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GeneSiC SEMICONDUCTOR

GA03JT12-247

Normally – OFF Silicon Carbide Super Junction Transistor

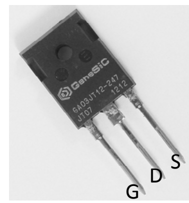
V_{DS}	=	1200 V
$V_{DS(ON)}$	=	1.4 V
I_D	=	3 A
$R_{DS(ON)}$	=	460 mΩ

Features

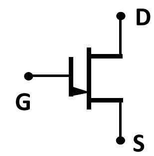
- 175 °C maximum operating temperature
- Temperature independent switching performance
- Gate oxide free SiC switch
- Suitable for connecting an anti-parallel diode
- Positive temperature coefficient for easy paralleling
- Low gate charge
- Low intrinsic capacitance

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 V	1200	V
Continuous Drain Current	I_D	$T_{C,MAX}$ = 95 °C	3	A
Gate Peak Current	I_{GM}		5	A
Reverse Gate – Source Voltage	V_{SG}		25	V
Reverse Drain – Source Voltage	V_{SD}		25	V
Power Dissipation	P_{tot}	T_C = 25 °C	91	W
Storage Temperature	T_{stg}		-55 to 175	°C

Electrical Characteristics at T_j = 175 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
On Characteristics						
Drain – Source On Voltage	$V_{DS(ON)}$	I_D = 3 A, I_G = 250 mA, T_j = 25 °C I_D = 3 A, I_G = 500 mA, T_j = 125 °C I_D = 3 A, I_G = 1000 mA, T_j = 175 °C		1.4 1.6 2.2		V
Drain – Source On Resistance	$R_{DS(ON)}$	I_D = 3 A, I_G = 250 mA, T_j = 25 °C I_D = 3 A, I_G = 500 mA, T_j = 125 °C I_D = 3 A, I_G = 1000 mA, T_j = 175 °C		460 530 720		mΩ
Gate Forward Voltage	$V_{GS(FWD)}$	I_G = 500 mA, T_j = 25 °C I_G = 500 mA, T_j = 175 °C		3.3 3.1		V
DC Current Gain	β	V_{DS} = 5 V, I_D = 3 A, T_j = 25 °C V_{DS} = 5 V, I_D = 3 A, T_j = 175 °C		54 32		
Off Characteristics						
Drain Leakage Current	I_{DSS}	V_R = 1100 V, V_{GS} = 0 V, T_j = 25 °C V_R = 1100 V, V_{GS} = 0 V, T_j = 125 °C V_R = 1100 V, V_{GS} = 0 V, T_j = 175 °C		105 158 210		nA

Electrical Characteristics at T_j = 175 °C, unless otherwise specified

Parameter	Symbol	Conditions	Values min.	Values typ.	Values max.	Unit
Switching Characteristics						
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 800 V, I_D = 3 A, $R_{G(on)}$ = $R_{G(off)}$ = 22 Ω, V_{GS} = -8/15 V, L = 1.05 mH, FWD = GB05SLT12, T_j = 25 °C Refer to Figure 13 for gate current waveform		8		ns
Rise Time	t_r			17		ns
Turn Off Delay Time	$t_{d(off)}$			51		ns
Fall Time	t_f			45		ns
Turn-On Energy Per Pulse	E_{on}			107		µJ
Turn-Off Energy Per Pulse	E_{off}			28		µJ
Total Switching Energy	E_{ts}			135		µJ
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 800 V, I_D = 3 A, $R_{G(on)}$ = $R_{G(off)}$ = 44 Ω, V_{GS} = -8/15 V, L = 1.05 mH, FWD = GB05SLT12, T_j = 175 °C Refer to Figure 13 for gate current waveform		22		ns
Rise Time	t_r			13		ns
Turn Off Delay Time	$t_{d(off)}$			66		ns
Fall Time	t_f			51		ns
Turn-On Energy Per Pulse	E_{on}			78		µJ
Turn-Off Energy Per Pulse	E_{off}			42		µJ
Total Switching Energy	E_{ts}			120		µJ
Thermal Characteristics						
Thermal resistance, junction - case	R_{thJC}			1.64		°C/W

Figures

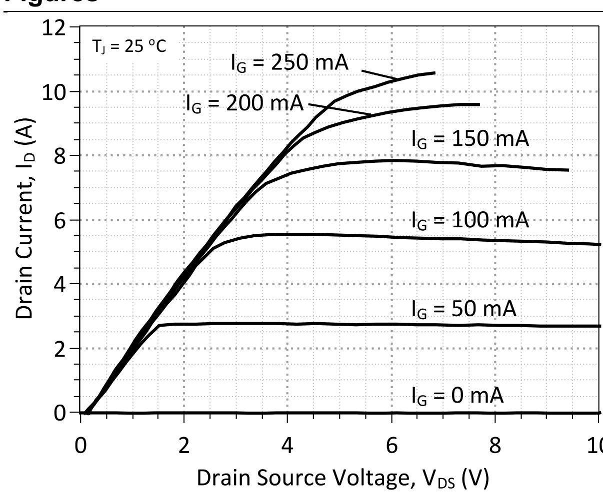


Figure 1: Typical Output Characteristics at 25 °C

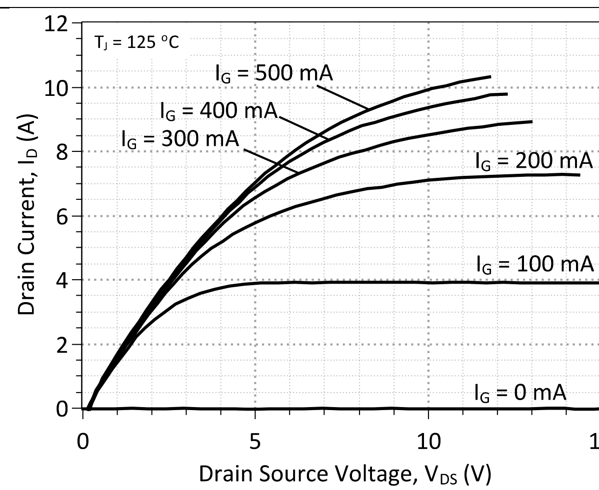


Figure 2: Typical Output Characteristics at 125 °C

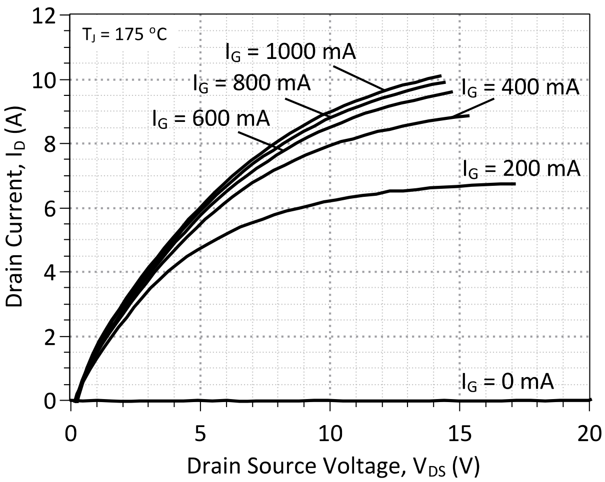


Figure 3: Typical Output Characteristics at 175 °C

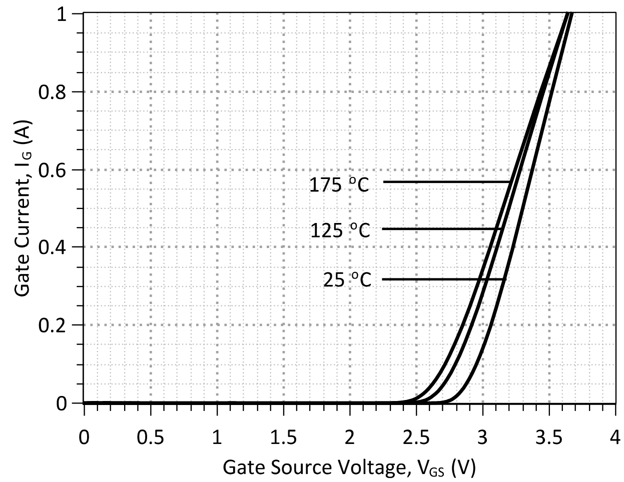


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

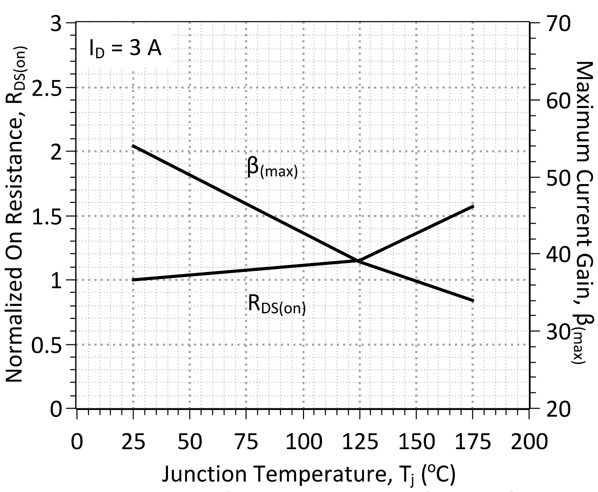


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

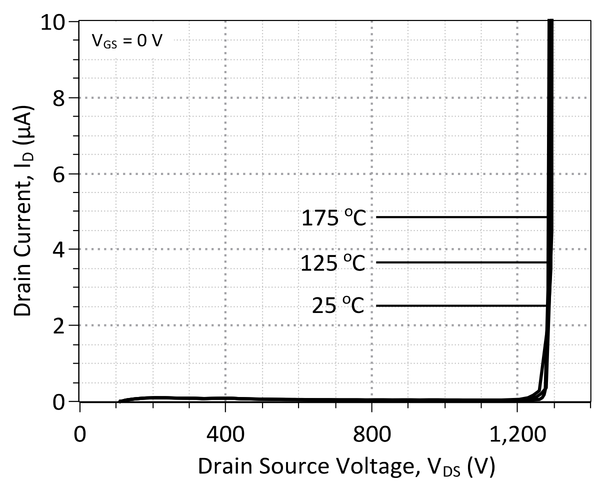


Figure 6: Typical Blocking Characteristics

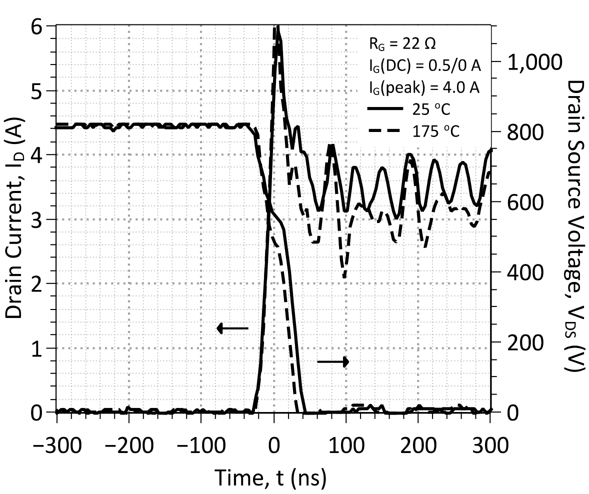


Figure 7: Typical Hard-switched Turn On Waveforms

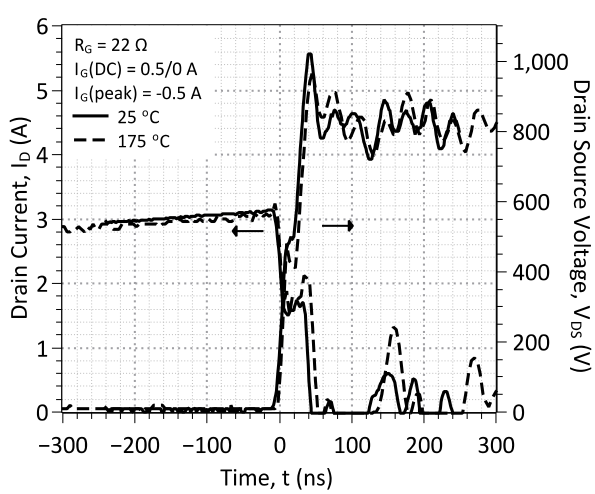


Figure 8: Typical Hard-switched Turn Off Waveforms

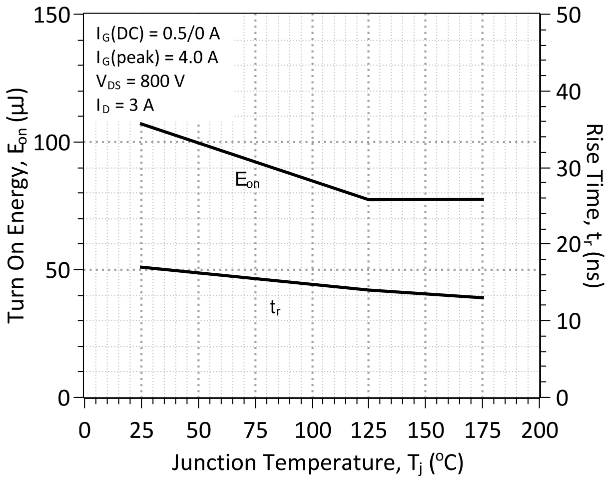


Figure 9: Typical Turn On Energy Losses and Switching Times vs. Temperature

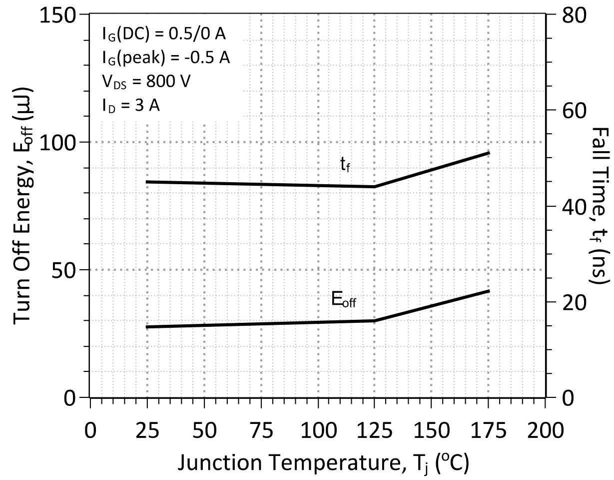


Figure 10: Typical Turn Off Energy Losses and Switching Times vs. Temperature

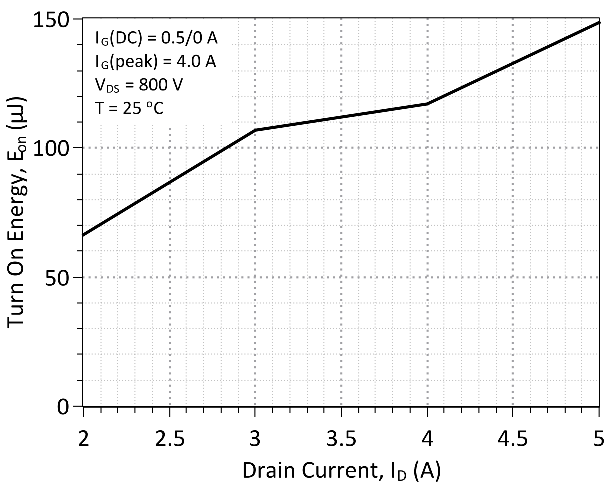


Figure 11: Typical Turn On Energy Losses vs. Drain Current

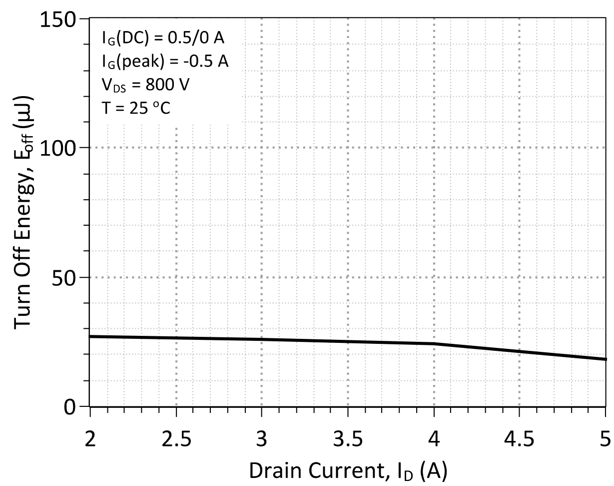


Figure 12: Typical Turn Off Energy Losses vs. Drain Current

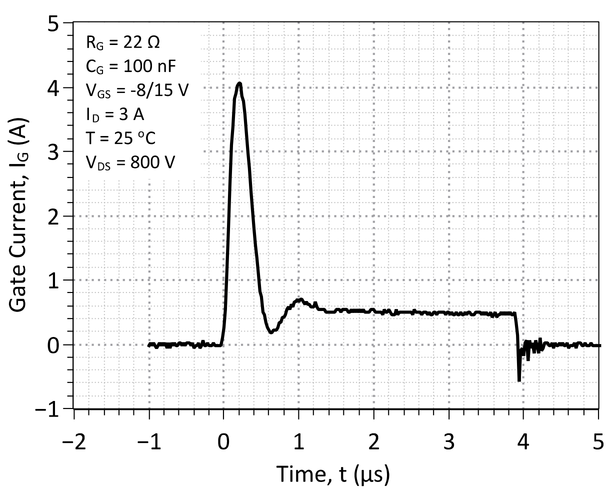


Figure 13: Typical Gate Current Waveform

Gate Drive Technique (Option #1)

To drive the GA03JT12-247 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 GA03JT12-247 is available below.

Gate Drive Technique (Option #2)

The GA03JT12-247 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.

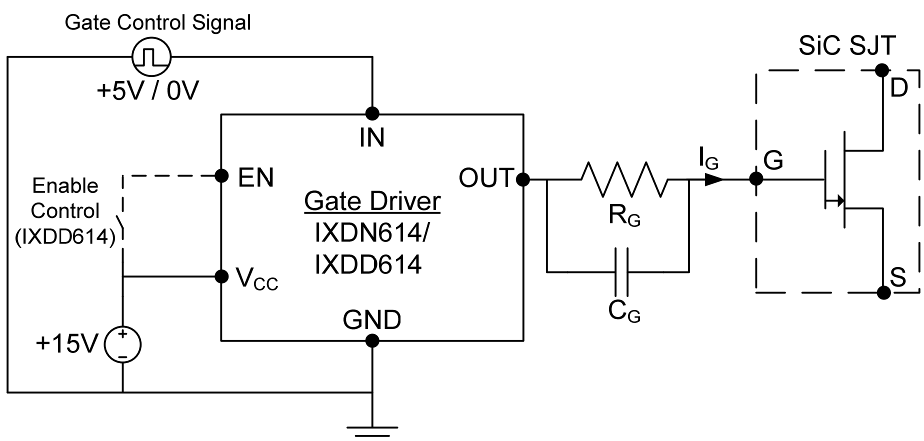
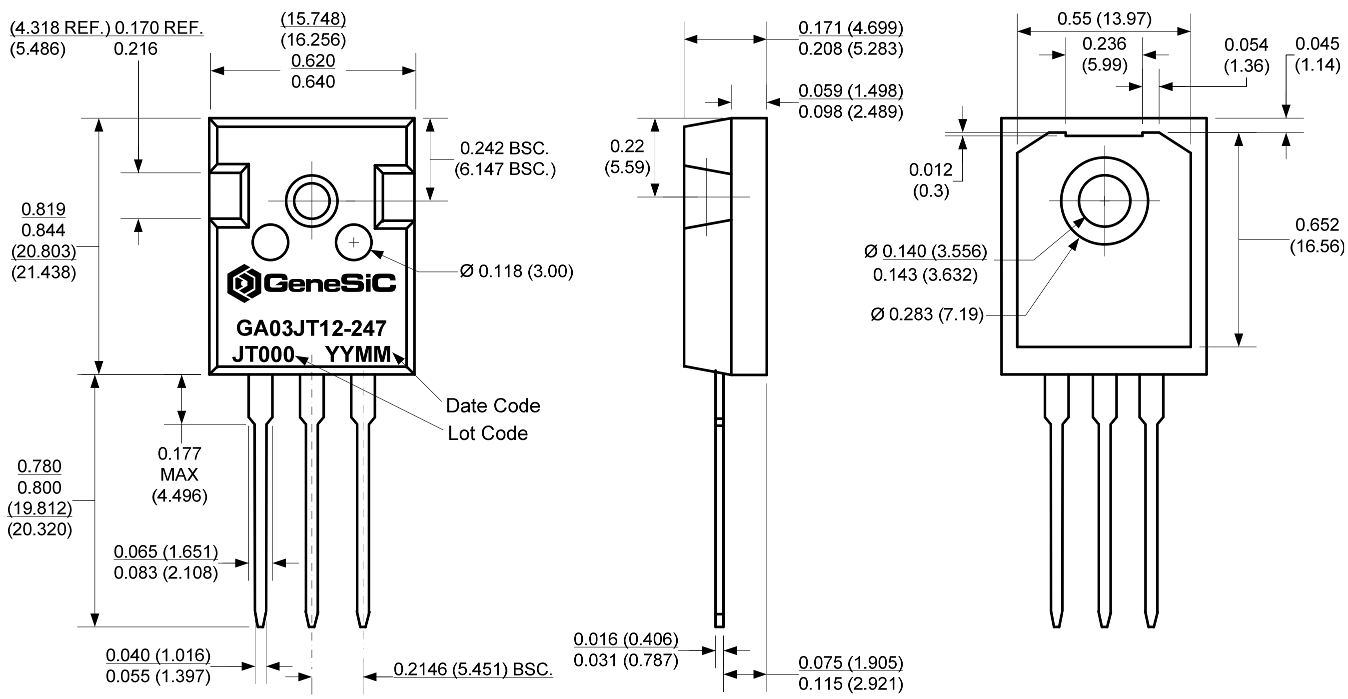


Figure 14: Recommended Gate Diver Configuration (Option #2)

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	$I_G \approx 0.5$ A	5	22		Ω
Gate Capacitance	C_G	$I_G \approx 0.5$ A		100		nF

Package Dimensions

TO-247AB **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
2013/02/21	1	Revised electrical characteristics	
2012/11/30	0	Initial release	

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