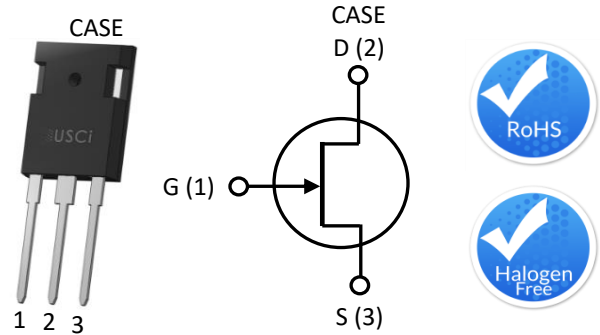


Description

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 $V_{GS} = 0\text{ V}$ is also ideal for current protection circuits without the need for active control, as well as for cascode operation.



Part Number	Package	Marking
UJ3N120035K3S	TO-247-3L	UJ3N120035K3S

Features

- ◆ Typical on-resistance $R_{DS(on),typ}$ of 35mΩ
- ◆ 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 ⁽¹⁾	-20 to +20	
Continuous drain current ⁽²⁾	I_D	$T_C = 25^\circ\text{C}$	63	A
		$T_C = 100^\circ\text{C}$	46	A
Pulsed drain current ⁽³⁾	I_{DM}	$T_C = 25^\circ\text{C}$	185	A
Power dissipation	P_{tot}	$T_C = 25^\circ\text{C}$	429	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	BV_{DS}	$V_{GS} = -20\text{V}, I_D = 1\text{mA}$	1200			V
Total drain leakage current	I_D	$V_{DS} = 1200\text{V}, V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$		10	60	μA
		$V_{DS} = 1200\text{V}, V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$		35		
Total gate leakage current	I_G	$V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$		12	100	μA
		$V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$		50		
Drain-source on-resistance	$R_{DS(on)}$	$V_{GS} = 2\text{V}, I_D = 20\text{A}, T_J = 25^\circ\text{C}$		31		mΩ
		$V_{GS} = 0\text{V}, I_D = 20\text{A}, T_J = 25^\circ\text{C}$		35	45	
		$V_{GS} = 2\text{V}, I_D = 20\text{A}, T_J = 175^\circ\text{C}$		68		
		$V_{GS} = 0\text{V}, I_D = 20\text{A}, T_J = 175^\circ\text{C}$		76		
Gate threshold voltage	$V_{G(th)}$	$V_{DS} = 5\text{V}, I_D = 70\text{mA}$	-14	-11.5	-6	V
Gate resistance	R_G	$f = 1\text{MHz}, \text{open drain}$		2.4		Ω

Typical Performance - Dynamic

Parameter	symbol	Test Conditions	Value			Units	
			Min	Typ	Max		
Input capacitance	C_{iss}	$V_{DS} = 100V,$ $V_{GS} = -20V,$ $f = 100kHz$		2145		pF	
Output capacitance	C_{oss}			180			
Reverse transfer capacitance	C_{rss}			172			
Effective output capacitance, energy related	$C_{oss(er)}$	$V_{DS} = 0V$ to 800V, $V_{GS} = -20V$		105		pF	
Total gate charge	Q_G	$V_{DS}=800V, I_D = 40A,$ $V_{GS}=-18V$ to 0V		235		nC	
Gate-drain charge	Q_{GD}			130			
Gate-source charge	Q_{GS}			25			
Turn-on delay time	$t_{d(on)}$	$V_{DS}=800V, I_D=40A,$ Gate Driver = -18V to 0V, $R_{G,EXT} = 1\Omega,$ Inductive Load, FWD: UJ3D1220KSD $T_J = 25^\circ C$		25		ns	
Rise time	t_r			37			
Turn-off delay time	$t_{d(off)}$			48			
Fall time	t_f			39			
Turn-on energy	E_{ON}			935			μJ
Turn-off energy	E_{OFF}			828			
Total switching energy	E_{TOTAL}		1763				
Turn-on delay time	$t_{d(on)}$	$V_{DS}=800V, I_D=40A,$ Gate Driver = -18V to 0V, $R_{G,EXT} = 1\Omega,$ Inductive Load, FWD: UJ3D1220KSD $T_J = 150^\circ C$		24		ns	
Rise time	t_r			35			
Turn-off delay time	$t_{d(off)}$			43			
Fall time	t_f			37			
Turn-on energy	E_{ON}			880			μJ
Turn-off energy	E_{OFF}			800			
Total switching energy	E_{TOTAL}		1680				

Thermal Characteristics

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Thermal resistance, junction-to-case	$R_{\theta JC}$			0.27	0.35	$^\circ C/W$

Typical Performance Diagrams

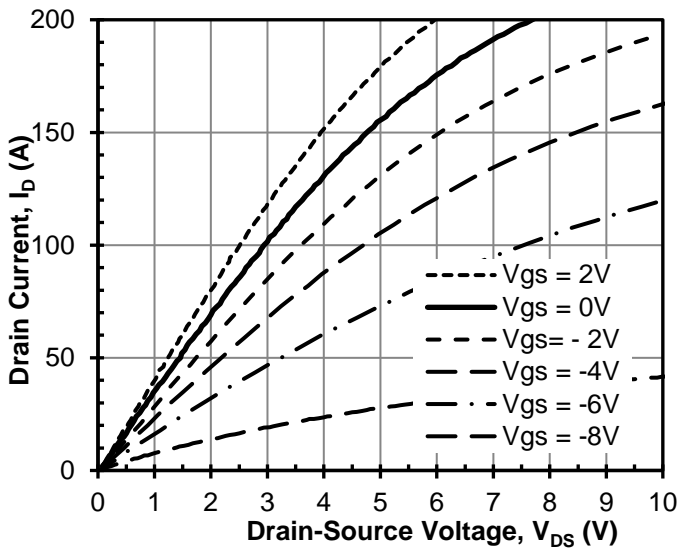


Figure 1 Typical output characteristics at $T_J = -55^\circ\text{C}$

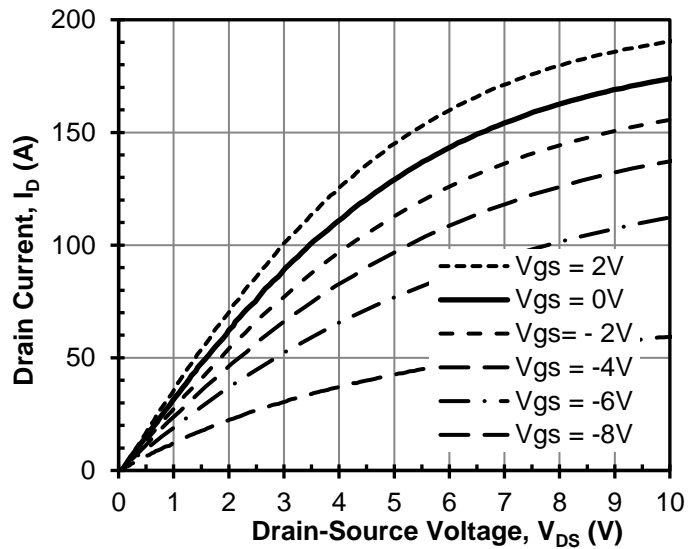


Figure 2 Typical output characteristics at $T_J = 25^\circ\text{C}$

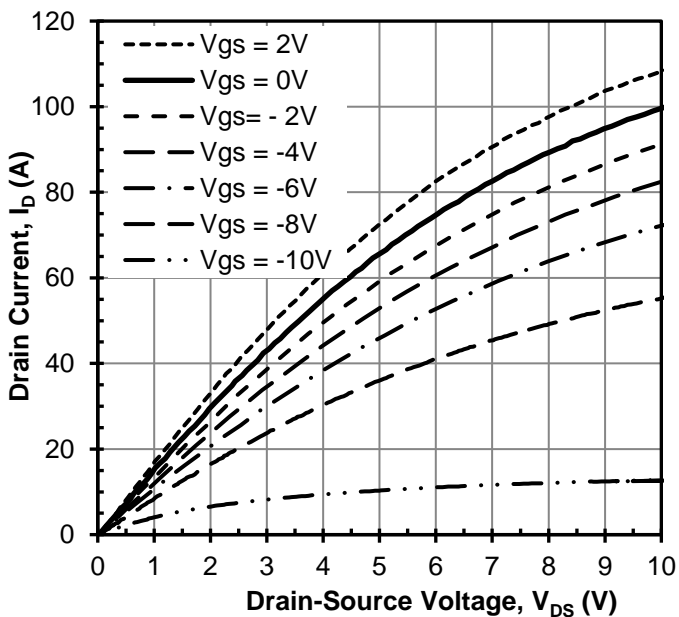


Figure 3 Typical output characteristics at $T_J = 175^\circ\text{C}$

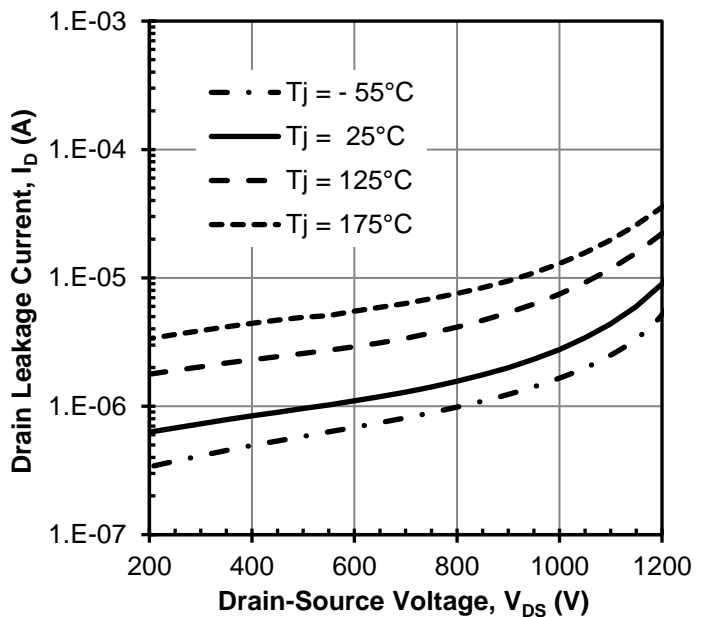


Figure 4 Typical drain-source leakage at $V_{GS} = -20\text{V}$

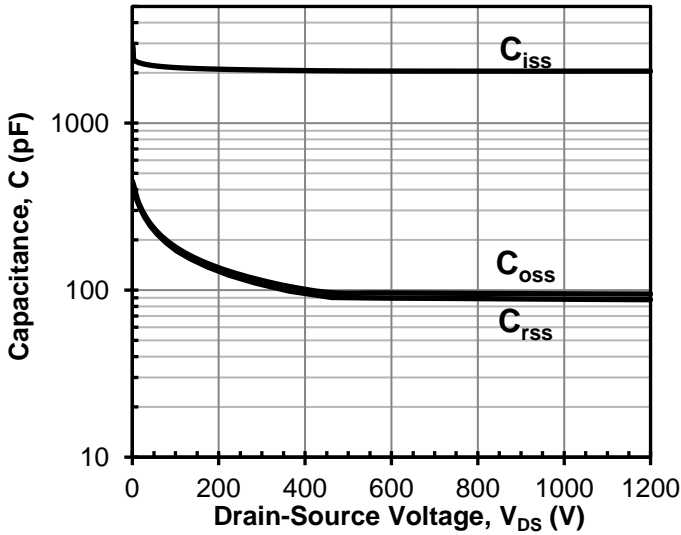


Figure 5 Typical capacitances at 100kHz and $V_{GS} = -20V$

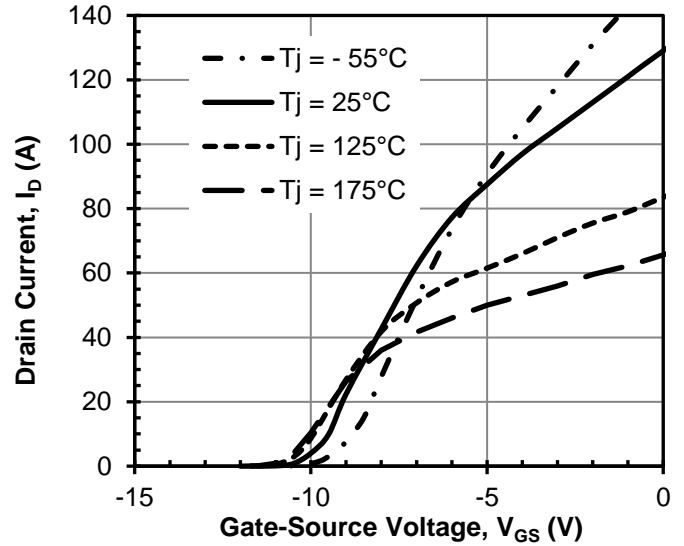


Figure 6 Typical transfer characteristics at $V_{DS} = 5V$

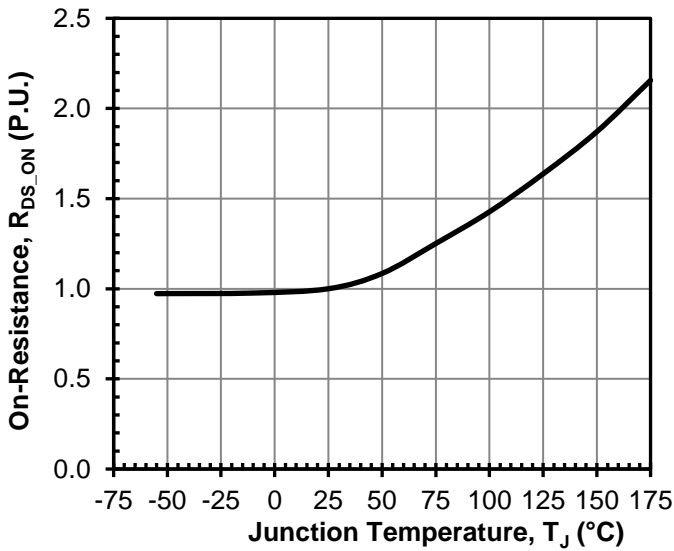


Figure 7 Normalized on-resistance vs. temperature at $V_{GS} = 0V$ and $I_D = 20A$

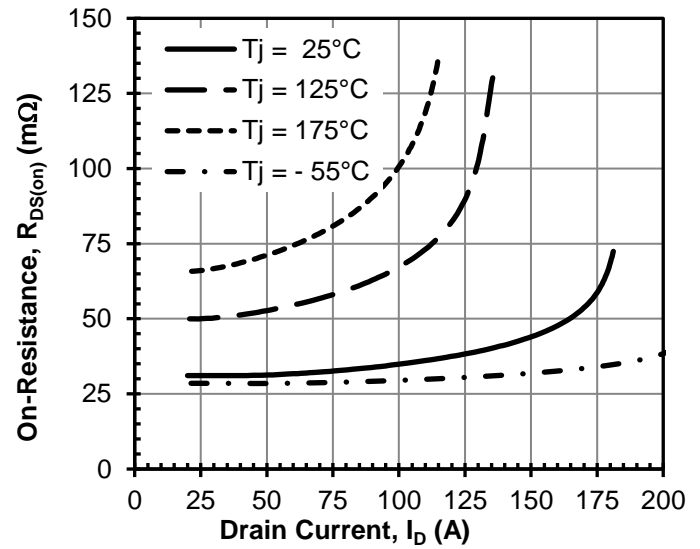


Figure 8 Typical drain-source on-resistance at $V_{GS} = 0V$

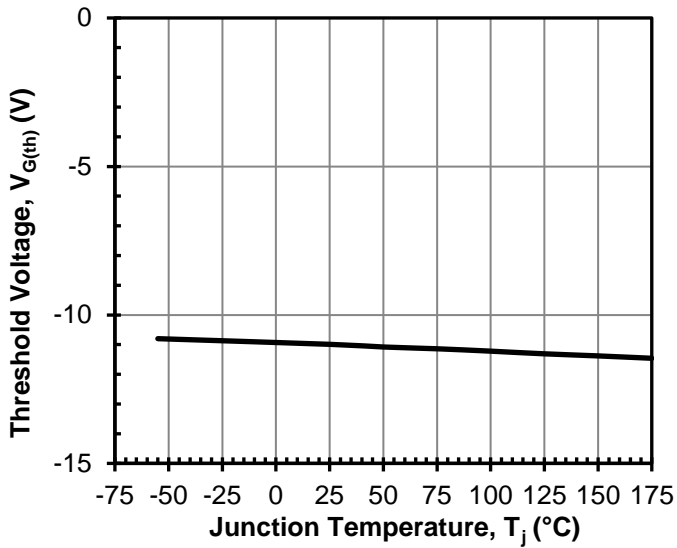


Figure 9 Threshold voltage vs. T_j
at $V_{DS} = 5V$ and $I_D = 70mA$

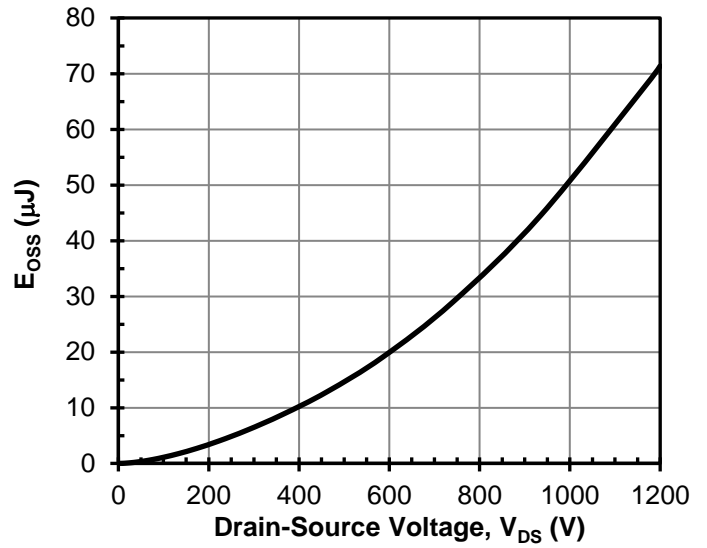


Figure 10 Typical stored energy in C_{oss}
at $V_{GS} = -20V$

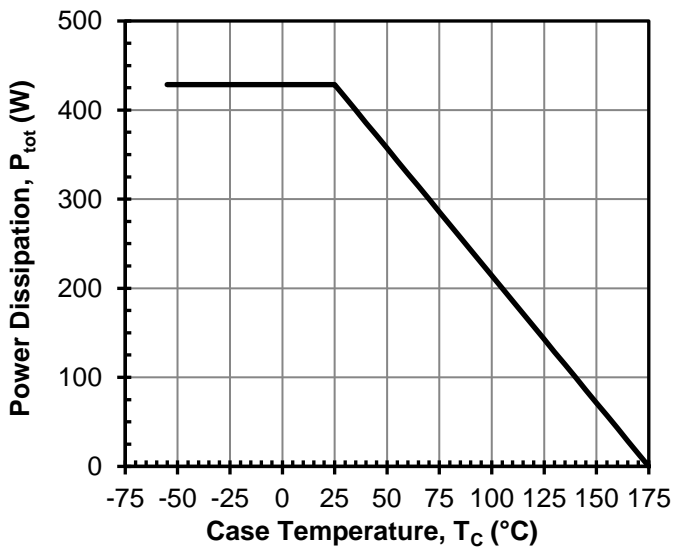


Figure 11 Total power Dissipation

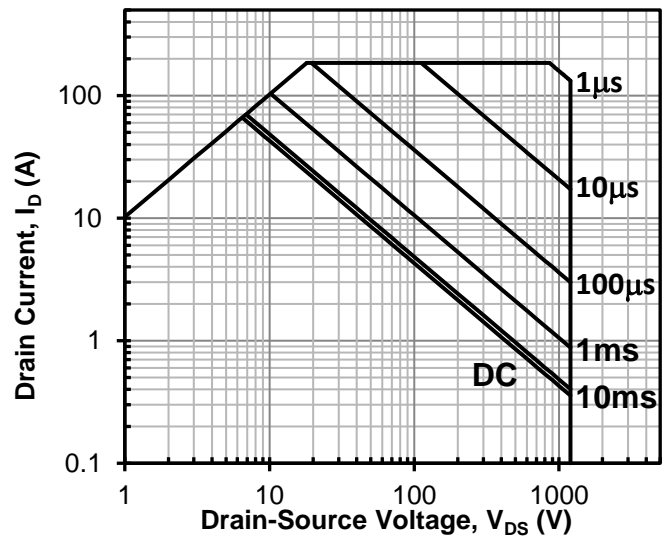


Figure 12 Safe operation area
 $T_c = 25^\circ C$, Parameter t_p

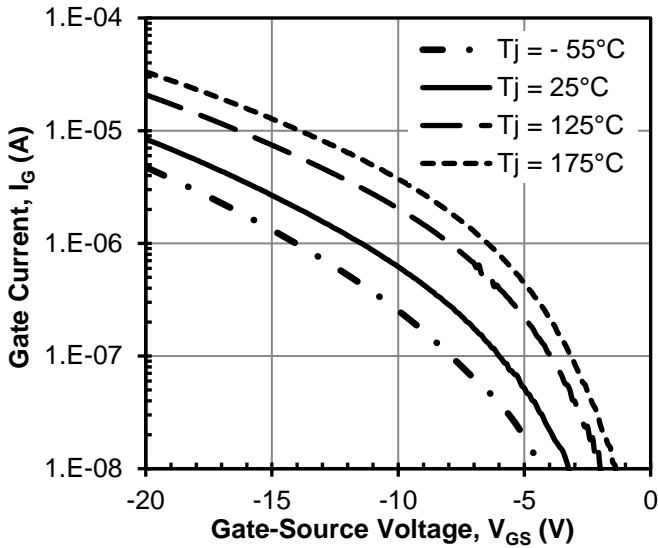


Figure 13 Typical gate leakage current at $V_{DS} = 0V$

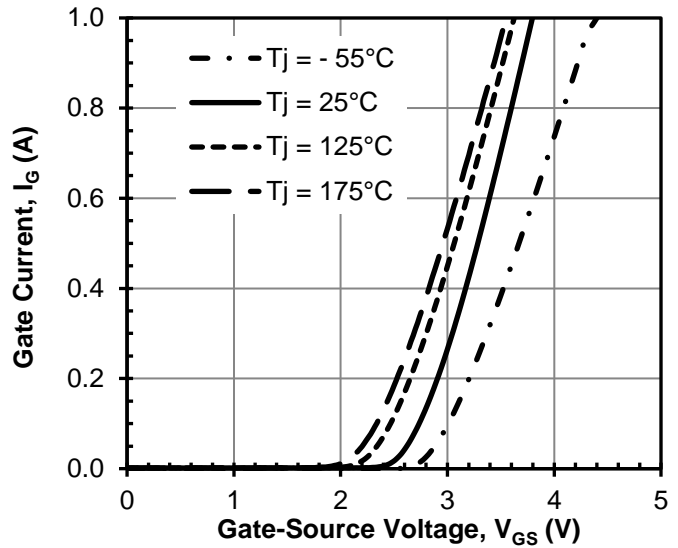


Figure 14 Typical gate forward current at $V_{DS} = 0V$

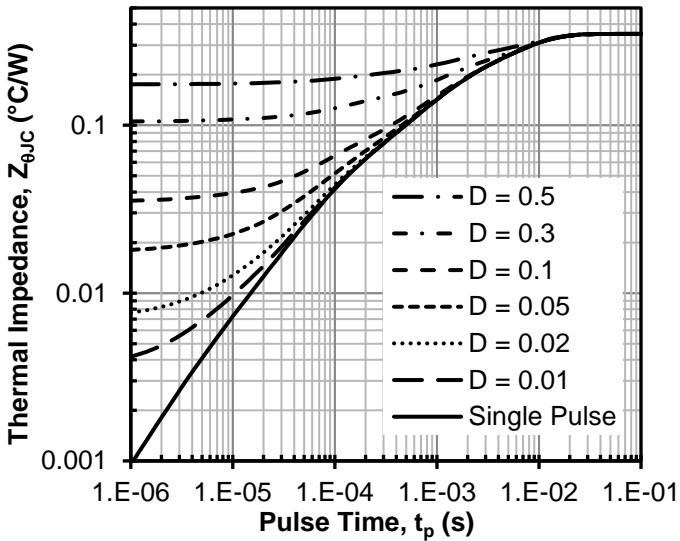


Figure 15 Maximum transient thermal impedance

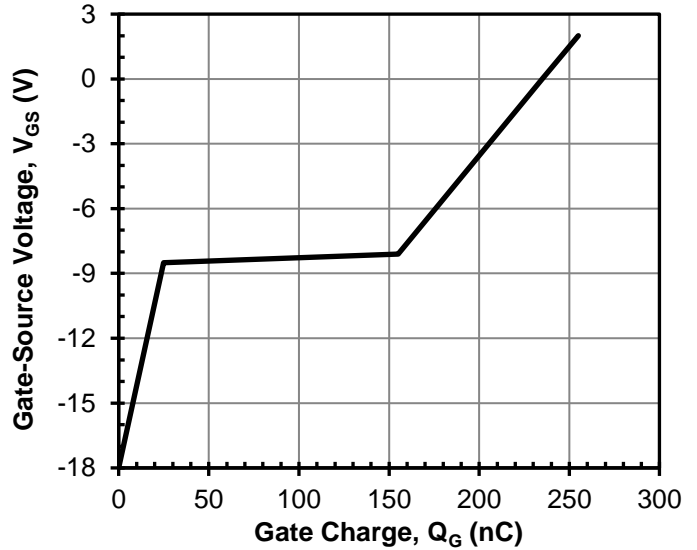


Figure 16 Typical gate charge at $V_{DS} = 800V$ and $I_D = 40A$

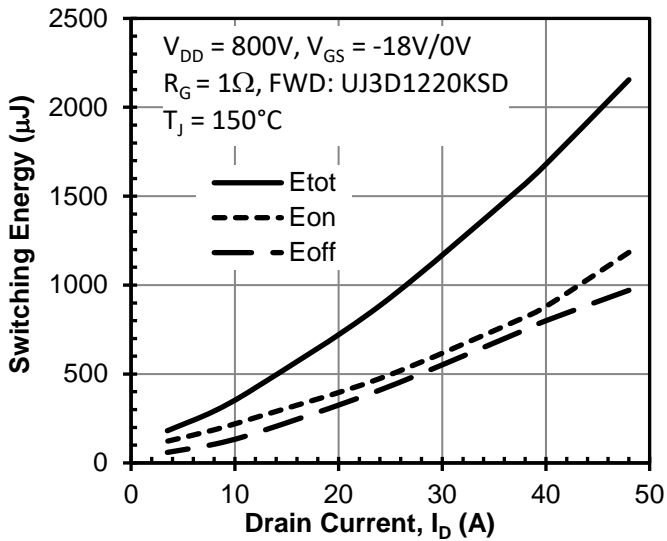


Figure 17 Clamped inductive switching energy vs. drain current at $T_J = 150^\circ\text{C}$

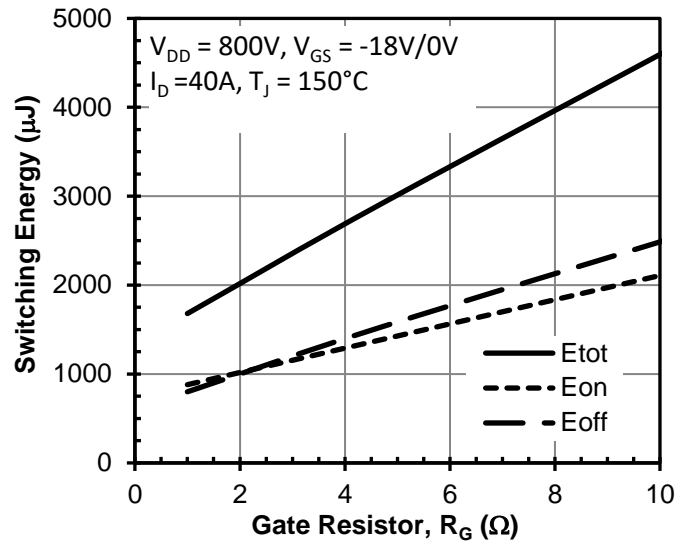


Figure 18 Clamped inductive switching turn-off energy vs. gate resistor R_G

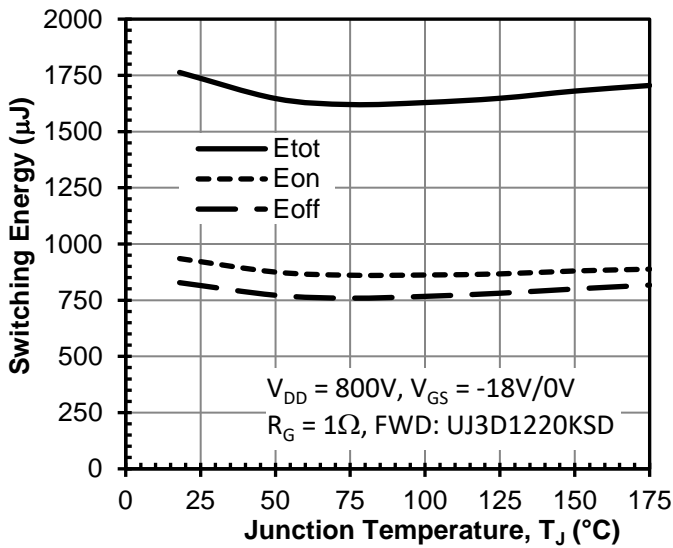


Figure 19 Clamped inductive switching energy vs. junction temperature at $I_D = 40A$

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