SCT3022KLHRC11

SiC Power MOSFET N-Channel Enhancement Mode

Features

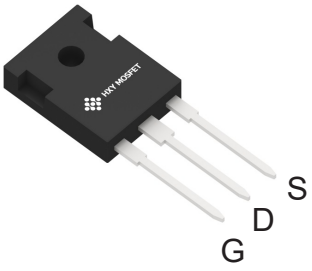
- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

Benefits

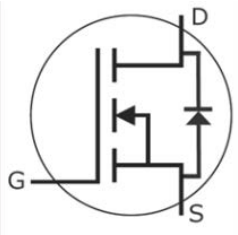
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



TO-247
Package



Ordering Part Number	Package	Brand
SCT3022KLHRC11	TO-247	HXY MOSFET

Maximum Ratings (T_C = 25 ˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V	V_{GS} = 0 V, I_D = 100 μA	
V_{GSmax}	Gate - Source Voltage (dynamic)	-8/+19	V	AC (f >1 Hz)	Note 1
V_{GSop}	Gate - Source Voltage (static)	-4/+15	V	Static	Note 2
I_D	Continuous Drain Current	81	A	V_{GS} = 15 V, T_C = 25˚C	Fig. 19 Note 3
		56		V_{GS} = 15 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	200	A	Pulse width t_P limited by T_{jmax}	
P_D	Power Dissipation	469	W	T_C=25˚C, T_J = 175 ˚C	Fig. 20
T_J , T_{stg}	Operating Junction and Storage Temperature	-40 to +175	˚C		
T_L	Solder Temperature	260	˚C	1.6mm (0.063”) from case for 10s	
M_d	Mounting Torque	1 8.8	Nm lbf-in	M3 or 6-32 screw	

Electrical Characteristics (T_C = 25˚C unless other wise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	V_{GS} = 0 V, I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.5	3.6	V	V_{DS} = V_{GS}, I_D = 17.7 mA	Fig. 11
			2.0		V	V_{DS} = V_{GS}, I_D = 17.7 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	μA	V_{DS} = 1200 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		10	250	nA	V_{GS} = 15 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance	14.7	21	28.8	mΩ	V_{GS} = 15 V, I_D = 50 A	Fig. 4, 5, 6
			38			V_{GS} = 15 V, I_D = 50 A, T_J = 175ºC	
g_{fs}	Transconductance		35		S	V_{DS}= 20 V, I_{DS}= 50 A	Fig. 7
			33			V_{DS}= 20 V, I_{DS}= 50 A, T_J = 175ºC	
C_{iss}	Input Capacitance		4818		pF	V_{GS} = 0 V, V_{DS} = 1000 V f=100KHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		180				
C_{rss}	Reverse Transfer Capacitance		12				
E_{oss}	C_{oss} Stored Energy		99		μJ		Fig. 16
E_{ON}	Turn-On Switching Energy (SiC Diode FWD)		3.05		mJ	V_{DS} = 800 V, V_{GS} = -4 V/+15 V, I_D = 50 A, $R_{G(ext)}$ = 5Ω, L= 65.7 μH, T_J = 175ºC	Fig. 26, 29
E_{OFF}	Turn Off Switching Energy (SiC Diode FWD)		1.67				
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		4.65		mJ	V_{DS} = 800 V, V_{GS} = -4 V/+15 V, I_D = 50 A, $R_{G(ext)}$ = 5Ω, L= 65.7 μH, T_J = 175ºC	Fig. 26, 29
E_{OFF}	Turn Off Switching Energy (Body Diode FWD)		1.58				
$t_{d(on)}$	Turn-On Delay Time		142		ns	V_{DD} = 800 V, V_{GS} = -4 V/15 V $R_{G(ext)}$ = 2.5 Ω, L= 65.7 μH Timing relative to VDS, Inductive load	Fig. 27
t_r	Rise Time		27				
$t_{d(off)}$	Turn-Off Delay Time		72				
t_f	Fall Time		25				
$R_{G(int)}$	Internal Gate Resistance		3.3		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		51		nC	V_{DS} = 800 V, V_{GS} = -4 V/15 V I_D = 50 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		54				
Q_g	Total Gate Charge		160				

Reverse Diode Characteristics (T^C = 25˚C unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.6		V	V_{GS} = -4 V, I_{SD} = 25 A, T_J = 25 °C	Fig. 8, 9, 10
		4.2		V	V_{GS} = -4 V, I_{SD} = 25 A, T_J = 175 °C	
I_S	Continuous Diode Forward Current		90	A	V_{GS} = -4 V, T_C = 25˚C	Note 1
$I_{S,\ pulse}$	Diode pulse Current		200	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	Note 1
t_{rr}	Reverse Recover time	81		ns	V_{GS} = -4 V, I_{SD} = 50 A, V_R = 800 V dif/dt = 1000 A/μs, T_J = 175 °C	Note 1
Q_{rr}	Reverse Recovery Charge	879		nC		
I_{rrm}	Peak Reverse Recovery Current	19		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.32	°C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			

Typical Performance

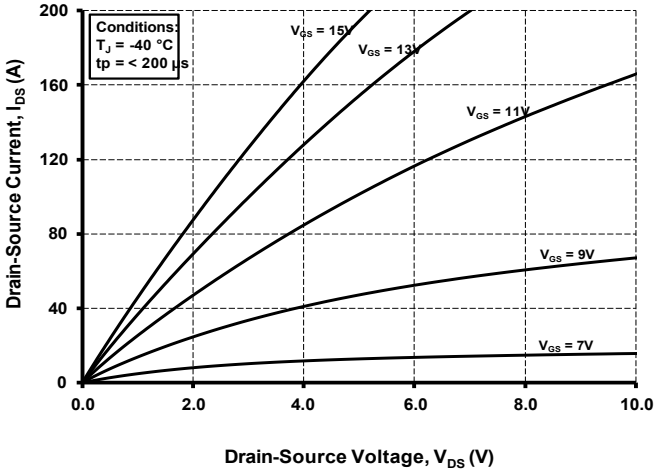


Figure 1. Output Characteristics T_J = -40 ºC

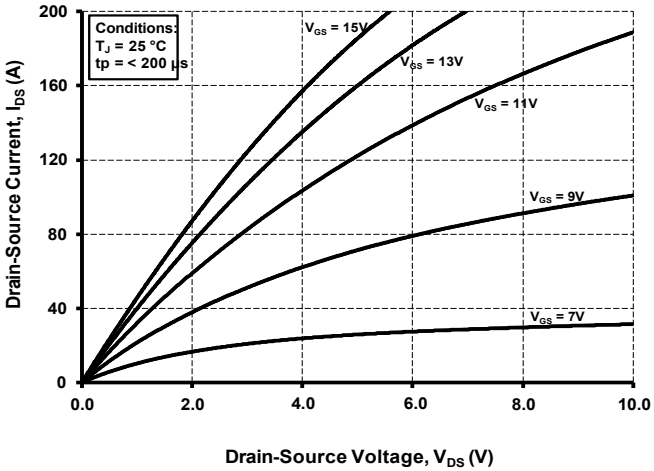


Figure 2. Output Characteristics T_J = 25 ºC

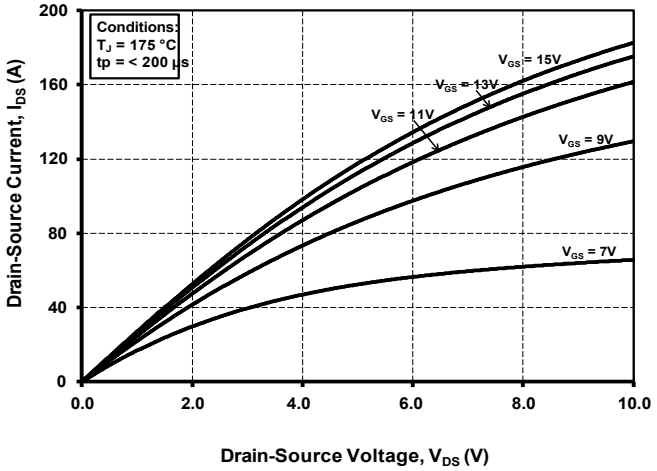


Figure 3. Output Characteristics T_J = 175 ºC

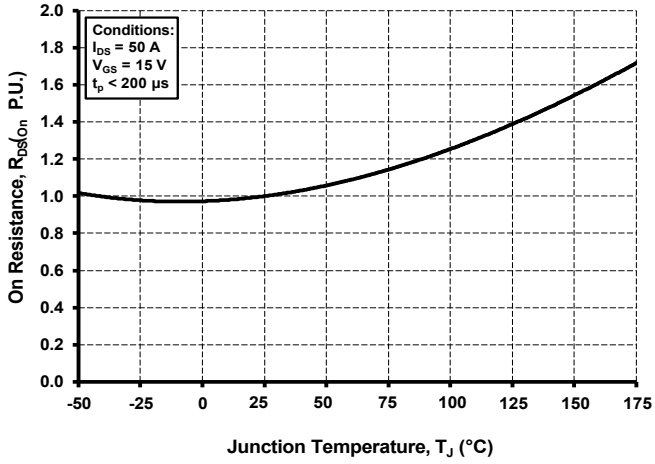


Figure 4. Normalized On-Resistance vs. Temperature

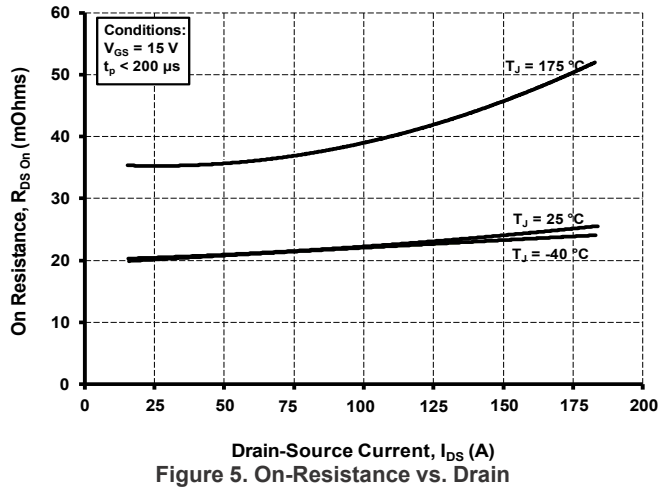


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

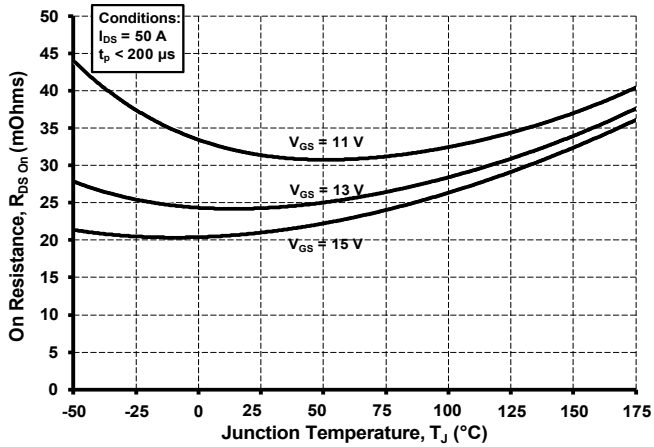


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

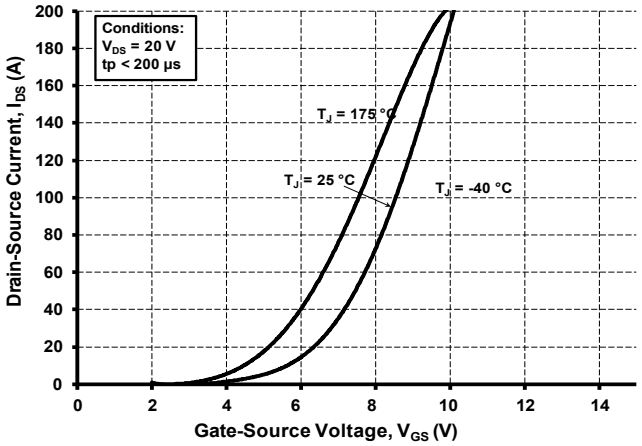


Figure 7. Transfer Characteristic for Various Junction Temperatures

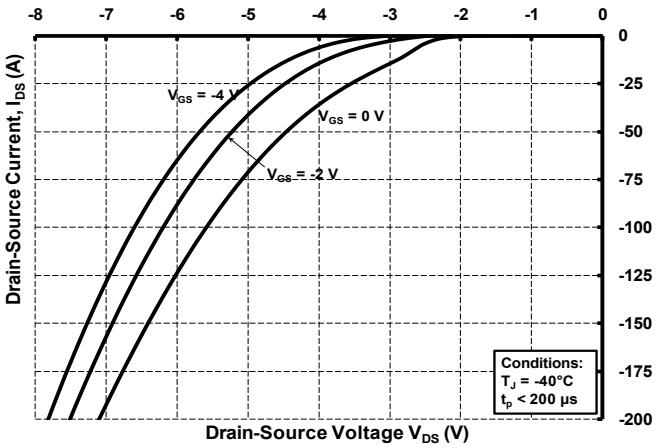


Figure 8. Body Diode Characteristic at -40 ºC

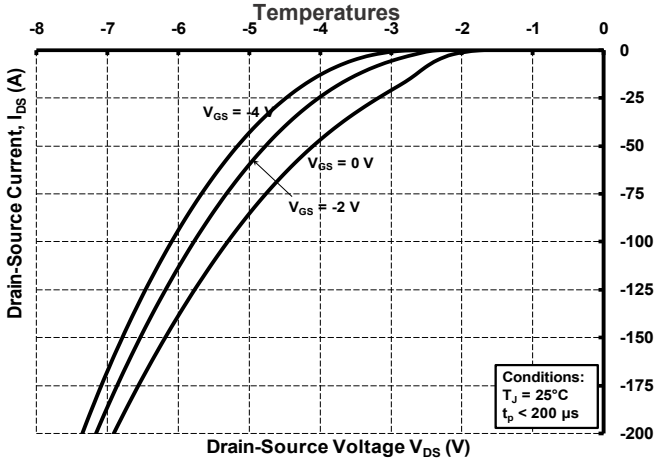


Figure 9. Body Diode Characteristic at 25 ºC

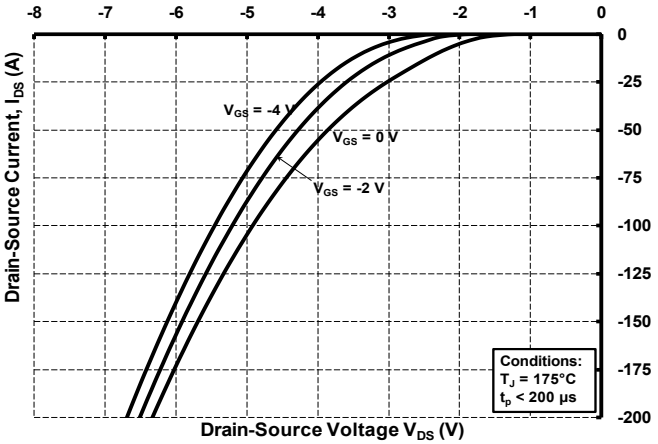


Figure 10. Body Diode Characteristic at

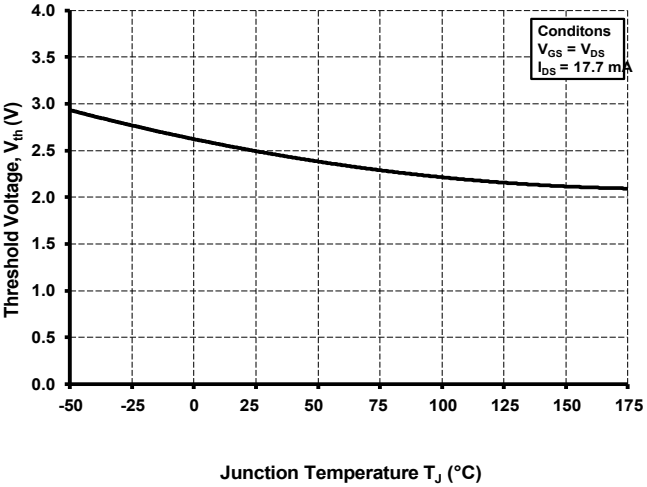


Figure 11. Threshold Voltage vs. Temperature

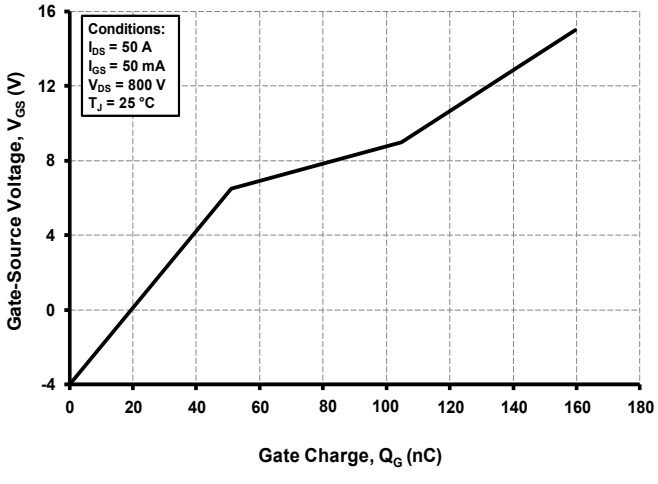


Figure 12. Gate Charge Characteristics

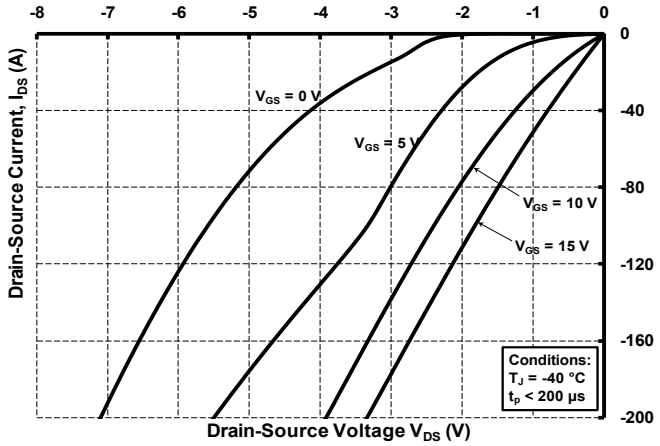


Figure 13. 3rd Quadrant Characteristic at -40 ºC

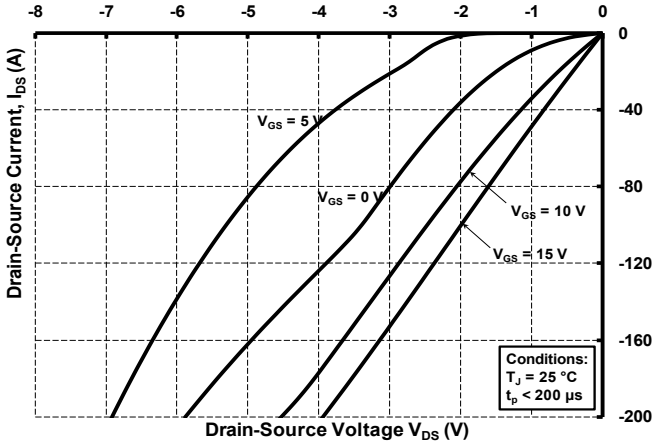


Figure 14. 3rd Quadrant Characteristic at 25 ºC

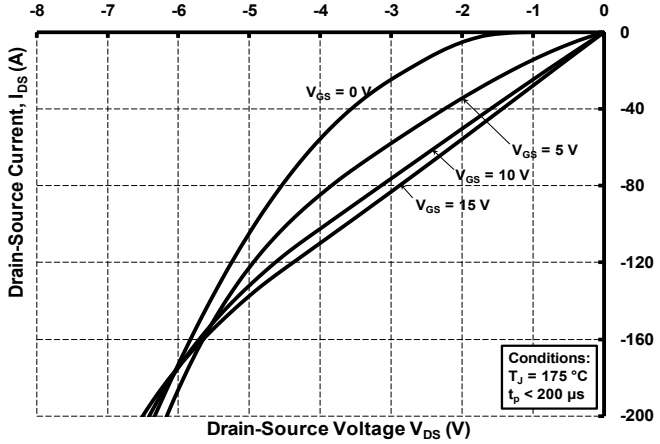


Figure 15. 3rd Quadrant Characteristic at 175 ºC

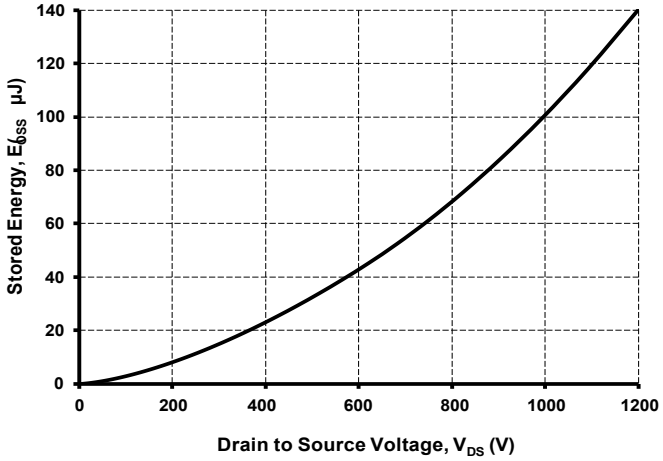


Figure 16. Output Capacitor Stored Energy

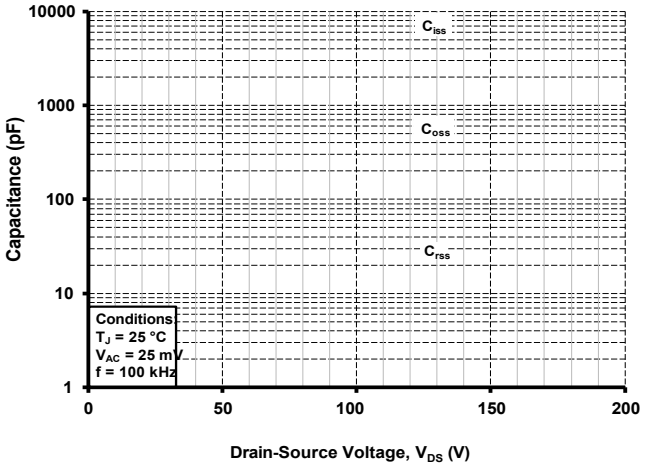


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

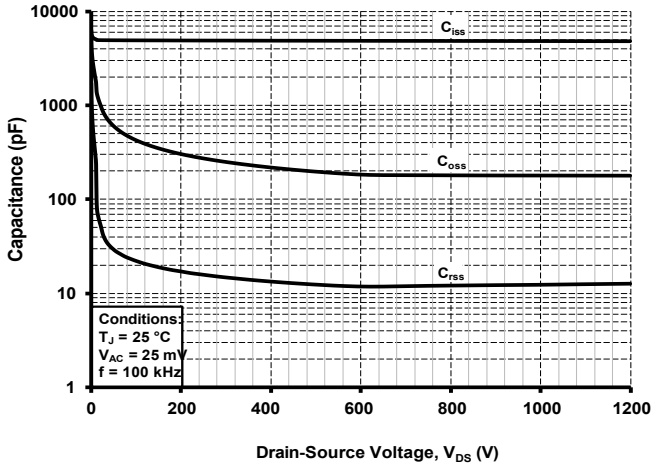


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

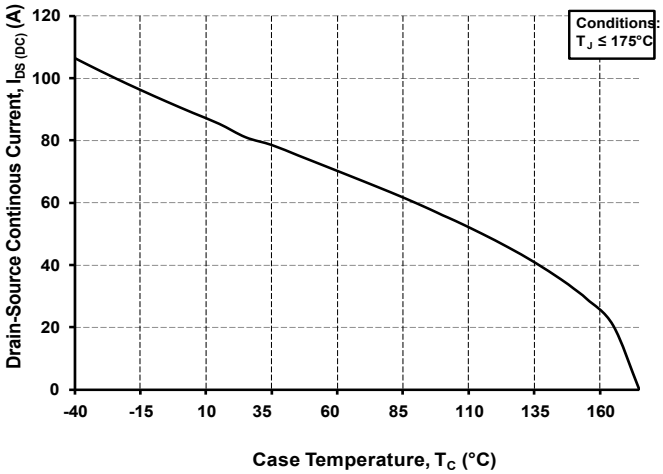


Figure 19. Continuous Drain Current Derating vs. Case Temperature

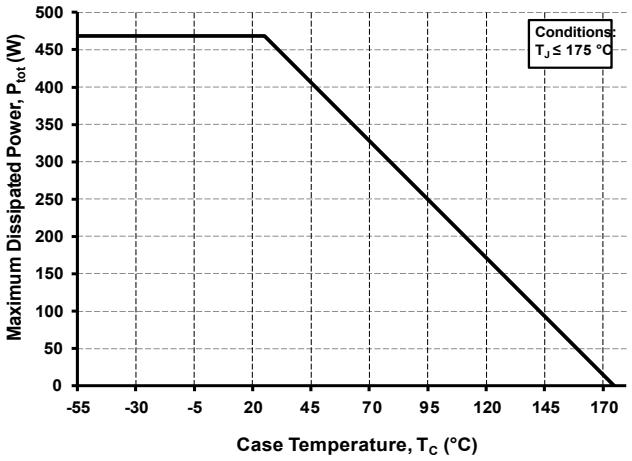


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

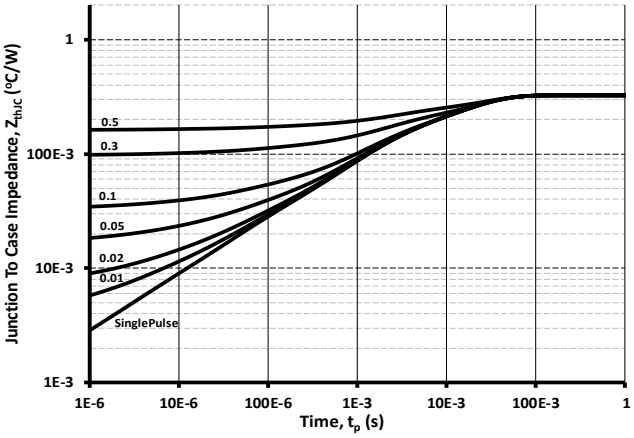


Figure 21. Transient Thermal Impedance (Junction - Case)

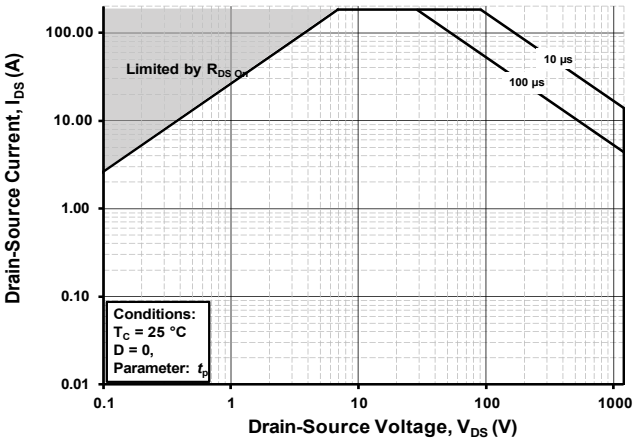


Figure 22. Safe Operating Area

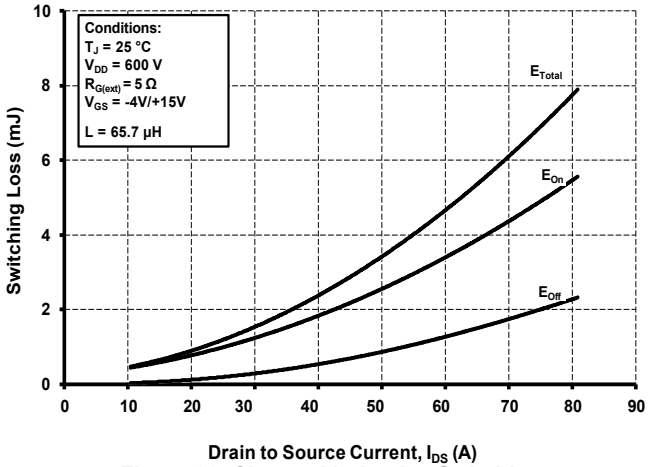


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

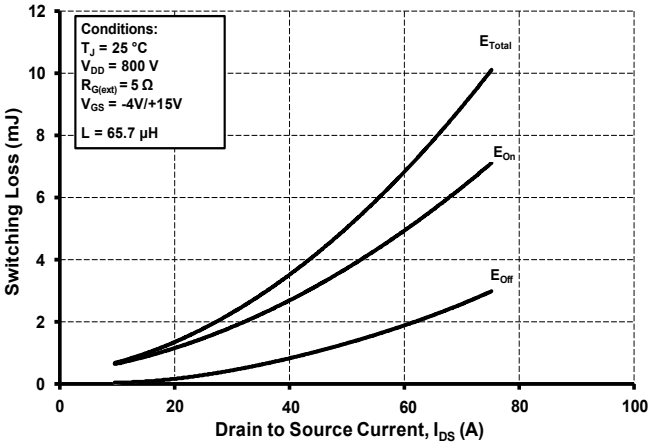


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

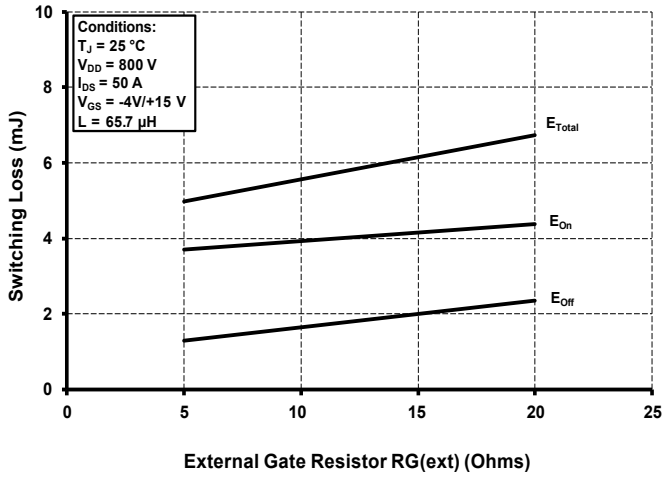


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

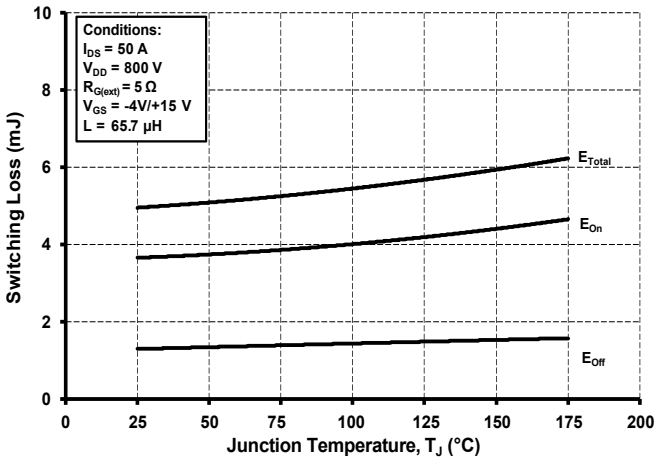


Figure 26. Clamped Inductive Switching Energy vs. Temperature

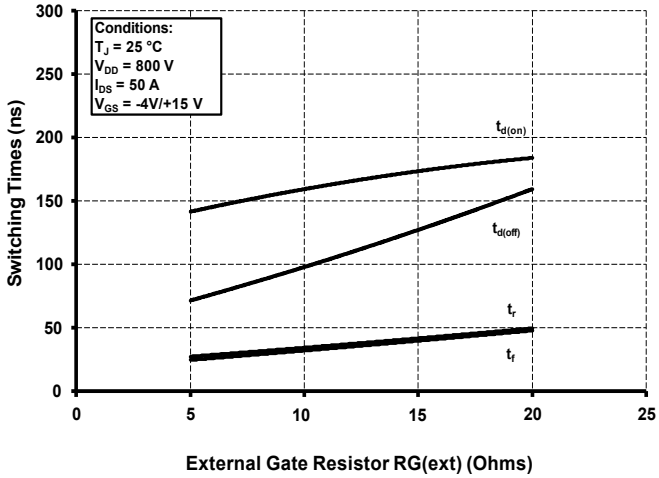


Figure 27. Switching Times vs. $R_{G(ext)}$

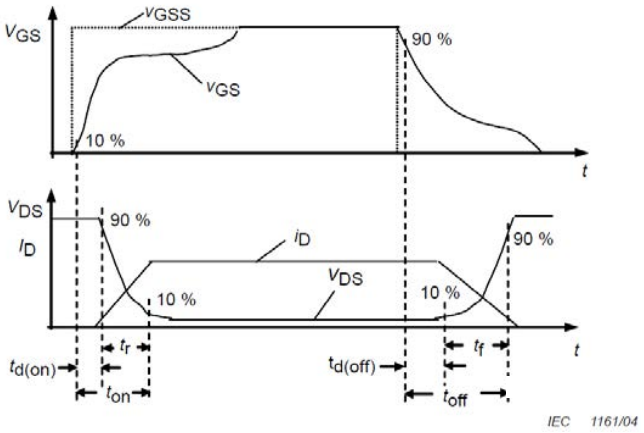
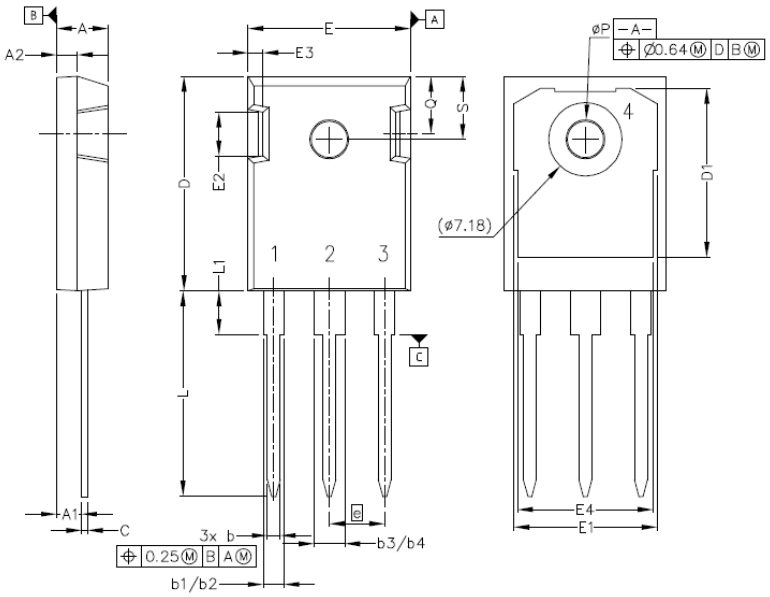
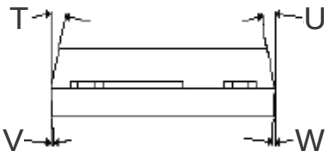


Figure 28. Switching Times Definition

Package Dimensions

Package TO-247



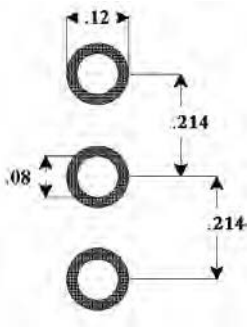


Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.049	0.95	1.25
E	.620	.635	15.75	16.13
E1	.516	.557	13.10	14.15
E2	.145	.201	3.68	5.10
E3	.039	.075	1.00	1.90
E4	.487	.529	12.38	13.43
e	.214 BSC		5.44 BSC	
N	3		3	
L	.780	.800	19.81	20.32
L1	.161	.173	4.10	4.40
ØP	.138	.144	3.51	3.65
Q	.216	.236	5.49	6.00
S	.238	.248	6.04	6.30
T	9°	11°	9°	11°
U	9°	11°	9°	11°
V	2°	8°	2°	8°
W	2°	8°	2°	8°

Recommended Solder Pad Layout



TO-247

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