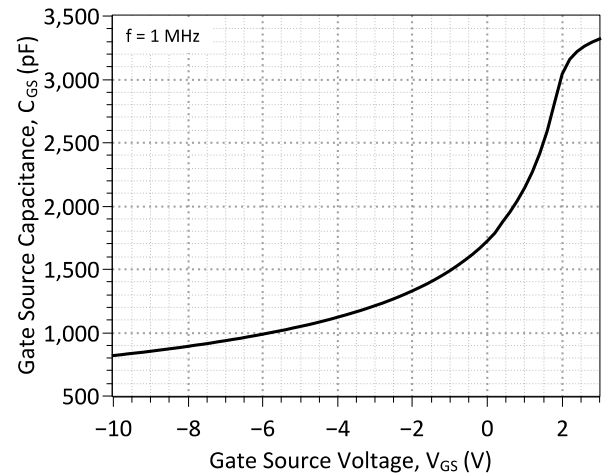


Figure 8: Capacitance Characteristics

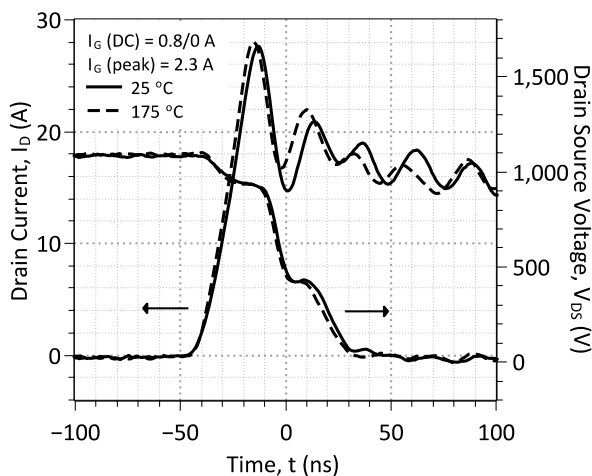


Figure 9: Typical Hard-switched Turn On Waveforms

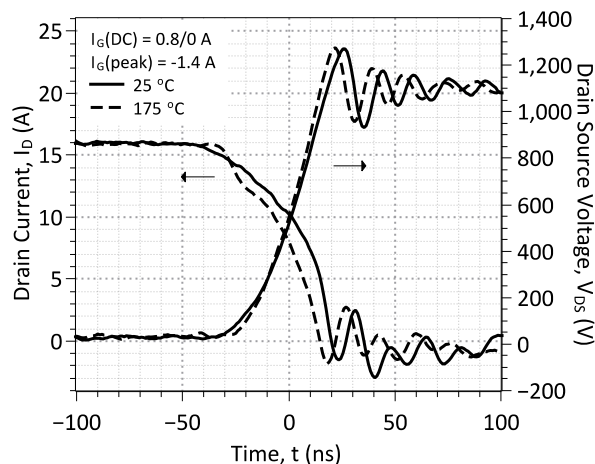


Figure 10: Typical Hard-switched Turn Off Waveforms

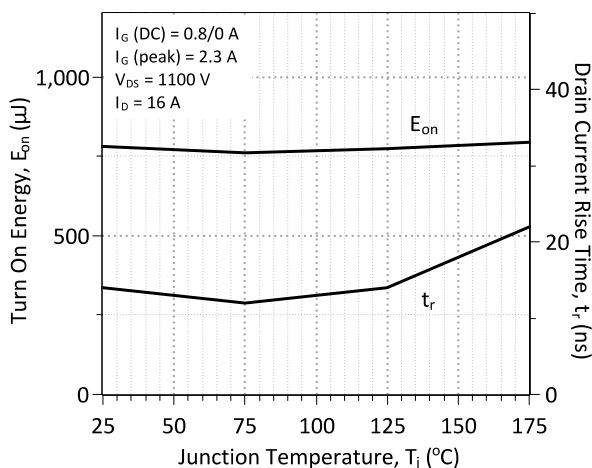


Figure 11: Typical Turn On Energy Losses and Switching Times vs. Temperature

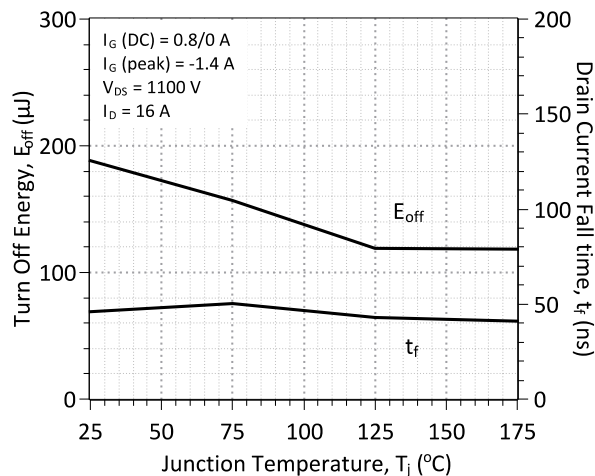


Figure 12: Typical Turn Off Energy Losses and Switching Times vs. Temperature

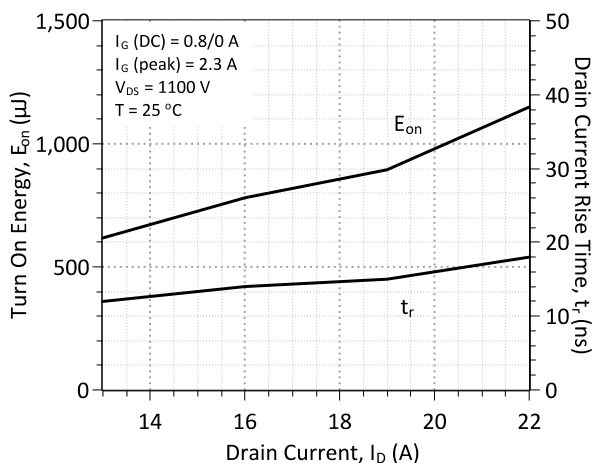


Figure 13: Typical Turn On Energy Losses vs. Drain Current

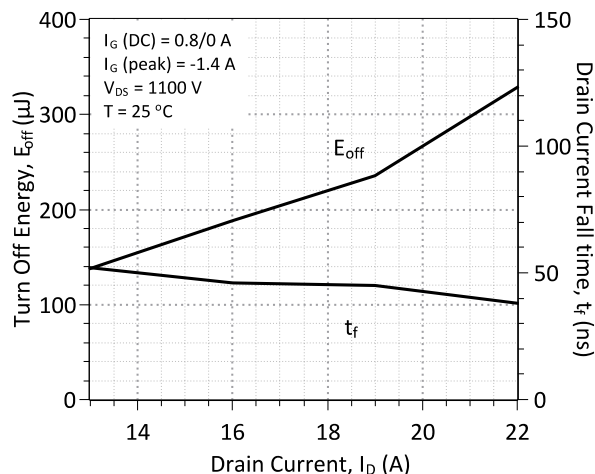


Figure 14: Typical Turn Off Energy Losses vs. Drain Current

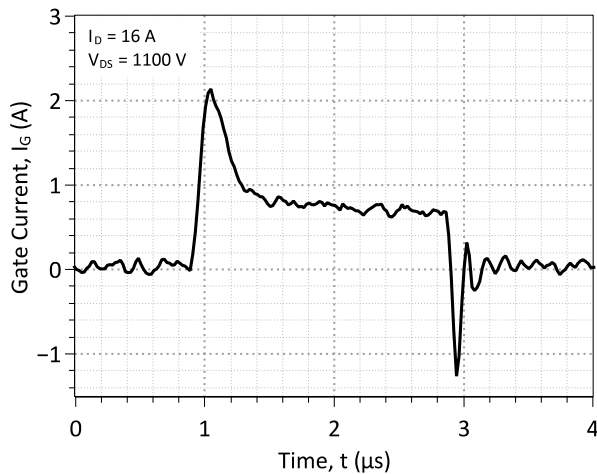


Figure 15: Typical Gate Current Waveform

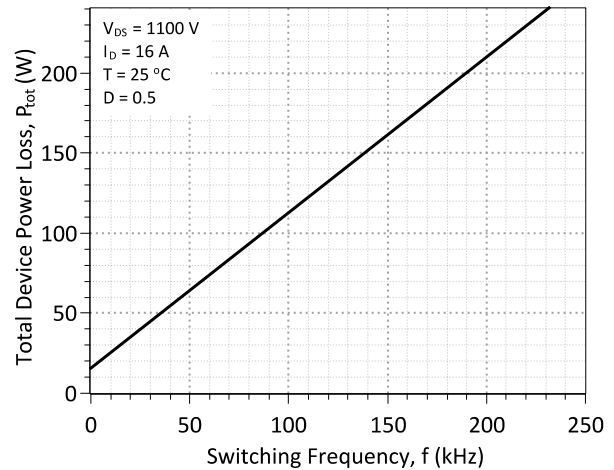


Figure 16: Typical Hard Switched Device Power Loss vs. Switching Frequency¹

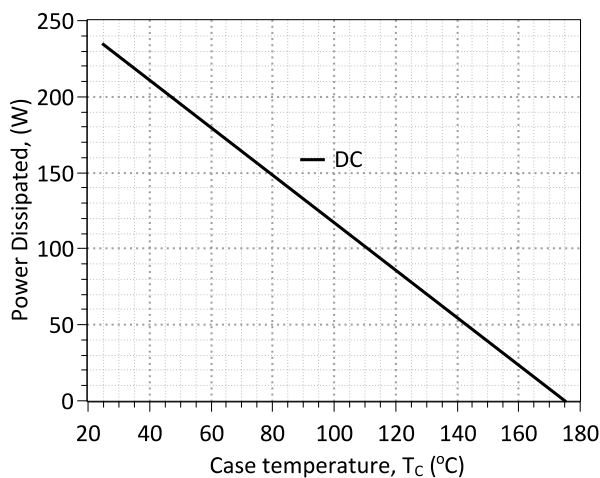


Figure 17: Power Derating Curve

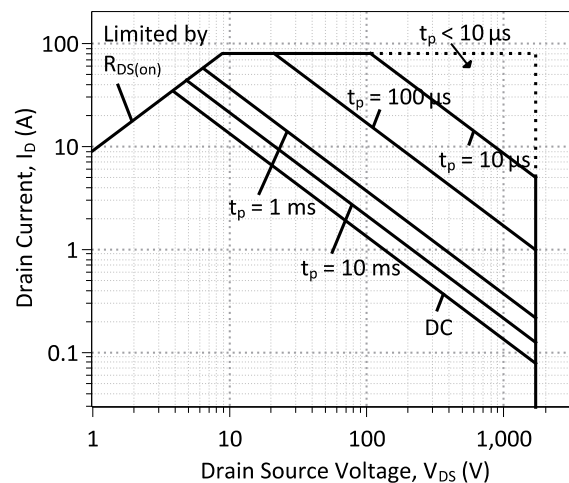


Figure 18: Forward Bias Safe Operating Area

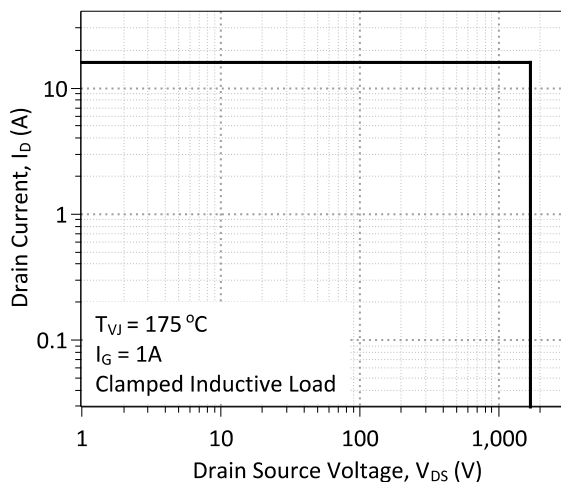


Figure 19: Turn-Off Safe Operating Area

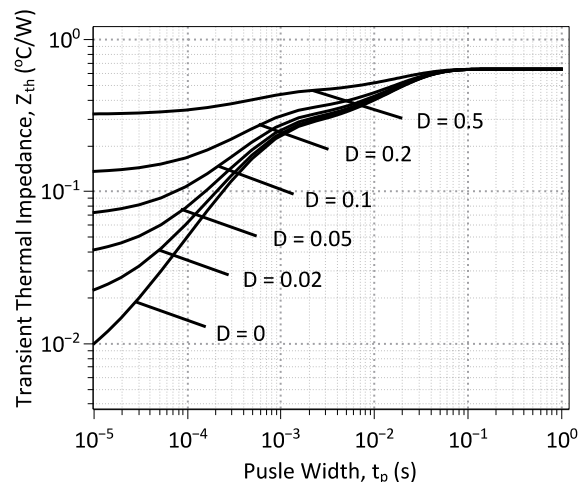


Figure 20: Transient Thermal Impedance

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 GA16JT17-247 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 GA16JT17-247 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.

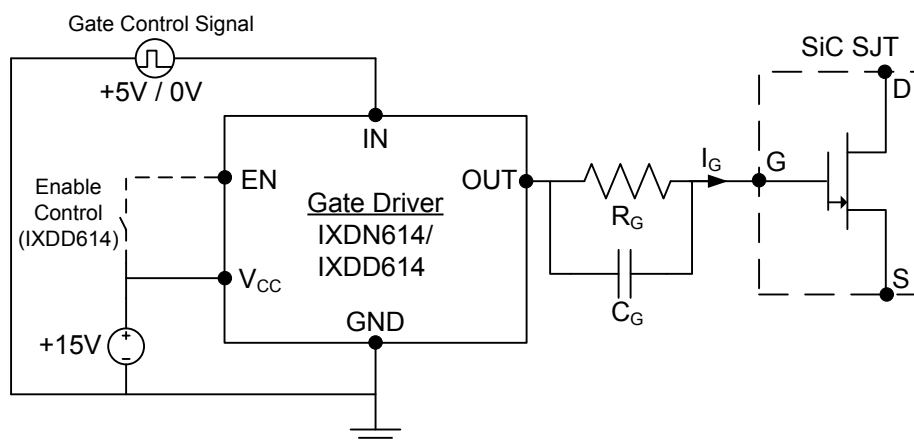
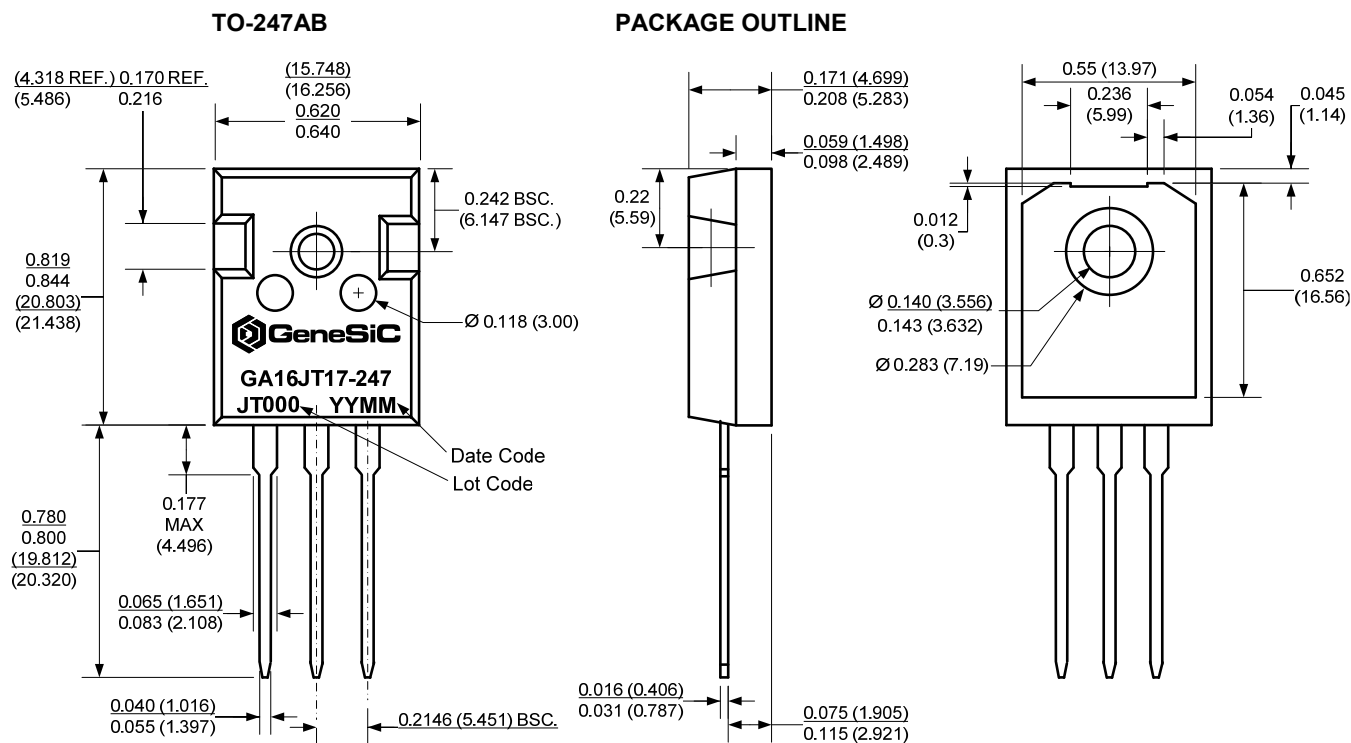


Figure 21: Recommended Gate Diver Configuration (Option #2)

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	6.5		V
Off State Voltage, Both Drivers	GND	V _{EE}		-10	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
2013/11/12	4	Updated Electrical Characteristics	
2013/08/29	3	Updated Switching Characteristics	
2013/06/14	2	Updated Electrical Characteristics	
2013/02/21	1	Revised electrical characteristics	
2012/12/03	0	Initial release	

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SPICE Model Parameters

Copy the following code into a SPICE software program for simulation of the GA16JT17 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 GA16JT17 NPN
+ IS      6.03E-47
+ ISE     1.72E-28
+ EG      3.2
+ BF      52
+ BR      0.55
+ IKF     300
+ NF      1
+ NE      1.868
+ RB      0.26
+ RE      0.1
+ RC      0.01
+ CJC     5.68E-10
+ VJC     2.978967839
+ MJC     0.466424924
+ CJE     1.72E-09
+ VJE     2.77859888
+ MJE     0.484150812
+ XTI     3
+ XTB     -1.2
+ TRC1    6.00E-03
+ VCEO    1700
+ ICRATING 16
+ MFG      GeneSiC_Semiconductor
*
*      End of GA16JT17 SPICE Model
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