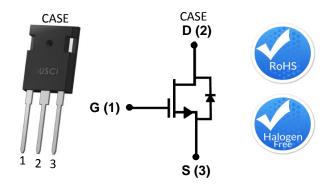
Datasheet

# Description

United Silicon Carbide's cascode products co-package its xJ series highperformance 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 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.



Part Number	Package	Marking
UJC1210K	TO-247-3L	UJC1210K

#### **Typical Applications**

- EV charging
- PV inverters
- Switch mode power supplies
- Power factor correction modules
- Motor drives
- Induction heating

#### Features

- Max. on-resistance  $R_{DS(on)max}$  of  $100m\Omega$
- Standard 12V gate drive
- Maximum operating temperature of 150°C
- Excellent reverse recovery
- Low gate charge
- Low intrinsic capacitance
- RoHS compliant

# **Maximum Ratings**

Parameter	Symbol	Test Conditions	Value	Units
Drain-source voltage	V <sub>DS</sub>		1200	V
Gate-source voltage	V <sub>GS</sub>	DC	-25 to +25	V
Continuous drain current <sup>1</sup>	1	T <sub>C</sub> = 25°C	21.5	А
Continuous drain current	I <sub>D</sub>	T <sub>C</sub> = 100°C	14	А
Pulsed drain current <sup>2</sup>	I <sub>DM</sub>	T <sub>C</sub> = 25°C	66.5	А
Short-circuit withstand time <sup>3</sup>	t <sub>sc</sub>	V <sub>GS</sub> =15V, V <sub>CC</sub> <600V	4	μs
Single pulsed avalanche energy <sup>3</sup>	E <sub>AS</sub>	L=15mH, I <sub>AS</sub> =2.8A	64	mJ
Power dissipation	P <sub>tot</sub>	T <sub>C</sub> = 25°C	113.6	w
Maximum junction temperature	T <sub>J,max</sub>		150	°C
Operating and storage temperature	T <sub>J</sub> , T <sub>STG</sub>		-55 to 150	°C
Max. lead temperature for soldering, 1/8" from case for 5 Seconds	TL		250	°C

- 1 Limited by T<sub>J,max</sub>
- 2 Pulse width t<sub>p</sub> limited by T<sub>J,max</sub>
- 3 Starting  $T_J = 25^{\circ}C$

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# **Electrical Characteristics** (T<sub>J</sub> = +25°C unless otherwise specified)

### **Typical Performance - Static**

Parameter	Symbol	Test Conditions	Value			Units
Farameter			Min	Тур	Max	Units
Drain-source breakdown voltage	BV <sub>DS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =1mA	1200			V
Total drain leakage current	I <sub>DSS</sub>	V <sub>DS</sub> = 1200V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C		70	500	
		V <sub>DS</sub> = 1200V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C		150		μΑ
Total gate leakage current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, T <sub>j</sub> =25°C, V <sub>GS</sub> = -20V / +20V		5	100	nA
Drain-source on-resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =12V, I <sub>D</sub> =10A, T <sub>J</sub> = 25°C		70	100	- mΩ
		V <sub>GS</sub> =12V, I <sub>D</sub> =10A, T <sub>J</sub> = 150°C		161		
Gate threshold voltage	V <sub>G(th)</sub>	V <sub>DS</sub> = 5V, I <sub>D</sub> = 10mA	4.5	5	5.5	V
Gate resistance	R <sub>G</sub>	f = 1MHz, open drain		1.1		Ω

#### **Typical Performance - Reverse Diode**

Parameter	Symbol	Test Conditions	Value			L lusites
			Min	Тур	Max	Units
Diode continuous forward current <sup>1</sup>	۱ <sub>s</sub>	T <sub>C</sub> = 25°C			21.5	А
Diode pulse current <sup>2</sup>	I <sub>S,pulse</sub>	T <sub>C</sub> = 25°C			66.5	А
Forward voltage	V <sub>FSD</sub>	V <sub>GS</sub> = 0V, I <sub>F</sub> =10A, T <sub>J</sub> = 25°C		1.4	2	- V
		V <sub>GS</sub> = 0V, I <sub>F</sub> = 10A, T <sub>J</sub> =150°C		2		
Reverse recovery charge	Q <sub>rr</sub>	$V_{R}$ =800V, I <sub>F</sub> =14A, $V_{GS}$ =0V, $R_{G_{EXT}}$ = 22 $\Omega$		112		nC
Reverse recovery time	t <sub>rr</sub>	di/dt=1550A/µs, T」 = 25°C		34		ns
Reverse recovery charge	Q <sub>rr</sub>	$V_{R}$ =800V, I <sub>F</sub> =14A, $V_{GS}$ =0V,R <sub>G_EXT</sub> = 22 $\Omega$		127		nC
Reverse recovery time	t <sub>rr</sub>	di/dt=1550A/µs, Tյ = 150°C		36		ns

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# **Typical Performance - Dynamic**

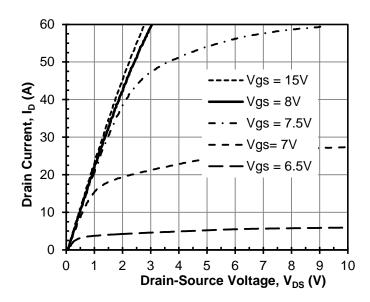
$\begin{array}{ c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Parameter	symbol	Test Conditions	Value			Units	
$ \begin{array}{ c c c c c c } \hline \mbox{Output capacitance} & C_{oss} & V_{GS} = 0V, & 106 & PF \\ \hline \mbox{Reverse transfer capacitance} & C_{rss} & f = 100 \text{ MHz} & 3.5 & PF \\ \hline \mbox{Reverse transfer capacitance, energy related} & C_{oss(er)} & V_{DS} = 0V to 800V, & V_{SS} = 0V & 100 & PF \\ \hline \mbox{Effective output capacitance, time related} & C_{oss(tr)} & V_{DS} = 0V to 800V, & V_{SS} = 0V & 18.5 & \muJ \\ \hline \mbox{Total gate charge} & Q_G & V_{DS} = 800V, V_{SS} = 0V & 18.5 & \muJ \\ \hline \mbox{Total gate charge} & Q_G & V_{DS} = 800V, V_{SS} = 0V & 12V & 15 & 0 \\ \hline \mbox{Gate-drain charge} & Q_{GS} & V_{DS} = 800V, I_D = 14A, & 15 & 0 \\ \hline \mbox{Turn-on delay time} & t_{d(ori)} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on delay time} & t_{d(ori)} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on feargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \\mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \\mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 800V, I_D = 14A, & 322 & 0 \\ \hline \\mbox{Turn-on ff eargy} & E_{ON} & V_{DS} = 200 & 0 \\ $				Min	Тур	Max	Units	
Reverse transfer capacitance $C_{rss}$ $f = 100 \text{ Hz}$ $3.5$ Effective output capacitance, energy related $C_{oss(er)}$ $V_{DS} = 0V$ to $800V$ , $V_{GS} = 0V$ $57$ $pF$ Effective output capacitance, time related $C_{oss(er)}$ $V_{DS} = 0V$ to $800V$ , $V_{GS} = 0V$ $100$ $pF$ Effective output capacitance, time related $C_{oss(er)}$ $V_{DS} = 800V$ , $V_{CS} = 0V$ $100$ $pF$ Coss stored energy $E_{oss}$ $V_{DS} = 800V$ , $V_{cs} = 0V$ $18.5$ $\muJ$ Total gate charge $Q_{G}$ $V_{DS} = 800V$ , $I_D = 14A$ , $V_{GS} = 0V$ to $12V$ $47.5$ $nC$ Gate-drain charge $Q_{GS}$ $V_{DS} = 800V$ , $I_D = 14A$ , $V_{GS} = 0V$ to $12V$ $15$ $nC$ Turn-on delay time $t_{d(on)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $V_{GS} = 0V$ to $12V$ $32$ $nC$ Turn-off delay time $t_q$ $Turn-off R_{G,EXT} = 22\Omega$ $Inductive Load,FWD: UJ2D1210T32\muJTurn-off delay timet_qTurn-off R_{G,EXT} = 2\OmegaSC = 00000000000000000000000000000000000$	Input capacitance	-	V <sub>DS</sub> = 100V,					
Effective output capacitance, energy related $C_{ossterl}$ $V_{DS} = 0V to 800V, V_{CS} = 0V$ $57$ $pF$ Effective output capacitance, time related $C_{ossterl}$ $V_{DS} = 0V to 800V, V_{CS} = 0V$ $100$ $pF$ Effective output capacitance, time related $C_{ossterl}$ $V_{DS} = 800V, V_{CS} = 0V$ $100$ $pF$ Coss stored energy $E_{oss}$ $V_{DS} = 800V, V_{CS} = 0V$ $18.5$ $\mu$ Total gate charge $Q_{G}$ $V_{DS} = 800V, V_{DS} = 14A, V_{GS} = 0V$ $15.5$ $nC$ Gate-drain charge $Q_{GS}$ $V_{DS} = 800V, I_{D} = 14A, V_{GS} = 0V$ $15$ $nC$ Gate-source charge $Q_{GS}$ $V_{DS} = 800V, I_{D} = 14A, GAT15nCTurn-on delay timet_{d(orfl)}V_{DS} = 800V, I_{D} = 14A, GAT17nCTurn-off delay timet_{q(orfl)}Turn-off R_{GEXT} = 22\Omega, Inductive Load, FWD: UJ2D1210TT_{T_{J}} = 25^{\circ}C94nCTurn-off delay timet_{d(orfl)}V_{DS} = 800V, I_{D} = 14A, GAT266\muTurn-off delay timet_{d(orfl)}V_{DS} = 800V, I_{D} = 14A, GAT266\muTurn-off delay timet_{d(orfl)}V_{DS} = 800V, I_{D} = 14A, GAT266\muTurn-off delay timet_{d(orfl)}V_{DS} = 800V, I_{D} = 14A, GAT21nRise timet_{r}V_{DS} = 800V, I_{D} = 14A, GAT21nTurn-off delay timet_{d(orfl)}Turn-off R_{G,EXT} = 2\Omega, Inductive Load, FWD: UJD21210TT_{T} = 150^{\circ}C21T$	Output capacitance				106		pF	
Effective output capacitance, energy related $C_{oss}(er)$ $V_{OS} = 0V$ $57$ $pF$ Effective output capacitance, time related $C_{oss}(tr)$ $V_{DS} = 0V$ to $800V$ , $V_{GS} = 0V$ $100$ $pF$ C_{OSS} stored energy $E_{oss}$ $V_{DS} = 800V$ , $V_{GS} = 0V$ $18.5$ $\muJ$ Total gate charge $Q_{G}$ $Q_{S}$ $V_{DS} = 800V$ , $V_{GS} = 0V$ $18.5$ $\muJ$ Gate-drain charge $Q_{GG}$ $V_{DS} = 800V$ , $V_{DS} = 14A$ , $V_{SS} = 0V$ $15$ $nC$ Gate-drain charge $Q_{GS}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $32$ $nC$ Turn-ondelay time $t_{d(on)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $32$ $nC$ Turn-off delay time $t_{d(off)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $32$ $nC$ Turn-off delay time $t_{d(off)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $32$ $nC$ Turn-off delay time $t_{d(off)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $266$ $PF$ Turn-off energy $E_{OFF}$ $T_J = 25^{\circ}C$ $56$ $\muJ$ Turn-off delay time $t_{d(off)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $211$ $\muJ$ Rise time $t_r$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $221$ $nS$ Turn-off delay time $t_{d(off)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $211$ $nS$ Rise time $t_r$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $211$ $nS$ Turn-off delay time $t_{d(off)}$ $V_{DS} = 800V$ , $I_D = 14A$ , $Gate$ $211$ $nS$	Reverse transfer capacitance	C <sub>rss</sub>	f = 100kHz		3.5			
Effective output capacitance, time related $C_{oss}(r)$ $V_{GS} = 0V$ 100 $pF$ $C_{OSS}$ stored energy $E_{oss}$ $V_{DS} = 800V, V_{GS} = 0V$ 18.5 $\mu$ Total gate charge $Q_G$ $V_{DS} = 800V, V_D = 14A, V_{GS} = 0V$ 15nCGate-drain charge $Q_{GS}$ $V_{DS} = 800V, I_D = 14A, V_{GS} = 0V$ 15nCGate-drain charge $Q_{GS}$ $V_{DS} = 800V, I_D = 14A, V_{GS} = 0V$ 15nCGate-drain charge $Q_{GS}$ $V_{DS} = 800V, I_D = 14A, Gate Driver = 0V to 12V$ 15nCTurn-on delay time $t_{d(off)}$ $V_{DS} = 800V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, Turn-on R_{G,EXT} = 2Q, S94nsFall timet_fTurn-off R_{G,EXT} = 22Q19nsnsTurn-on energyE_{ON}Inductive Load, FWD: UJ2D1210T56\muTurn-on delay timet_{d(off)}V_{DS} = 800V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 14A, Gate Driver = 0V to +12V, Turn-on R_{G,EXT} = 2Q, T_J = 000V, I_D = 00V, I_D = 00V$	Effective output capacitance, energy related	C <sub>oss(er)</sub>			57		pF	
Total gate charge $Q_G$ $V_{DS}$ =800V, $I_D$ = 14A, $V_{GS}$ =0V to 12V47.5nCGate-drain charge $Q_{GD}$ $V_{DS}$ =800V, $I_D$ = 14A, $V_{GS}$ =0V to 12V15nCGate-source charge $Q_{GS}$ $V_{DS}$ =800V, $I_D$ = 14A, $V_{DS}$ =800V, $I_D$ = 14A, Gate Driver =0V to 12V32 $I_T$ Turn-on delay time $t_q$ $T_r$ $T_r$ $I_T$ $I_T$ Turn-off delay time $t_q$ $T_r$ $I_T$ $I_T$ $I_T$ Fall time $t_r$ $T_r$ $I_S$ $I_S$ $I_S$ Turn-off energy $E_{ON}$ $E_{OTAL}$ $I_T$ $I_S$ $I_S$ Turn-off delay time $t_{d(off)}$ $V_{DS}$ =800V, $I_D$ =14A, Gate $FWD: UJ2D1210T$ $T_J$ = 25°C $I_S$ $I_S$ $I_S$ Turn-off delay time $t_{d(off)}$ $V_{DS}$ =800V, $I_D$ =14A, Gate $Driver =0V to +12V,$ $Turn-off delay timeI_{d(off)}I_{DS}I_STurn-off delay timet_{d(off)}V_{DS}=800V, I_D=14A, GateDriver =0V to +12V,Turn-off G_{SEXT} = 2\Omega,I_DZI_DZFall timet_qI_{d(off)}I_{DS}I_DZI_DZTurn-off G_{SEXT} = 2\Omega,I_DZI_DZI_DZI_DZFall timet_qI_{GOFF}I_{DS}I_DZI_DZTurn-off G_{SEXT} = 2\Omega,I_DZI_DZI_DZI_DZTurn-off G_{SEXT} = 2\Omega,I_DZI_DZI_DZI_DZTurn-off G_{SEXT} = 2\Omega,I_DZI_DZI_DZI_DZ$	Effective output capacitance, time related	C <sub>oss(tr)</sub>			100		pF	
Gate-drain charge Q <sub>GD</sub> V <sub>DS</sub> =800V, I <sub>D</sub> = 14A, V <sub>GS</sub> =0V to 12V 15 nC   Gate-source charge Q <sub>GS</sub> V <sub>DS</sub> =800V, I <sub>D</sub> = 14A, V <sub>GS</sub> =0V to 12V 15 nC   Turn-on delay time t <sub>d(on)</sub> V <sub>DS</sub> =800V, I <sub>D</sub> = 14A, Gate Driver = 0V to 12V, Turn-on R <sub>G,EXT</sub> = 2Ω, Turn-off delay time 32 17 nC   Fall time t <sub>d(off)</sub> Turn-on R <sub>G,EXT</sub> = 2Ω, Turn-on R <sub>G,EXT</sub> = 2Ω, Turn-off R <sub>G,EXT</sub> = 2Ω, Turn-on delay time 19 115 nS   Turn-on delay time t <sub>d(off)</sub> Turn-off R <sub>G,EXT</sub> = 2Ω, Turn-off R <sub>G,EXT</sub> = 2Ω, Turn-off delay time 19 115 nS   Turn-on delay time t <sub>d(on)</sub> V <sub>DS</sub> =800V, I <sub>D</sub> =14A, Gate Driver = 0V to +12V, Turn-on R <sub>G,EXT</sub> = 2Ω, Turn-off delay time 32 µJ   Fall time t <sub>r</sub> V <sub>DS</sub> =800V, I <sub>D</sub> =14A, Gate Driver = 0V to +12V, Turn-on R <sub>G,EXT</sub> = 2Ω, Turn-off R <sub>G,EXT</sub> = 2Ω, Turn-	C <sub>oss</sub> stored energy	E <sub>oss</sub>	$V_{DS} = 800V, V_{GS} = 0V$		18.5		μ	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Total gate charge	Q <sub>G</sub>			47.5		nC	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Gate-drain charge	Q <sub>GD</sub>			15			
NormalizationNorma	Gate-source charge	Q <sub>GS</sub>	V <sub>GS</sub> -0V to 12V		15			
Rise time $t_r$ Driver =0V to +12V, Turn-off delay time17nsFall time $t_{d(off)}$ $t_{rot}$ $Turn-on R_{G,EXT} = 2\Omega,$ Turn-on R_{G,EXT} = 22 $\Omega$ 19 $urn-on R_{G,EXT} = 2\Omega,$ Turn-off R_{G,EXT} = 22 $\Omega$ 19 $urn-on R_{G,EXT} = 2\Omega,$ Turn-off R_{G,EXT} = 22 $\Omega$ 19 $\mu$ Turn-off energy $E_{ON}$ $E_{OFF}$ $run-off R_{G,EXT} = 2\Omega,$ Turn-off energy $266$ $\mu$ Turn-on delay time $E_{OFF}$ $r_{J} = 25^{\circ}C$ $322$ $\mu$ Turn-off delay time $t_{d(on)}$ $v_{DS}$ =800V, $I_D$ =14A, Gate Driver =0V to +12V, Turn-on $R_{G,EXT} = 2\Omega,$ $32$ $ns$ Fall time $t_r$ $Turn-on R_{G,EXT} = 2\Omega,$ Turn-off $R_{G,EXT} = 2\Omega,$ $102$ $ns$ Fall time $t_r$ $Turn-on R_{G,EXT} = 2\Omega,$ Turn-off $R_{G,EXT} = 2\Omega,$ $102$ $ns$ Turn-off energy $E_{ON}$ $E_{OFF}$ $run-off R_{G,EXT} = 2\Omega,$ $FWD: UJ2D1210TT_J = 150^{\circ}C290\mu$	Turn-on delay time	t <sub>d(on)</sub>			32		_	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Rise time	t <sub>r</sub>	Driver =0V to +12V,		17			
Turn-on energy $E_{ON}$ Inductive Load, FWD: UJ2D1210T $T_J = 25^{\circ}C$ 266 $\mu$ Turn-off energy $E_{OFF}$ $F_{WD:} UJ2D1210T$ $T_J = 25^{\circ}C$ $56$ $\mu$ Turn-on delay time $t_{d(on)}$ $V_{DS}=800V, I_D=14A, Gate$ Driver =0V to +12V, Turn-onff delay time $32$ $32$ Turn-off delay time $t_{d(off)}$ $Turn-on R_{G,EXT} = 2\Omega$ , Inductive Load, FWD: UJ2D1210T $T_J = 150^{\circ}C$ $102$ $ns$	Turn-off delay time	t <sub>d(off)</sub>			94			
Turn-off energy $E_{ON}$ FWD: UJ2D1210T $Z66$ $\mu$ Turn-off energy $E_{OFF}$ $FWD: UJ2D1210T$ $56$ $\mu$ Total switching energy $E_{TOTAL}$ $T_J = 25^{\circ}C$ $322$ $322$ Turn-on delay time $t_{d(on)}$ $V_{DS}=800V, I_D=14A, Gate$ $32$ $32$ Rise time $t_r$ $T_{OFF} = 0V to +12V,$ $Turn-on R_{G,EXT} = 2\Omega,$ $102$ $ns$ Fall time $t_f$ $Turn-off R_{G,EXT} = 22\Omega,$ $102$ $102$ $ns$ Turn-off energy $E_{ON}$ $E_{OFF}$ $FWD: UJ2D1210T$ $78$ $\mu$ Turn-off energy $E_{OFF}$ $T_J = 150^{\circ}C$ $78$ $\mu$	Fall time	t <sub>f</sub>	-,		19			
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Turn-on energy	E <sub>ON</sub>	FWD: UJ2D1210T		266			
Total switching energy $E_{TOTAL}$ 322Turn-on delay time $t_{d(on)}$ $V_{DS}$ =800V, $I_D$ =14A, Gate32Rise time $t_r$ $V_{DS}$ =800V, $I_D$ =14A, Gate21Turn-off delay time $t_{d(off)}$ Turn-on $R_{G,EXT} = 2\Omega$ ,102Fall time $t_f$ Turn-off $R_{G,EXT} = 22\Omega$ 21Turn-on energy $E_{ON}$ Inductive Load, FWD: UJ2D1210T290Turn-off energy $E_{OFF}$ $T_J = 150^{\circ}C$ 78	Turn-off energy	E <sub>OFF</sub>			56			
Rise time $t_r$ $V_{DS}=800V, I_D=14A, Gate$ $21$ nsTurn-off delay time $t_{d(off)}$ Turn-on $R_{G,EXT} = 2\Omega$ , $102$ $102$ nsFall time $t_f$ Turn-off $R_{G,EXT} = 22\Omega$ $21$ $102$ $102$ $102$ Turn-on energy $E_{ON}$ Inductive Load, FWD: UJ2D1210T $FWD: UJ2D1210T$ $78$ $\mu J$	Total switching energy	E <sub>TOTAL</sub>			322			
Kise time $t_r$ Driver =0V to +12V, Turn-off delay timeDriver =0V to +12V, Turn-on R_{G,EXT} = 2\Omega,Driver =0V to +12V, Turn-on R_{G,EXT} = 2\Omega,Inductive Load, FWD: UJ2D1210TDriver =0V to +12V, Turn-off R_{G,EXT} = 2\Omega,Inductive Load, FWD: UJ2D1210TInductive Load, FWD: UJ2D1210TPrice PointPrice P	Turn-on delay time	t <sub>d(on)</sub>	Driver =0V to +12V, Turn-on $R_{G,EXT} = 2\Omega$ , Turn-off $R_{G,EXT} = 22\Omega$ Inductive Load, FWD: UJ2D1210T		32			
Turn-off delay time $t_{d(off)}$ Turn-on $R_{G,EXT} = 2\Omega$ , Turn-off $R_{G,EXT} = 2\Omega$ , Turn-off $R_{G,EXT} = 2\Omega$ , Turn-off $R_{G,EXT} = 2\Omega$ , Inductive Load, FWD: UJ2D1210T T_J = 150°C102Turn-off delay time $t_f$ Turn-off $R_{G,EXT} = 2\Omega$ , Turn-off $R_{G,EXT} = 2\Omega$ , 	Rise time	t <sub>r</sub>			21			
Fall time $t_f$ Turn-off $R_{G,EXT} = 22\Omega$ 21Turn-on energy $E_{ON}$ Inductive Load, FWD: UJ2D1210T $T_J = 150^{\circ}C$ 290Inductive Load, FWD: UJ2D1210T 	Turn-off delay time	t <sub>d(off)</sub>			102		115	
Turn-off energy $E_{OFF}$ FWD: UJ2D1210T250Turn-off energy $E_{OFF}$ $T_{J} = 150^{\circ}C$ 78 $\mu J$	Fall time	t <sub>f</sub>			21			
Turn-off energy $E_{OFF}$ $T_{J} = 150^{\circ}C$ $78$ $\mu$	Turn-on energy	E <sub>ON</sub>			290			
	Turn-off energy	E <sub>OFF</sub>			78		μ	
	Total switching energy	E <sub>TOTAL</sub>			368		]	

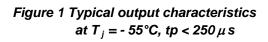
#### **Thermal Characteristics**

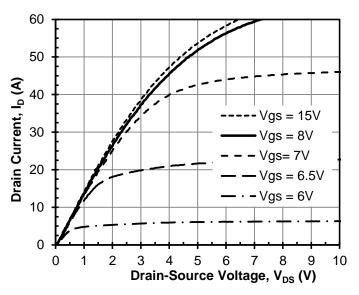
Parameter	symbol	Test Conditions		Units		
			Min	Тур	Max	Units
Thermal resistance, junction-to-case	$R_{\theta JC}$			0.85	1.1	°C/W

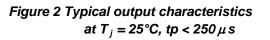
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# **Typical Performance Diagrams**



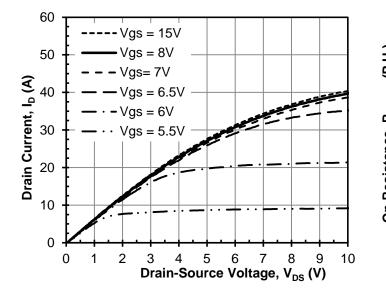


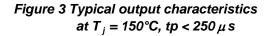


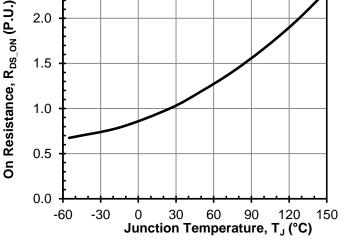


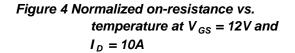
2.5

2.0

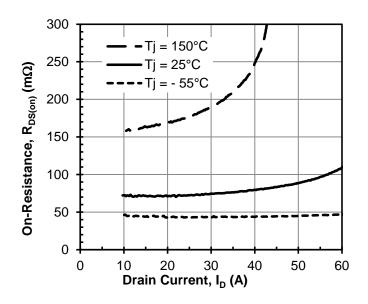


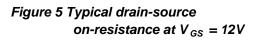


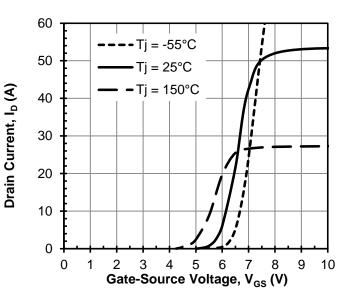


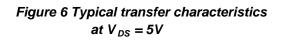


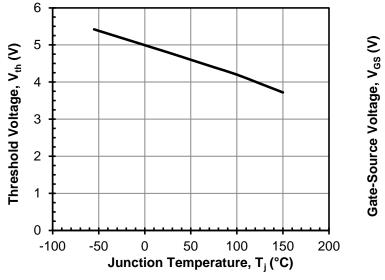
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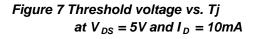












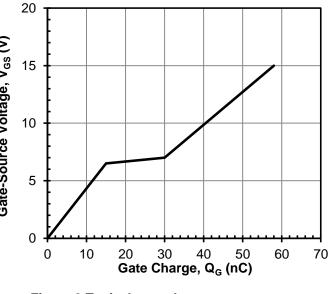


Figure 8 Typical gate charge at  $V_{DS} = 800V$  and  $I_D = 14A$ 

Vgs = 0V

Vgs= 5V

Vgs = 8V

Vgs = 15V

-3

0

-5

10

-15

-20

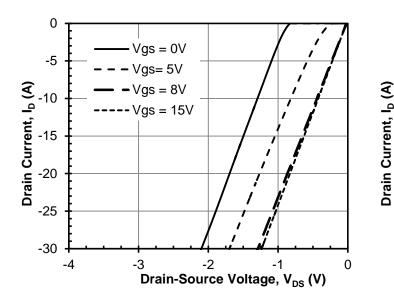
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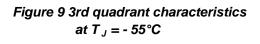
-30

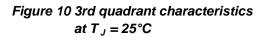
-4

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0



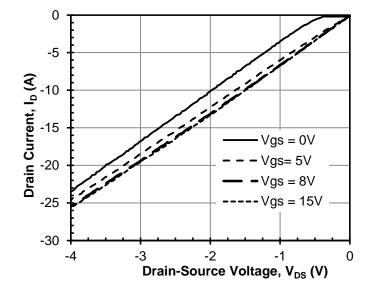


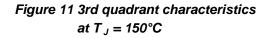


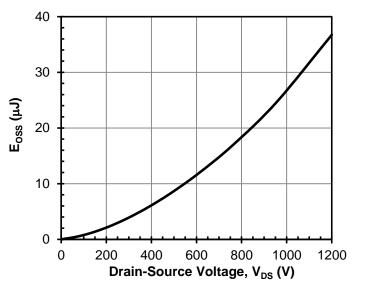
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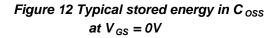
Drain-Source Voltage, V<sub>DS</sub> (V)

-1









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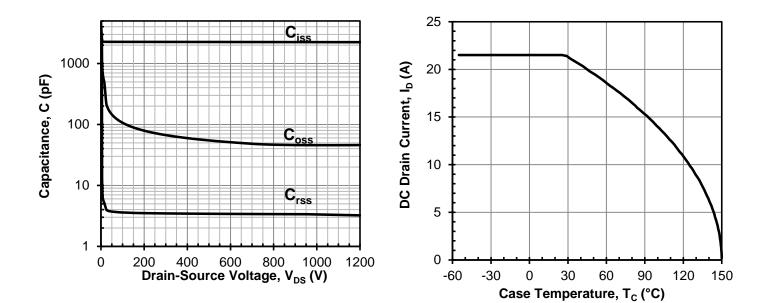
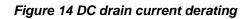


Figure 13 Typical capacitances at 100kHz and V  $_{\rm GS}$  = 0V



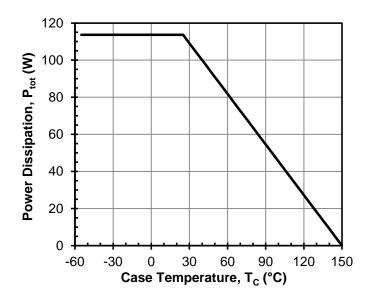


Figure 15 Total power dissipation

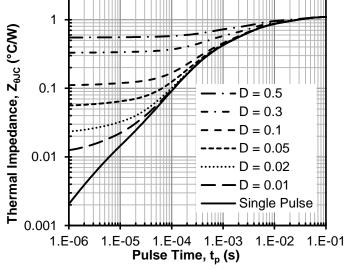
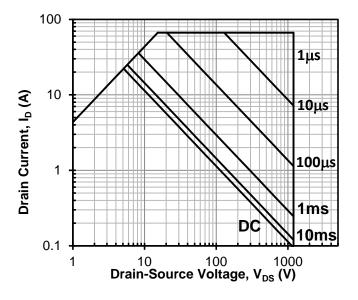
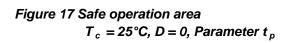


Figure 16 Maximum transient thermal impedance

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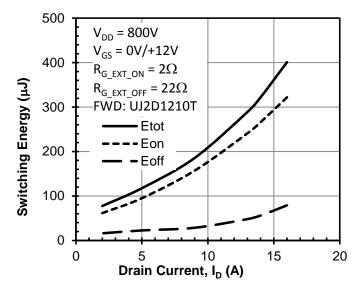
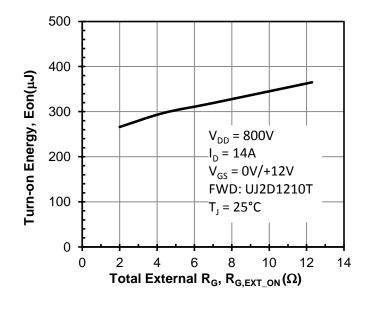
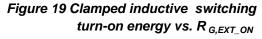


Figure 18 Clamped inductive switching energy vs. drain current at  $T_J = 25^{\circ}C$ 





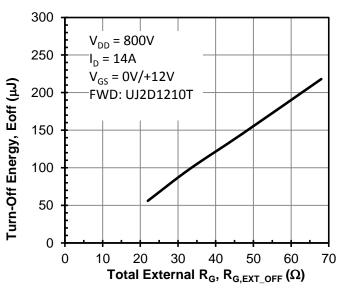


Figure 20 Clamped inductive switching turn-off energy vs. R<sub>G,EXT\_OFF</sub>

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# **Applications Information**

SiC cascodes are enhancement-mode power siwtches formed by a high-voltage SiC depletion-mode JFET and a low-voltage silicon MOSFET connected in series. The silicon MOSFET serves as the control unit while the SiC JFET provides high voltage blocking in the off state. This combination of devices in a single package provides compatibility with standard gate drivers and offers superior performance in terms of low on-resistance (R<sub>DS(on)</sub>), output capacitance (Coss), gate charge (Qg), and reverse recovery charge (Qrr) leading to low conduction and switching losses. The SiC cascodes also provide excellent reverse conduction capability eliminating the need for an external anti-parallel diode.

Like other high performance power switches, proper PCB layout design to minimize circuit parasitics is strongly recommended due to the high dv/dt and di/dt rates. An external gate resistor is recommended when the cascode is working in the diode mode in order to achieve the optimum reverse recover performance. For more information on cascode operation, see www.unitedsic.com.

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