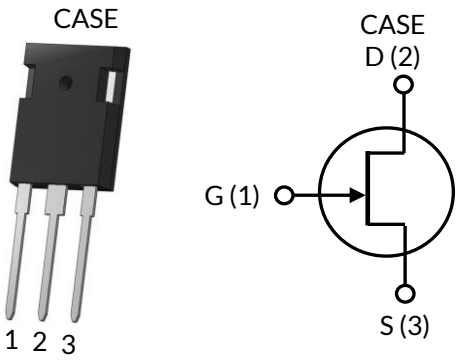
DATASHEET

UJ3N120065K3S

1200V-66mΩ SiC Normally-on JFET

Rev. A, November 2019



Part Number	Package	Marking
UJ3N120065K3S	TO-247-3L	UJ3N120065K3S

Description

UnitedSiC 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.

Features

- Typical on-resistance $R_{DS(on),typ}$ of 66mΩ
- 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]	-30 to +20	V
Continuous drain current [2]	I_D	T_C = 25°C	34	A
		T_C = 100°C	25	A
Pulsed drain current [3]	I_{DM}	T_C = 25°C	90	A
Power dissipation	P_{tot}	T_C = 25°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 > 1Ω.
2. Limited by $T_{J,max}$
3. Pulse width t_p limited by $T_{J,max}$

Thermal Characteristics

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

Electrical Characteristics (T_J = +25°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_{DSS}	V_{DS}=1200V, V_{GS}=-20V, T_J=25°C		5	30	µA
		V_{DS}=1200V, V_{GS}=-20V, T_J=175°C		56		
Total gate leakage current	I_{GSS}	V_{GS}=-20V, T_J=25°C		0.1	50	µA
		V_{GS}=-20V, T_J=175°C		1		µA
Drain-source on-resistance	$R_{DS(on)}$	V_{GS}=2V, I_D=10A, T_J=25°C		55		mΩ
		V_{GS}=0V, I_D=10A, T_J=25°C		66	90	
		V_{GS}=2V, I_D=10A, T_J=175°C		122		
		V_{GS}=0V, I_D=10A, T_J=175°C		142		
Gate threshold voltage	$V_{G(th)}$	V_{DS}=5V, I_D=35mA	-9.3	-6.6	-4.7	V
Gate resistance	R_G	f=1MHz, open drain		2.6		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		1008		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		56		pF
C_{OSS} stored energy	E_{oss}	V_{DS}=800V, V_{GS}=-20V		18		µJ
Total gate charge	Q_G	V_{DS}=800V, I_D=25A, V_{GS} = -18V to 0V		114		nC
Gate-drain charge	Q_{GD}			75		
Gate-source charge	Q_{GS}			16		
Turn-on delay time	$t_{d(on)}$	V_{DS}=800V, I_D=25A, Gate Driver =-18V to 0V, R_G=1Ω, Inductive Load, FWD: UJ2D1215T T_J=25°C		32		ns
Rise time	t_r			43		
Turn-off delay time	$t_{d(off)}$			19		
Fall time	t_f			16		
Turn-on energy	E_{ON}			785		µJ
Turn-off energy	E_{OFF}			150		
Total switching energy	E_{TOTAL}			935		
Turn-on delay time	$t_{d(on)}$	V_{DS}=800V, I_D=25A, Gate Driver =-18V to 0V, R_G=1Ω, Inductive Load, FWD: UJ2D1215T T_J=150°C		28		ns
Rise time	t_r			42		
Turn-off delay time	$t_{d(off)}$			18		
Fall time	t_f			15		
Turn-on energy	E_{ON}			730		µJ
Turn-off energy	E_{OFF}			146		
Total switching energy	E_{TOTAL}			876		

Typical Performance Diagrams

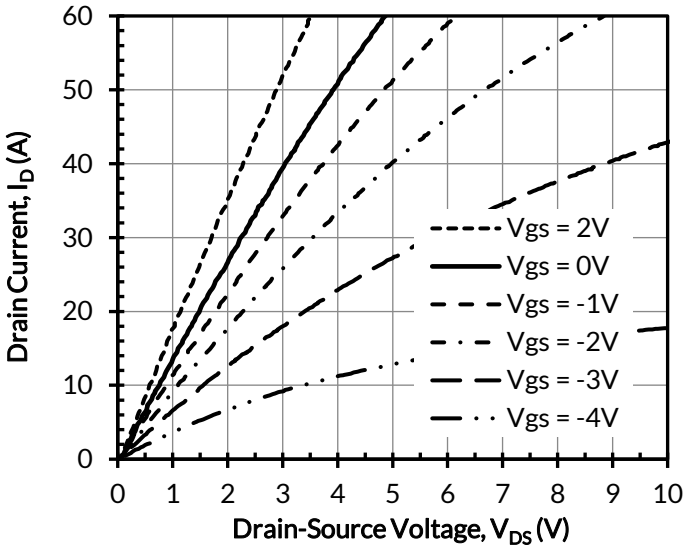


Figure 1. Typical output characteristics at T_J = - 55°C, tp < 250µs

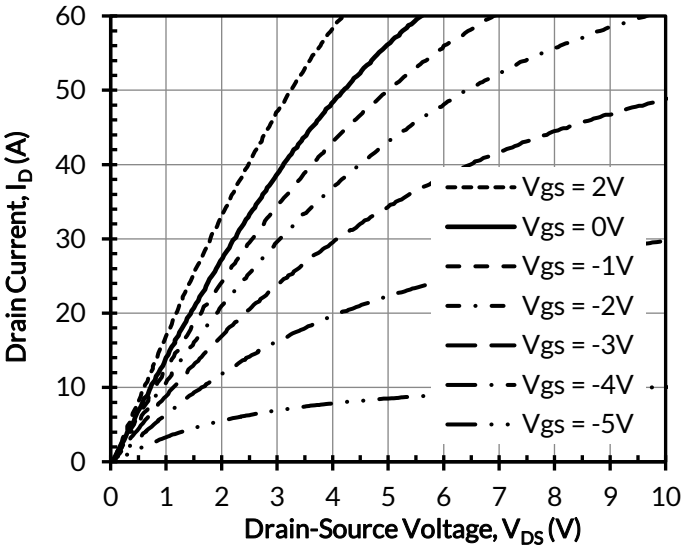


Figure 2. Typical output characteristics at T_J = 25°C, tp < 250µs

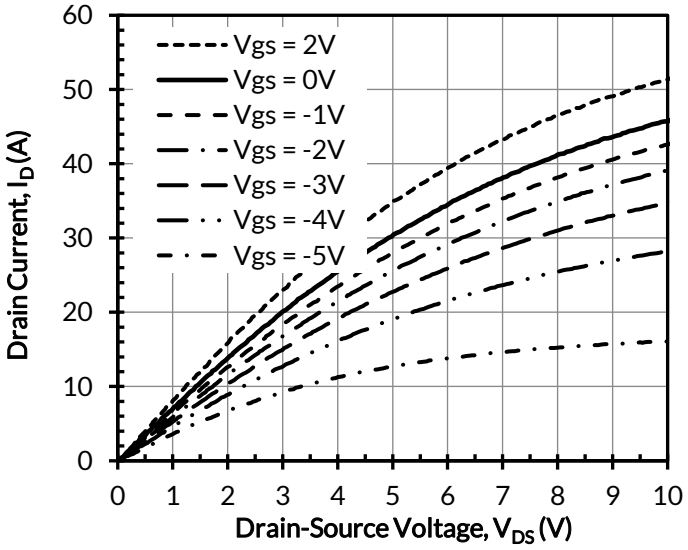


Figure 3. Typical output characteristics at T_J = 175°C, tp < 250µs

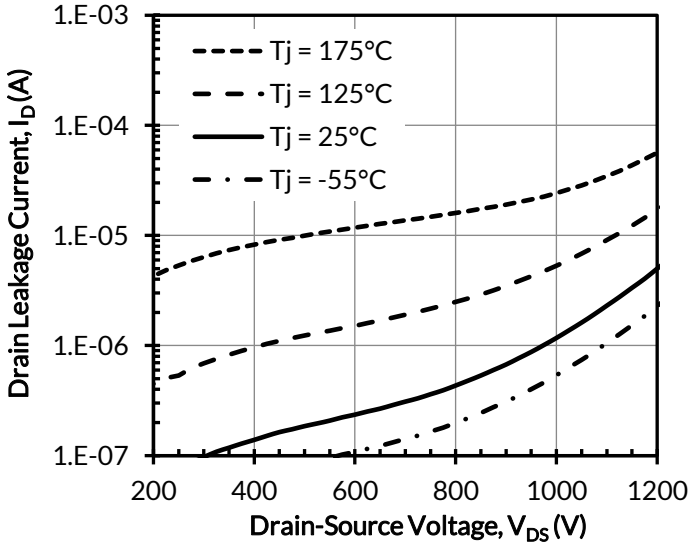


Figure 4. Typical drain-source leakage at V_{GS} = -20V

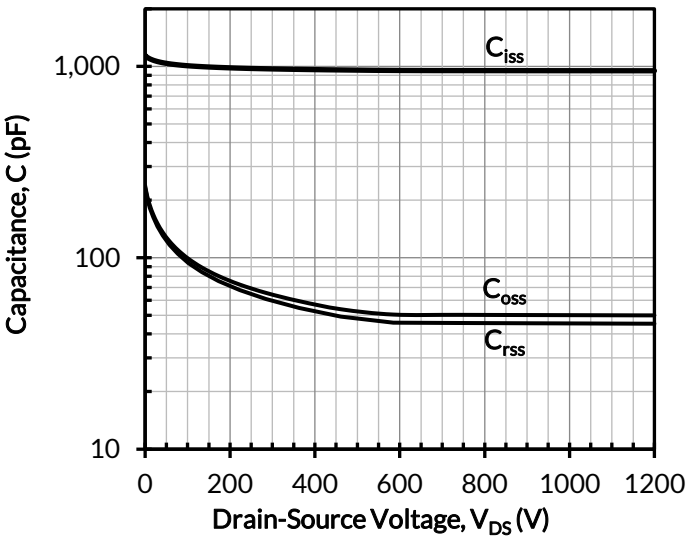


Figure 5. Typical capacitances at f = 100kHz and V_{GS} = -20V

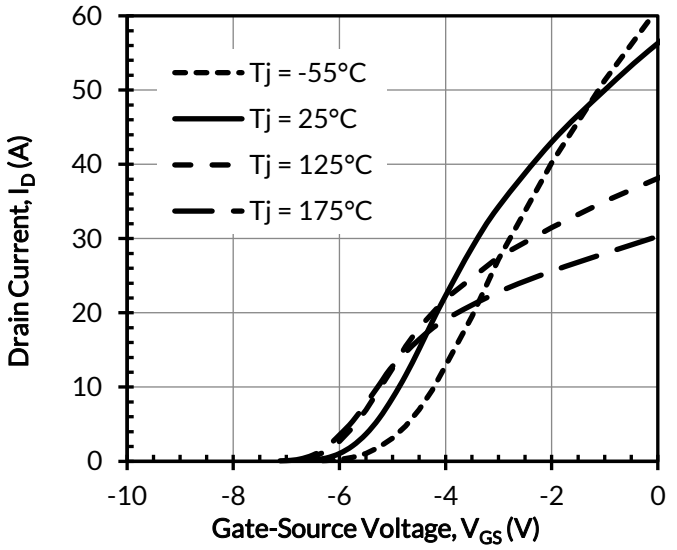


Figure 6. Typical transfer characteristics at V_{DS} = 5V

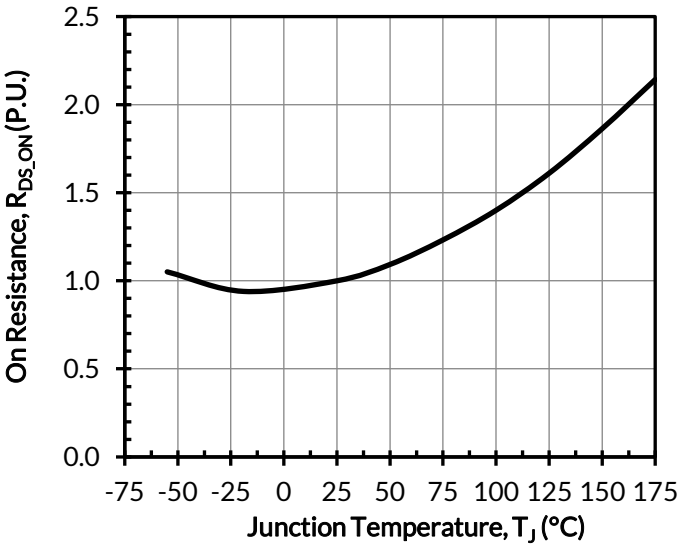


Figure 7. Normalized on-resistance vs. temperature at V_{GS} = 0V and I_D = 10A

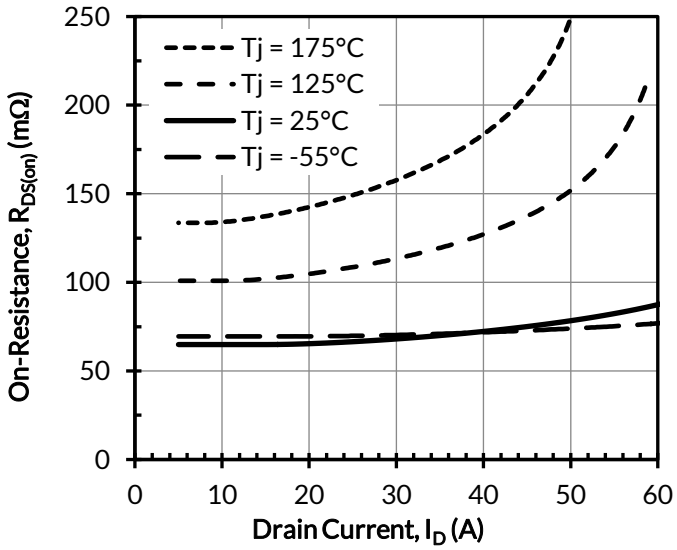


Figure 8. Typical drain-source on-resistances at V_{GS} = 0V

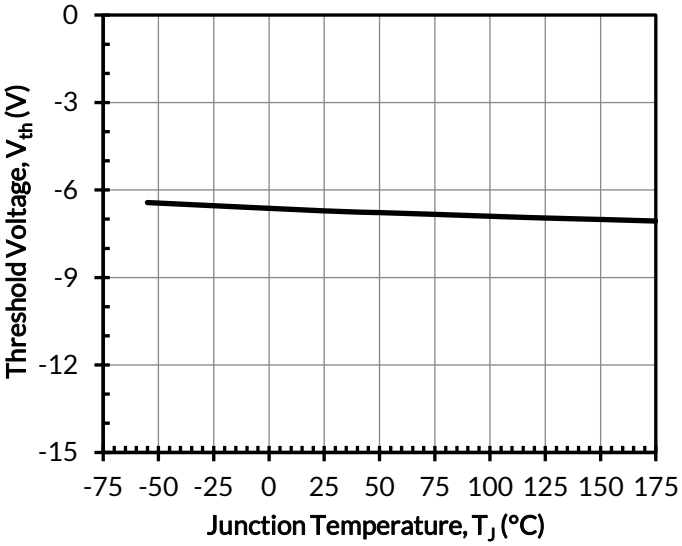


Figure 9. Threshold voltage vs. junction temperature at V_{DS} = 5V and I_D = 35mA

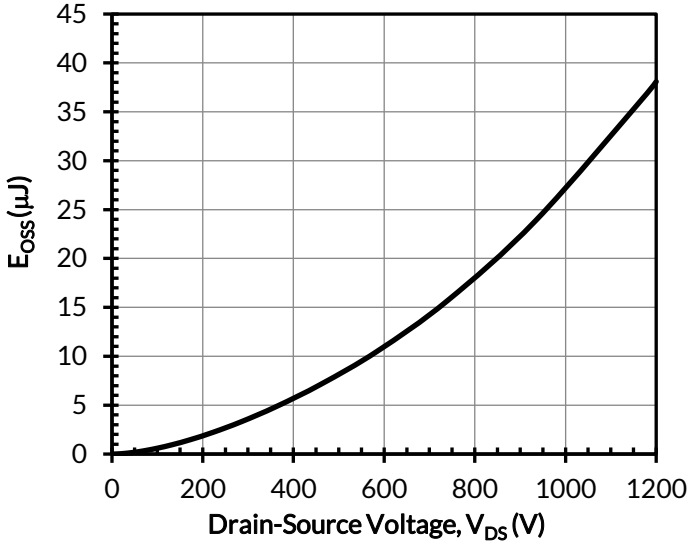


Figure 10. Typical stored energy in C_{OSS} at V_{GS} = -20V

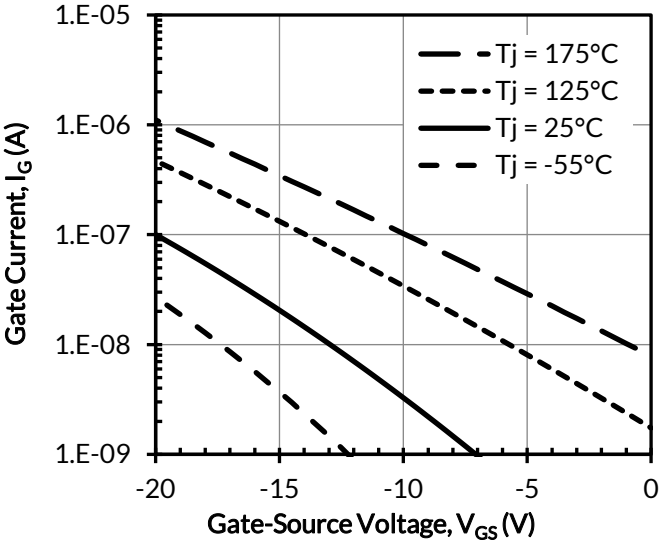


Figure 11. Typical gate leakage at V_{DS} = 0V

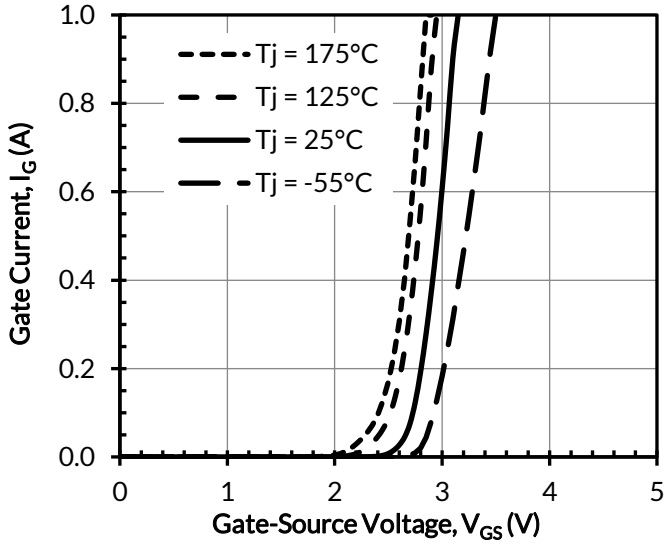


Figure 12. Typical gate forward current at V_{DS} = 0V

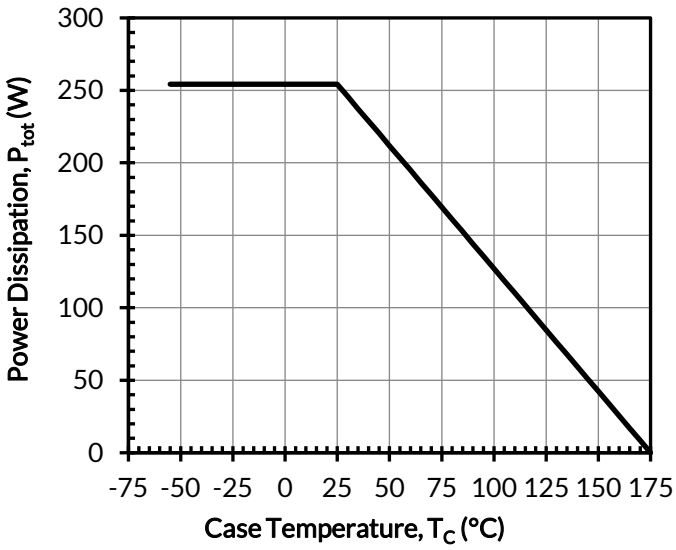


Figure 13. Total power Dissipation

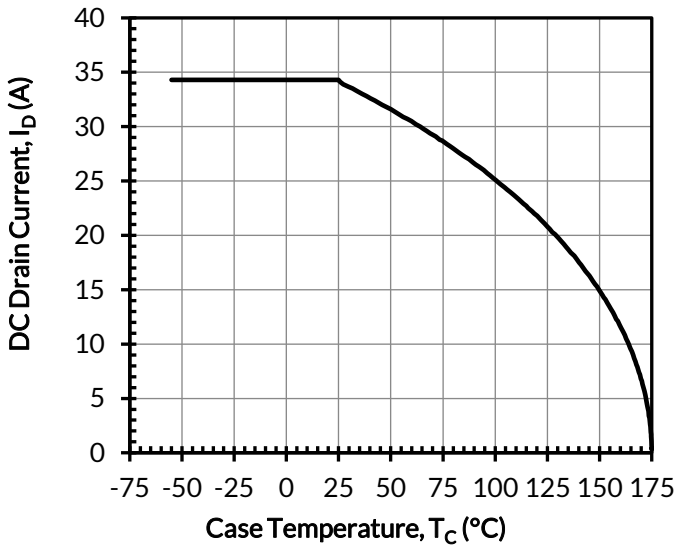


Figure 14. DC drain current derating

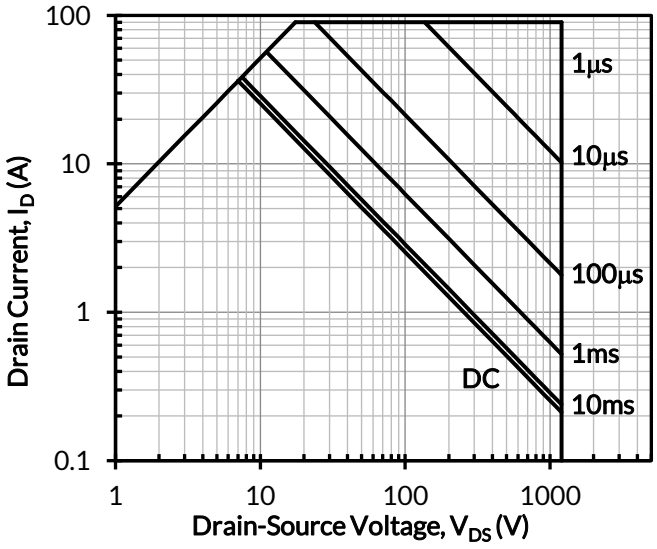


Figure 15. Safe operation area at T_C =25°C, Parameter t_p

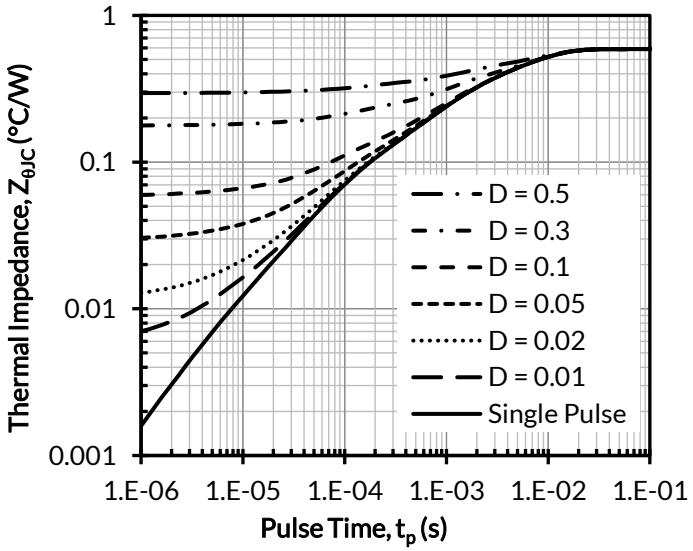


Figure 16. Maximum transient thermal impedance

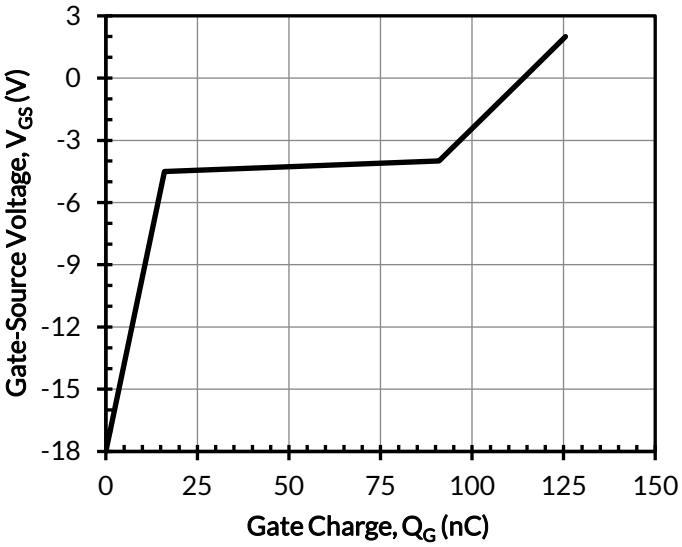


Figure 17. Typical gate charge at V_{DS} = 800V and I_D = 25A

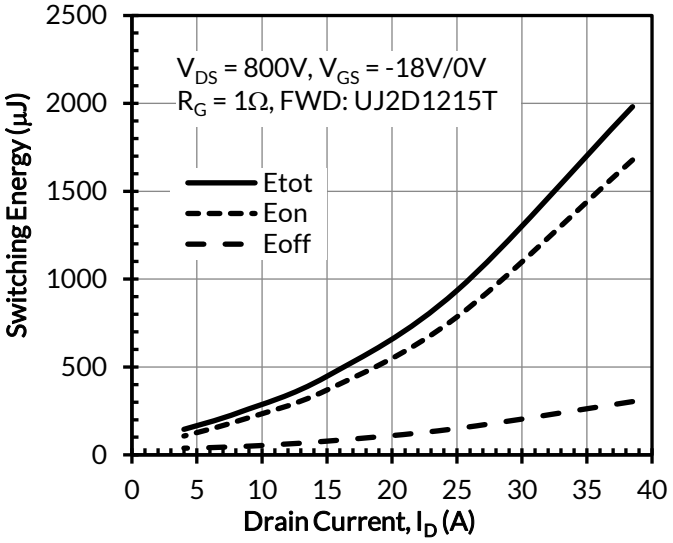


Figure 18. Clamped inductive switching energy vs. drain current at T_J = 25°C

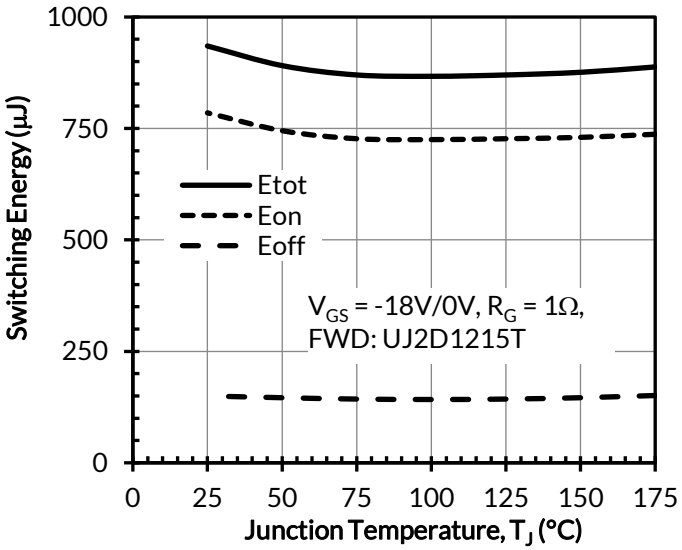


Figure 19. Clamped inductive switching energy vs. junction temperature at V_{DS} = 800V and I_D = 25A

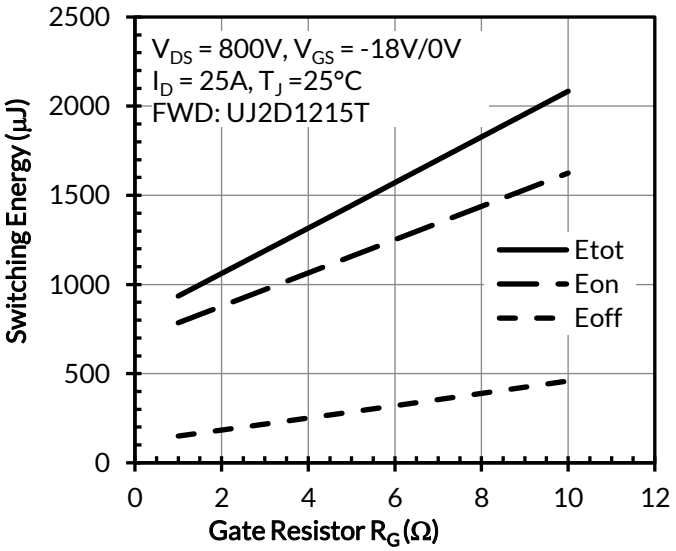


Figure 20. Clamped inductive switching energy vs. gate resistor R_G

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