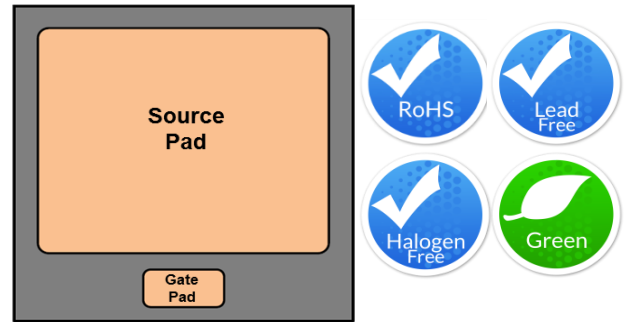


## Description

United Silicon Carbide, Inc offers the xJ series of high-performance 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  $V_{GS} = 0\text{ V}$  is also ideal for current protection circuits without the need for active control, as well as for cascode operation.



Part Number	Package
UJN1205Z	Die

## Features

- ◆ Low On-Resistance  $R_{DS(on)max}$  of 0.045Ω
- ◆ 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>	$I_D$	$T_C = 25^\circ\text{C}$	38	A
		$T_C = 125^\circ\text{C}$	23	A
Pulsed drain current <sup>(2)</sup>	$I_{DM}$	$T_j = 125^\circ\text{C}$	80	A
		$T_j = 175^\circ\text{C}$	55	
Operating and storage temperature	$T_J, T_{STG}$		-55 to 175	°C

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

(2) Assumes a maximum junction-to-case thermal resistance of 0.65°C/W

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

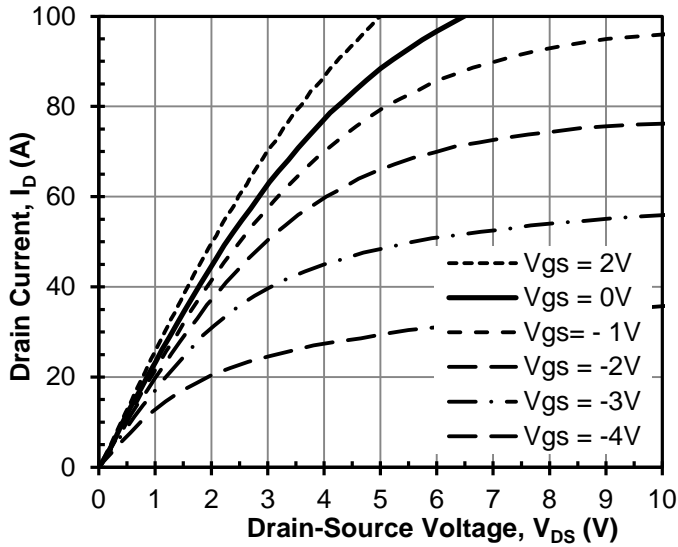
**Typical Performance - Static**

Parameter	Symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Drain-source breakdown voltage	$BV_{DS}$	$V_{GS} = -20V, I_D = 1mA$	1200			V
Total drain leakage current	$I_D$	$V_{DS} = 1200V,$ $V_{GS} = -20V, T_J = 25^\circ\text{C}$		10	800	$\mu\text{A}$
		$V_{DS} = 1200V,$ $V_{GS} = -20V, T_J = 175^\circ\text{C}$		30	2400	
Total gate leakage current	$I_G$	$V_{GS} = -20V, T_J = 25^\circ\text{C}$		1	250	$\mu\text{A}$
		$V_{GS} = -20V, T_J = 175^\circ\text{C}$		10		
Drain-source on-resistance	$R_{DS(on)}$	$V_{GS} = 2V, I_D = 20A,$ $T_J = 25^\circ\text{C}$		35	45	$\text{m}\Omega$
		$V_{GS} = 0V, I_D = 20A,$ $T_J = 25^\circ\text{C}$		42	55	
		$V_{GS} = 2V, I_D = 20A,$ $T_J = 175^\circ\text{C}$		105	135	
		$V_{GS} = 0V, I_D = 20A,$ $T_J = 175^\circ\text{C}$		135	165	
Gate threshold voltage	$V_{G(th)}$	$V_{DS} = 5V, I_D = 70mA$	-10	-6	-4	V
Gate Resistance	$R_G$	$V_{GS} = 0V, f = 1MHz$		5		$\Omega$

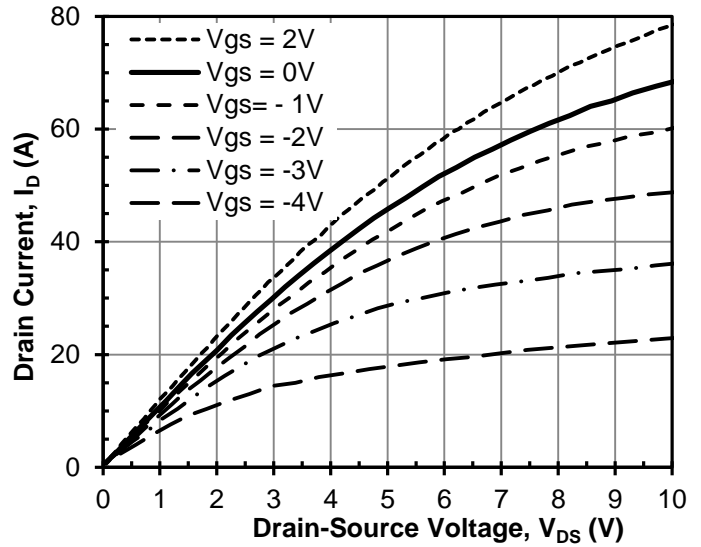
**Typical Performance - Dynamic** (Refer to the datasheet of the packaged device UJN1205K)

Parameter	symbol	Test Conditions	Value			Units	
			Min	Typ	Max		
Input capacitance	$C_{iss}$	$V_{DS} = 100V,$ $V_{GS} = -20V,$ $f = 100kHz$		1020		pF	
Output capacitance	$C_{oss}$			154			
Reverse transfer capacitance	$C_{rss}$			146			
Effective output capacitance, energy related	$C_{oss(er)}$	$V_{DS} = 0V$ to 600V, $V_{GS} = -20V$		91		pF	
Total gate charge	$Q_G$	$V_{DS}=600V, I_D = 30A,$ $V_{GS}=-15V$ to 2.5V		107		nC	
Gate-drain charge	$Q_{GD}$			74			
Gate-source charge	$Q_{GS}$			10			
Turn-on delay time	$t_{d(on)}$	$V_{DS}=600V, I_D=30A,$ Gate Driver =-15V to +5V, $R_{G,EXT} = 2.5\Omega,$ Inductive Load, $T_J = 25^\circ C$		30		ns	
Rise time	$t_r$			28			
Turn-off delay time	$t_{d(off)}$			32			
Fall time	$t_f$			35		$\mu J$	
Turn-on energy	$E_{ON}$			467			
Turn-off energy	$E_{OFF}$			515			
Total switching energy	$E_{TOTAL}$			982			
Turn-on delay time	$t_{d(on)}$		$V_{DS}=600V, I_D=30A,$ Gate Driver =-15V to +5V, $R_{G,EXT} = 2.5\Omega,$ Inductive Load, $T_J = 150^\circ C$		32		ns
Rise time	$t_r$				30		
Turn-off delay time	$t_{d(off)}$			32			
Fall time	$t_f$			33		$\mu J$	
Turn-on energy	$E_{ON}$			512			
Turn-off energy	$E_{OFF}$			448			
Total switching energy	$E_{TOTAL}$			960			

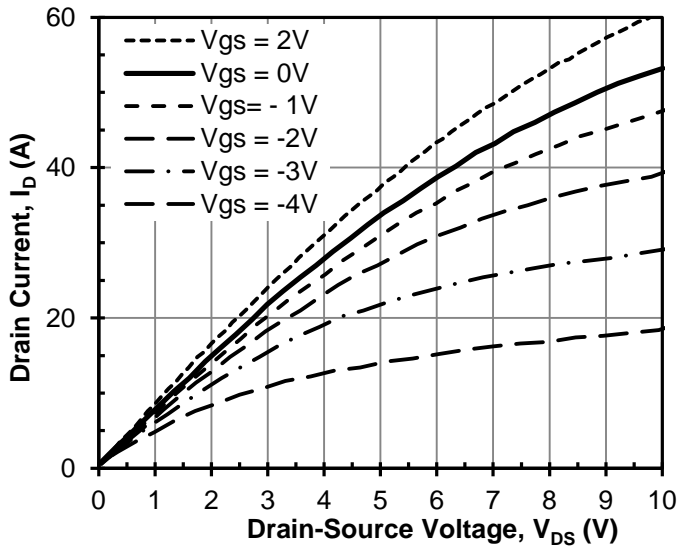
**Typical Performance Diagrams**



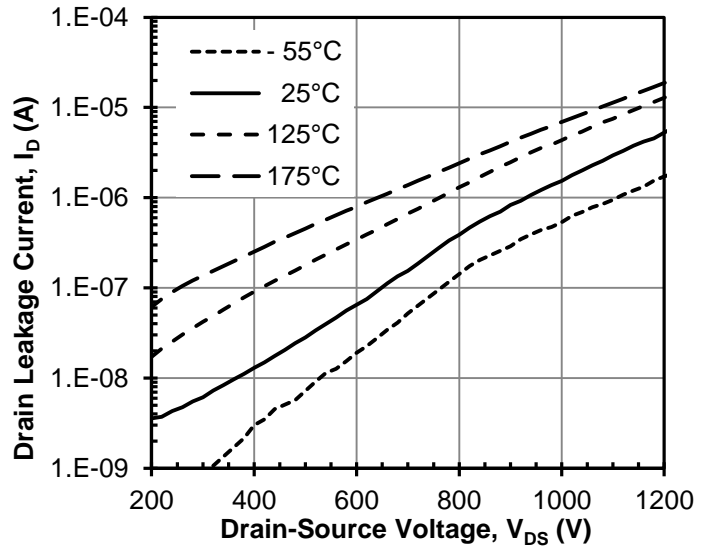
**Figure 1 Typical output characteristics at  $T_j = 25^\circ\text{C}$**



**Figure 2 Typical output characteristics at  $T_j = 125^\circ\text{C}$**



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



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

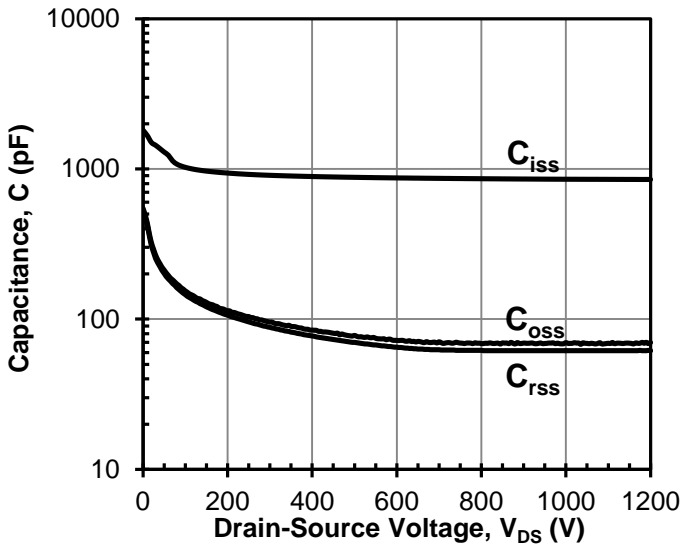


Figure 5 Typical capacitances at 100kHz at  $V_{GS} = -20V$

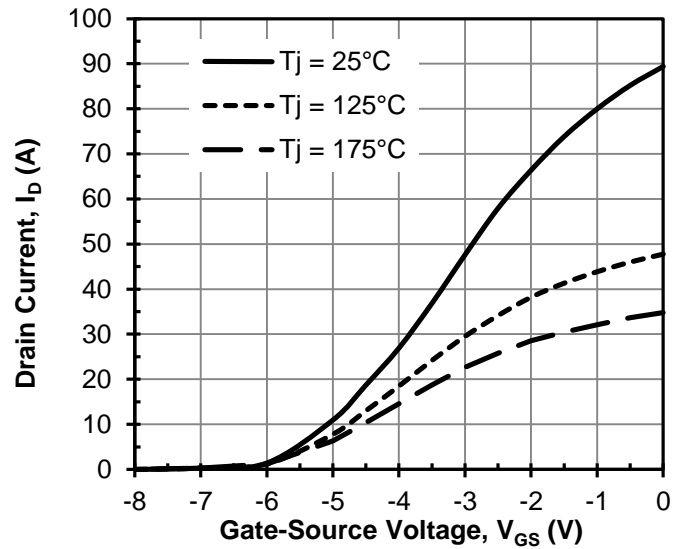


Figure 6 Typical transfer characteristics at  $V_{DS} = 5V$

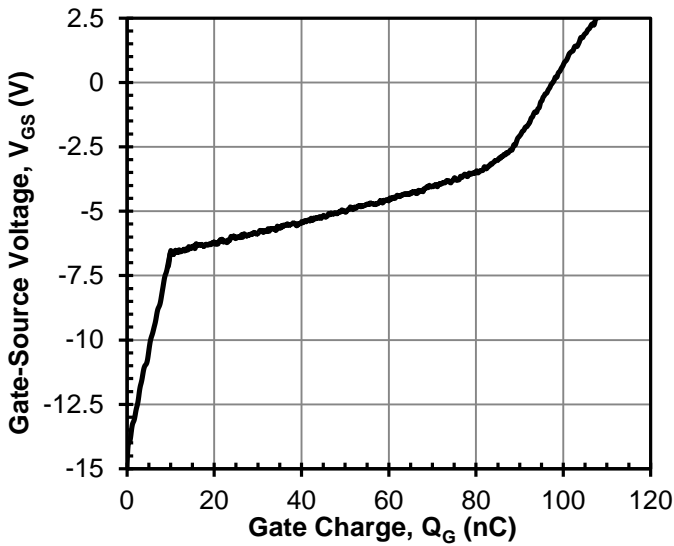


Figure 7 Typical gate charge at  $V_{DS} = 600V$  and  $I_D = 30A$

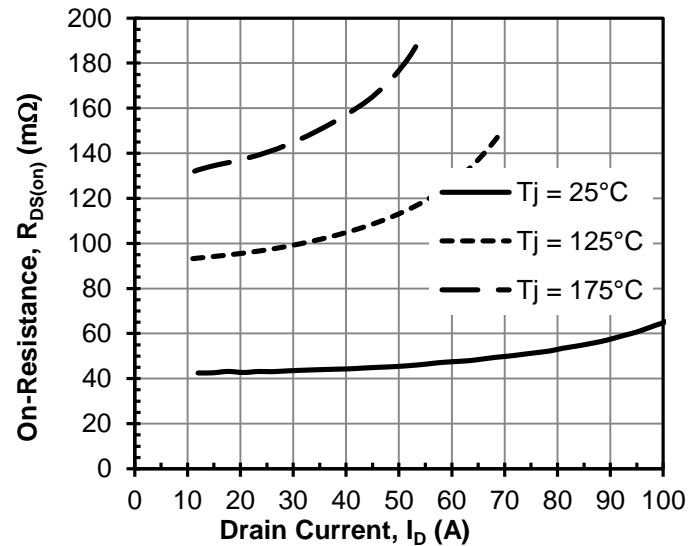


Figure 8 Typical drain-source on-resistance at  $V_{GS} = 0V$

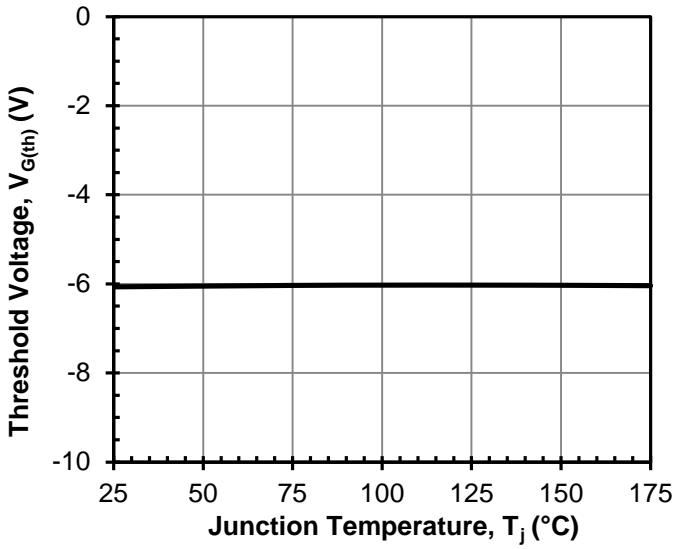


Figure 9 Threshold voltage vs.  $T_j$   
at  $V_{DS} = 5V$  and  $I_D = 70mA$

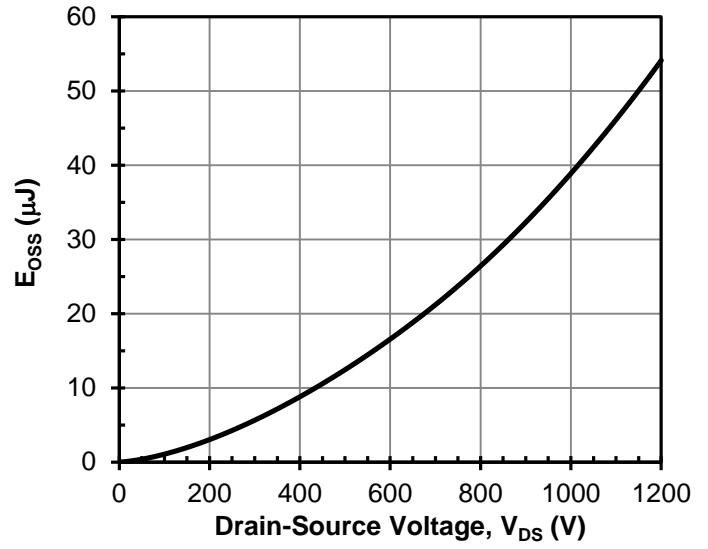


Figure 10 Typical stored energy in  $C_{oss}$   
at  $V_{GS} = -20V$

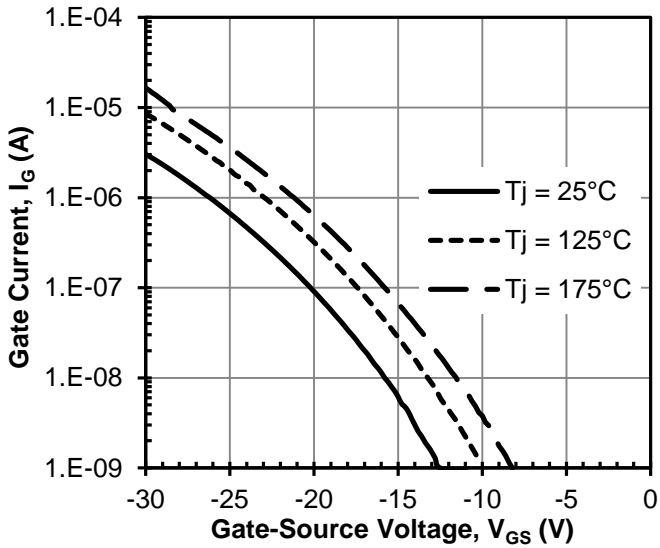


Figure 11 Typical gate leakage current  
at  $V_{DS} = 0V$

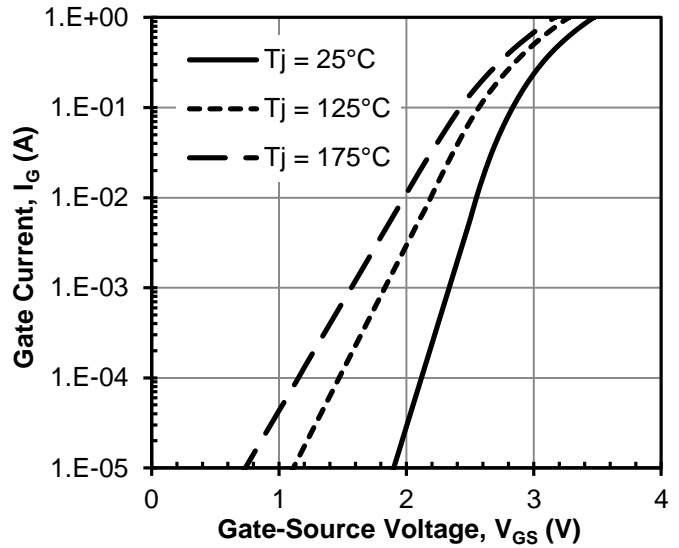
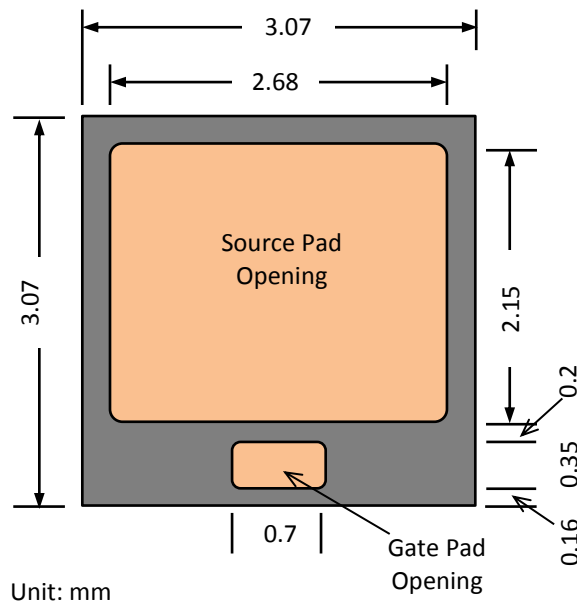


Figure 12 Typical gate forward current  
at  $V_{DS} = 0V$

### Mechanical Characteristics

Parameter	Typical Value	Units
Die Dimensions (L x W)	3.07 x 3.07	mm
Source Pad Metal Dimensions (L x W)	2.68 x 2.15	mm
Gate Pad Metal Dimensions (L x W)	0.7 x 0.35	mm
Source Metallization (Al)	5	μm
Gate Metallization (Al)	5	μm
Backside Drain Metallization (Ti/Ni/Au)	0.07/0.1/0.1	μm
Die Thickness	150	μm

### Chip Dimensions



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