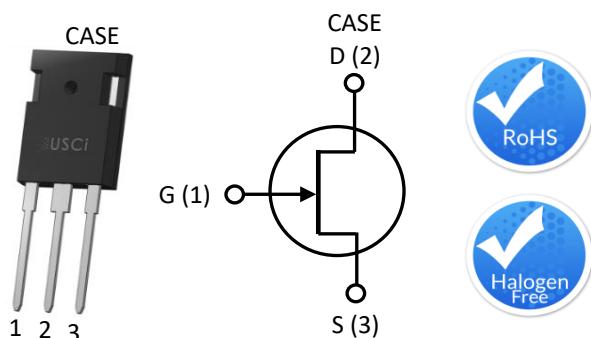


## Description

United Silicon Carbide, Inc offers the high-performance G3 SiC normally-on JFET transistors. This series exhibits ultra-low on resistance ( $R_{DS(ON)}$ ) and gate charge ( $Q_G$ ) allowing for low conduction and switching loss. The device normally-on characteristics with low  $R_{DS(ON)}$  at  $V_{GS} = 0$  V is also ideal for current protection circuits without the need for active control, as well as for cascode operation.



Part Number	Package	Marking
UJ3N120070K3S	TO-247-3L	UJ3N120070K3S

## Features

- ◆ Typical on-resistance  $R_{DS(on),typ}$  of 70mΩ
- ◆ Voltage controlled
- ◆ Maximum operating temperature of 175°C
- ◆ Extremely fast switching not dependent on temperature
- ◆ Low gate charge
- ◆ Low intrinsic capacitance
- ◆ RoHS compliant

## Typical Applications

- ◆ Over current protection circuits
- ◆ DC-AC inverters
- ◆ Switch mode power supplies
- ◆ Power factor correction modules
- ◆ Motor drives
- ◆ Induction heating

## Maximum Ratings

Parameter	Symbol	Test Conditions	Value	Units
Drain-source voltage	$V_{DS}$		1200	V
Gate-source voltage	$V_{GS}$	DC	-20 to +3	V
		AC <sup>(1)</sup>	-20 to +20	
Continuous drain current <sup>(2)</sup>	$I_D$	$T_C = 25^\circ\text{C}$	33.5	A
		$T_C = 100^\circ\text{C}$	24.5	A
Pulsed drain current <sup>(3)</sup>	$I_{DM}$	$T_C = 25^\circ\text{C}$	85	A
Power dissipation	$P_{tot}$	$T_C = 25^\circ\text{C}$	254	W
Maximum junction temperature	$T_{J,max}$		175	°C
Operating and storage temperature	$T_J, T_{STG}$		-55 to 175	°C
Max. lead temperature for soldering, 1/8" from case for 5 seconds	$T_L$		250	°C

(1) +20V AC rating applies for turn-on pulses <200ns applied with external  $R_G > 1\Omega$ .

(2) Limited by  $T_{J,max}$

(3) Pulse width  $t_p$  limited by  $T_{J,max}$

**Electrical Characteristics ( $T_J = +25^\circ\text{C}$  unless otherwise specified)**
**Typical Performance - Static**

Parameter	Symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Drain-source breakdown voltage	$\text{BV}_{\text{DS}}$	$V_{\text{GS}} = -20\text{V}, I_{\text{D}} = 1\text{mA}$	1200			V
Total drain leakage current	$I_{\text{D}}$	$V_{\text{DS}} = 1200\text{V}, V_{\text{GS}} = -20\text{V}, T_J = 25^\circ\text{C}$		5	30	$\mu\text{A}$
		$V_{\text{DS}} = 1200\text{V}, V_{\text{GS}} = -20\text{V}, T_J = 175^\circ\text{C}$		18		
Total gate leakage current	$I_{\text{G}}$	$V_{\text{GS}} = -20\text{V}, T_J = 25^\circ\text{C}$		5	50	$\mu\text{A}$
		$V_{\text{GS}} = -20\text{V}, T_J = 175^\circ\text{C}$		20		
Drain-source on-resistance	$R_{\text{DS(on)}}$	$V_{\text{GS}} = 2\text{V}, I_{\text{D}} = 10\text{A}, T_J = 25^\circ\text{C}$		63		$\text{m}\Omega$
		$V_{\text{GS}} = 0\text{V}, I_{\text{D}} = 10\text{A}, T_J = 25^\circ\text{C}$		70	90	
		$V_{\text{GS}} = 2\text{V}, I_{\text{D}} = 10\text{A}, T_J = 175^\circ\text{C}$		139		
		$V_{\text{GS}} = 0\text{V}, I_{\text{D}} = 10\text{A}, T_J = 175^\circ\text{C}$		154		
Gate threshold voltage	$V_{\text{G(th)}}$	$V_{\text{DS}} = 5\text{V}, I_{\text{D}} = 35\text{mA}$	-14	-11.5	-6	V
Gate resistance	$R_{\text{G}}$	f = 1MHz, open drain		3.3		$\Omega$

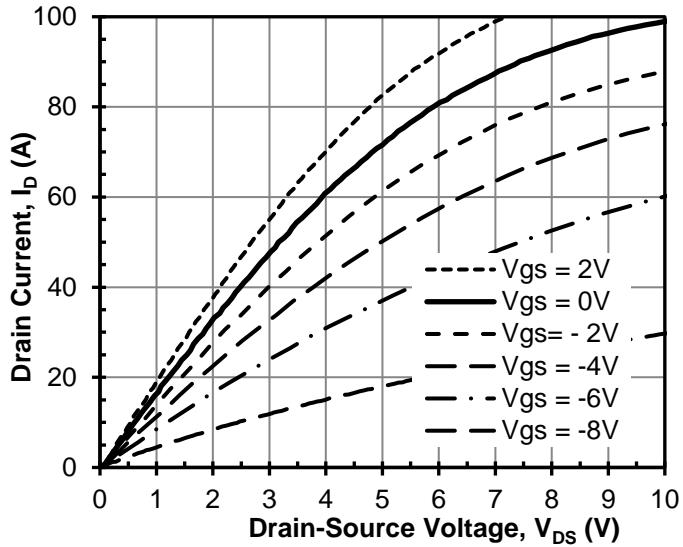
**Typical Performance - Dynamic**

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Input capacitance	$C_{iss}$	$V_{DS} = 100V$ , $V_{GS} = -20V$ , $f = 100kHz$		985		pF
Output capacitance	$C_{oss}$			100		
Reverse transfer capacitance	$C_{rss}$			95		
Effective output capacitance, energy related	$C_{oss(er)}$	$V_{DS} = 0V$ to $800V$ , $V_{GS} = -20V$		52		pF
Total gate charge	$Q_G$	$V_{DS}=800V$ , $I_D = 25A$ , $V_{GS}=-18V$ to $0V$		116		nC
Gate-drain charge	$Q_{GD}$			63		
Gate-source charge	$Q_{GS}$			11		
Turn-on delay time	$t_{d(on)}$	$V_{DS}=800V$ , $I_D=25A$ , Gate Driver =-18V to 0V, $R_{G,EXT} = 1\Omega$ , Inductive Load, FWD: UJ2D1215T $T_J = 25^\circ C$		17		ns
Rise time	$t_r$			25		
Turn-off delay time	$t_{d(off)}$			29		
Fall time	$t_f$			39		
Turn-on energy	$E_{ON}$			434		$\mu J$
Turn-off energy	$E_{OFF}$			393		
Total switching energy	$E_{TOTAL}$			827		
Turn-on delay time	$t_{d(on)}$	$V_{DS}=800V$ , $I_D=25A$ , Gate Driver =-18V to 0V, $R_{G,EXT} = 1\Omega$ , Inductive Load, FWD: UJ2D1215T $T_J = 150^\circ C$		17		ns
Rise time	$t_r$			23		
Turn-off delay time	$t_{d(off)}$			25		
Fall time	$t_f$			24		
Turn-on energy	$E_{ON}$			418		$\mu J$
Turn-off energy	$E_{OFF}$			278		
Total switching energy	$E_{TOTAL}$			696		

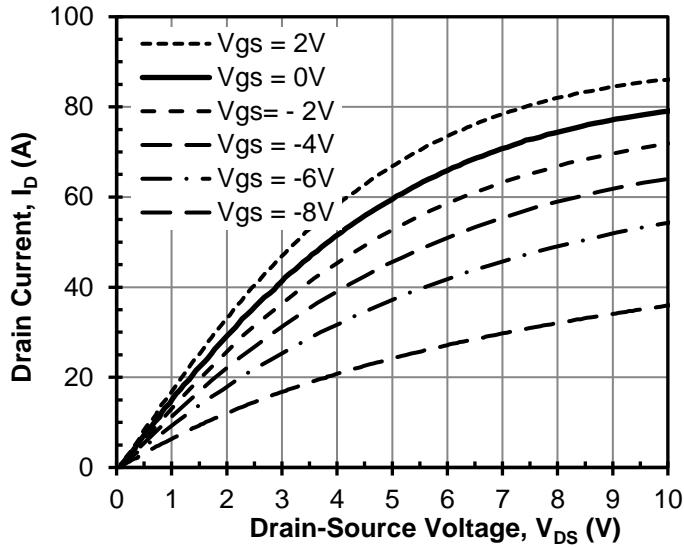
**Thermal Characteristics**

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Thermal resistance, junction-to-case	$R_{0JC}$			0.45	0.59	°C/W

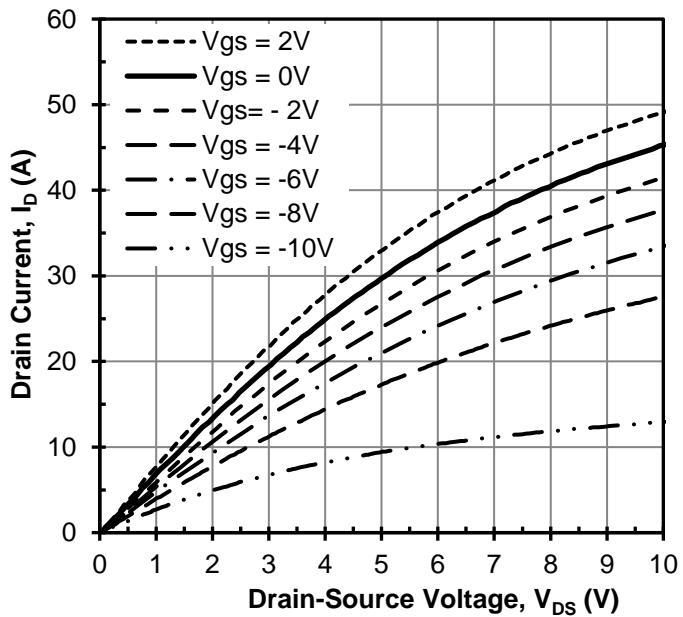
### Typical Performance Diagrams



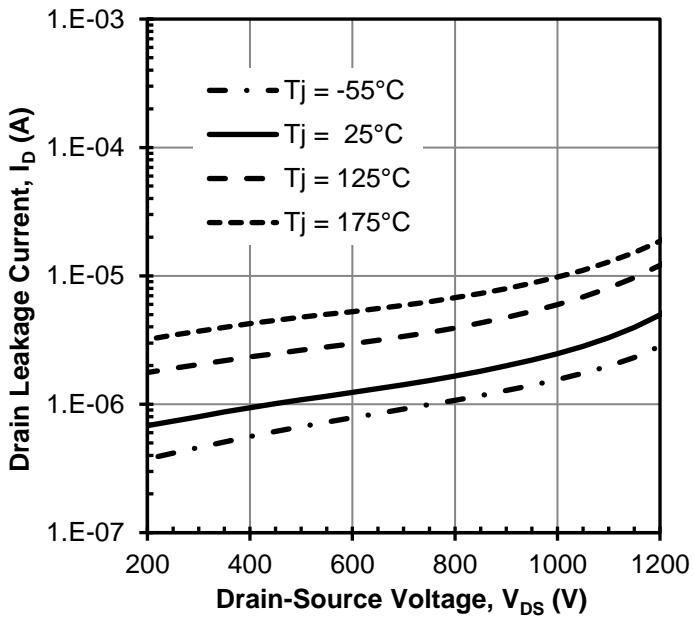
**Figure 1** Typical output characteristics  
at  $T_J = -55^\circ\text{C}$



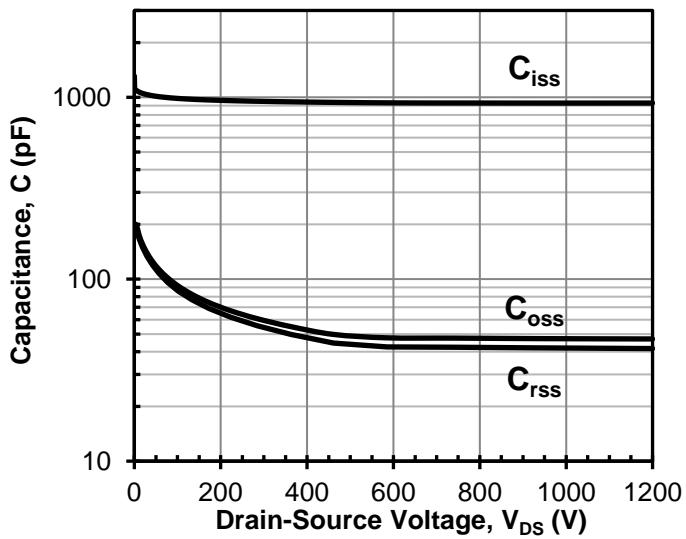
**Figure 2** Typical output characteristics  
at  $T_J = 25^\circ\text{C}$



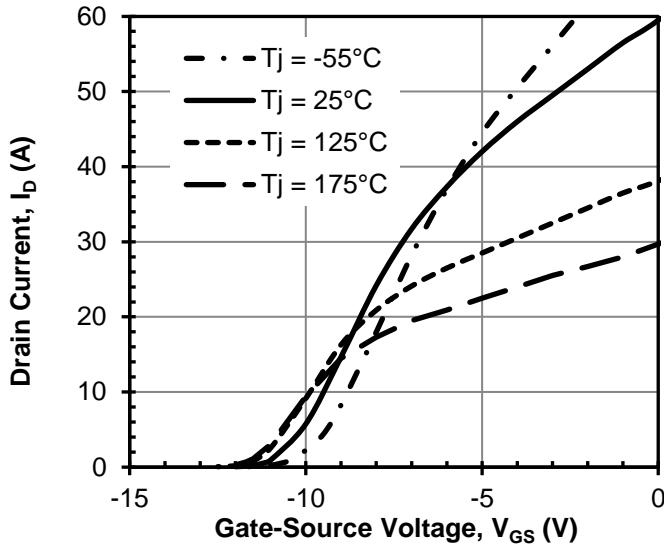
**Figure 3** Typical output characteristics  
at  $T_J = 175^\circ\text{C}$



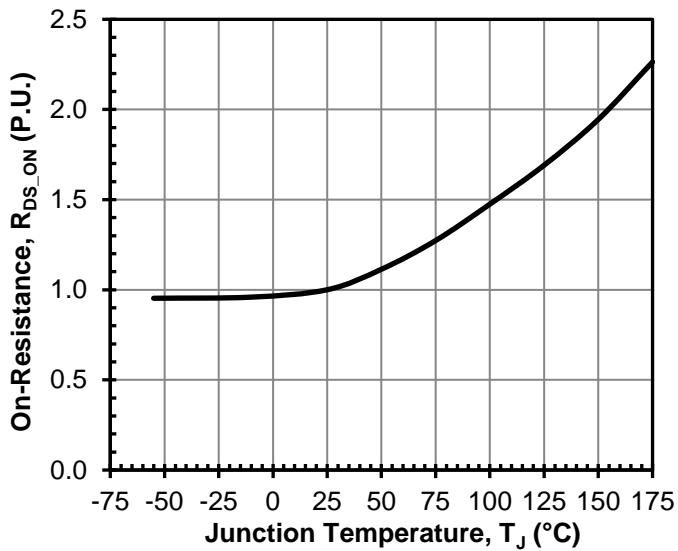
**Figure 4** Typical drain-source leakage  
at  $V_{GS} = -20\text{V}$



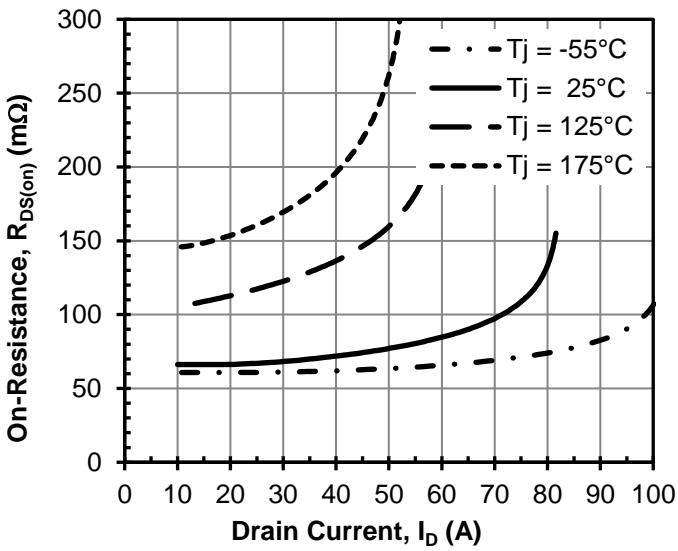
**Figure 5** Typical capacitances at 100kHz  
and  $V_{GS} = -20V$



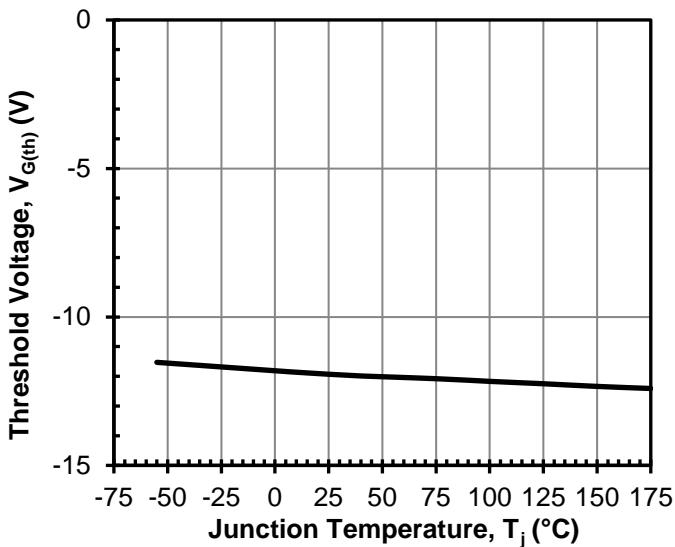
**Figure 6** Typical transfer characteristics  
at  $V_{DS} = 5V$



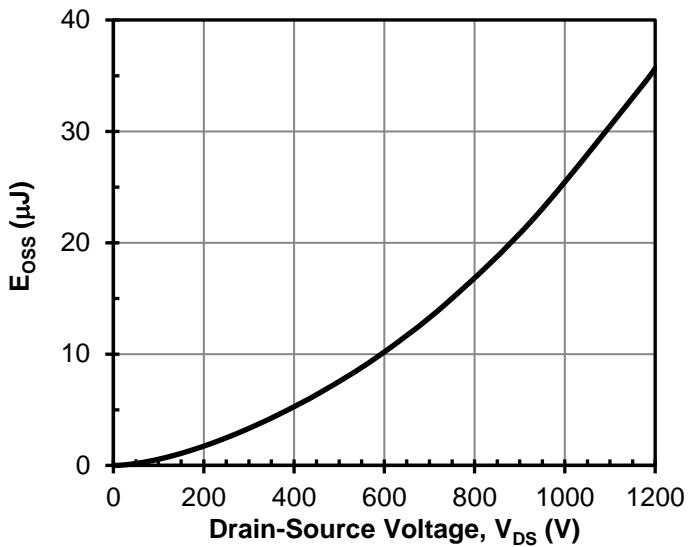
**Figure 7** Normalized on-resistance vs.  
temperature at  $V_{GS} = 0V$  and  $I_D = 10A$



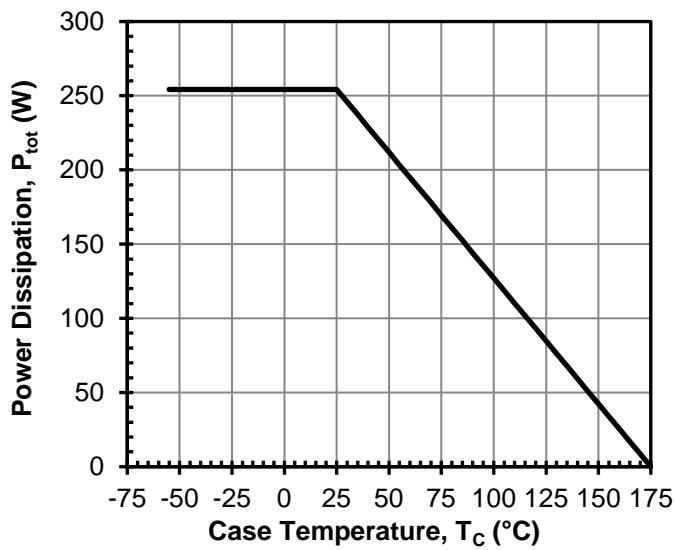
**Figure 8** Typical drain-source  
on-resistance at  $V_{GS} = 0V$



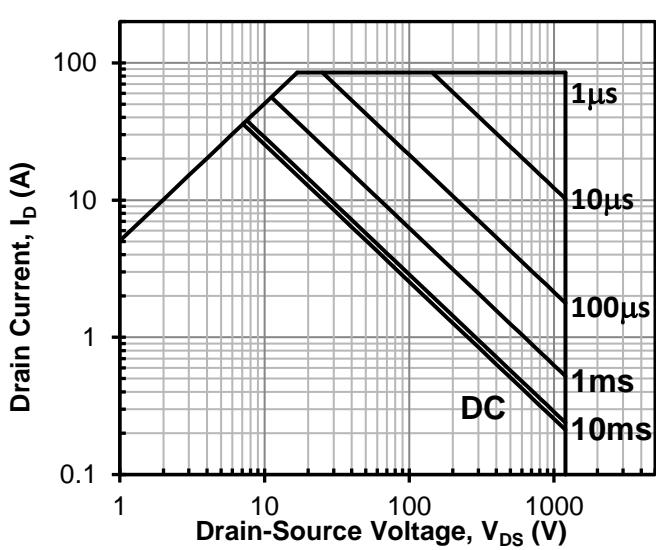
**Figure 9 Threshold voltage vs.  $T_j$   
at  $V_{DS} = 5V$  and  $I_D = 35mA$**



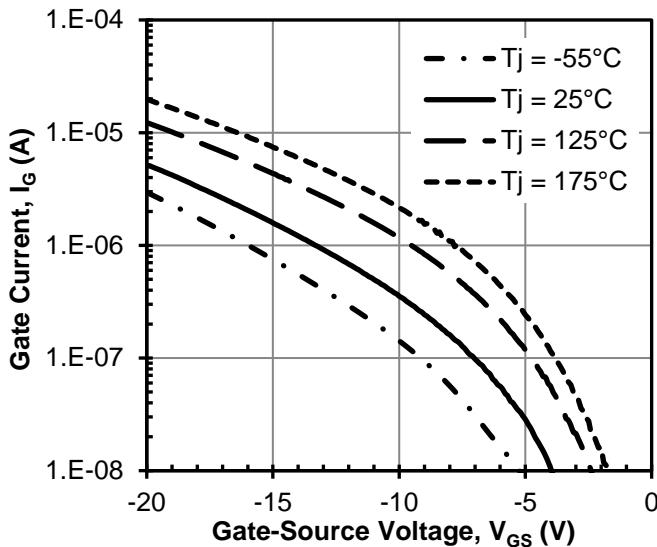
**Figure 10 Typical stored energy in  $C_{oss}$   
at  $V_{GS} = -20V$**



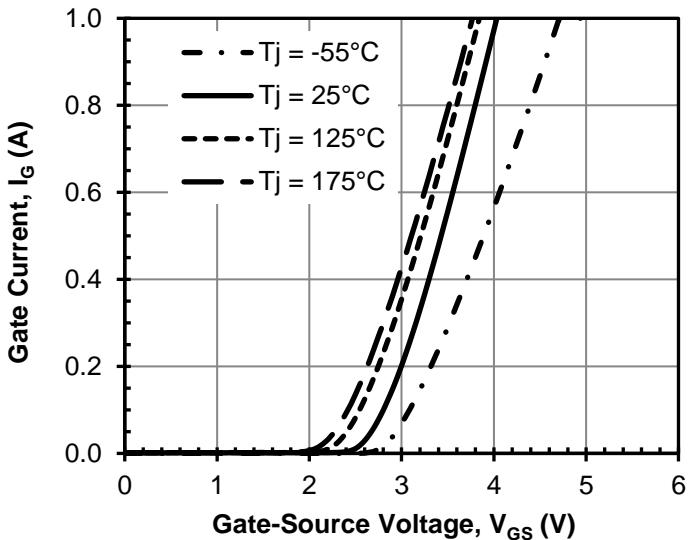
**Figure 11 Total power Dissipation**



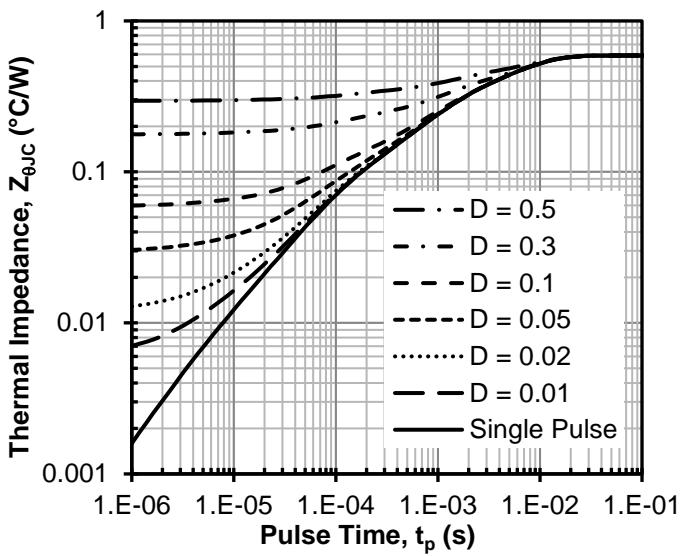
**Figure 12 Safe operation area  
 $T_c = 25^{\circ}C$ , Parameter  $t_p$**



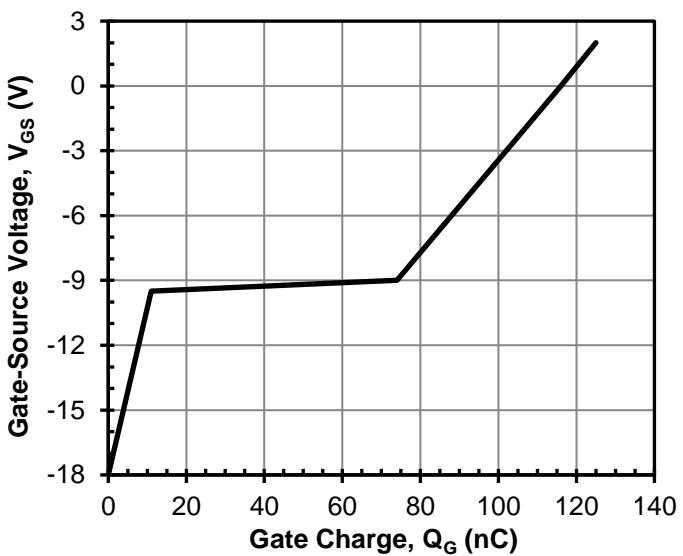
**Figure 13** Typical gate leakage current  
at  $V_{DS} = 0V$



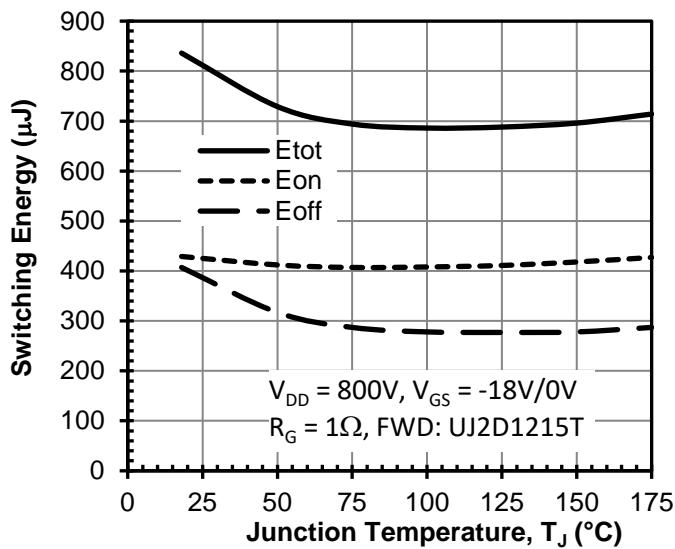
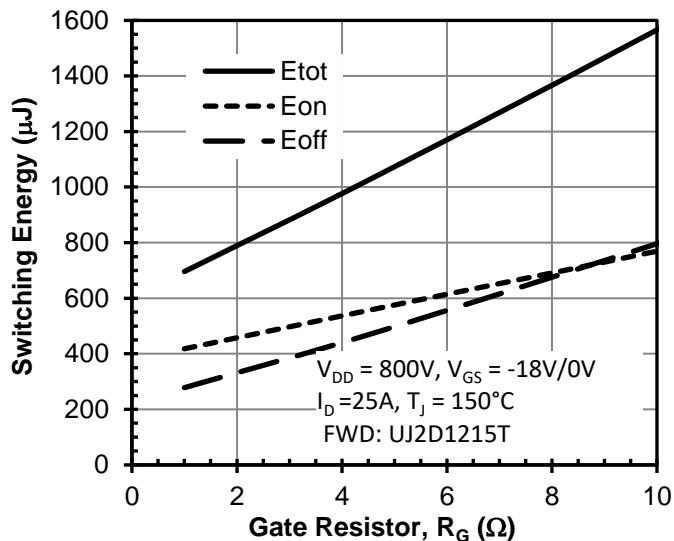
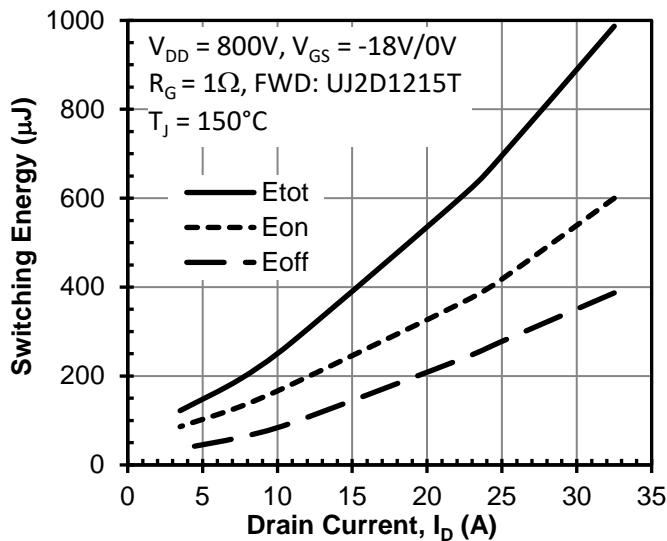
**Figure 14** Typical gate forward current  
at  $V_{DS} = 0V$



**Figure 15** Maximum transient  
thermal impedance



**Figure 16** Typical gate charge  
at  $V_{DS} = 800V$  and  $I_D = 25A$



**Figure 19** Clamped inductive switching energy vs. junction temperature at  $I_D = 25\text{A}$

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#### Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: [org@eplast1.ru](mailto:org@eplast1.ru)

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.