

Normally – OFF Silicon Carbide Super Junction Transistor

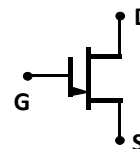
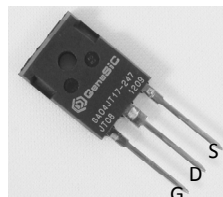
V_{DS}	=	1700 V
$V_{DS(ON)}$	=	2.0 V
I_D	=	4 A
$R_{DS(ON)}$	=	500 mΩ

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	$T_{C,MAX} = 95\text{ °C}$	4	A
Gate Peak Current	I_{GM}		5	A
Reverse Gate – Source Voltage	V_{SG}		60	V
Reverse Drain – Source Voltage	V_{SD}		50	V
Power Dissipation	P_{tot}	$T_C = 25\text{ °C}$	91	W
Storage Temperature	T_{stg}		-55 to 175	°C

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

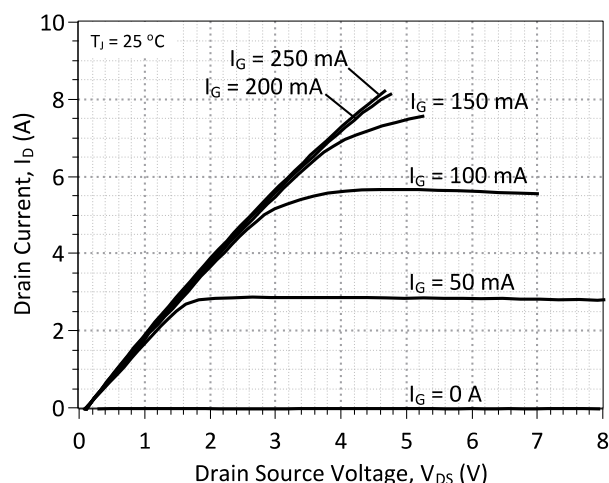
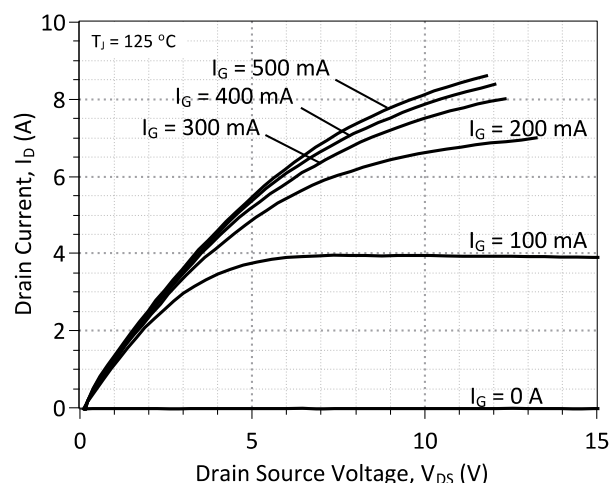
Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	V _{DS(ON)}	I _D = 4 A, I _G = 250 mA, T _J = 25 °C		2.0		V
		I _D = 4 A, I _G = 500 mA, T _J = 125 °C		3.3		
		I _D = 4 A, I _G = 500 mA, T _J = 175 °C		4.5		
Drain – Source On Resistance	R _{DS(ON)}	I _D = 4 A, I _G = 250 mA, T _J = 25 °C		500		mΩ
		I _D = 4 A, I _G = 500 mA, T _J = 125 °C		800		
		I _D = 4 A, I _G = 500 mA, T _J = 175 °C		1100		
Gate Forward Voltage	V _{GS(FWD)}	I _G = 500 mA, T _J = 25 °C		3.3		V
		I _G = 500 mA, T _J = 175 °C		3.2		
DC Current Gain	β	V _{DS} = 5 V, I _D = 4 A, T _J = 25 °C		60		
		V _{DS} = 5 V, I _D = 4 A, T _J = 175 °C		35		
Off Characteristics						
Drain Leakage Current	I _{DSS}	V _R = 1700 V, V _{GS} = 0 V, T _J = 25 °C		0.5		μA
		V _R = 1700 V, V _{GS} = 0 V, T _J = 125 °C		1.0		
		V _R = 1700 V, V _{GS} = 0 V, T _J = 175 °C		2.0		

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

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	$V_{DD} = 1100\text{ V}$, $I_D = 4\text{ A}$, $R_{G(on)} = R_{G(off)} = 44\ \Omega$, $V_{GS} = -8/15\text{ V}$, $L = 1.1\text{ mH}$, $FWD = GB05SLT12$, $T_j = 25\text{ }^{\circ}\text{C}$		35		ns
Rise Time	t_r			28		ns
Turn Off Delay Time	$t_{d(off)}$			60		ns
Fall Time	t_f			50		ns
Turn-On Energy Per Pulse	E_{on}			323		μJ
Turn-Off Energy Per Pulse	E_{off}	Refer to Figure 11 for gate current waveform		60		μJ
Total Switching Energy	E_{ts}			383		μJ
Turn On Delay Time	$t_{d(on)}$	$V_{DD} = 1100\text{ V}$, $I_D = 4\text{ A}$, $R_{G(on)} = R_{G(off)} = 44\ \Omega$, $V_{GS} = -8/15\text{ V}$, $L = 1.1\text{ mH}$, $FWD = GB05SLT12$, $T_j = 175\text{ }^{\circ}\text{C}$		30		ns
Rise Time	t_r			14		ns
Turn Off Delay Time	$t_{d(off)}$			73		ns
Fall Time	t_f			58		ns
Turn-On Energy Per Pulse	E_{on}			172		μJ
Turn-Off Energy Per Pulse	E_{off}	Refer to Figure 11 for gate current waveform		73		μJ
Total Switching Energy	E_{ts}			245		μJ

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}	1.64	$^\circ\text{C/W}$
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Figure 1: Typical Output Characteristics at 25°C

Figure 2: Typical Output Characteristics at 125°C

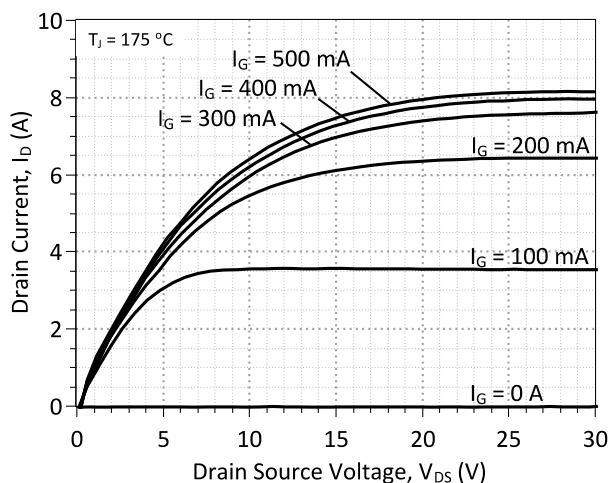


Figure 3: Typical Output Characteristics at 175 °C

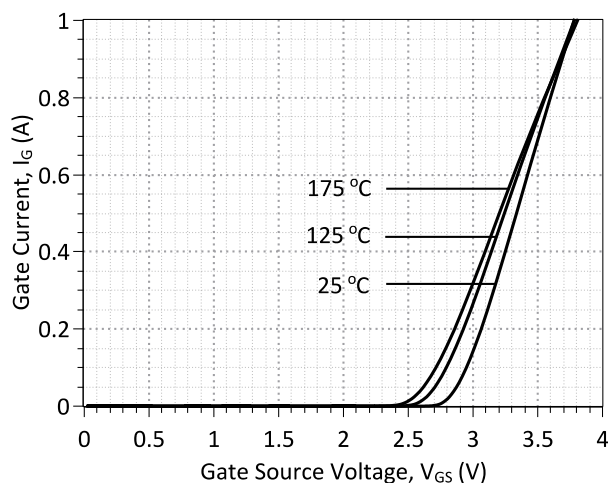


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

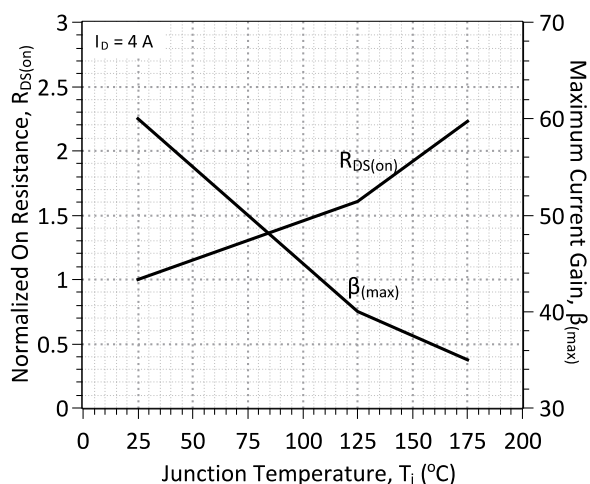


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

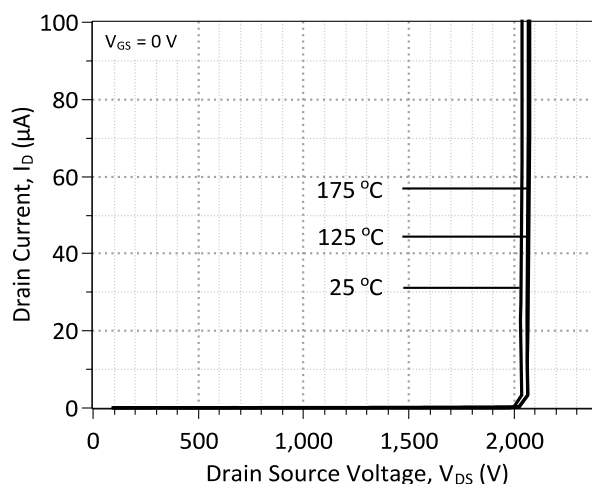


Figure 6: Typical Blocking Characteristics

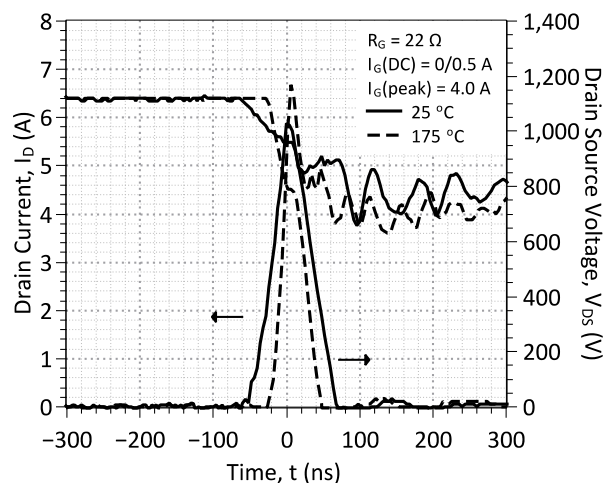


Figure 7: Typical Hard-switched Turn On Waveforms

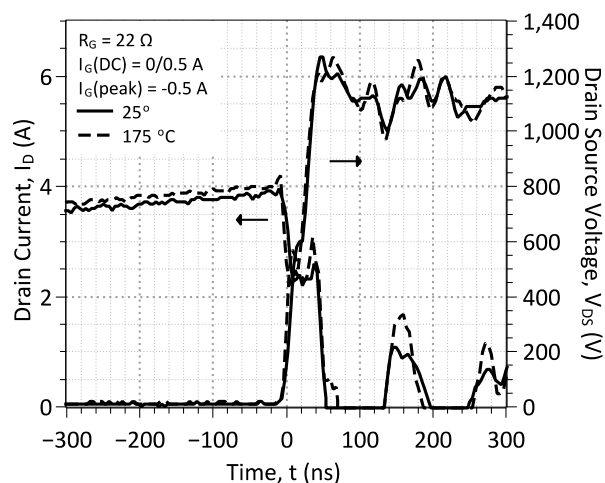


Figure 8: Typical Hard-switched Turn Off Waveforms

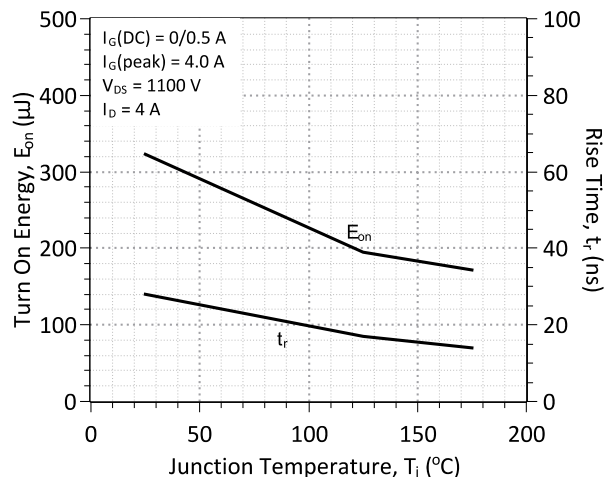


Figure 9: Typical Turn On Energy Losses and Switching Times vs. Temperature

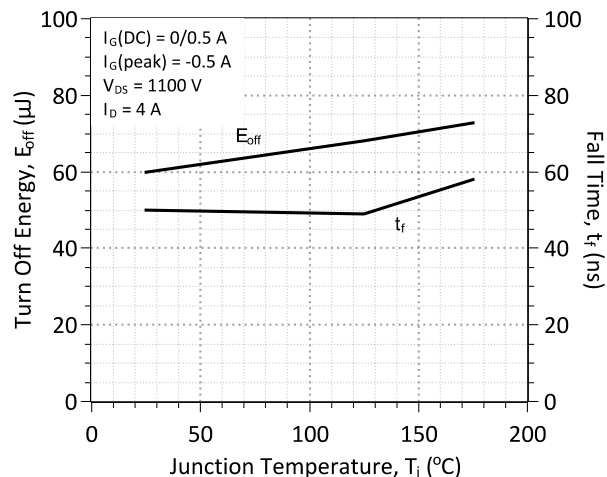


Figure 10: Typical Turn Off Energy Losses and Switching Times vs. Temperature

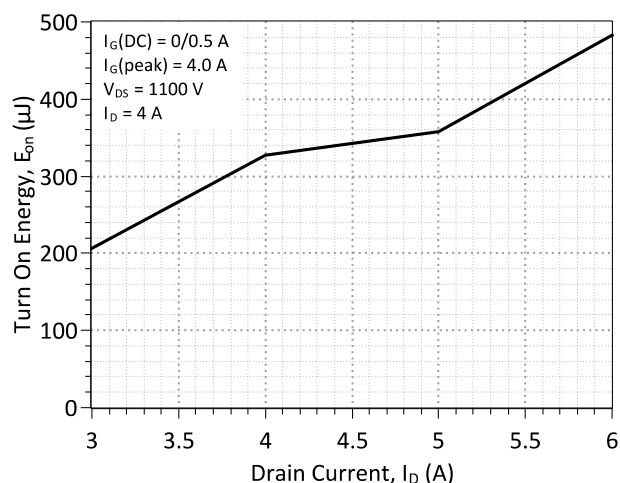


Figure 11: Typical Turn On Energy Losses vs. Drain Current

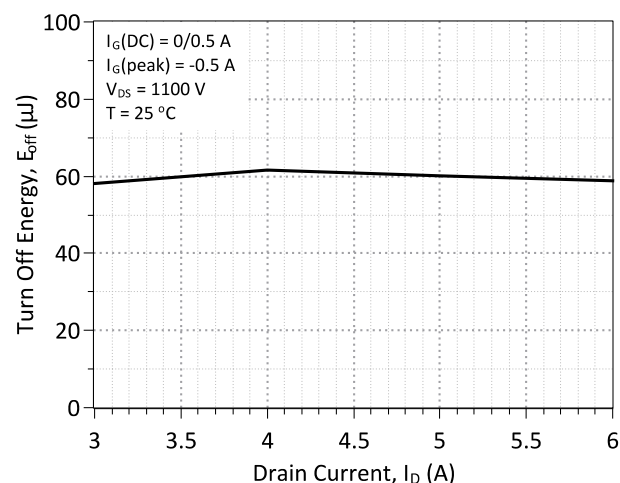


Figure 12: Typical Turn Off Energy Losses vs. Drain Current

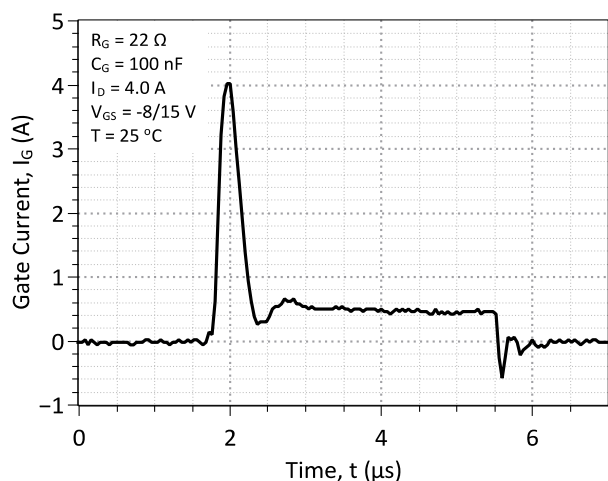


Figure 13: Typical Gate Current Waveform

Gate Drive Technique (Option #1)

To drive the GA04JT17-247 with the lowest gate drive losses, a custom-designed, dual voltage source gate drive configuration is recommended [for example, see Figure 5(a) in J. Rabkowski et al. IEEE Trans. Power Electronics 27(5), 2633-2642 (2012)]. More details on using this optimized gate drive technique will be made available shortly. An effective simple alternative for ultra-fast switching of the GA04JT17-247 is available below.

Gate Drive Technique (Option #2)

The GA04JT17-247 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 from the manufacturer at www.ixys.com.

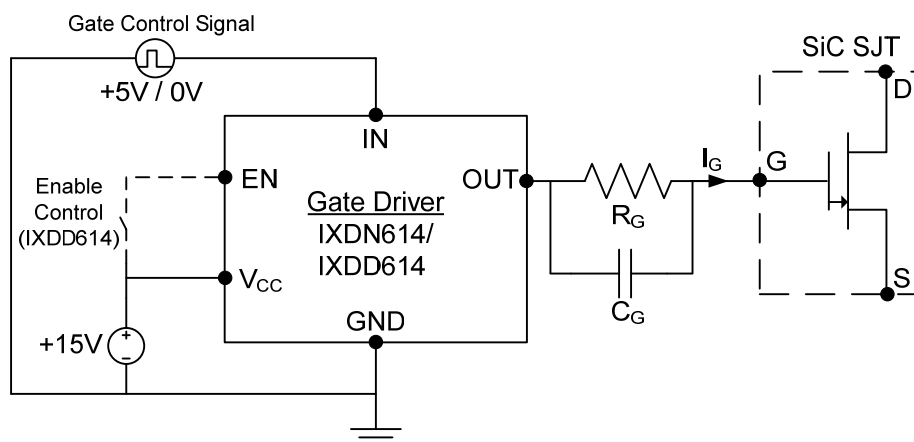
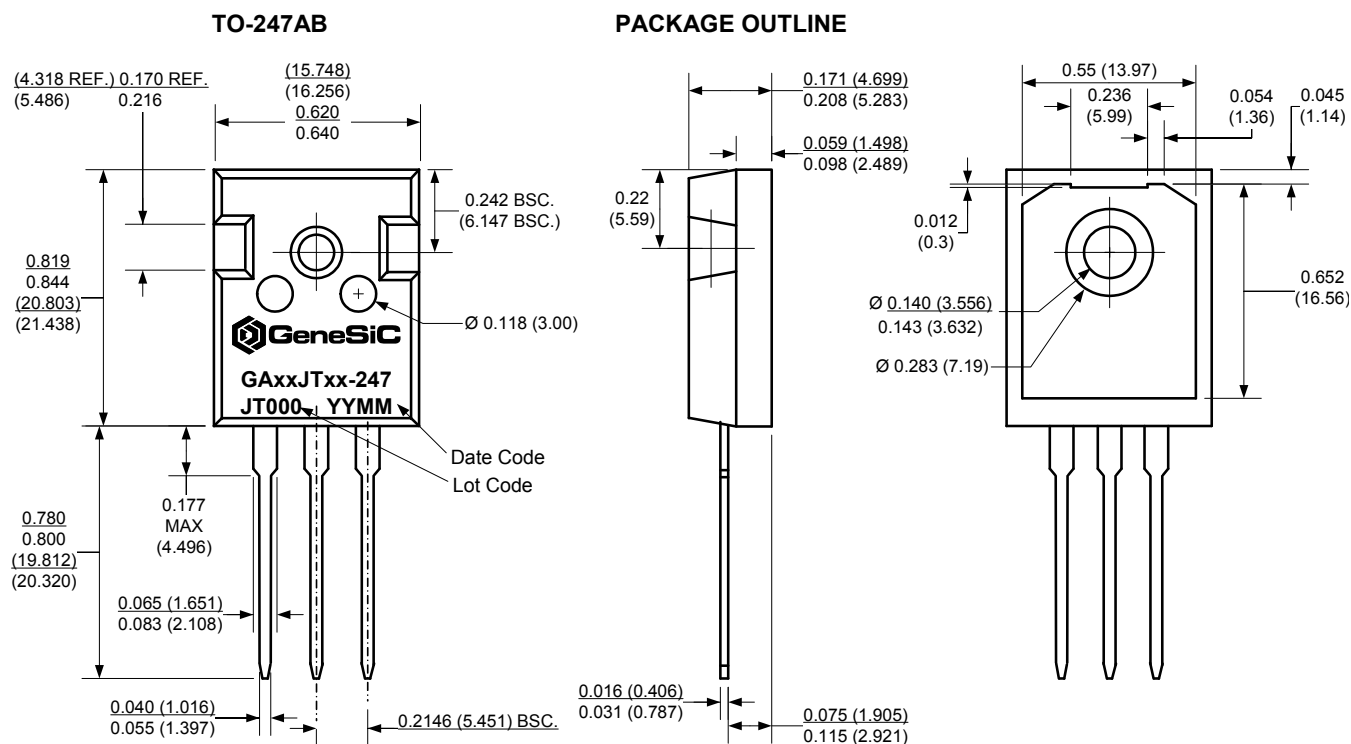


Figure 14: Recommended Gate Driver Configuration (Option #2)

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Gate Driver Pins (IXDD614/IXDN614)						
Supply Voltage	V _{CC}		-0.3	15	40	V
Gate Control Input Signal, Low	IN		-5.0	0	0.8	V
Gate Control Input Signal, High	IN		3.0	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		4.5	14	A
Output Current, Continuous	I _{OUT}			0.5	4.0	A
Passive Gate Components						
Gate Resistance	R _G	I _G ≈ 0.5 A	5	22		Ω
Gate Capacitance	C _G	I _G ≈ 0.5 A		100		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
2013/02/21	1	Revised electrical characteristics	
2012/12/03	0	Initial release	

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