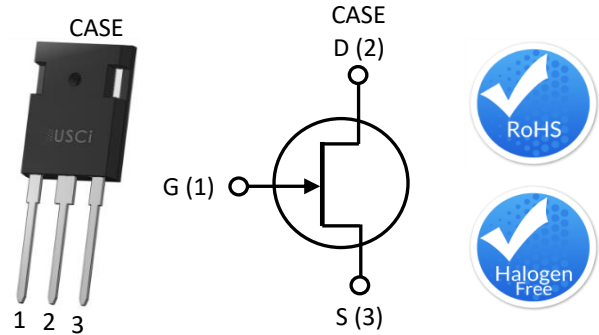


## Description

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
UJ3N065080K3S	TO-247-3L	UJ3N065080K3S

## Features

- ◆ Typical on-resistance  $R_{DS(on),typ}$  of 80mΩ
- ◆ 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	$V_{DS}$		650	V
Gate-source voltage	$V_{GS}$	DC	-20 to +3	V
		AC <sup>(1)</sup>	-20 to +20	
Continuous drain current <sup>(2)</sup>	$I_D$	$T_C = 25^\circ\text{C}$	32	A
		$T_C = 100^\circ\text{C}$	24	A
Pulsed drain current <sup>(3)</sup>	$I_{DM}$	$T_C = 25^\circ\text{C}$	72	A
Power dissipation	$P_{tot}$	$T_C = 25^\circ\text{C}$	190	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	$BV_{DS}$	$V_{GS} = -20\text{V}, I_D = 1\text{mA}$	650			V
Total drain leakage current	$I_D$	$V_{DS} = 650\text{V},$ $V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$		8	60	$\mu\text{A}$
		$V_{DS} = 650\text{V},$ $V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$		30		
Total gate leakage current	$I_G$	$V_{GS} = -20\text{V}, T_J = 25^\circ\text{C}$		10	50	$\mu\text{A}$
		$V_{GS} = -20\text{V}, T_J = 175^\circ\text{C}$		32		
Drain-source on-resistance	$R_{DS(on)}$	$V_{GS} = 2\text{V}, I_D = 10\text{A},$ $T_J = 25^\circ\text{C}$		68		mΩ
		$V_{GS} = 0\text{V}, I_D = 10\text{A},$ $T_J = 25^\circ\text{C}$		80	95	
		$V_{GS} = 2\text{V}, I_D = 10\text{A},$ $T_J = 175^\circ\text{C}$		114		
		$V_{GS} = 0\text{V}, I_D = 10\text{A},$ $T_J = 175^\circ\text{C}$		130		
Gate threshold voltage	$V_{G(th)}$	$V_{DS} = 5\text{V}, I_D = 20\text{mA}$	-14	-11.5	-6	V
Gate resistance	$R_G$	f = 1MHz, open drain		3.7		Ω

**Typical Performance - Dynamic**

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Input capacitance	$C_{iss}$	$V_{DS} = 100V,$ $V_{GS} = -20V,$ $f = 100kHz$		630		pF
Output capacitance	$C_{oss}$			94		
Reverse transfer capacitance	$C_{rss}$			88		
Effective output capacitance, energy related	$C_{oss(er)}$	$V_{DS} = 0V$ to 400V, $V_{GS} = -20V$		69		pF
Total gate charge	$Q_G$	$V_{DS}=400V, I_D = 24A,$ $V_{GS}=-18V$ to 0V		75		nC
Gate-drain charge	$Q_{GD}$			43		
Gate-source charge	$Q_{GS}$			7		
Turn-on delay time	$t_{d(on)}$	$V_{DS}=400V, I_D=24A,$ Gate Driver = -18V to 0V, $R_{G,EXT} = 1\Omega,$ Inductive Load, FWD: UJ3D06510TS $T_J = 25^\circ C$		6		ns
Rise time	$t_r$			25		
Turn-off delay time	$t_{d(off)}$			14		
Fall time	$t_f$			31		
Turn-on energy	$E_{ON}$			149		$\mu J$
Turn-off energy	$E_{OFF}$			183		
Total switching energy	$E_{TOTAL}$			332		
Turn-on delay time	$t_{d(on)}$		$V_{DS}=400V, I_D=24A,$ Gate Driver = -18V to 0V, $R_{G,EXT} = 1\Omega,$ Inductive Load, FWD: UJ3D06510TS $T_J = 150^\circ C$		6	
Rise time	$t_r$			24		
Turn-off delay time	$t_{d(off)}$			14		
Fall time	$t_f$			14		
Turn-on energy	$E_{ON}$			134		$\mu J$
Turn-off energy	$E_{OFF}$			103		
Total switching energy	$E_{TOTAL}$			237		

**Thermal Characteristics**

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Thermal resistance, junction-to-case	$R_{\theta JC}$			0.61	0.79	$^\circ C/W$

Typical Performance Diagrams

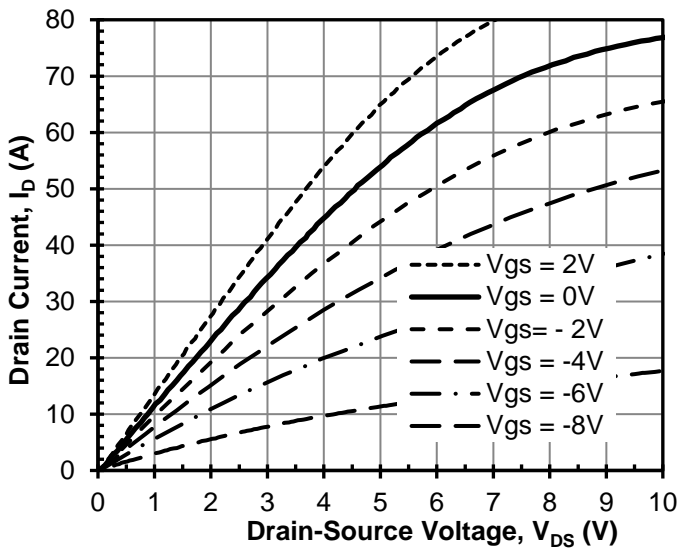


Figure 1 Typical output characteristics at  $T_J = 55^\circ\text{C}$

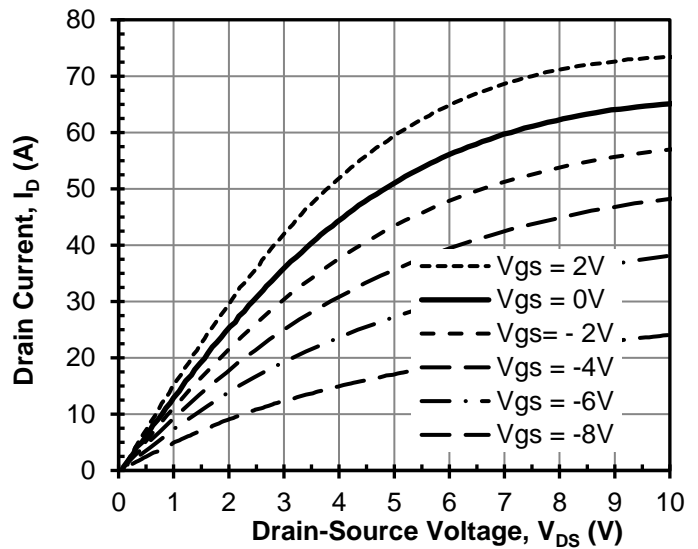


Figure 2 Typical output characteristics at  $T_J = 25^\circ\text{C}$

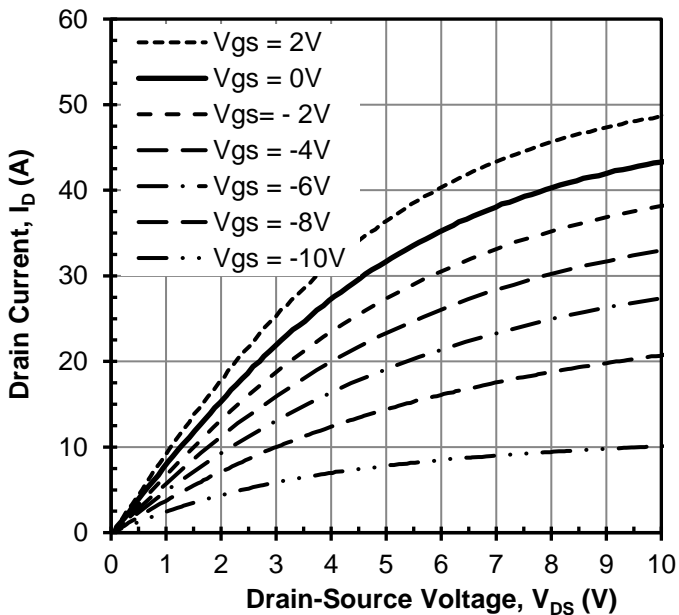


Figure 3 Typical output characteristics at  $T_J = 175^\circ\text{C}$

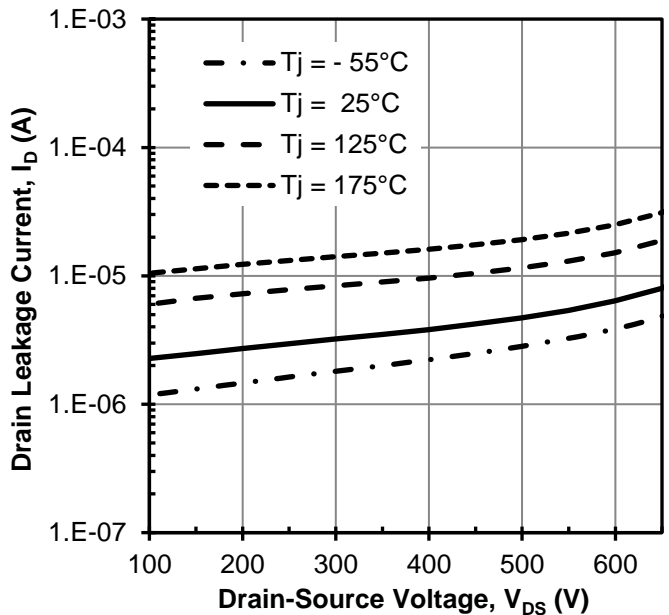


Figure 4 Typical drain-source leakage at  $V_{GS} = -20\text{V}$

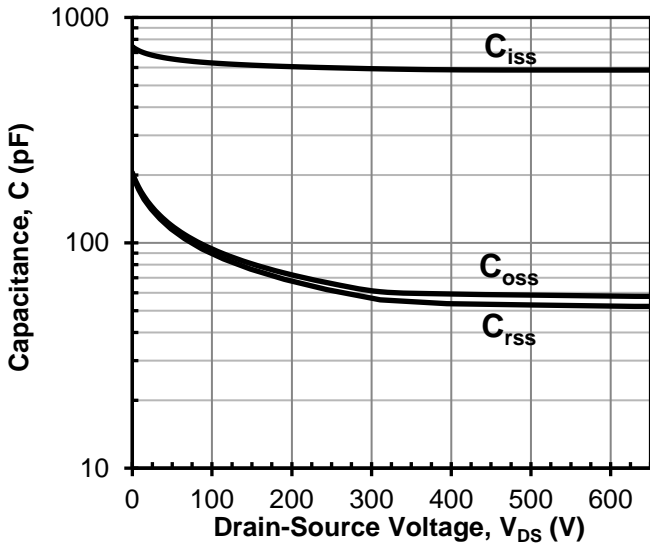


Figure 5 Typical capacitances at 100kHz and  $V_{GS} = -20V$

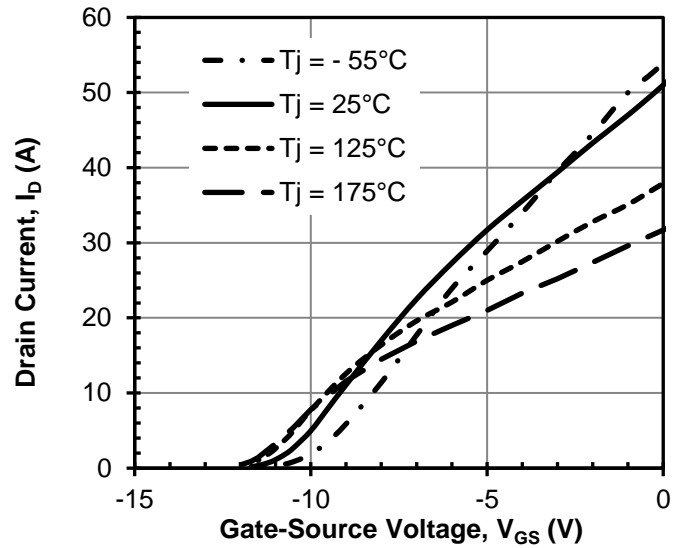


Figure 6 Typical transfer characteristics at  $V_{DS} = 5V$

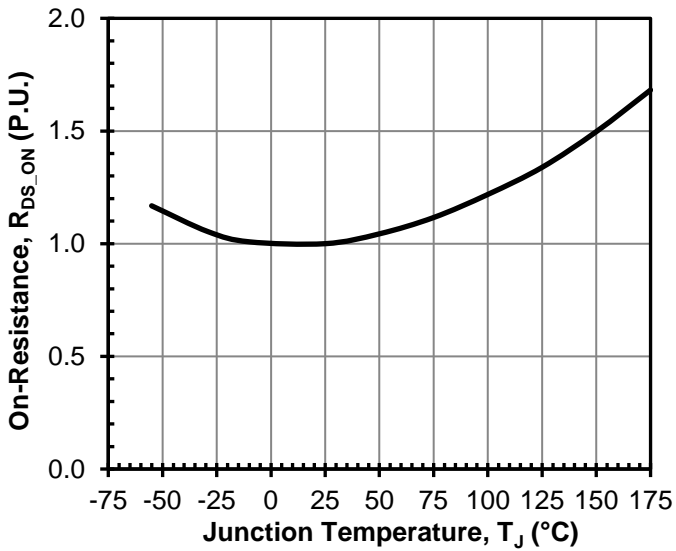


Figure 7 Normalized on-resistance vs. temperature at  $V_{GS} = 0V$  and  $I_D = 10A$

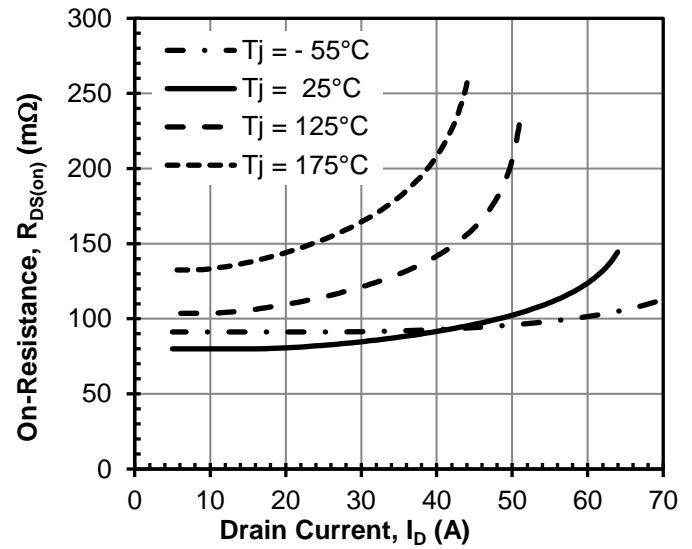


Figure 8 Typical drain-source on-resistance at  $V_{GS} = 0V$

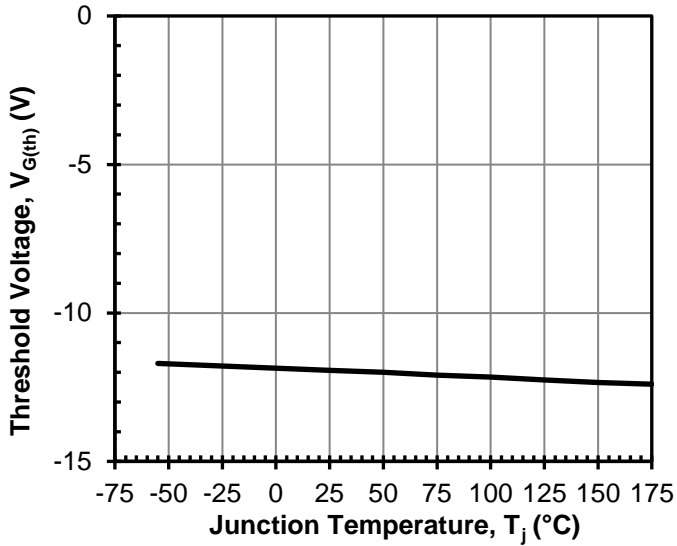


Figure 9 Threshold voltage vs.  $T_j$   
at  $V_{DS} = 5V$  and  $I_D = 20mA$

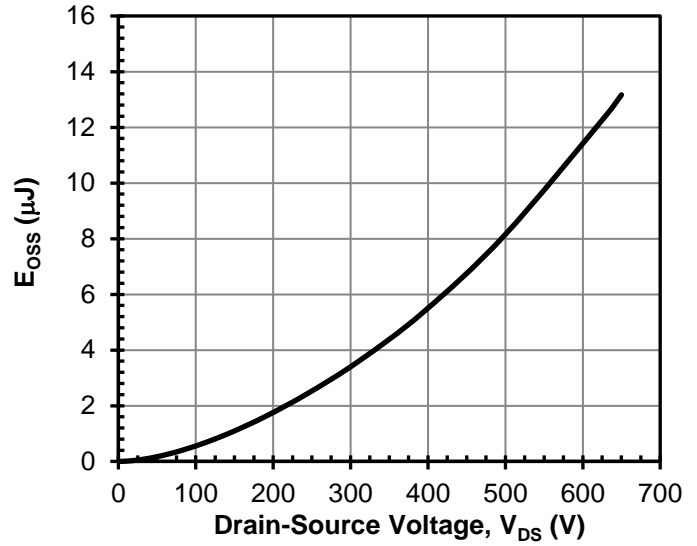


Figure 10 Typical stored energy in  $C_{oss}$   
at  $V_{GS} = -20V$

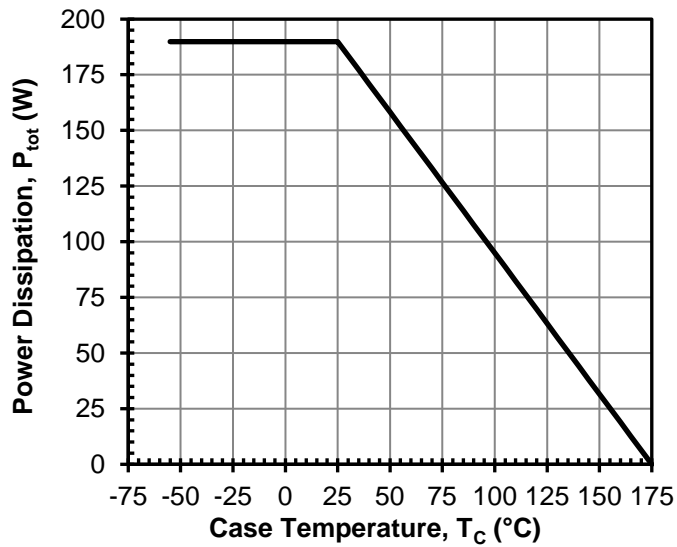


Figure 11 Total power Dissipation

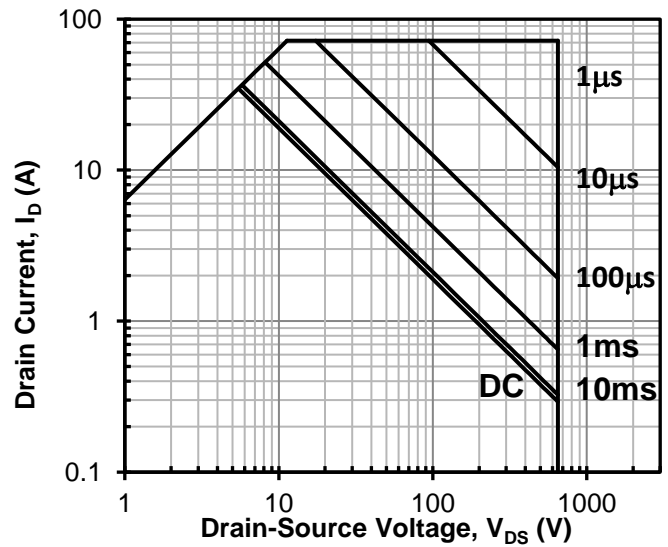


Figure 12 Safe operation area  
 $T_c = 25°C$ , Parameter  $t_p$

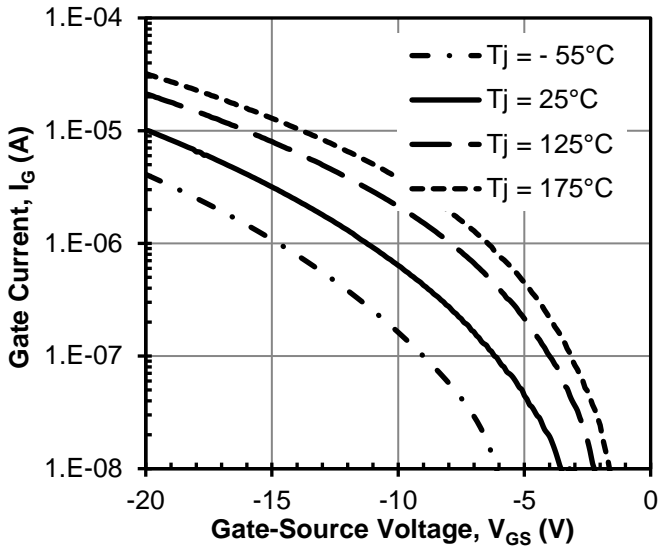


Figure 13 Typical gate leakage current at  $V_{DS} = 0V$

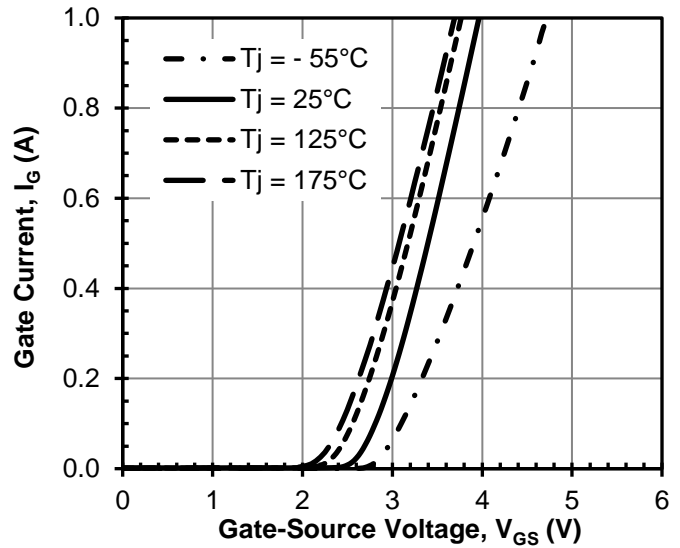


Figure 14 Typical gate forward current at  $V_{DS} = 0V$

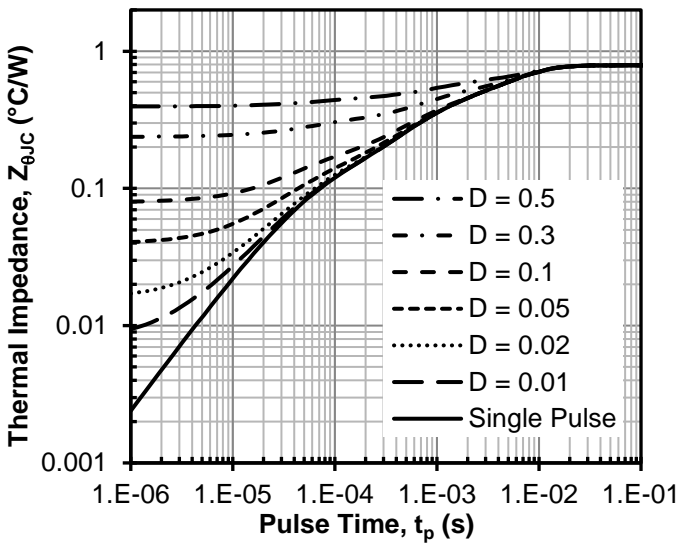


Figure 15 Maximum transient thermal impedance

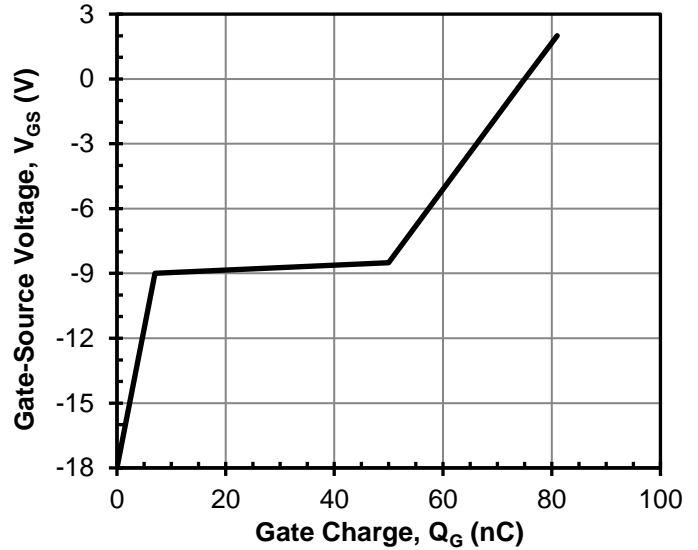


Figure 16 Typical gate charge at  $V_{DS} = 400V$  and  $I_D = 24A$

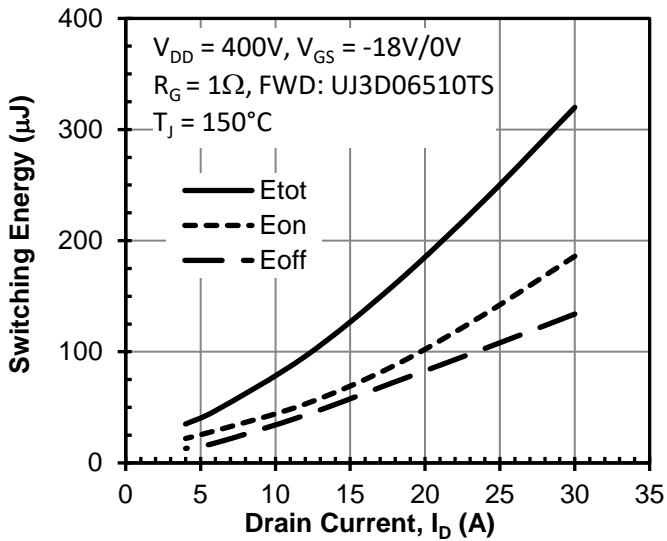


Figure 17 Clamped inductive switching energy vs. drain current at  $T_J = 150^\circ\text{C}$

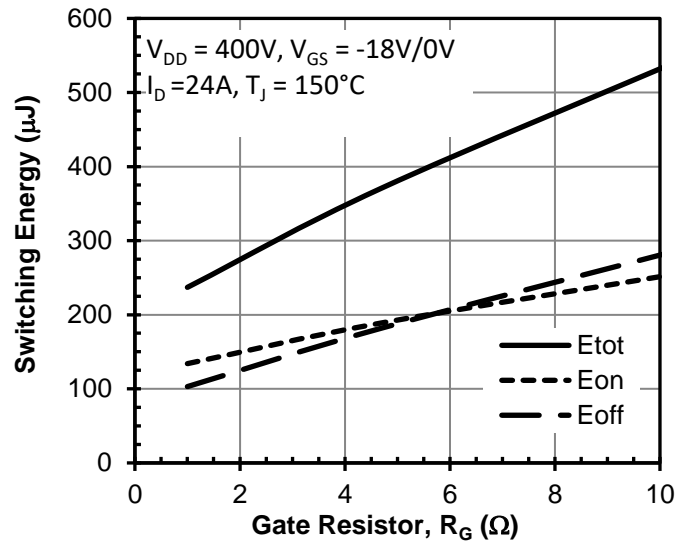


Figure 18 Clamped inductive switching turn-off energy vs. gate resistor  $R_G$

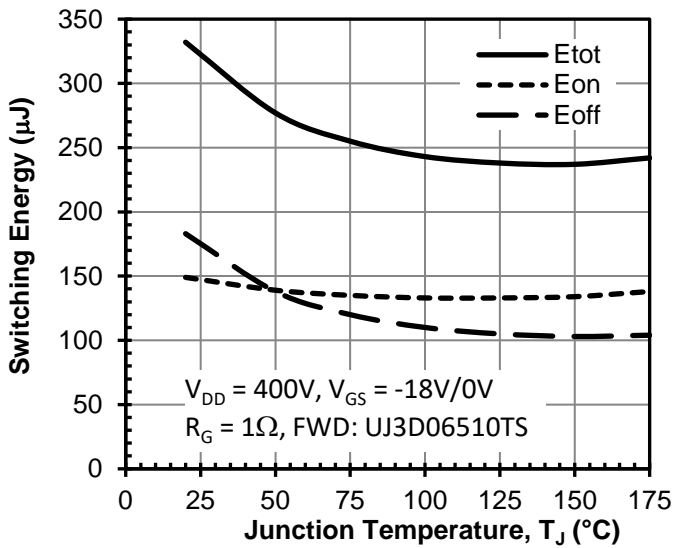


Figure 19 Clamped inductive switching energy vs. junction temperature at  $I_D = 24A$



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