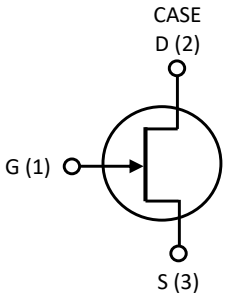
UnitedSiC

35mΩ - 1200V SiC Normally-On JFET | UJ3N120035K3S

Datasheet

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
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°C	63	A
		T_C = 100°C	46	A
Pulsed drain current (3)	I_{DM}	T_C = 25°C	185	A
Power dissipation	P_{tot}	T_C=25°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 > 1Ω.

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

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

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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_D	V_{DS} = 1200V, V_{GS} = -20V, T_J = 25°C		10	60	µA
		V_{DS} = 1200V, V_{GS} = -20V, T_J = 175°C		35		
Total gate leakage current	I_G	V_{GS}=-20V, T_j=25°C		12	100	µA
		V_{GS}=-20V, T_j=175°C		50		
Drain-source on-resistance	$R_{DS(on)}$	V_{GS}=2V, I_D=20A, T_J = 25°C		31		mΩ
		V_{GS}=0V, I_D=20A, T_J = 25°C		35	45	
		V_{GS}=2V, I_D=20A, T_J = 175°C		68		
		V_{GS}=0V, I_D=20A, T_J = 175°C		76		
Gate threshold voltage	$V_{G(th)}$	V_{DS} = 5V, I_D = 70mA	-14	-11.5	-6	V
Gate resistance	R_G	f = 1MHz, open drain		2.4		Ω

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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, $R_{G,EXT}$ = 1Ω, Inductive Load, FWD: UJ3D1220KSD T_J = 25°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, $R_{G,EXT}$ = 1Ω, Inductive Load, FWD: UJ3D1220KSD T_J = 150°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	°C/W

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Typical Performance Diagrams

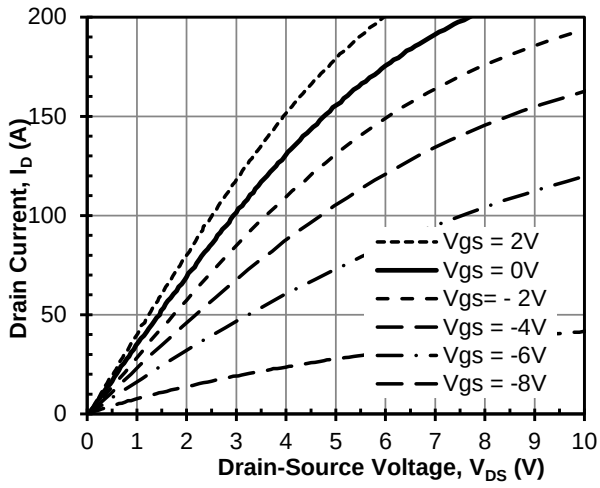

Figure 1 Typical output characteristics at T_J = -55°C

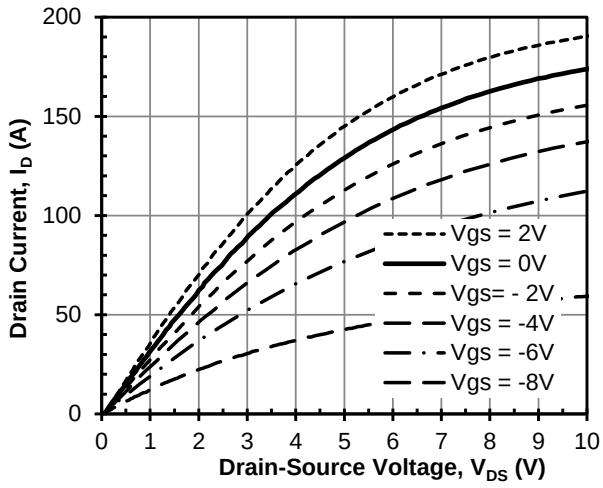

Figure 2 Typical output characteristics at T_J = 25°C

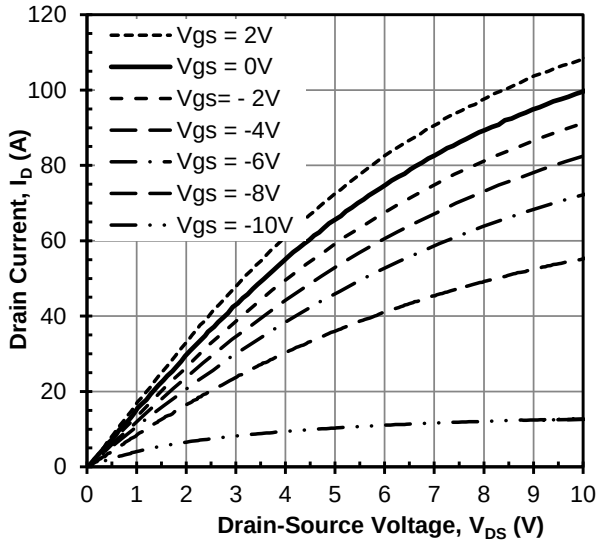

Figure 3 Typical output characteristics at T_J = 175°C

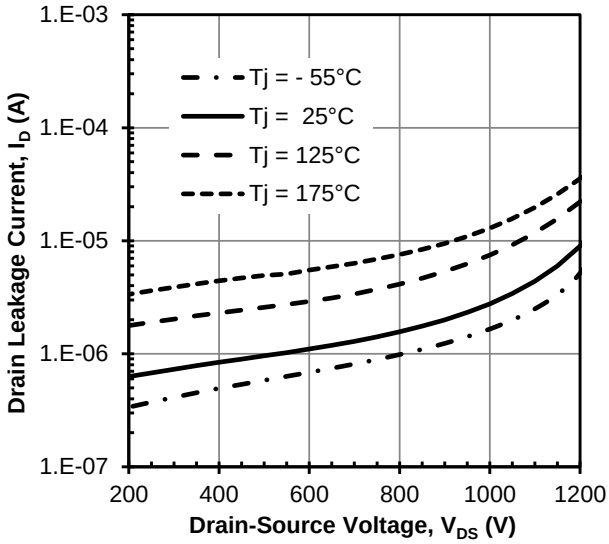

Figure 4 Typical drain-source leakage at V_{GS} = -20V

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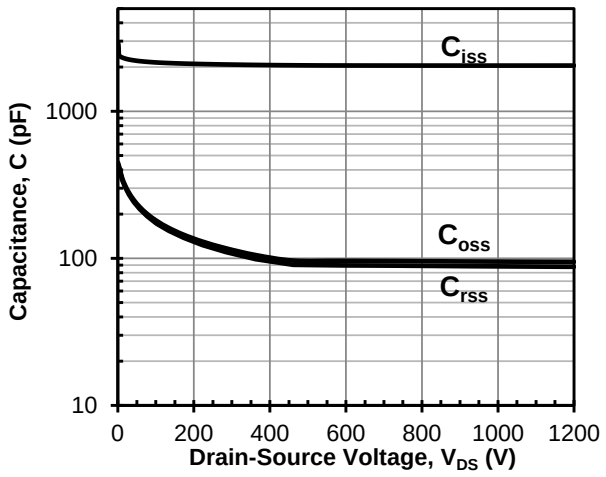

Figure 5 Typical capacitances at 100kHz and V_{GS} = -20V

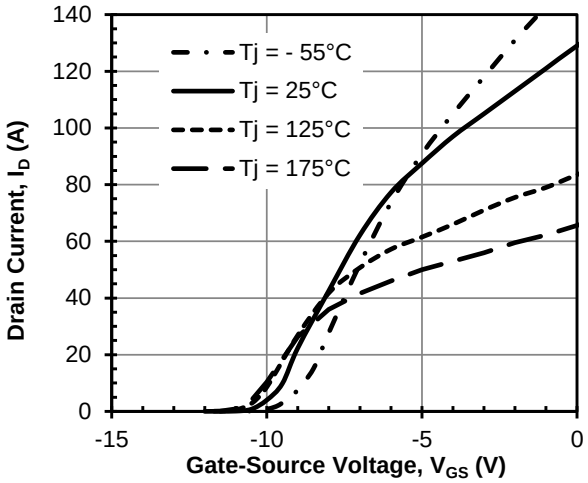

Figure 6 Typical transfer characteristics at V_{DS} = 5V

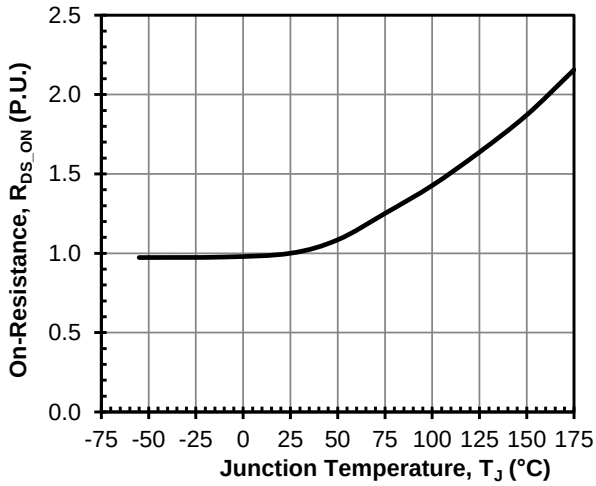

Figure 7 Normalized on-resistance vs. temperature at V_{GS} = 0V and I_D = 20A

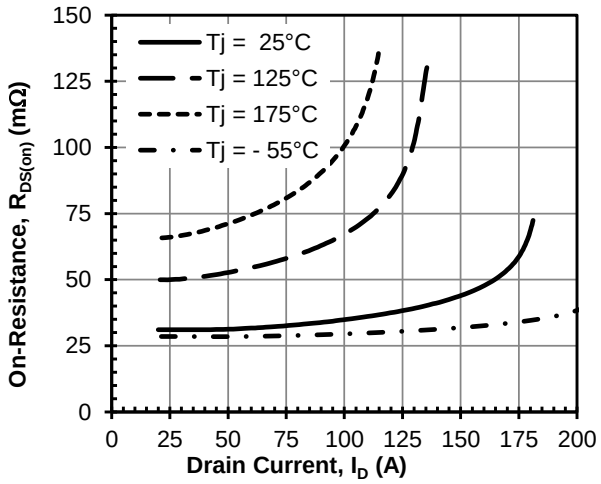

Figure 8 Typical drain-source on-resistance at V_{GS} = 0V

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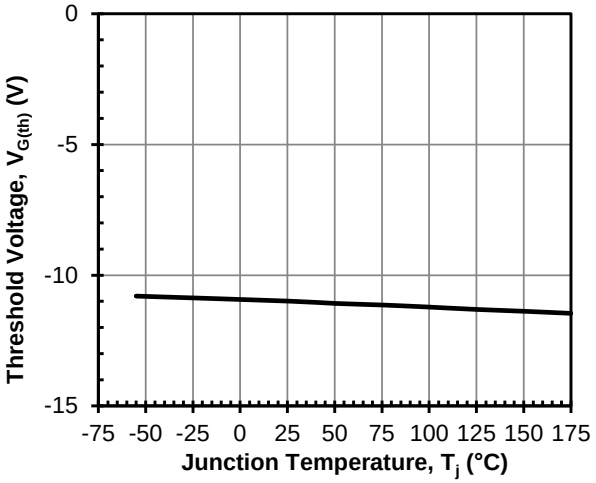

Figure 9 Threshold voltage vs. Tj at V_{DS} = 5V and I_D = 70mA

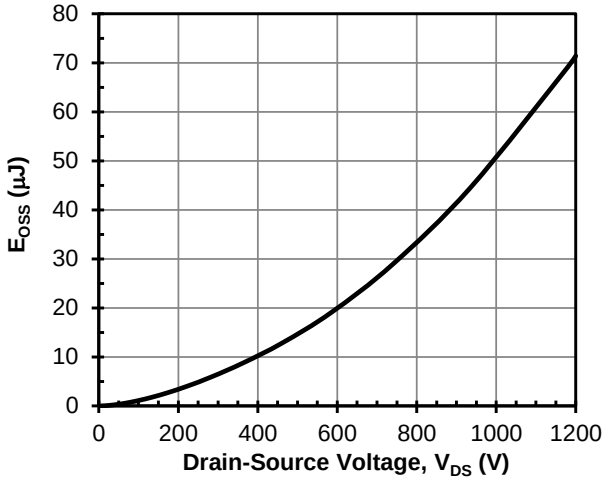

Figure 10 Typical stored energy in C_{OSS} at V_{GS} = -20V

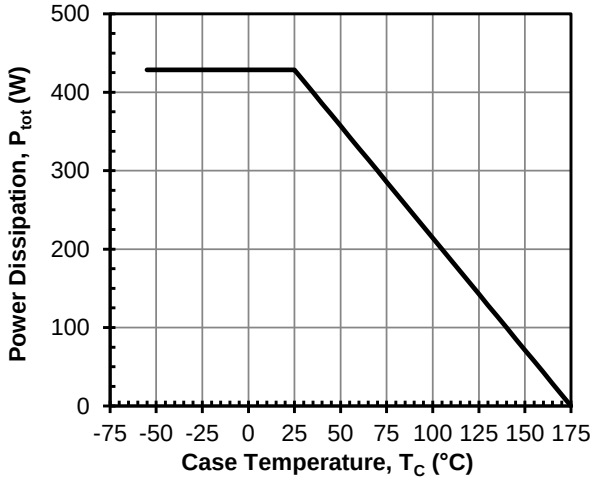

Figure 11 Total power Dissipation

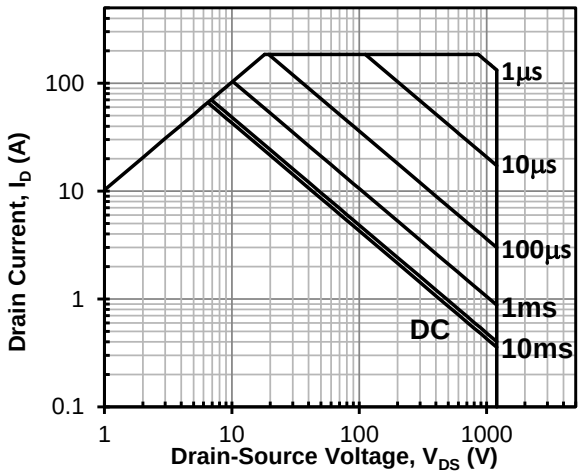

Figure 12 Safe operation area T_c = 25°C, Parameter t_p

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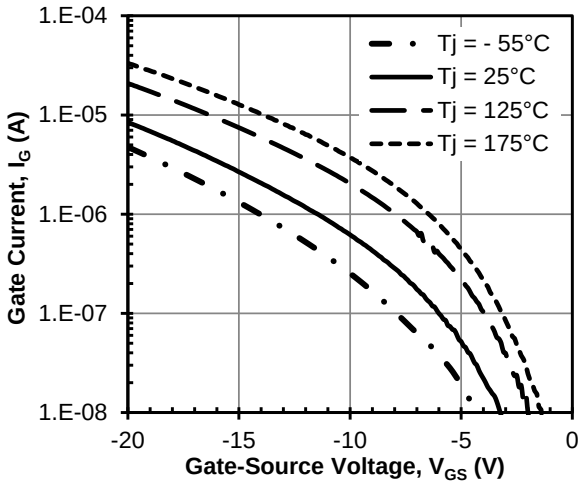

Figure 13 Typical gate leakage current at V_{DS} = 0V

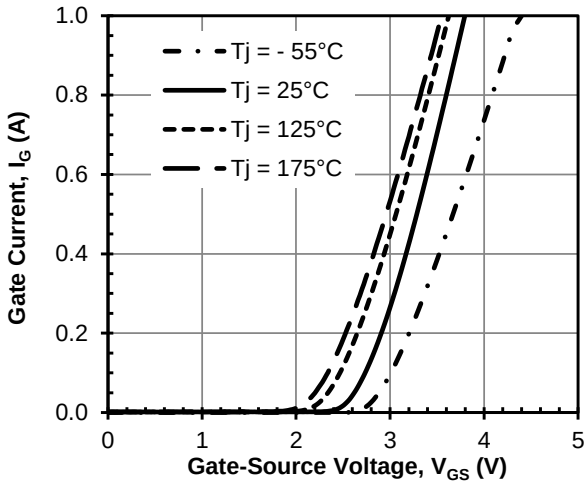

Figure 14 Typical gate forward current at V_{DS} = 0V

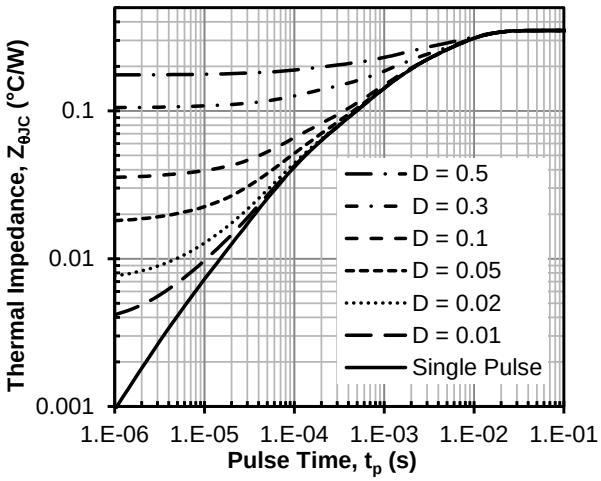

Figure 15 Maximum transient thermal impedance

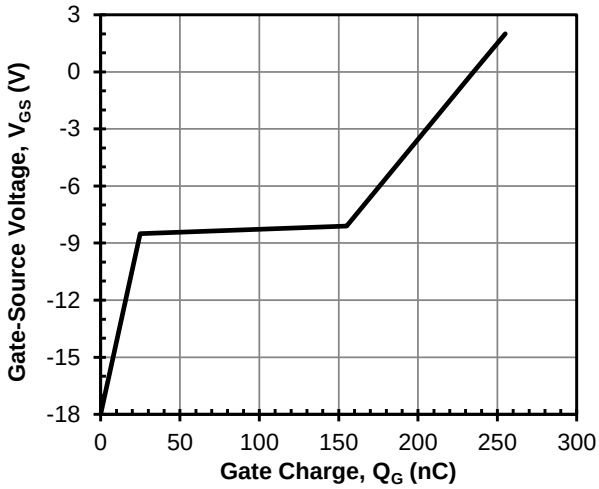

Figure 16 Typical gate charge at V_{DS} = 800V and I_D = 40A

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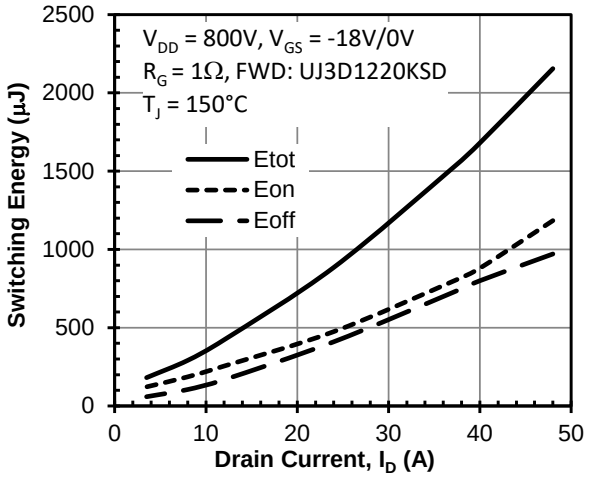

Figure 17 Clamped inductive switching energy vs. drain current at T_J = 150°C

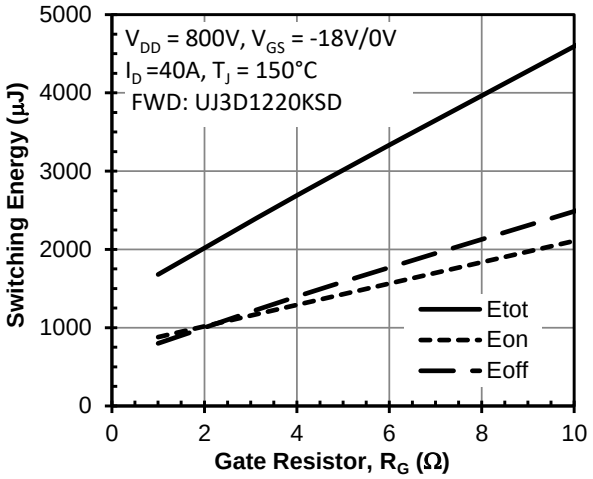

Figure 18 Clamped inductive switching energy vs. gate resistor R_G

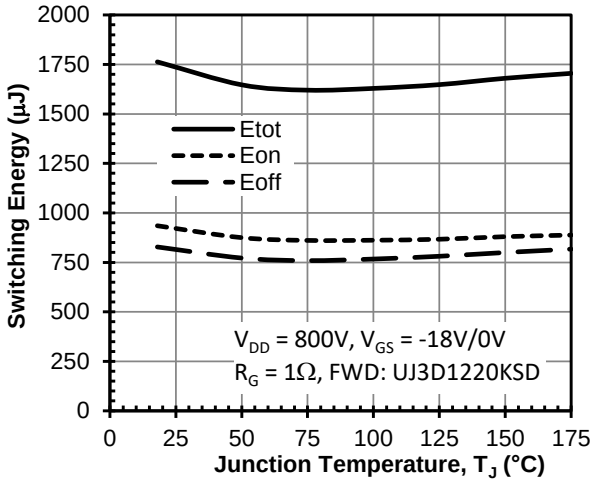

Figure 19 Clamped inductive switching energy vs. junction temperature at I_D = 40A

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