GeneSiC SEMICONDUCTOR — GA04JT17-247

Normally – OFF Silicon Carbide Super Junction Transistor

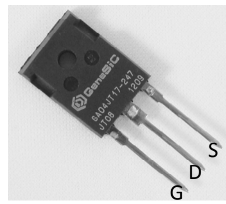
V_{DS}	=	1700 V
$V_{DS(ON)}$	=	2.0 V
I_D	=	4 A
$R_{DS(ON)}$	=	500 mΩ

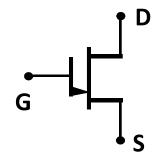
Features

- 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 V	1700	V
Continuous Drain Current	I_D	$T_{C,MAX}$ = 95 °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 °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 = 4 A, I_G = 250 mA, T_j = 25 °C I_D = 4 A, I_G = 500 mA, T_j = 125 °C I_D = 4 A, I_G = 500 mA, T_j = 175 °C		2.0 3.3 4.5		V
Drain – Source On Resistance	$R_{DS(ON)}$	I_D = 4 A, I_G = 250 mA, T_j = 25 °C I_D = 4 A, I_G = 500 mA, T_j = 125 °C I_D = 4 A, I_G = 500 mA, T_j = 175 °C		500 800 1100		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 3.2		V
DC Current Gain	β	V_{DS} = 5 V, I_D = 4 A, T_j = 25 °C V_{DS} = 5 V, I_D = 4 A, T_j = 175 °C		60 35		
Off Characteristics						
Drain Leakage Current	I_{DSS}	V_R = 1700 V, V_{GS} = 0 V, T_j = 25 °C V_R = 1700 V, V_{GS} = 0 V, T_j = 125 °C V_R = 1700 V, V_{GS} = 0 V, T_j = 175 °C		0.5 1.0 2.0		µA

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} = 1100 V, I_D = 4 A, $R_{G(on)}$ = $R_{G(off)}$ = 44 Ω, V_{GS} = -8/15 V, L = 1.1 mH, FWD = GB05SLT12, T_j = 25 °C Refer to Figure 11 for gate current waveform		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}			60		µJ
Total Switching Energy	E_{ts}			383		µJ
Turn On Delay Time	$t_{d(on)}$	V_{DD} = 1100 V, I_D = 4 A, $R_{G(on)}$ = $R_{G(off)}$ = 44 Ω, V_{GS} = -8/15 V, L = 1.1 mH, FWD = GB05SLT12, T_j = 175 °C Refer to Figure 11 for gate current waveform		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}			73		µJ
Total Switching Energy	E_{ts}			245		µJ

Thermal Characteristics

Thermal resistance, junction - case	R_{thJC}			1.64		°C/W

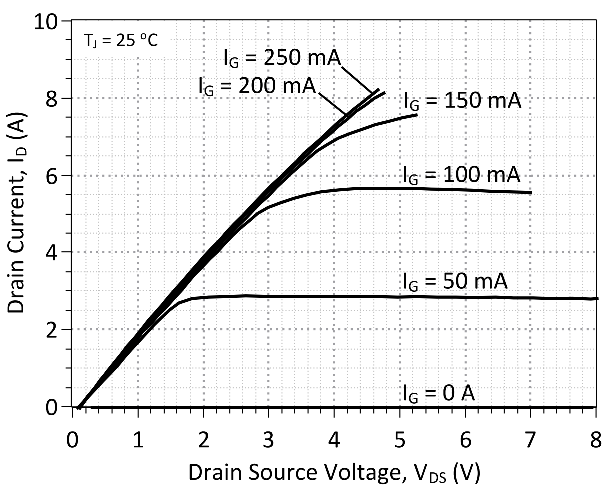


Figure 1: Typical Output Characteristics at 25 °C

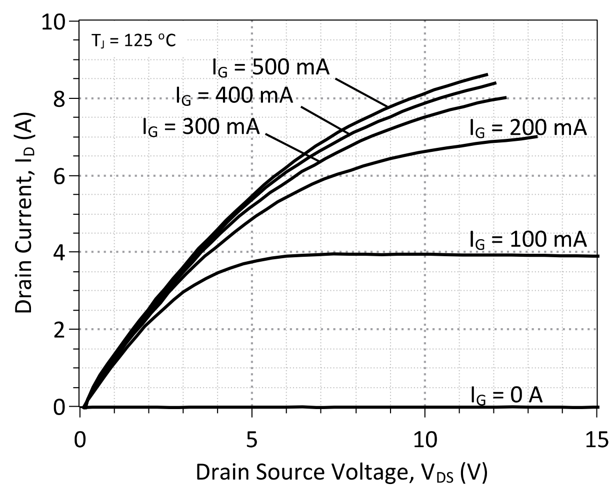


Figure 2: Typical Output Characteristics at 125 °C

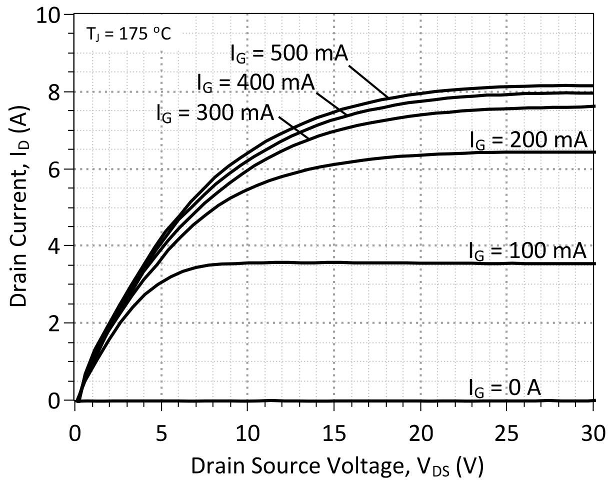


Figure 3: Typical Output Characteristics at 175 °C

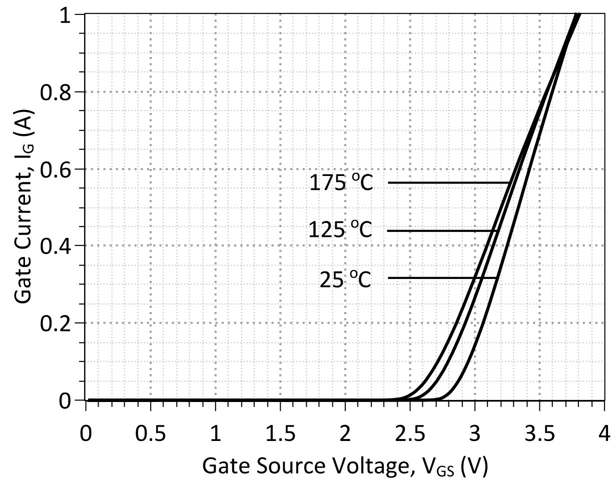


Figure 4: Typical Gate Source I-V Characteristics vs. Temperature

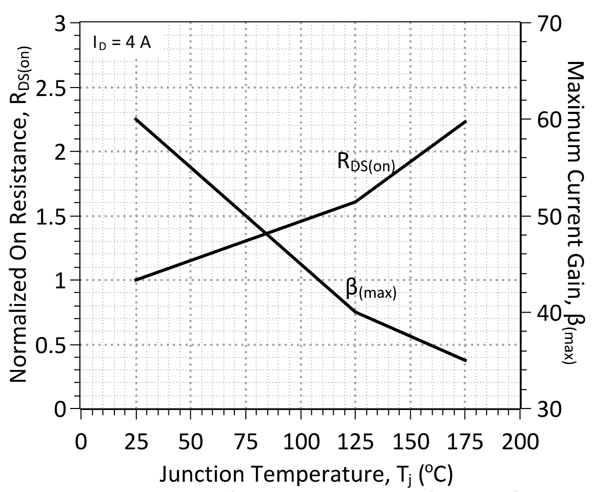


Figure 5: Normalized On-Resistance and Current Gain vs. Temperature

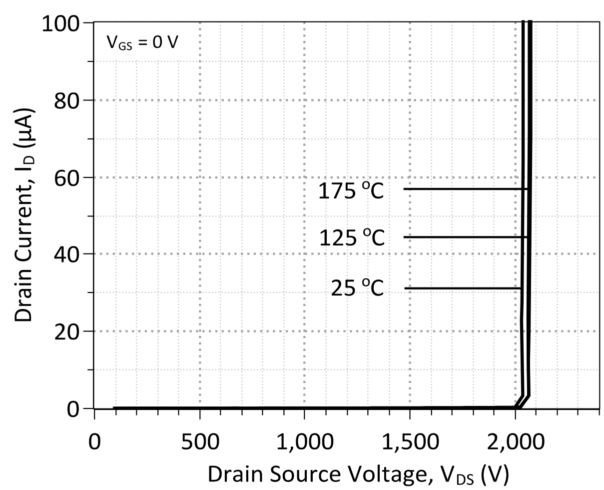


Figure 6: Typical Blocking Characteristics

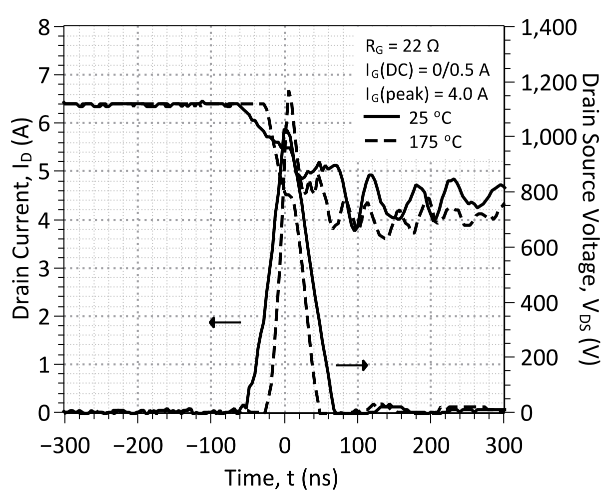


Figure 7: Typical Hard-switched Turn On Waveforms

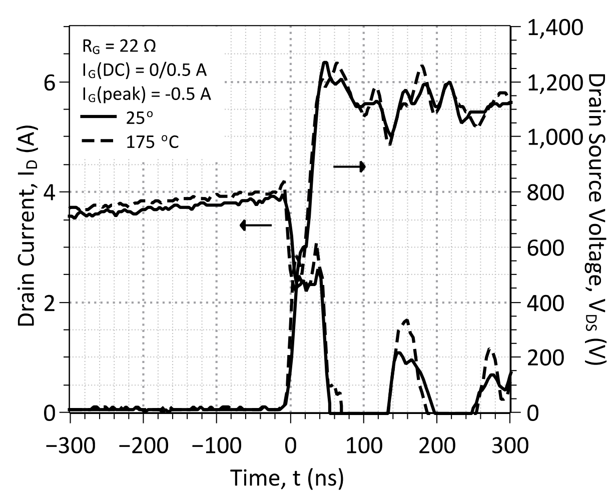


Figure 8: Typical Hard-switched Turn Off Waveforms

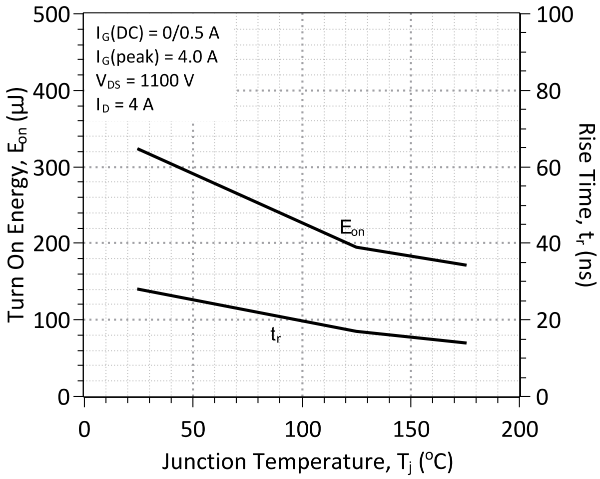


Figure 9: Typical Turn On Energy Losses and Switching Times vs. Temperature

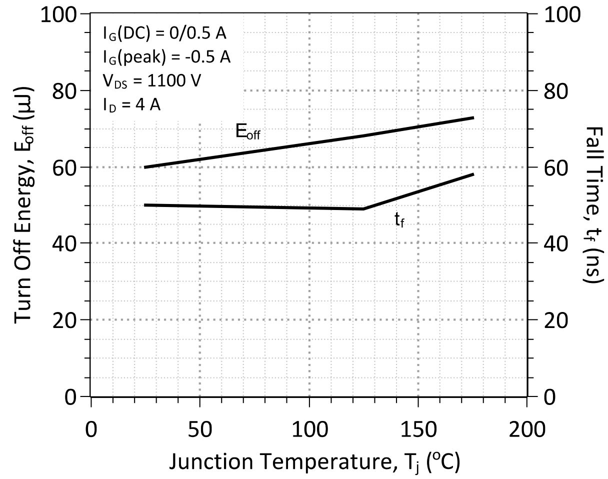


Figure 10: Typical Turn Off Energy Losses and Switching Times vs. Temperature

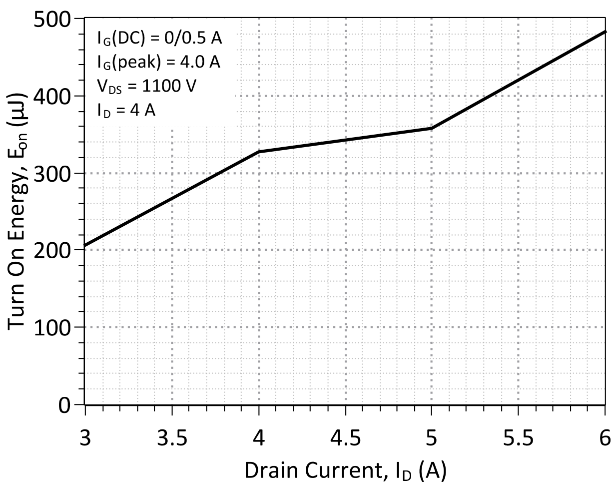


Figure 11: Typical Turn On Energy Losses vs. Drain Current

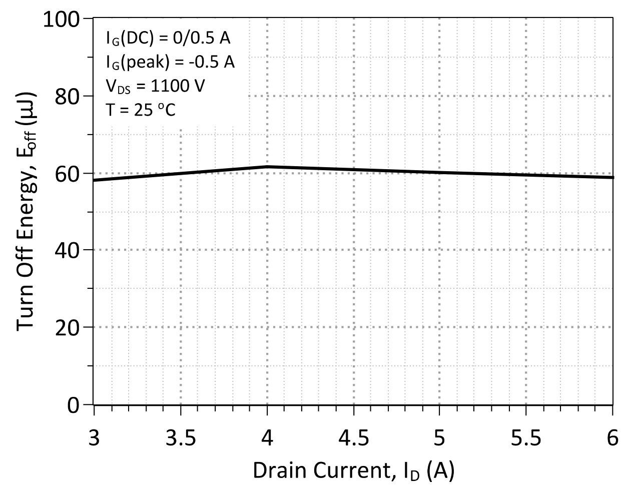


Figure 12: Typical Turn Off Energy Losses vs. Drain Current

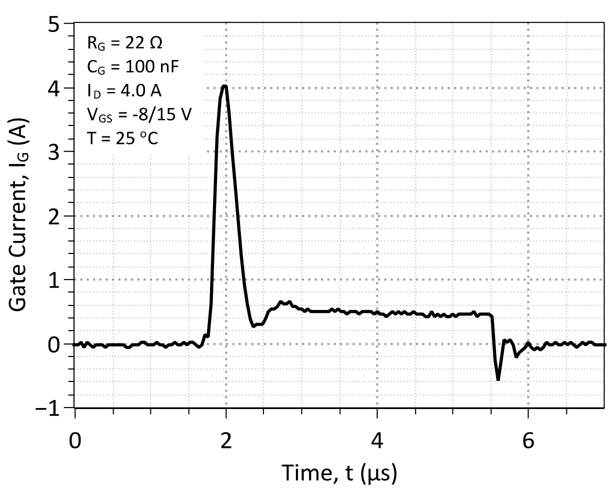


Figure 13: Typical Gate Current Waveform

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.

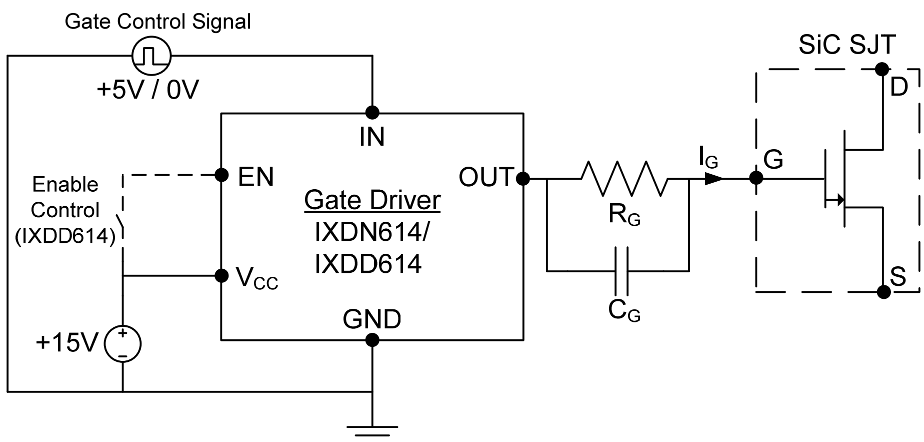
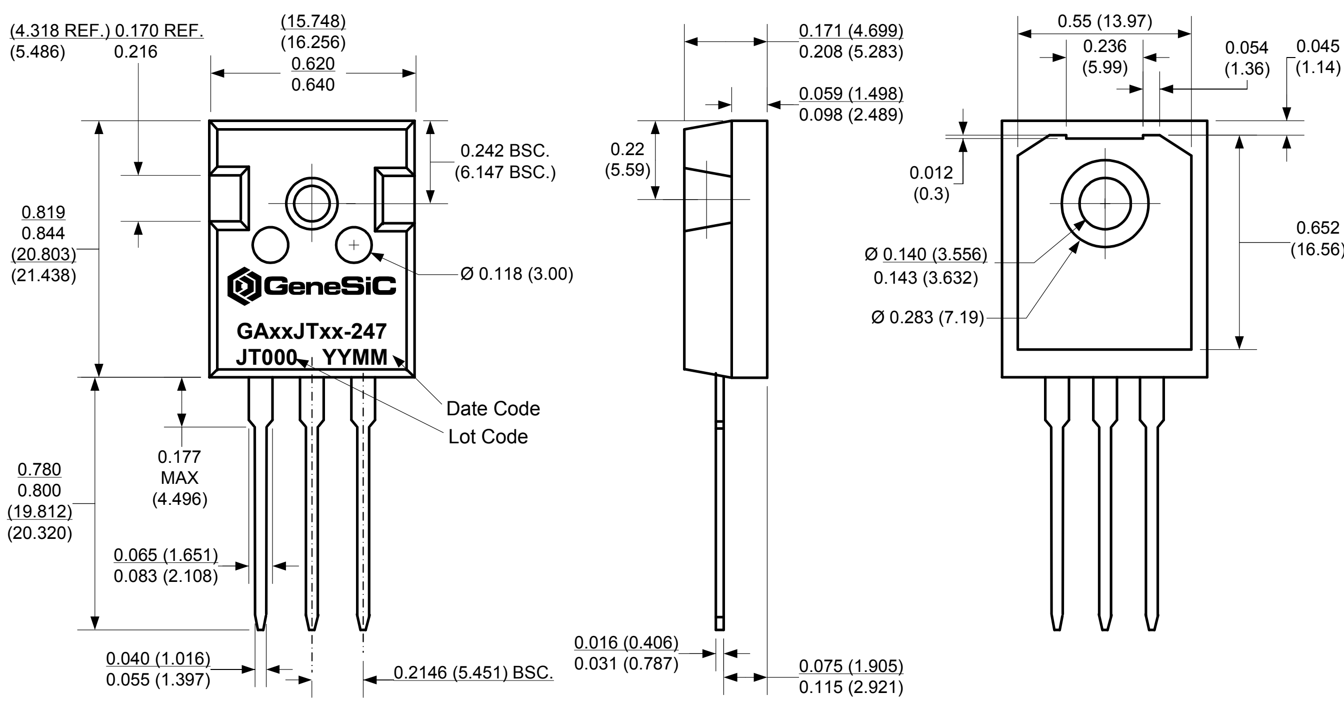


Figure 14: Recommended Gate Diver Configuration (Option #2)

Parameter	Symbol	Conditions	Values min.	Values typ.	Values max.	Unit
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	
2012/12/03	0	Initial release	

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43670 Trade Center Place Suite 155
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Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.