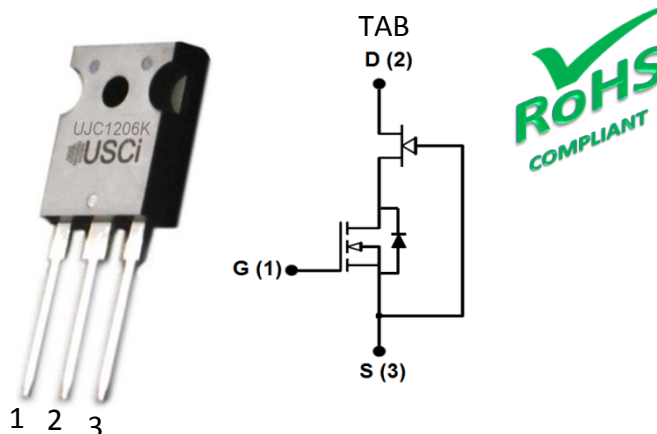


## Features

- Low On-Resistance  $R_{DS(on)max}$  of 0.06Ω
- Standard 12V gate drive
- Maximum operating temperature of 150°C
- Excellent Reverse Recovery
- Low gate charge
- Low intrinsic capacitance
- RoHS compliant



## Typical Applications

- EV Charging
- PV Inverters
- Switch Mode Power Supplies
- Power Factor Correction Modules
- Motor Drives
- Induction Heating

Part Number	Package	Marking
<b>UJC1206K</b>	<b>TO-247</b>	<b>UJC1206K</b>

## Descriptions

United Silicon Carbide's cascode products co-package its **xJ series** high-performance SiC JFETs with a cascode optimized MOSFET to produce the only standard gate drive SiC device in the market today. This series exhibits ultra-low on resistance and gate charge, but also the best reverse recovery characteristics of any device of similar ratings. These devices are excellent for switching inductive loads, and any application requiring standard gate drive.

## Maximum Ratings

Parameter	Symbol	Test Conditions	Value	Units
Drain-Source Voltage	$V_{DS}$		1200	V
Gate-Source Voltage	$V_{GS}$	DC	-20 to +20	V
Continuous Drain Current	$I_D$	$T_C = 25^\circ\text{C}$	35	A
Continuous Drain Current	$I_D$	$T_C = 100^\circ\text{C}$	22.5	A
Pulsed Drain Current	$I_{DM}$	$T_j = 25^\circ\text{C}$	110	A
		$T_j = 150^\circ\text{C}$	85	
Short-Circuit Withstand Time <sup>1</sup>	$t_{SC}$	$V_{GS}=15\text{V}, V_{CC}<600\text{V}$	4	μs
Single Pulsed Avalanche Energy <sup>1</sup>	$E_{AS}$	$L=15\text{mH}, I_{AS}=4.2\text{A}$	143	mJ
Power Dissipation	$P_{tot}$	$T_C = 25^\circ\text{C}$	192	W
Operating and Storage Temperature	$T_J, T_{STG}$		-55 to 150	°C
Max Lead Temperature for Soldering, 1/8" from Case for 5 Seconds	$T_L$		250	°C

<sup>1</sup> Starting  $T_j = 25^\circ\text{C}$

**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	$BV_{DS}$	$V_{GS}=0V, I_D=1mA$	1200			V
Total Drain Leakage Current	$I_D$	$V_{DS} = 1200V,$ $V_{GS} = 0V, T_J = 25^\circ\text{C}$		200	500	$\mu A$
		$V_{DS} = 1200V,$ $V_{GS} = 0V, T_J = 150^\circ\text{C}$		500		
Total Gate Leakage Current	$I_G$	$V_{DS}=0V, T_J=25^\circ\text{C}$ $V_{GS}=-20V/+20V$		6	100	nA
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=12V, I_F=20A,$ $T_J = 25^\circ\text{C}$		42	60	mΩ
		$V_{GS}=12V, I_F=20A,$ $T_J = 150^\circ\text{C}$		105	150	
Gate Threshold Voltage	$V_{G(th)}$	$V_{DS} = 5V, I_D = 250\mu A$		4.5		V
Gate Resistance	$R_G$	$V_{GS} = 0V, f = 1MHz$		1.2		Ω

**Typical Performance - Reverse Diode**

Parameter	Symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Forward Voltage	$V_{FSD}$	$V_{GS} = 0V, I_F = 20A,$ $T_J = 25^\circ\text{C}$	-	1.5		V
		$V_{GS} = 0V, I_F = 20A,$ $T_J = 150^\circ\text{C}$	-	2.3		
Reverse Recovery Charge	$Q_{rr}$	$V_R=800V, I_F=20A,$ $di/dt=1100A/\mu s$		120		nC

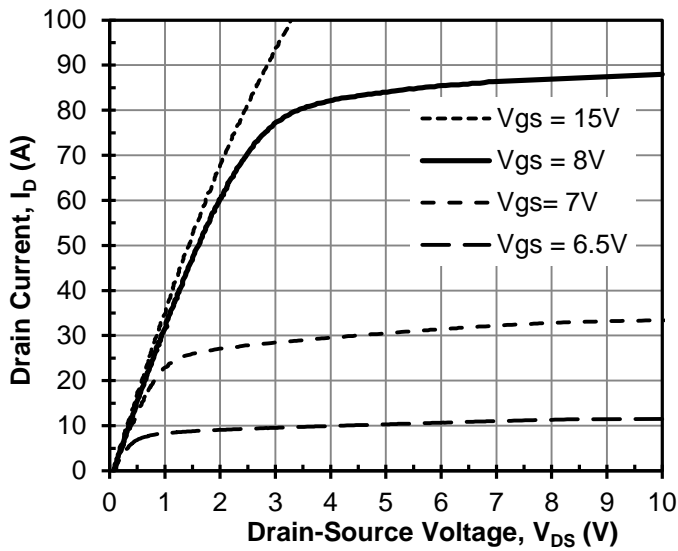
### Typical Performance - Dynamic

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Input Capacitance	$C_{iss}$	$V_{DS} = 100V,$ $V_{GS} = 0V,$ $f = 100kHz$		2285		pF
Output Capacitance	$C_{oss}$			185		
Reverse Transfer Capacitance	$C_{rss}$			2.45		
Effective Output Capacitance, Energy Related	$C_{oss(er)}$	$V_{DS} = 0V$ to 800V, $V_{GS} = 0V$		95		pF
Total Gate Charge	$Q_G$	$V_{DS}=800V, I_D = 20A,$ $V_{GS}=0V$ to 15V		62		nC
Gate-Drain Charge	$Q_{GD}$			20		
Gate-Source Charge	$Q_{GS}$			14		
Turn-on Delay Time	$t_{d(on)}$	$V_{DS}=800V, I_D=20A,$ Gate Driver = -5V to +12V, Turn-on $R_{G,EXT} = 2.1\Omega,$ Turn-off $R_{G,EXT} = 20\Omega$ Inductive Load, FWD: UJ2D1215T $T_J = 25^\circ C$		66		ns
Rise Time	$t_r$			14		
Turn-off Delay Time	$t_{d(off)}$			83		
Fall Time	$t_f$			14		
Turn-on Energy	$E_{ON}$	$V_{DS}=800V, I_D=20A,$ Gate Driver = -5V to +12V, Turn-on $R_{G,EXT} = 2.1\Omega,$ Turn-off $R_{G,EXT} = 20\Omega$ Inductive Load, FWD: UJ2D1215T $T_J = 150^\circ C$		397		$\mu J$
Turn-off Energy	$E_{OFF}$			77		
Total Switching Energy	$E_{TOTAL}$			474		
Turn-on Delay Time	$t_{d(on)}$			66		ns
Rise Time	$t_r$			16		
Turn-off Delay Time	$t_{d(off)}$			87		
Fall Time	$t_f$			14		
Turn-on Energy	$E_{ON}$	$V_{DS}=800V, I_D=20A,$ Gate Driver = -5V to +12V, Turn-on $R_{G,EXT} = 2.1\Omega,$ Turn-off $R_{G,EXT} = 20\Omega$ Inductive Load, FWD: UJ2D1215T $T_J = 150^\circ C$		424		$\mu J$
Turn-off Energy	$E_{OFF}$			94		
Total Switching Energy	$E_{TOTAL}$			518		

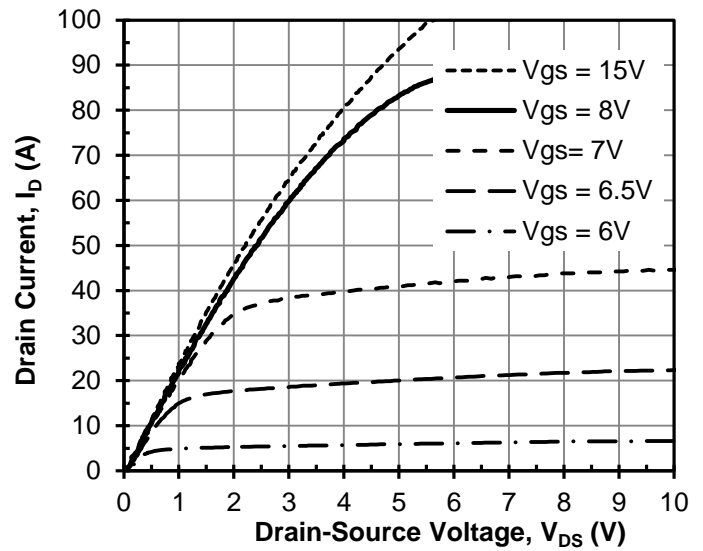
### Thermal characteristics

Parameter	symbol	Test Conditions	Value			Units
			Min	Typ	Max	
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$				0.65	$^\circ C/W$

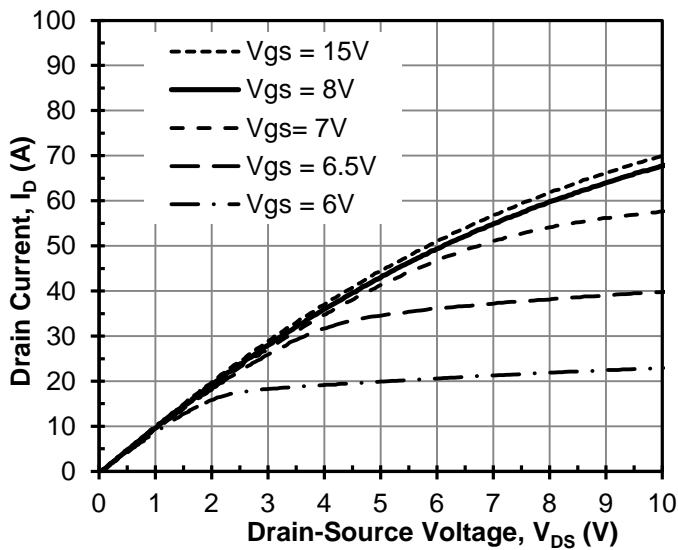
## Typical Performance Diagrams



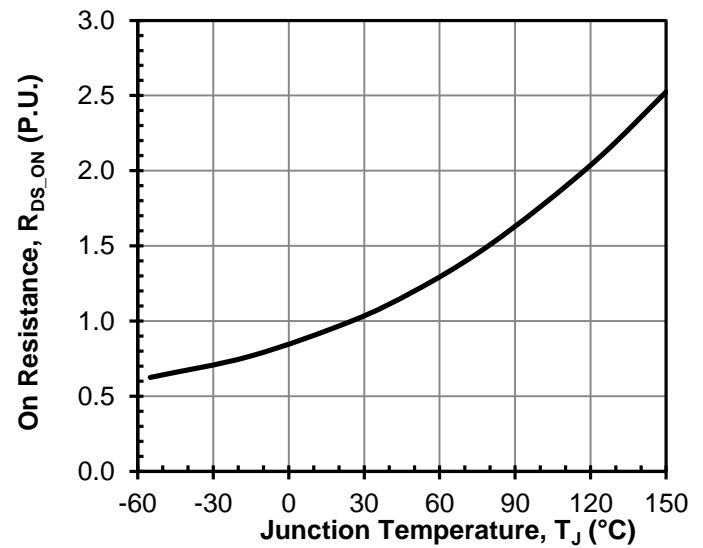
**Figure 1 Typical output characteristics**  
at  $T_j = -55^\circ\text{C}$ ,  $t_p < 250\mu\text{s}$



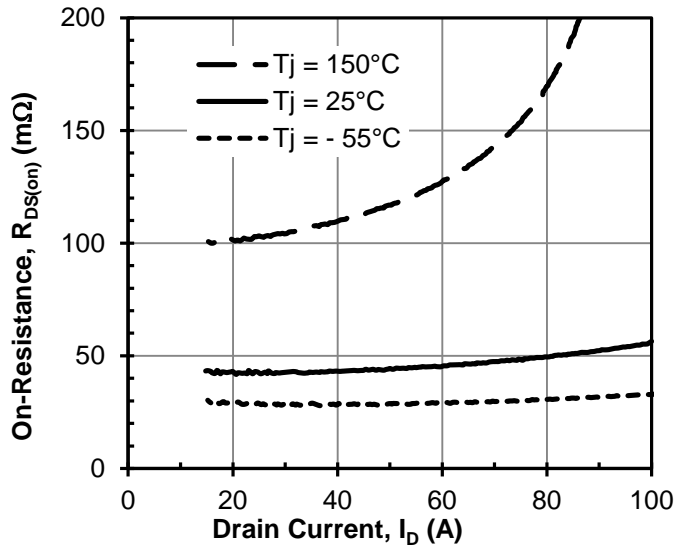
**Figure 2 Typical output characteristics**  
at  $T_j = 25^\circ\text{C}$ ,  $t_p < 250\mu\text{s}$



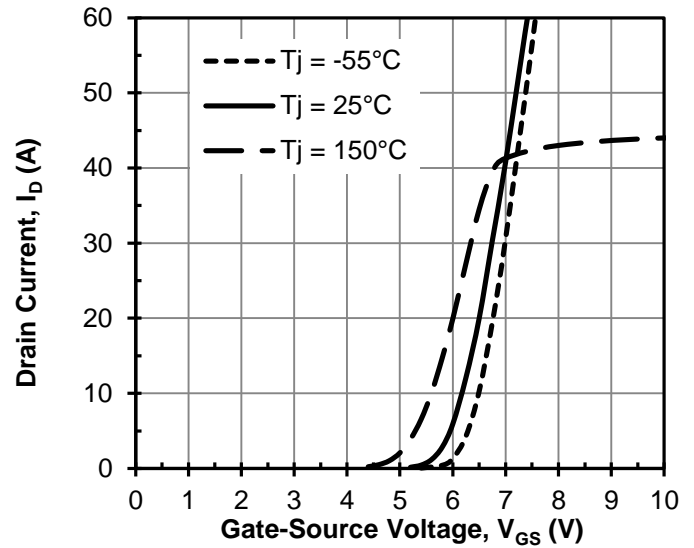
**Figure 3 Typical output characteristics**  
at  $T_j = 150^\circ\text{C}$ ,  $t_p < 250\mu\text{s}$



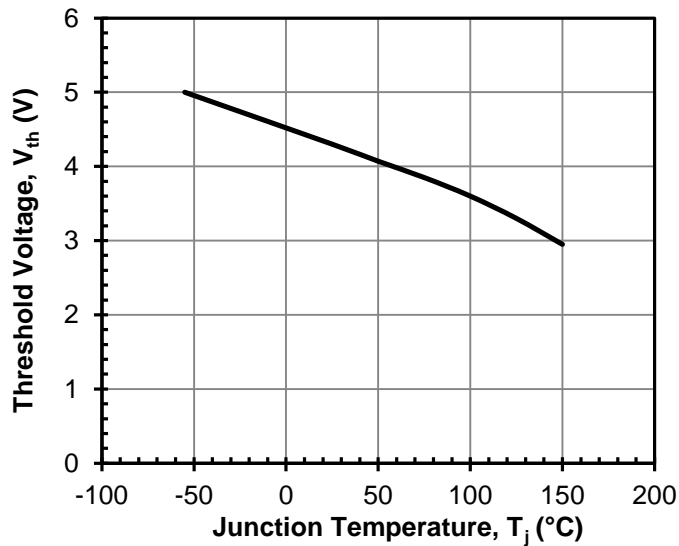
**Figure 4 Normalized on-resistance vs.**  
temperature at  $V_{GS} = 15\text{V}$  and  
 $I_D = 20\text{A}$



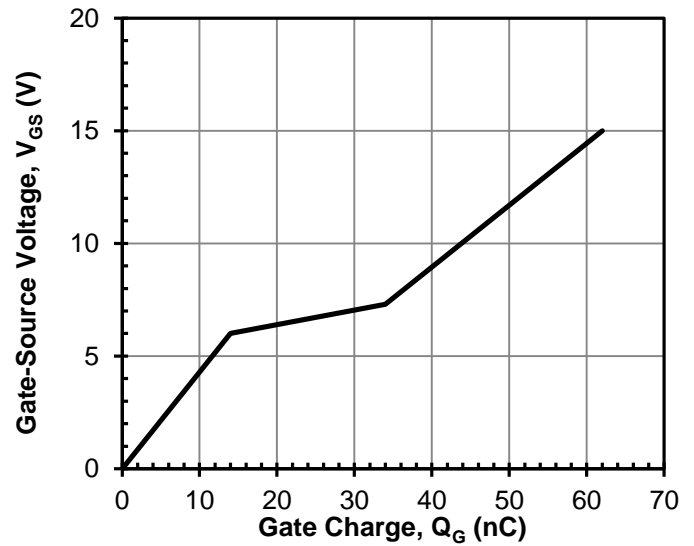
**Figure 5 Typical drain-source on-resistance at  $V_{GS} = 15V$**



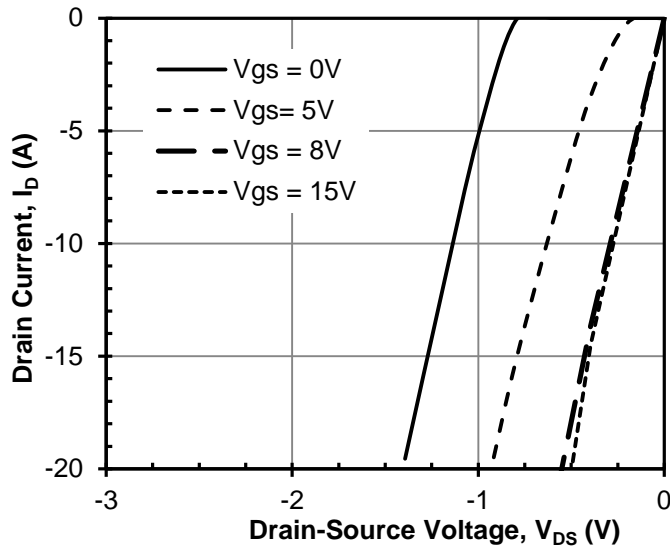
**Figure 6 Typical transfer characteristics at  $V_{DS} = 5V$**



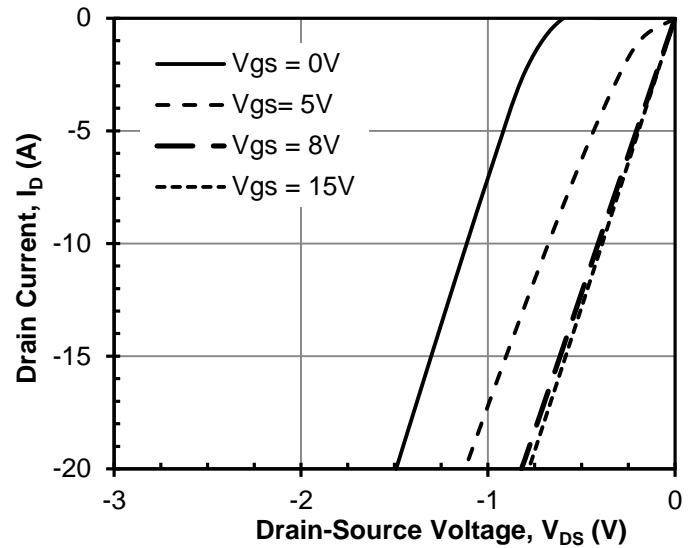
**Figure 7 Threshold voltage vs.  $T_j$  at  $V_{DS} = 5V$  and  $I_D = 250\mu A$**



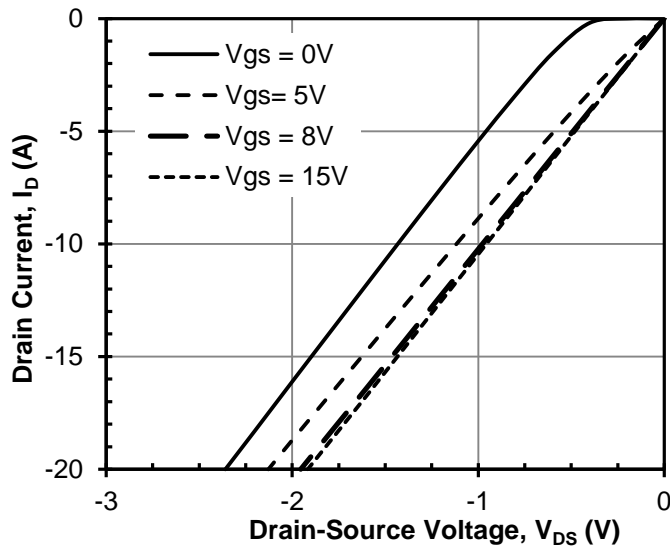
**Figure 8 Typical gate charge at  $V_{DS} = 800V$  and  $I_D = 20A$**



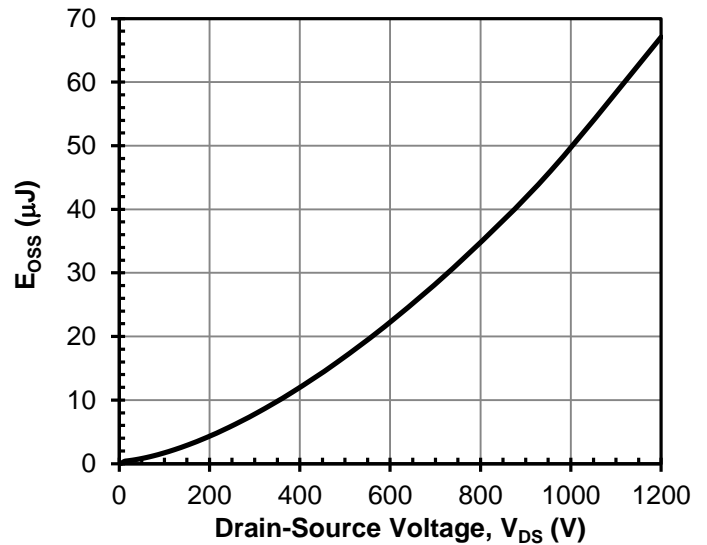
**Figure 9 3rd quadrant characteristics  
at  $T_J = -55^\circ\text{C}$**



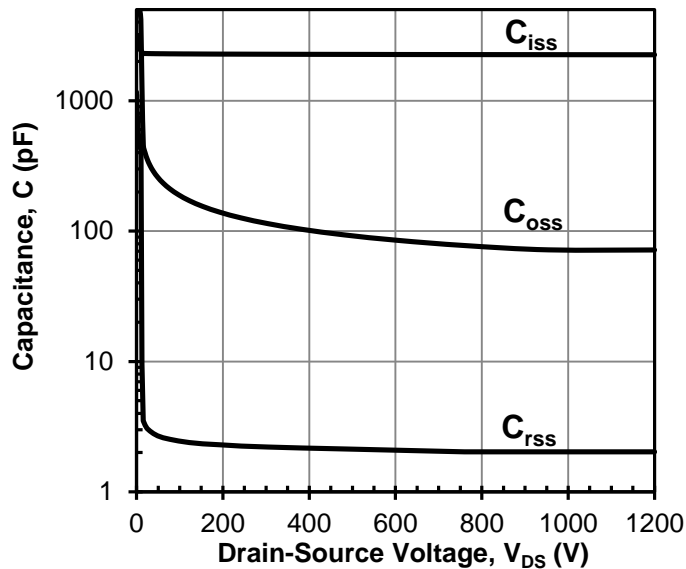
**Figure 10 3rd quadrant characteristics  
at  $T_J = 25^\circ\text{C}$**



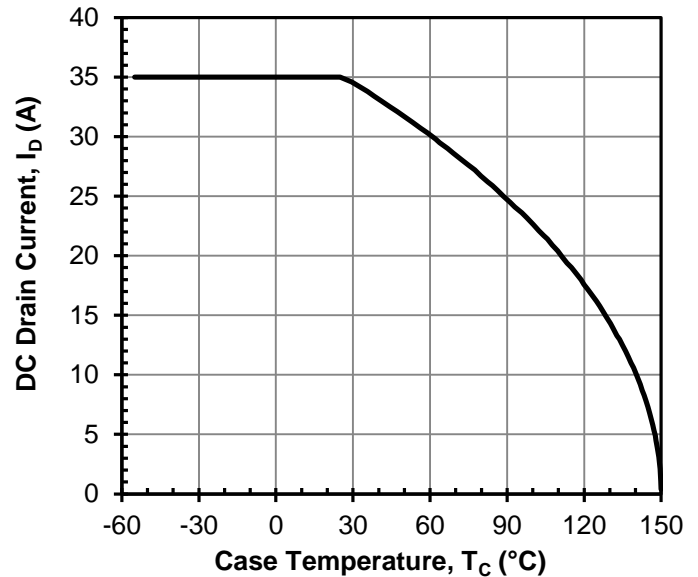
**Figure 11 3rd quadrant characteristics  
at  $T_J = 150^\circ\text{C}$**



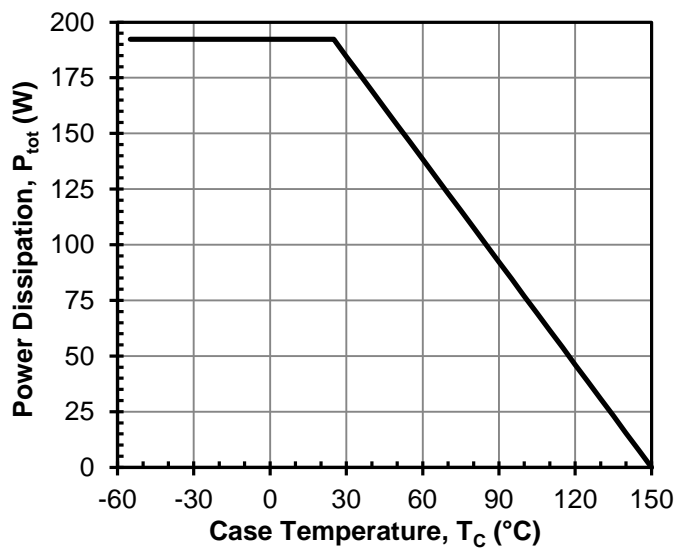
**Figure 12 Typical stored energy in  $C_{OSS}$   
at  $V_{GS} = 0\text{V}$**



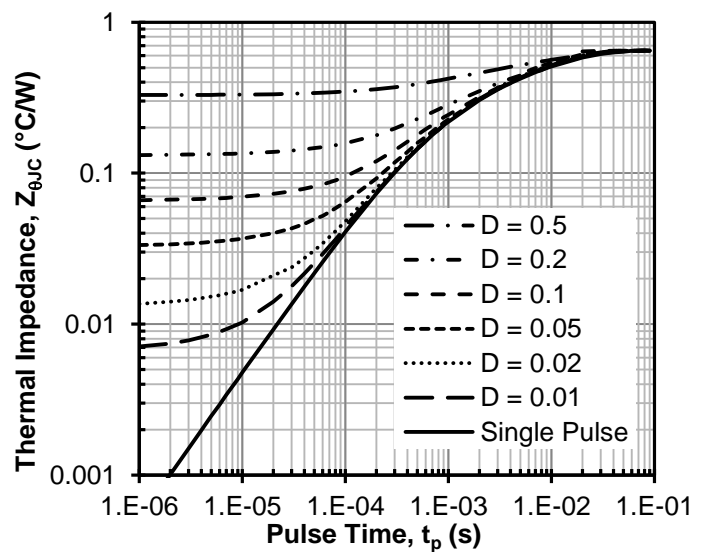
**Figure 13 Typical capacitances at 100kHz and  $V_{GS} = 0V$**



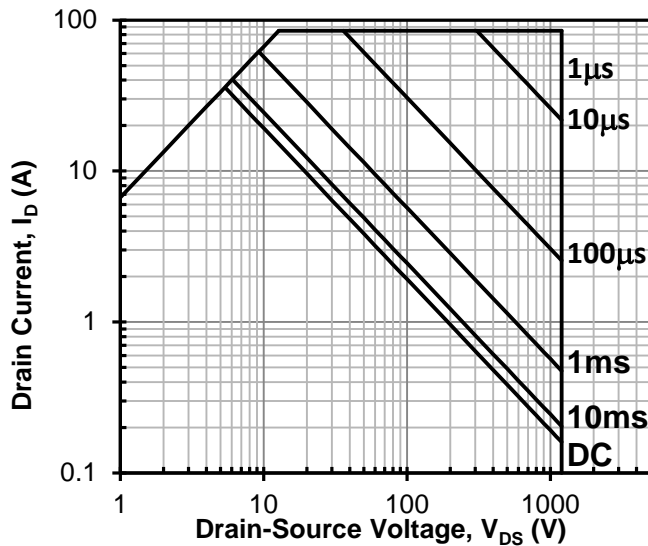
**Figure 14 DC drain current derating**



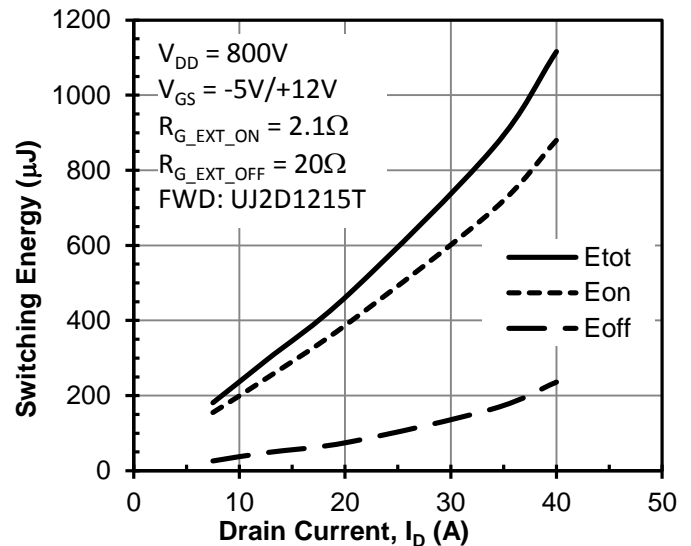
**Figure 15 Total power Dissipation**



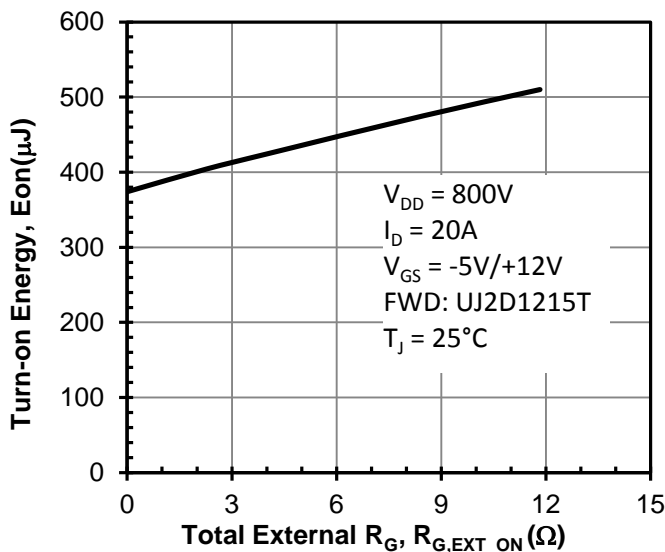
**Figure 16 Maximum transient thermal impedance**



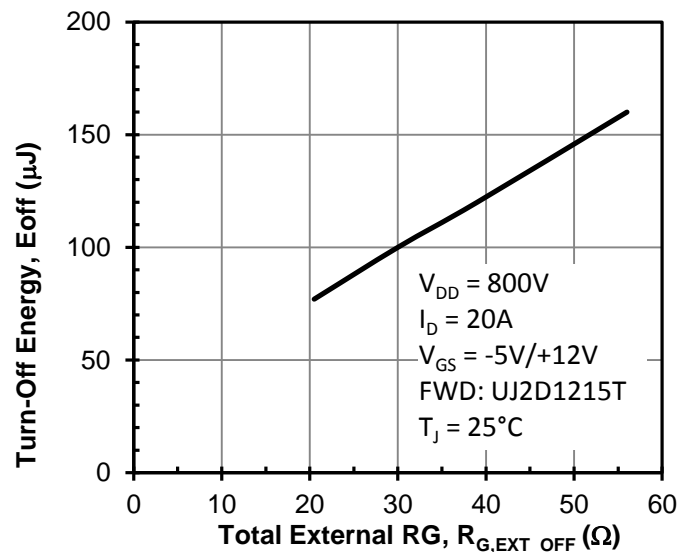
**Figure 17 Safe operation area**  
 $T_c = 25^\circ\text{C}$ ,  $D = 0$ , Parameter  $t_p$



**Figure 18 Clamped inductive switching energy vs. drain current at**  
 $T_J = 25^\circ\text{C}$

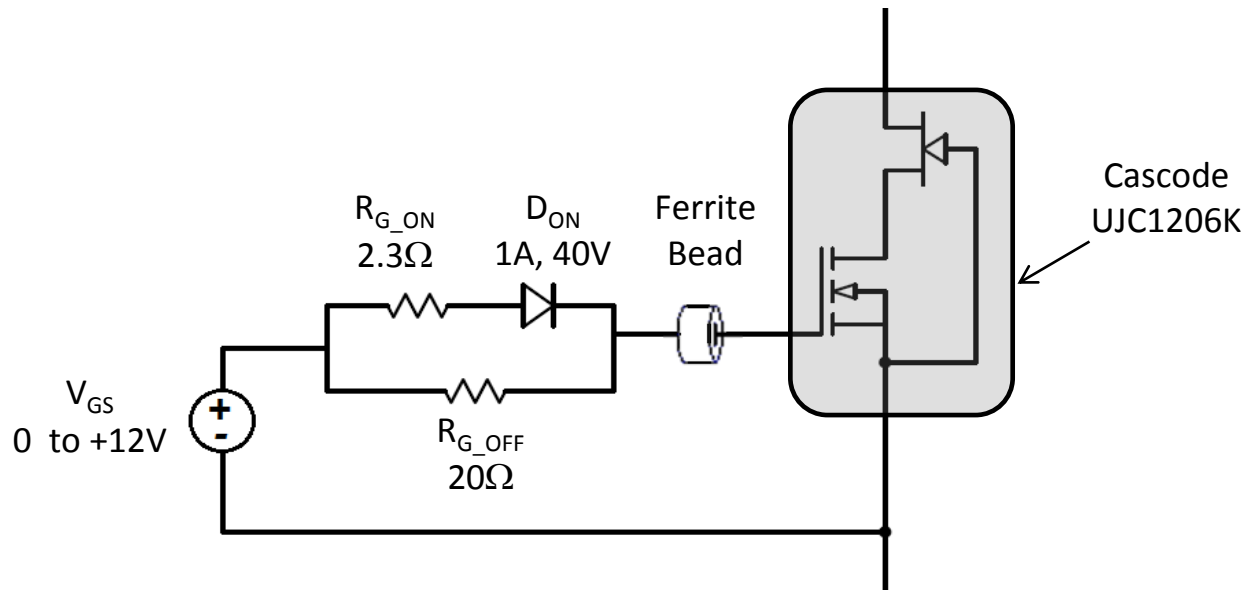


**Figure 19 Clamped inductive switching turn-on energy vs.  $R_{G\_EXT\_ON}$**



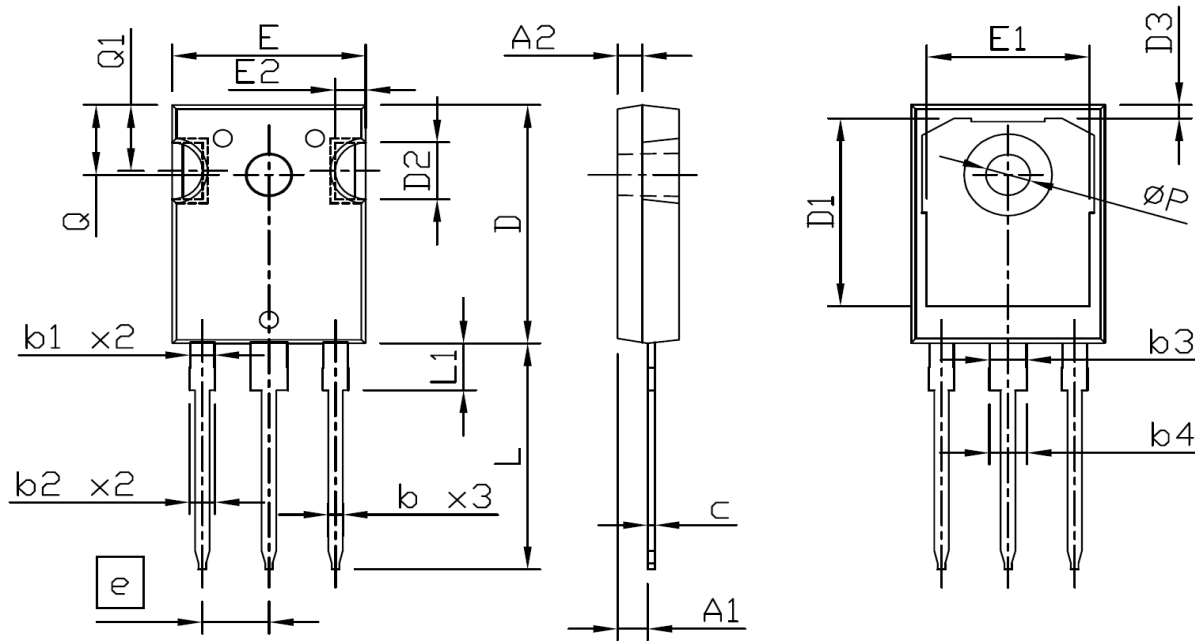
**Figure 20 Clamped inductive switching turn-off energy vs.  $R_{G\_EXT\_OFF}$**





**Figure 21 Rrecommended gate drive**

## Mechanical Characteristics



RECOMMENDED LAND PATTERN

UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.90	5.00	5.10	0.193	0.197	0.201
A1	2.31	2.42	2.52	0.091	0.095	0.099
A2	1.90	2.00	2.10	0.075	0.079	0.083
b	1.16	1.22	1.27	0.046	0.048	0.050
b1	1.96	2.02	2.07	0.078	0.080	0.081
b2	2.00	2.10	2.20	0.079	0.083	0.087
b3	2.96	3.02	3.07	0.117	0.119	0.121
b4	3.00	3.10	3.20	0.118	0.122	0.126
c	0.59	0.62	0.66	0.023	0.024	0.026
D	20.90	21.00	21.10	0.823	0.827	0.831
D1	16.25	16.55	16.85	0.640	0.652	0.663
D2	5.00 TYP			0.197 TYP		
D3	1.05	1.20	1.35	0.041	0.047	0.053
e	5.44 BSC			0.214 BSC		
E	15.70	15.80	15.90	0.618	0.622	0.626
E1	13.06	13.26	13.50	0.514	0.522	0.530
E2	2.50 TYP			0.098 TYP		
L	19.72	19.92	20.12	0.776	0.784	0.792
L1	---	---	4.30	---	---	0.169
Q	6.15 BSC			0.242 BSC		
Q1	5.60	5.80	6.00	0.220	0.228	0.236
ØP	3.55	3.60	3.70	0.140	0.142	0.146

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