



Features

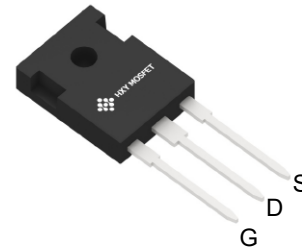
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

Benefits

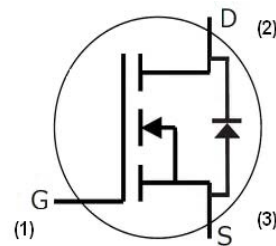
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC converters
- Battery Chargers
- Motor Drives
- Pulsed Power Applications



TO-247



Part Number	Package	Qty(PCS)
CI90N120SM	TO-247	30

Maximum Ratings ($T_c = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V	$V_{GS} = 0\text{ V}$, $I_D = 100\text{ }\mu\text{A}$	
V_{GSmax}	Gate - Source Voltage	-10/+25	V	Absolute maximum values	
V_{GSop}	Gate - Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	63	A	$V_{GS} = 20\text{ V}$, $T_c = 25^\circ\text{C}$	Fig. 19 Note 1
		39		$V_{GS} = 20\text{ V}$, $T_c = 100^\circ\text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	250	A	Pulse width t_p limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	378	W	$T_c = 25^\circ\text{C}$, $T_j = 150^\circ\text{C}$	Fig. 20
T_j, T_{stg}	Operating Junction and Storage Temperature	-55 to +150	$^\circ\text{C}$		
T_L	Solder Temperature	260	$^\circ\text{C}$	1.6mm (0.063") from case for 10s	
M_d	Mounting Torque	1 8.8	Nm lbf-in	M3 or 6-32 screw	

Note (1): Die limits are 90A (25°C) and 60A (100°C)



Electrical Characteristics (T_c = 25 °C unless otherwise 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	2.0	2.6	4	V	V _{DS} = V _{GS} , I _D = 15mA	Fig. 11
			2.3		V	V _{DS} = V _{GS} , I _D = 15mA, T _J = 150 °C	
I _{DSS}	Zero Gate Voltage Drain Current		2	100	μA	V _{DS} = 1200 V, V _{GS} = 0 V	
I _{GSS}	Gate-Source Leakage Current			250	nA	V _{GS} = 20 V, V _{DS} = 0 V	
R _{DS(on)}	Drain-Source On-State Resistance		25	34	mΩ	V _{GS} = 20 V, I _D = 50 A	Fig. 4,5,6
			41			V _{GS} = 20 V, I _D = 50 A, T _J = 150 °C	
g _{fs}	Transconductance		24.6		S	V _{DS} = 20 V, I _{DS} = 50 A	Fig. 7
			24			V _{DS} = 20 V, I _{DS} = 50 A, T _J = 150 °C	
C _{iss}	Input Capacitance		3140		pF	V _{GS} = 0 V	Fig. 17,18
C _{oss}	Output Capacitance		224			V _{DS} = 1000 V	
C _{rss}	Reverse Transfer Capacitance		9			f = 1 MHz	
E _{oss}	C _{oss} Stored Energy		128		μJ	V _{AC} = 25 mV	Fig 16
E _{ON}	Turn-On Switching Energy (Body Diode)		2.18		mJ	V _{DS} = 800 V, V _{GS} = -5/20 V, I _D = 50A, R _{G(ext)} = 2.5Ω, L = 99 μH	Fig. 25
E _{OFF}	Turn Off Switching Energy (Body Diode)		0.68			FWD = Internal Body Diode of MOSFET	
E _{ON}	Turn-On Switching Energy (External SiC Diode)		1.14		mJ	V _{DS} = 800 V, V _{GS} = -5/20 V, I _D = 50A, R _{G(ext)} = 2.5Ω, L = 99 μH	Fig. 25
E _{OFF}	Turn Off Switching Energy (External SiC Diode)		0.8			FWD = External SiC Diode	
t _{d(on)}	Turn-On Delay Time		15		ns	V _{DD} = 800 V, V _{GS} = -5/20 V I _D = 50 A, R _{G(ext)} = 2.5 Ω, Inductive Load Timing relative to V _{DS} Per IEC60747-8-4 pg 83	Fig. 27
t _r	Rise Time		58				
t _{d(off)}	Turn-Off Delay Time		33				
t _f	Fall Time		17				
R _{G(int)}	Internal Gate Resistance		1.0		Ω	f = 1 MHz, V _{AC} = 25 mV, ESR of C _{iss}	
Q _{gs}	Gate to Source Charge		46		nC	V _{DS} = 800 V, V _{GS} = -5/20 V I _D = 50 A Per IEC60747-8-4 pg 21	Fig. 12
Q _{gd}	Gate to Drain Charge		71.5				
Q _g	Total Gate Charge		194				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V _{SD}	Diode Forward Voltage	4.1		V	V _{GS} = -5 V, I _{SD} = 25 A	Fig. 8, 9, 10
		3.5		V	V _{GS} = -5 V, I _{SD} = 25 A, T _J = 150 °C	
I _S	Continuous Diode Forward Current		63		V _{GS} = -5 V, T _C = 25 °C	Note 2
I _{S, pulse}	Diode Pulse Current		250		V _{GS} = -5 V, Pulse width t _p limited by T _{Jmax}	
t _{rr}	Reverse Recovery Time	33		ns	V _{GS} = -5 V, I _{SD} = 50 A, T _J = 25 °C VR = 800 V dif/dt = 2180 A/μs	Note 2
Q _{rr}	Reverse Recovery Charge	487		nC		
I _{rrm}	Peak Reverse Recovery Current	24		A		
t _{rr}	Reverse Recovery Time	67		ns	V _{GS} = -5 V, I _{SD} = 50 A, T _J = 25 °C VR = 800 V dif/dt = 1320 A/μs	Note 2
Q _{rr}	Reverse Recovery Charge	386		nC		
I _{rrm}	Peak Reverse Recovery Current	15		A		

Note (2): When using SiC Body Diode the maximum recommended V_{GS} = -5V



Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.24	0.33	°C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient		40			

Typical Performance

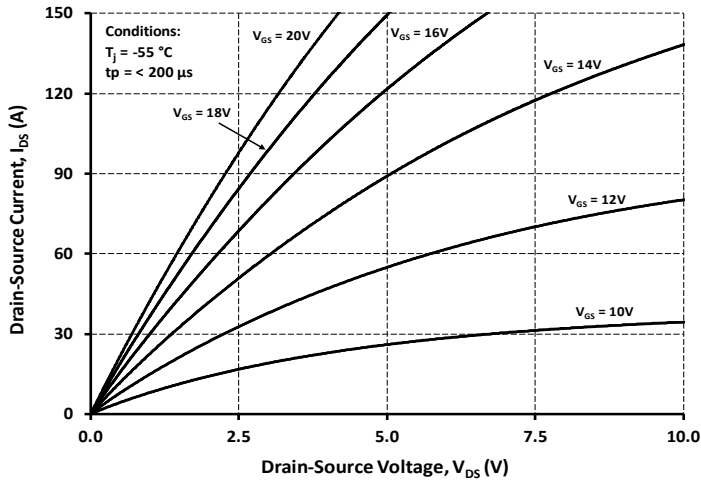


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

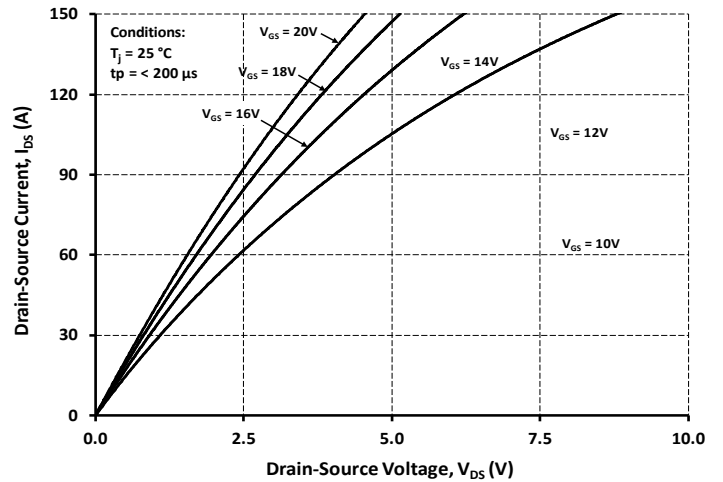


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

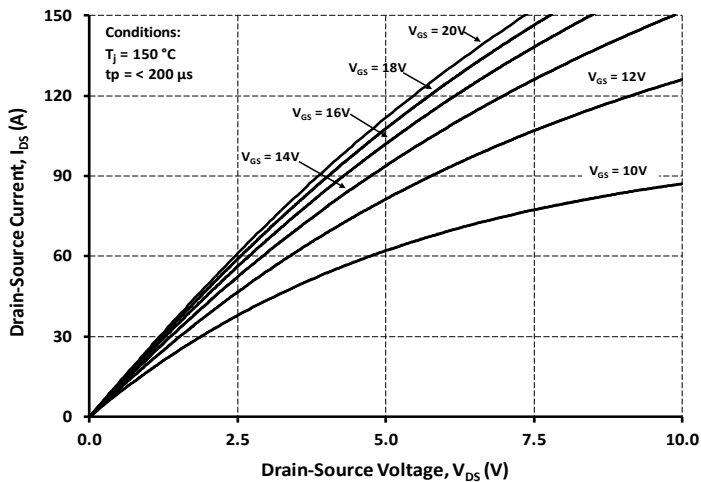


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

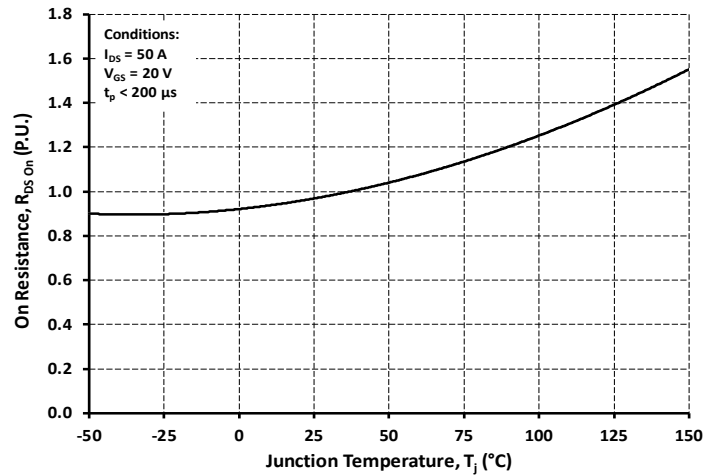


Figure 4. Normalized On-Resistance vs. Temperature

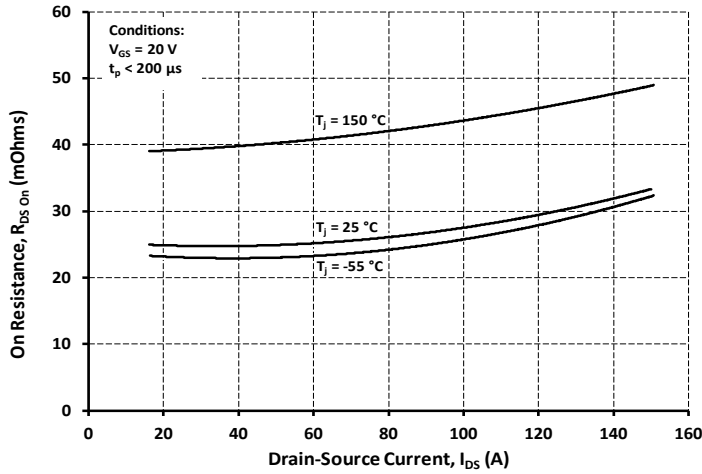


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

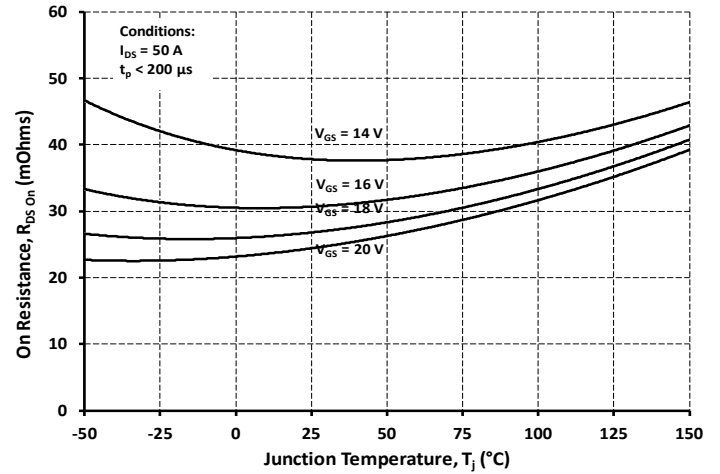


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

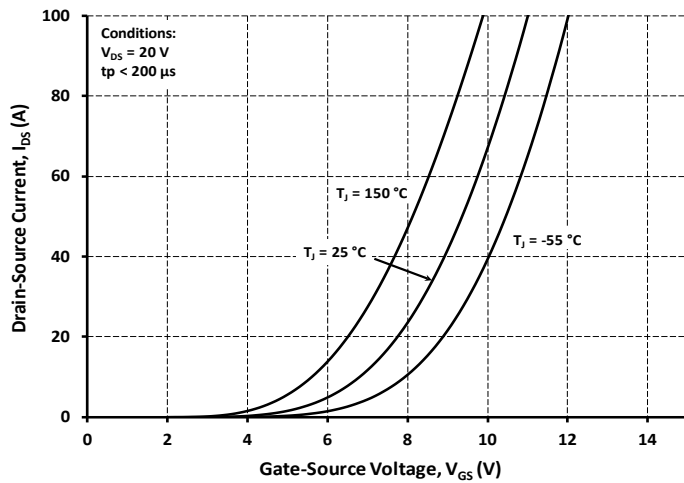


Figure 7. Transfer Characteristic For
Various Junction Temperatures

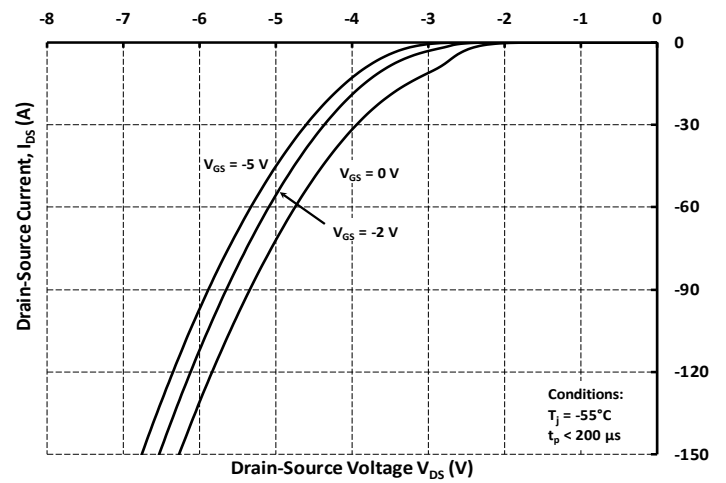


Figure 8. Body Diode Characteristic at $-55\text{ }^\circ\text{C}$

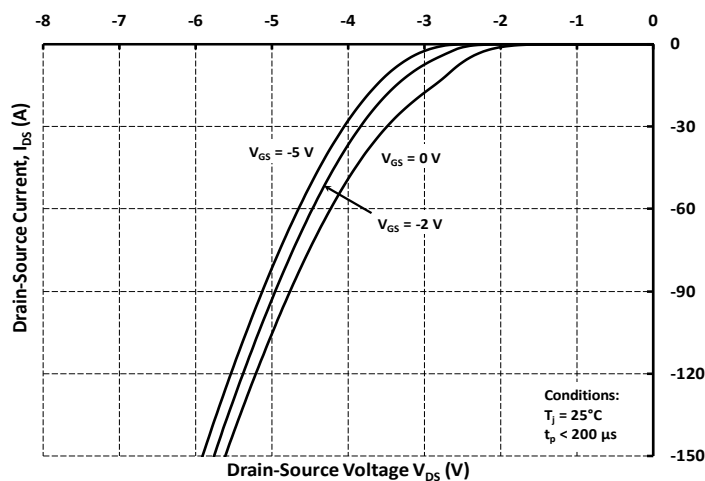


Figure 9. Body Diode Characteristic at $25\text{ }^\circ\text{C}$

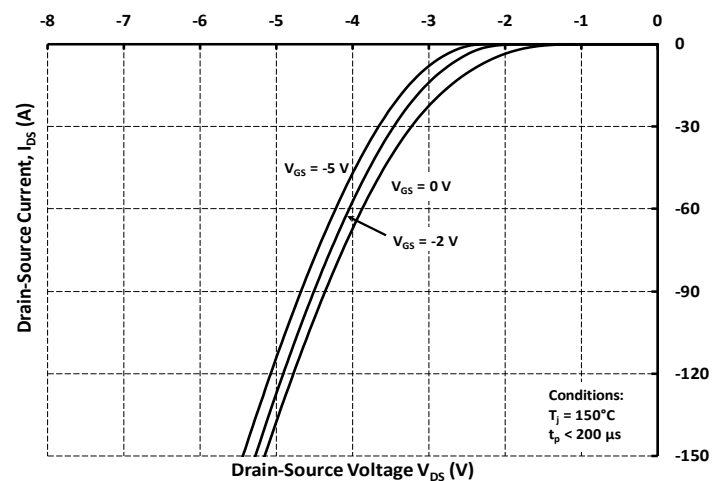


Figure 10. Body Diode Characteristic at $150\text{ }^\circ\text{C}$

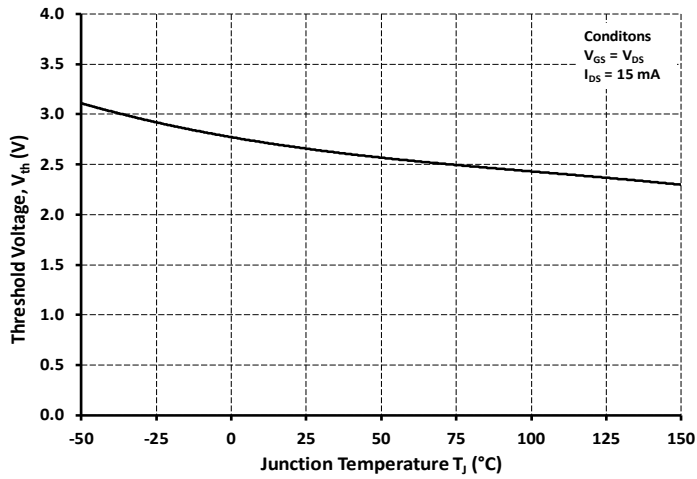


Figure 11. Threshold Voltage vs. Temperature

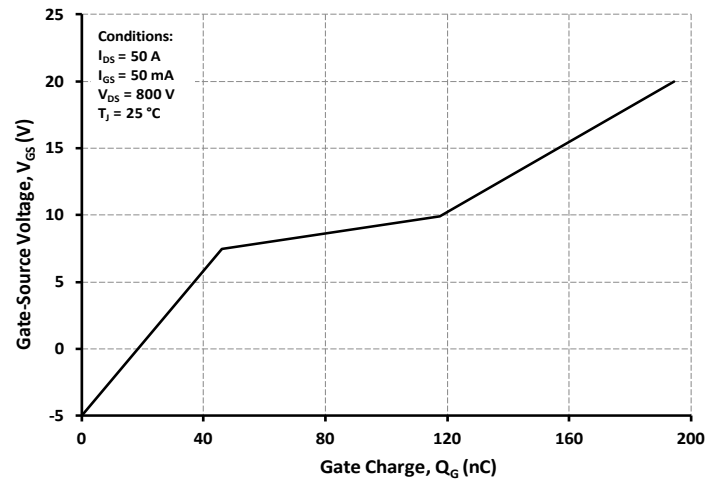


Figure 12. Gate Charge Characteristic

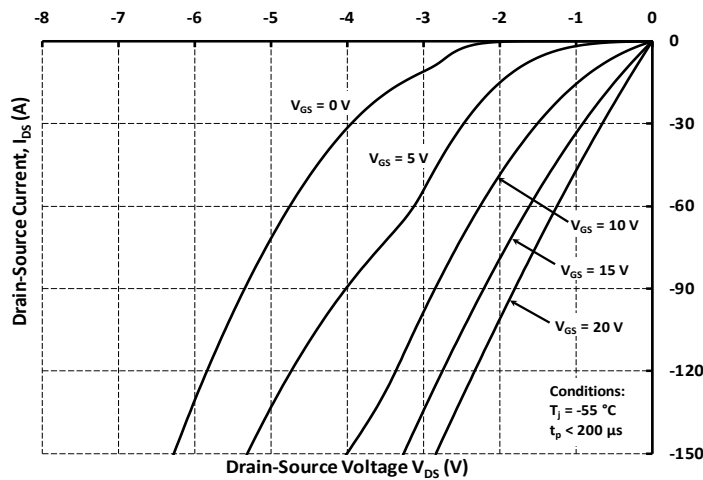


Figure 13. 3rd Quadrant Characteristic at -55°C

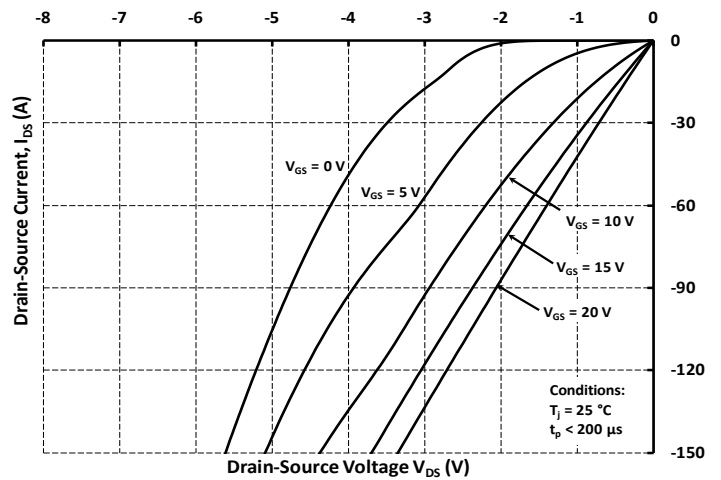


Figure 14. 3rd Quadrant Characteristic at 25°C

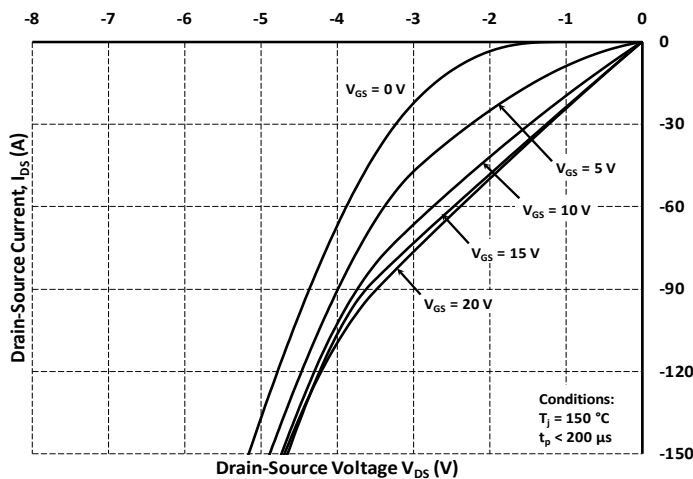


Figure 15. 3rd Quadrant Characteristic at 150°C

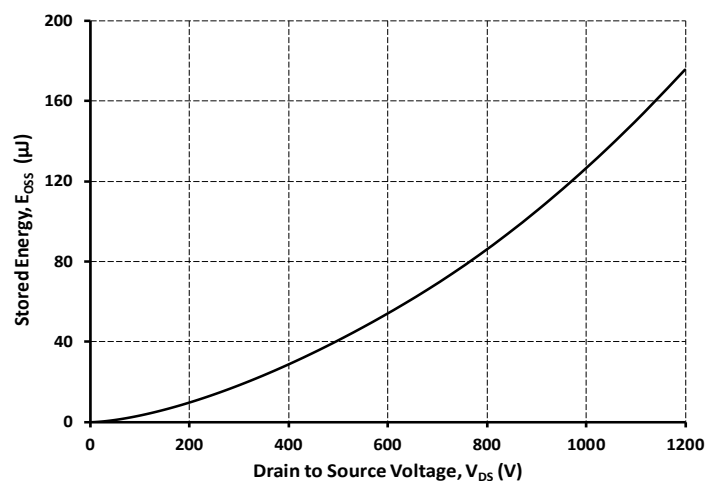
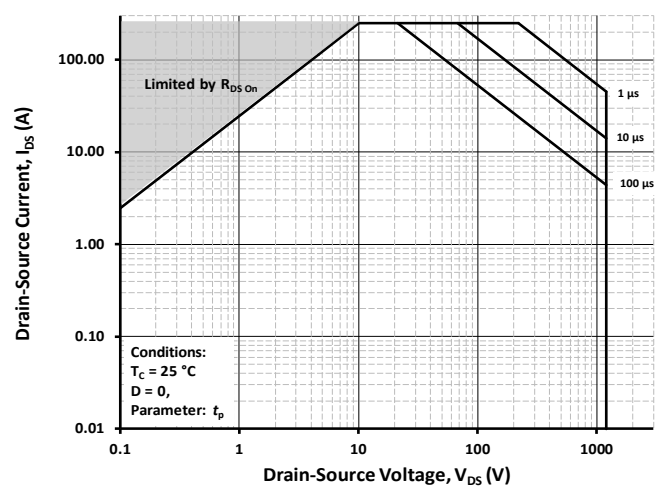
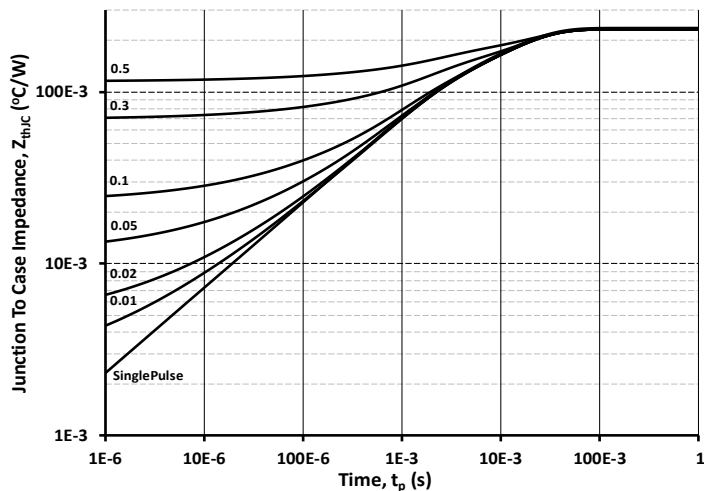
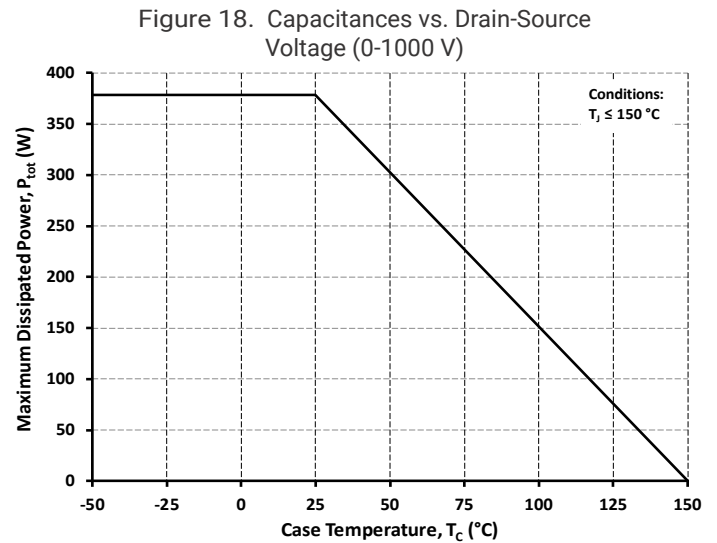
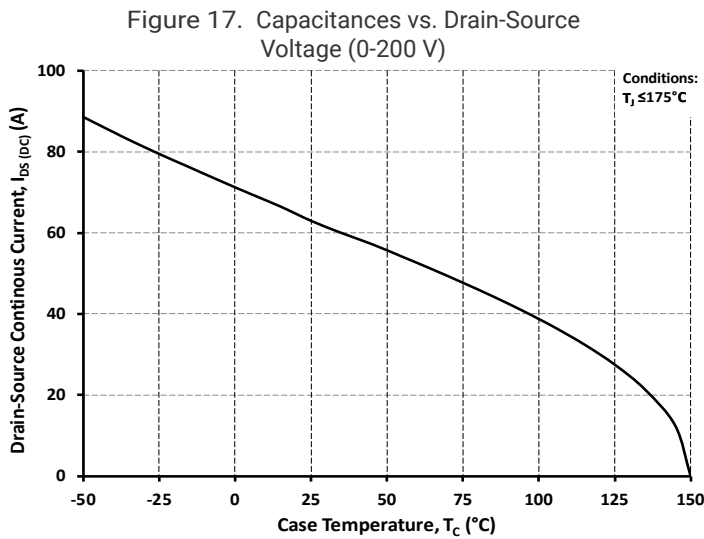
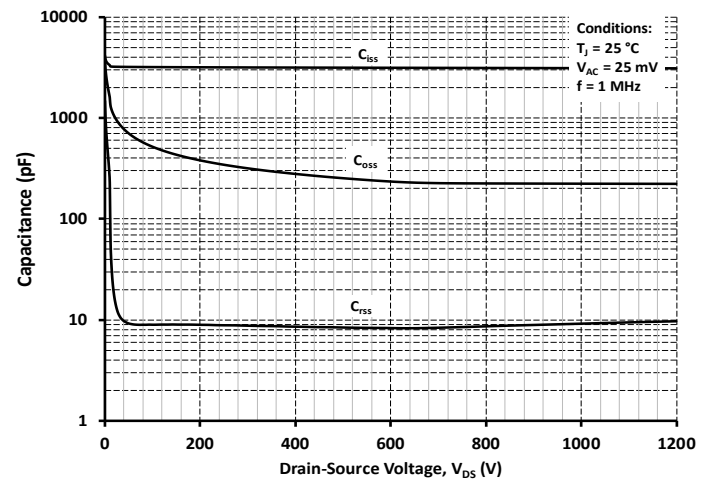
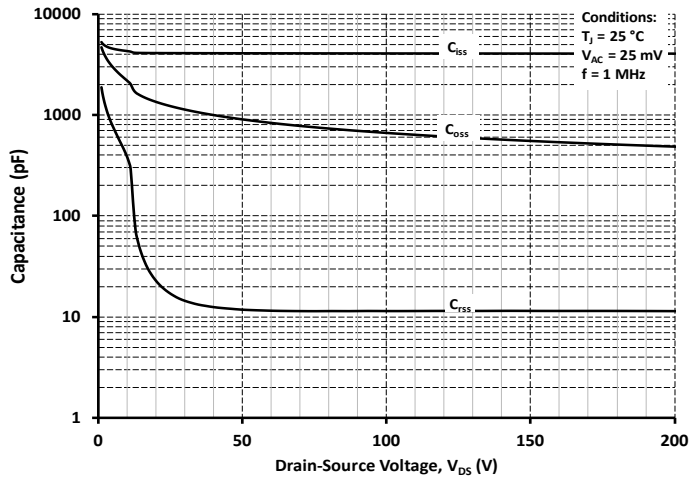


Figure 16. Output Capacitor Stored Energy



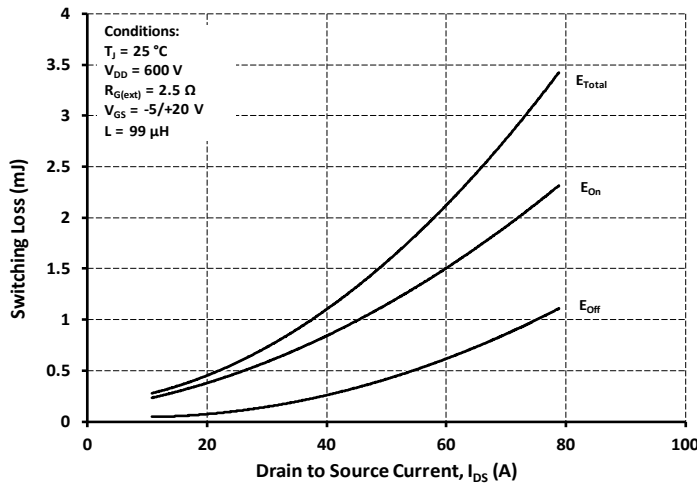


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600\text{V}$)

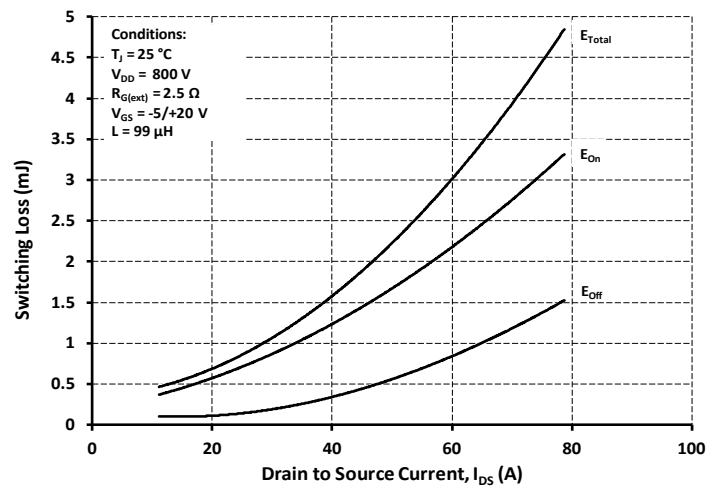


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800\text{V}$)

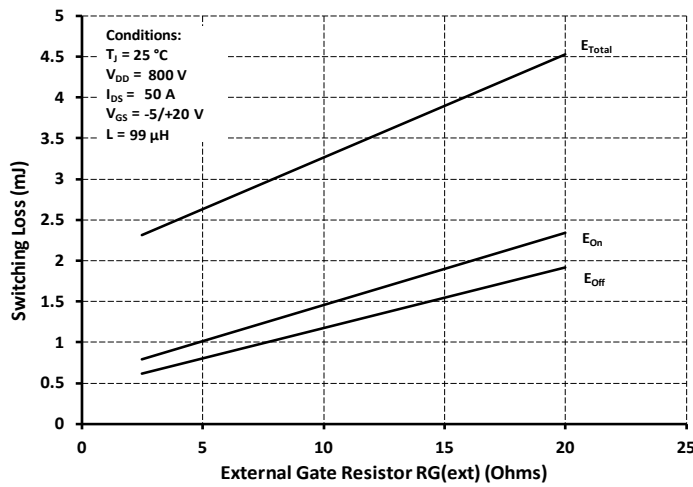


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$

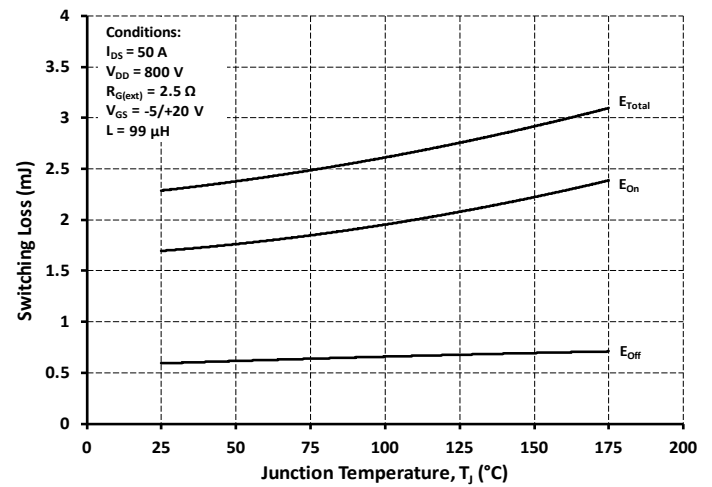


Figure 26. Clamped Inductive Switching Energy vs. Temperature

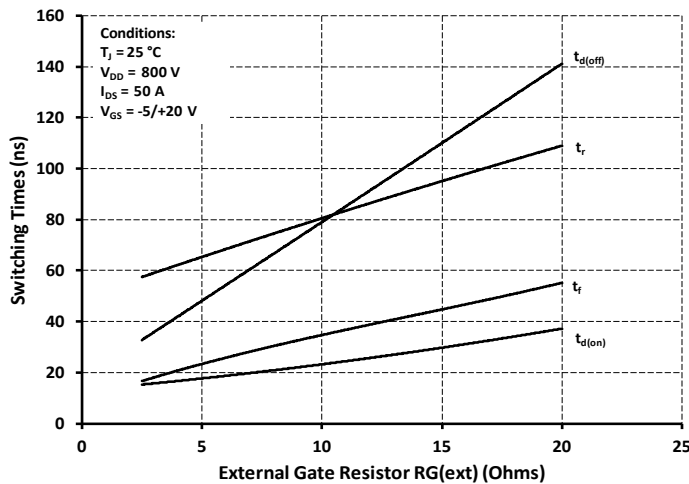
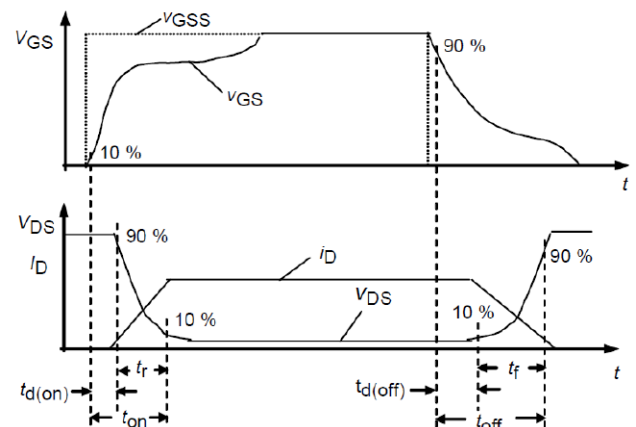


Figure 27. Switching Times vs. $R_{G(\text{ext})}$



IEC 1161/04

Figure 28. Switching Times Definition



Test Circuit Schematic

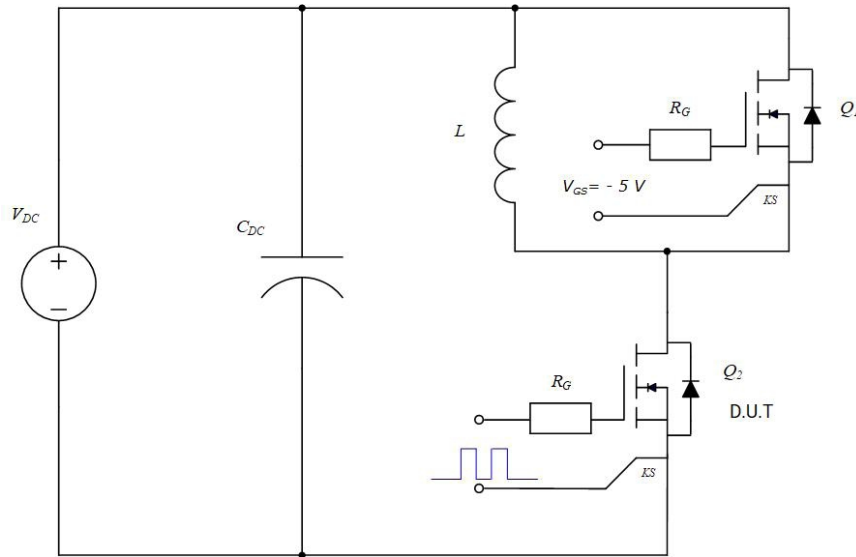


Figure 29. Clamped Inductive Switching
Waveform Test Circuit

ESD Ratings

ESD Test	Resulting Classification
ESD-HBM	3A (4000V - 8000V)
ESD-CDM	C3 ($\geq 1000\text{V}$)



Package Dimensions

Package T0-247

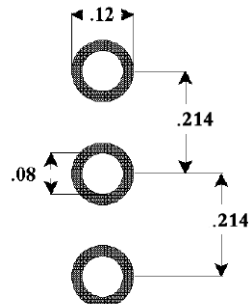


Pinout Information:

- 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



T0247-3L



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