



Features

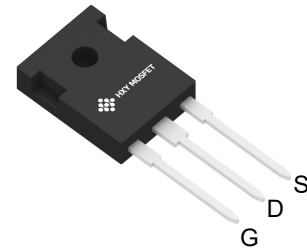
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

Benefits

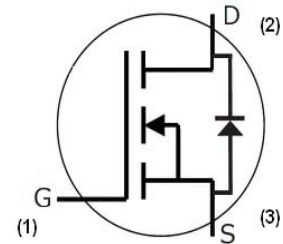
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

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



TO-247
(TO-247-3)



Part Number	Package	Qty(PCS)
HNVHL160N120SC1	TO247(TO-247-3)	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	18	A	$V_{GS} = 20\text{ V}$, $T_C = 25^\circ\text{C}$	Fig. 19
		12		$V_{GS} = 20\text{ V}$, $T_C = 100^\circ\text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	40	A	Pulse width t_p limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	125	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	



Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1200			V	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.9	4	V	$V_{DS} = V_{GS}, I_{DS} = 2.5\text{ mA}$	Fig. 11
			2.4		V	$V_{DS} = V_{GS}, I_{DS} = 2.5\text{ mA}, T_J = 150^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	μA	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	
I_{GSS}	Gate-Source Leakage Current			250	nA	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	
$R_{DS(on)}$	Drain-Source On-State Resistance		160	196	m Ω	$V_{GS} = 20\text{ V}, I_D = 10\text{ A}$	Fig. 4, 5, 6
			290			$V_{GS} = 20\text{ V}, I_D = 10\text{ A}, T_J = 150^\circ\text{C}$	
g_{fs}	Transconductance		3.8		S	$V_{DS} = 20\text{ V}, I_{DS} = 10\text{ A}$	Fig. 7
			5.3			$V_{DS} = 20\text{ V}, I_{DS} = 10\text{ A}, T_J = 150^\circ\text{C}$	
C_{iss}	Input Capacitance		606		pF	$V_{GS} = 0\text{ V}$	Fig. 17, 18
C_{oss}	Output Capacitance		55			$V_{DS} = 1000\text{ V}$	
C_{rss}	Reverse Transfer Capacitance		5			$f = 1\text{ MHz}$	
E_{oss}	C_{oss} Stored Energy		28		μJ	$V_{AC} = 25\text{ mV}$	Fig. 16
E_{AS}	Avalanche Energy, Single Pluse		600		mJ	$I_D = 10\text{ A}, V_{DD} = 50\text{ V}$	Fig. 29
E_{ON}	Turn-On Switching Energy		121		μJ	$V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}, I_D = 10\text{ A},$ $R_{G(ext)} = 2.5\Omega, L = 434\mu\text{H}$	Fig. 25
E_{OFF}	Turn Off Switching Energy		48				
$t_{d(on)}$	Turn-On Delay Time		7		ns	$V_{DD} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 10\text{ A}$ $R_{G(ext)} = 2.5\Omega, R_L = 80\Omega$ Timing relative to V_{DS} Per IEC60747-8-4 pg 83	Fig. 27
t_r	Rise Time		9				
$t_{d(off)}$	Turn-Off Delay Time		13				
t_f	Fall Time		14				
$R_{G(int)}$	Internal Gate Resistance		6.5		Ω	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	
Q_{gs}	Gate to Source Charge		11		nC	$V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 10\text{ A}$ Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		17				
Q_g	Total Gate Charge		40				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.9		V	$V_{GS} = -5\text{ V}, I_F = 5\text{ A}$	Fig. 8, 9, 10
		3.5			$V_{GS} = -5\text{ V}, I_F = 5\text{ A}, T_J = 150^\circ\text{C}$	
I_S	Continuous Diode Forward Current		25	A	$T_C = 25^\circ\text{C}$	Note 1
t_{rr}	Reverse Recovery Time	20		ns	$V_{GS} = -5\text{ V}, I_{SD} = 10\text{ A}, V_R = 800\text{ V}$ $\text{dif}/\text{dt} = 2400\text{ A}/\mu\text{s}$	Note 1
Q_{rr}	Reverse Recovery Charge	192		nC		
I_{rm}	Peak Reverse Recovery Current	16		A		

Note (1): When using SiC Body Diode the maximum recommended $V_{GS} = -5\text{ V}$

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.9	1.0	K/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient		40			



Typical Performance

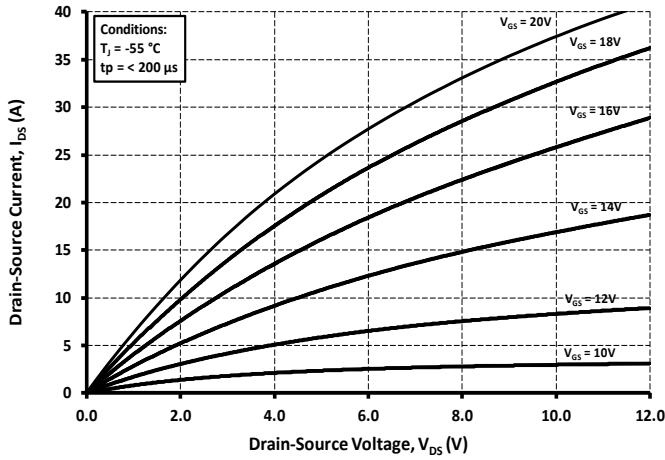


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

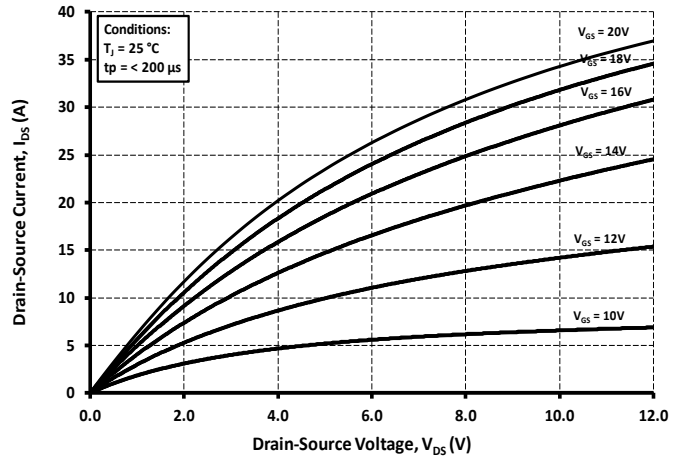


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

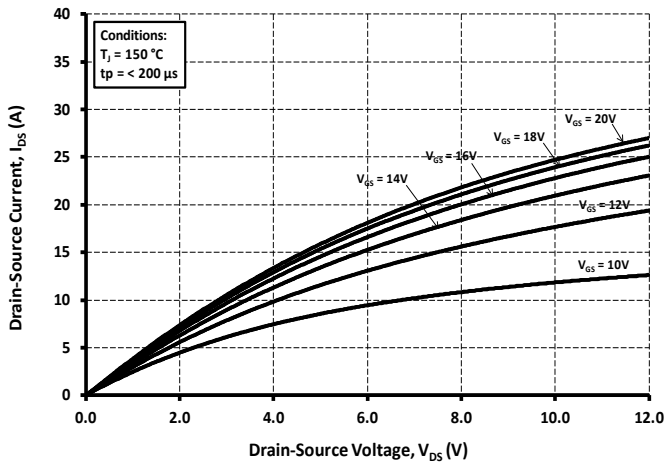


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

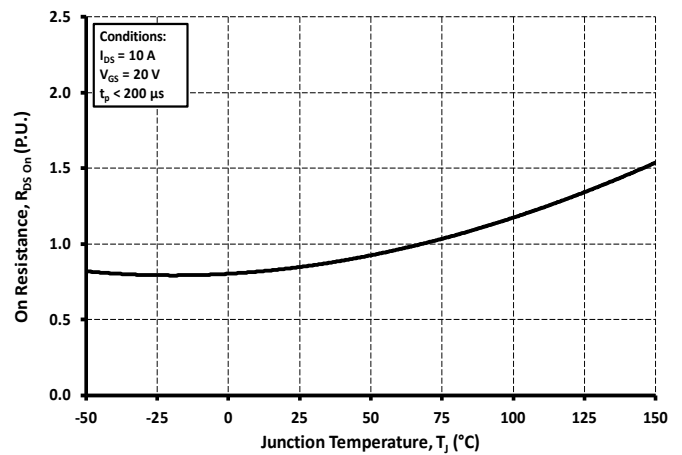


Figure 4. Normalized On-Resistance vs. Temperature

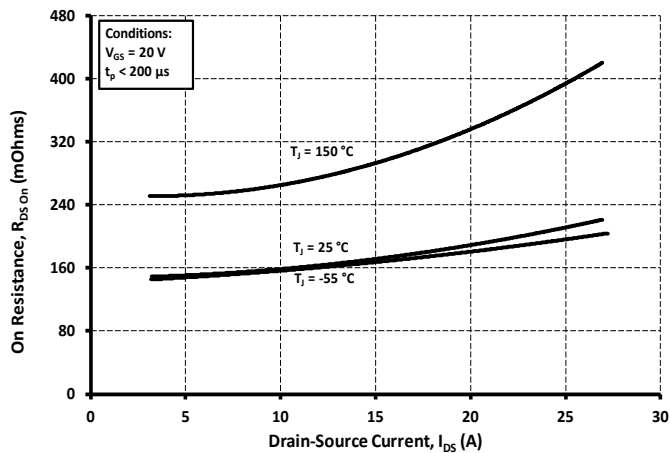


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

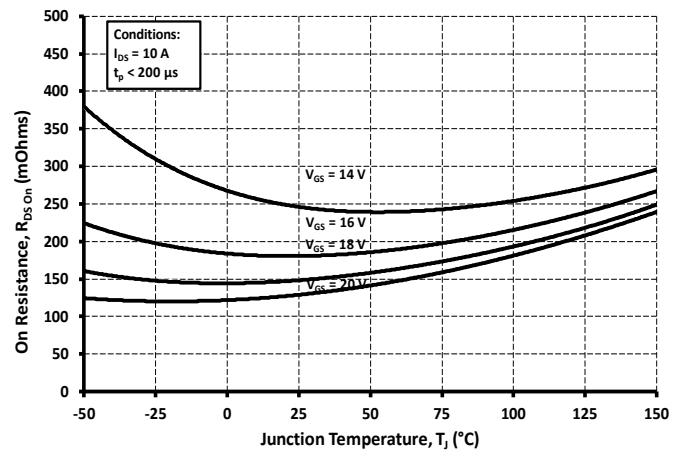


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage



Typical Performance

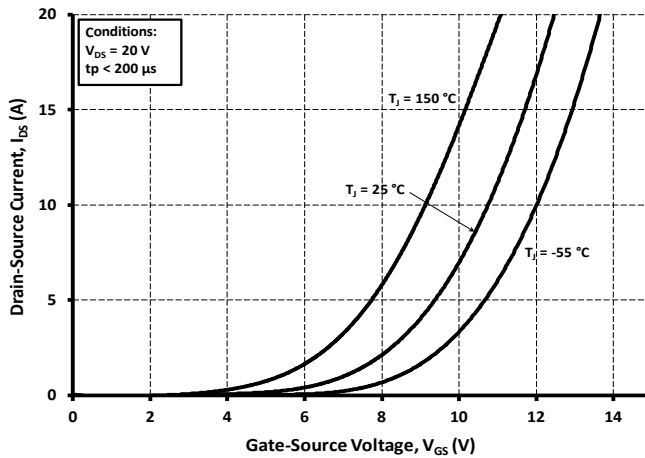


Figure 7. Transfer Characteristic for Various Junction Temperatures

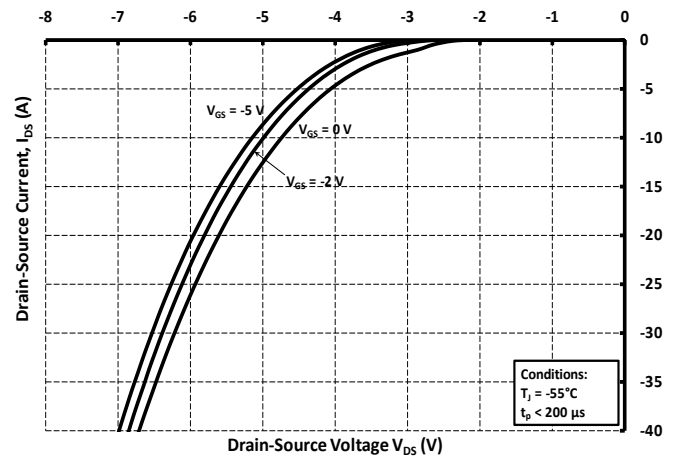


Figure 8. Body Diode Characteristic at $-55\text{ }^{\circ}\text{C}$

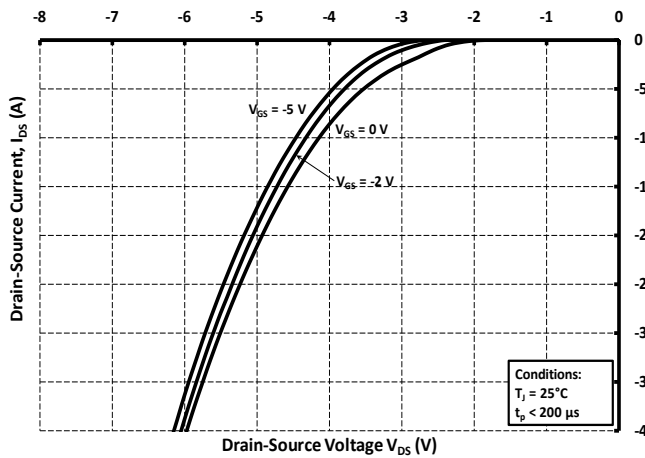


Figure 9. Body Diode Characteristic at $25\text{ }^{\circ}\text{C}$

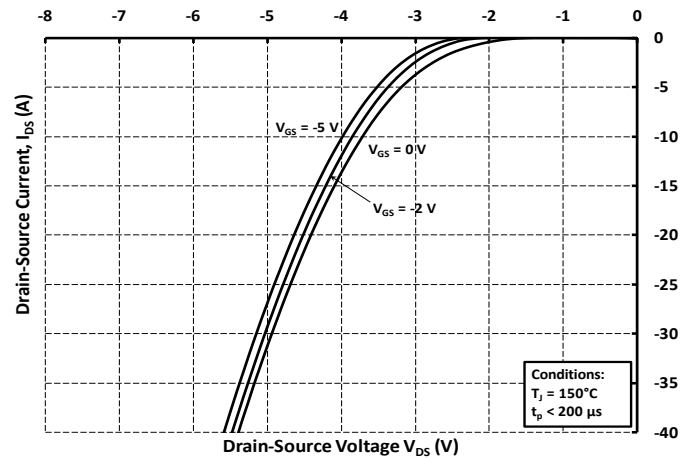


Figure 10. Body Diode Characteristic at $150\text{ }^{\circ}\text{C}$

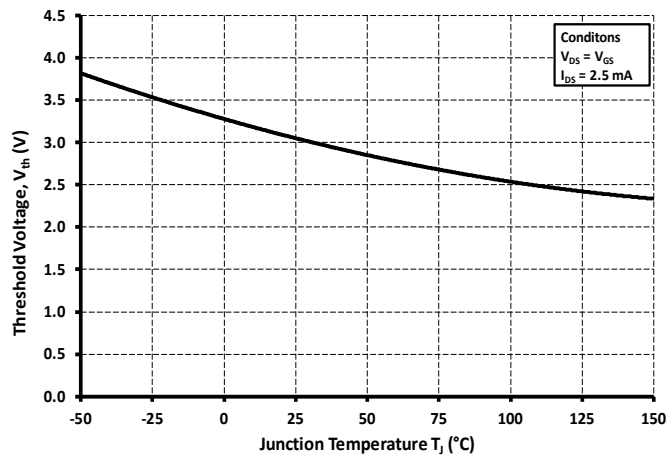


Figure 11. Threshold Voltage vs. Temperature

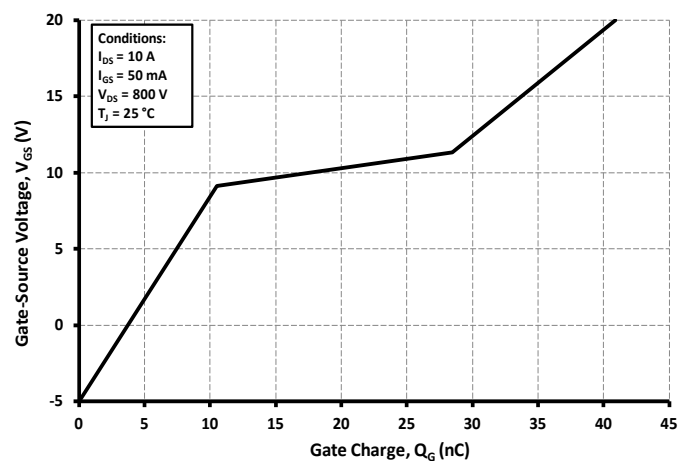


Figure 12. Gate Charge Characteristics



Typical Performance

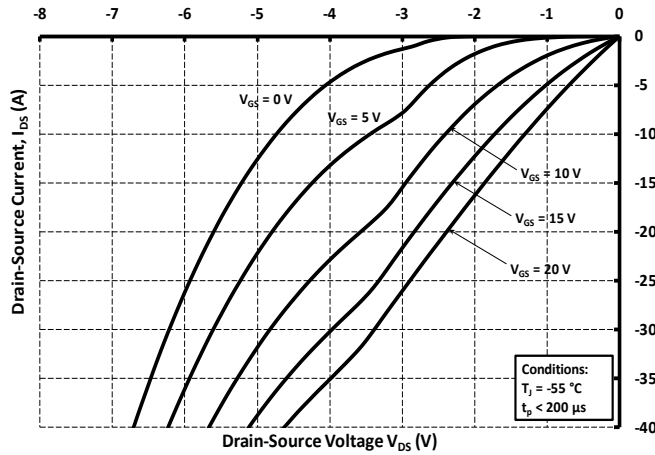


Figure 13. 3rd Quadrant Characteristic at -55 °C

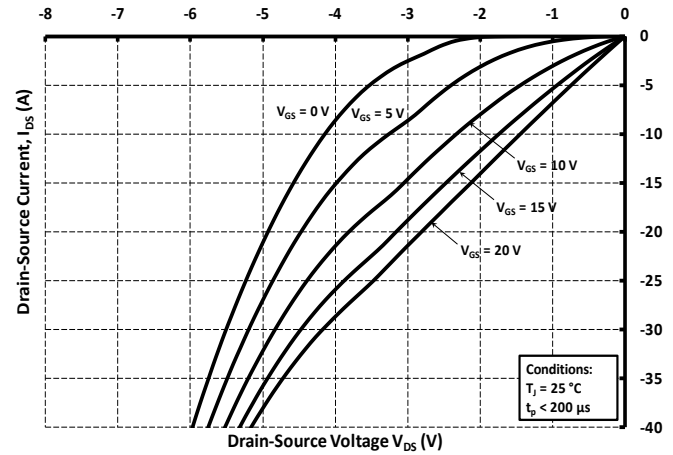


Figure 14. 3rd Quadrant Characteristic at 25 °C

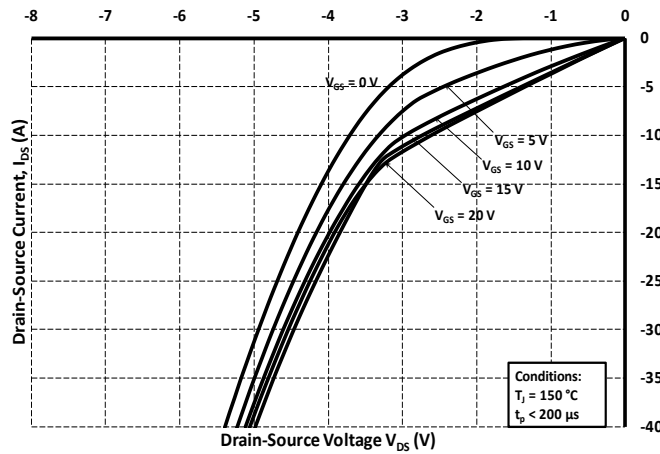


Figure 15. 3rd Quadrant Characteristic at 150 °C

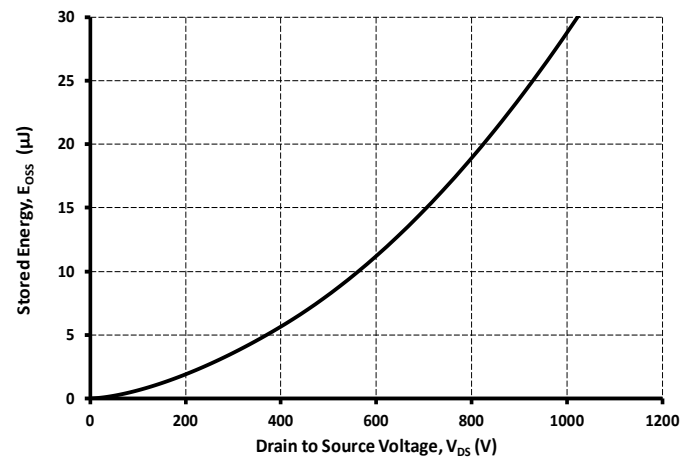


Figure 16. Output Capacitor Stored Energy

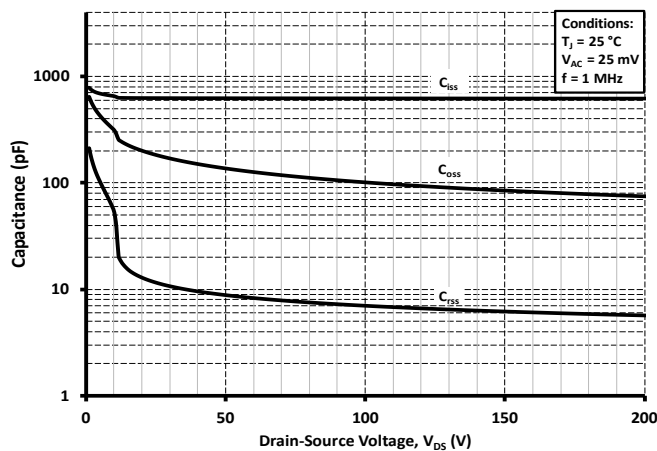


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

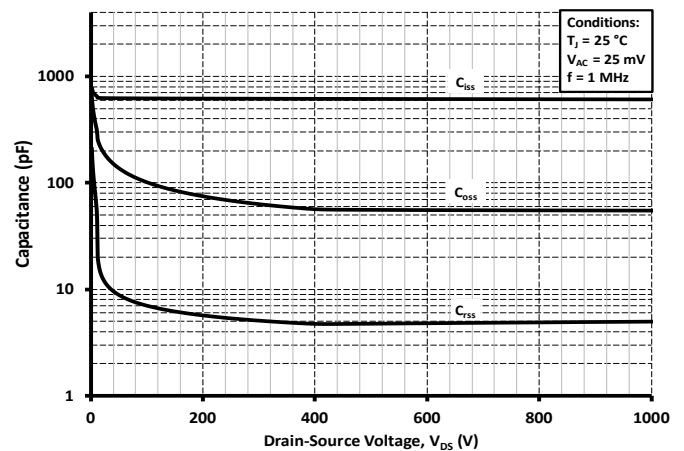


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)



Typical Performance

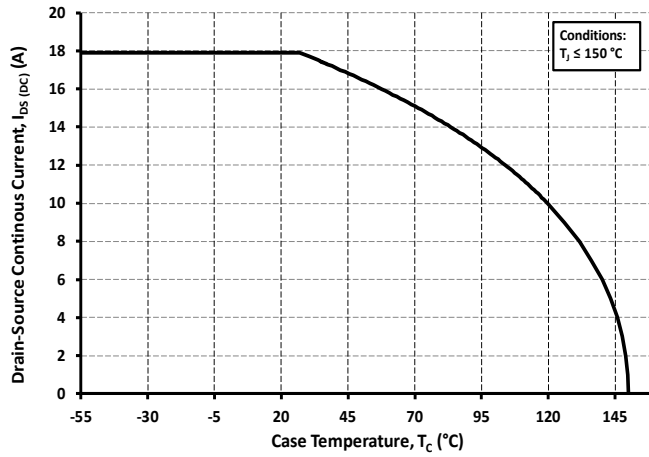


Figure 19. Continuous Drain Current Derating vs. Case Temperature

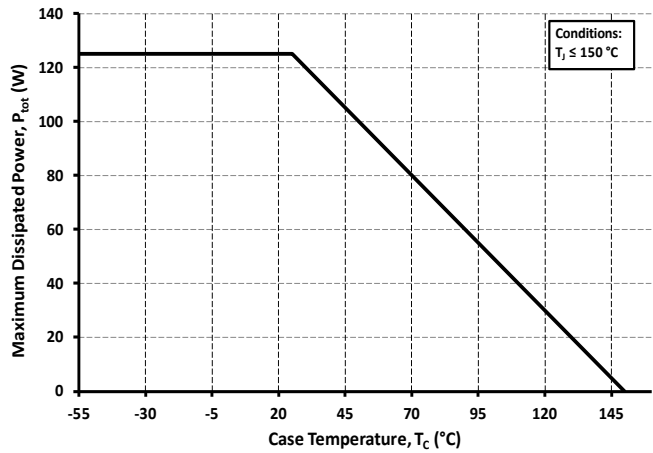


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

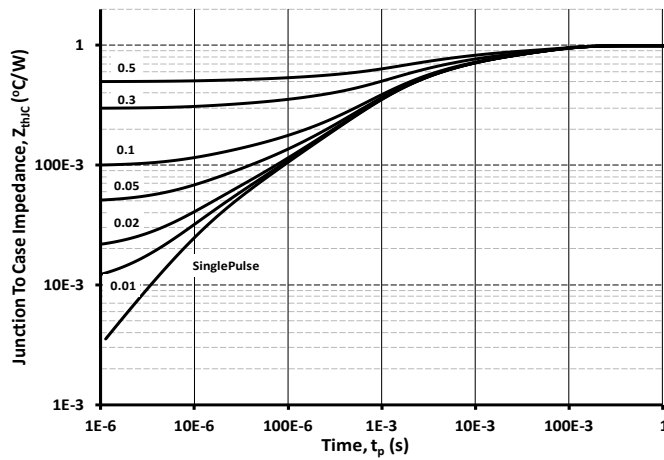


Figure 21. Transient Thermal Impedance (Junction - Case)

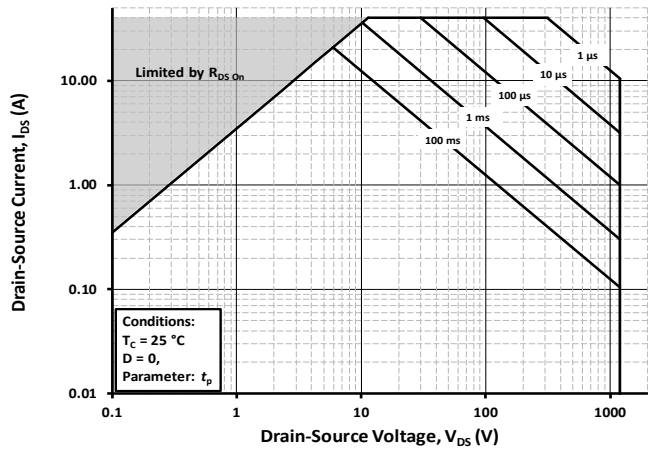


Figure 22. Safe Operating Area

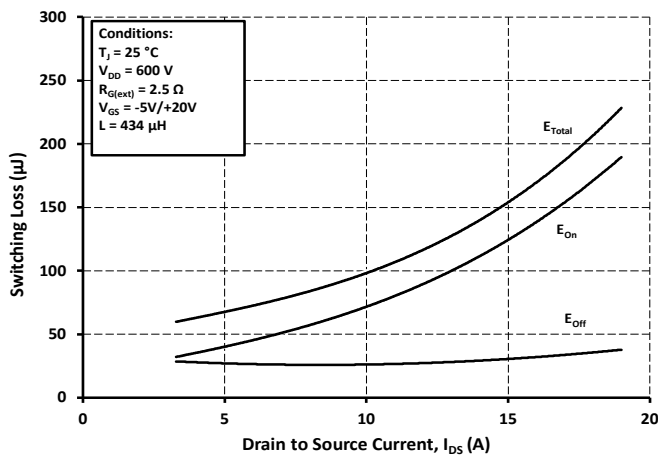


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DS} = 600\text{ V}$)

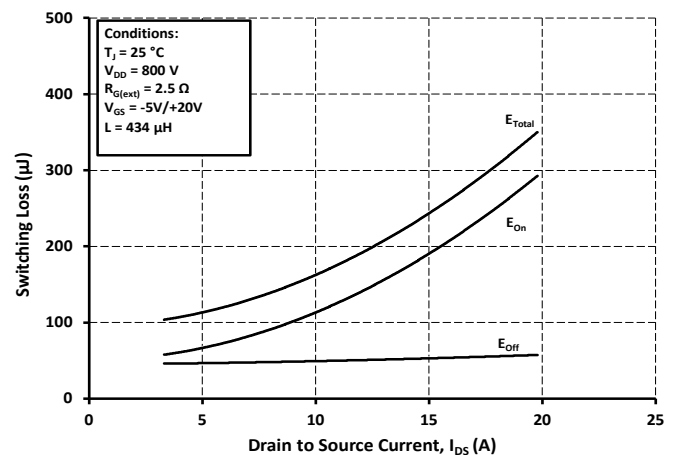


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DS} = 800\text{ V}$)



Typical Performance

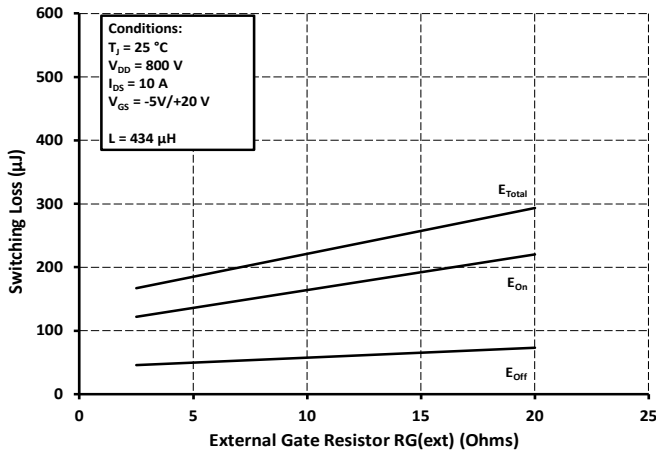


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

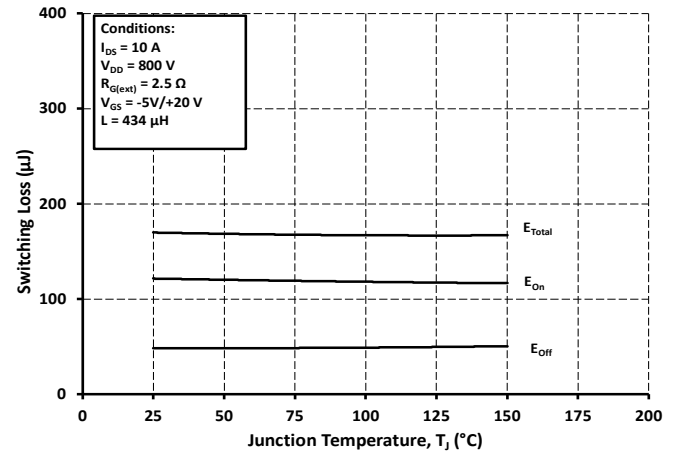


Figure 26. Clamped Inductive Switching Energy vs. Temperature

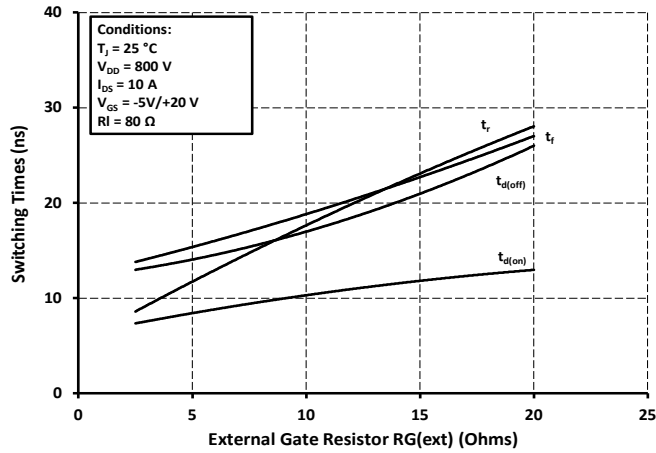


Figure 27. Switching Times vs. $R_{G(ext)}$

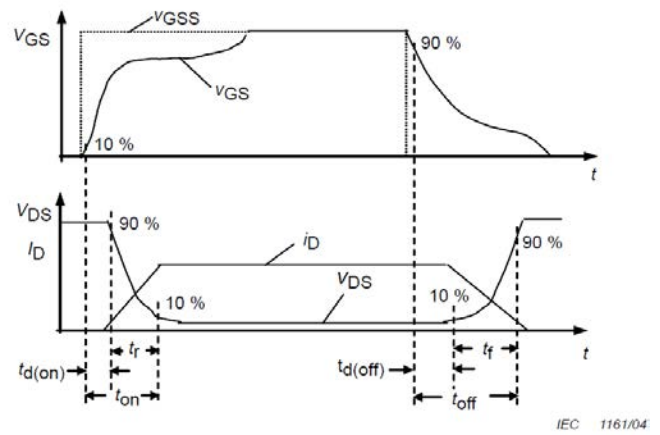


Figure 28. Switching Times Definition

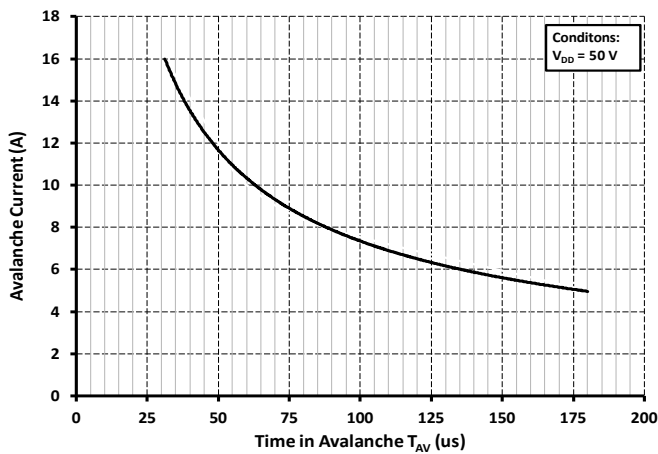


Figure 29. Single Avalanche SOA curve



Test Circuit Schematic

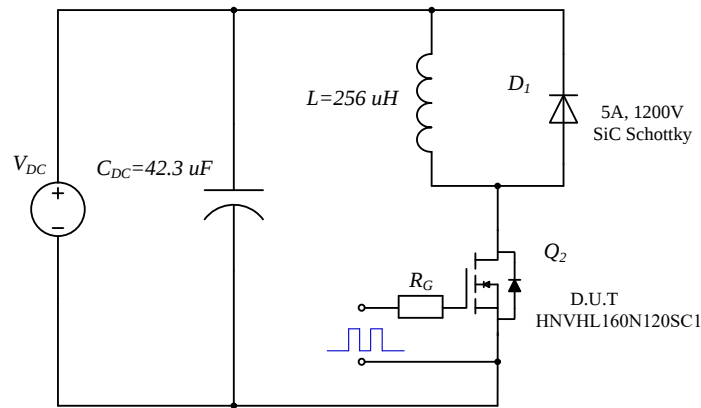


Figure 30. Clamped Inductive Switching Waveform Test Circuit

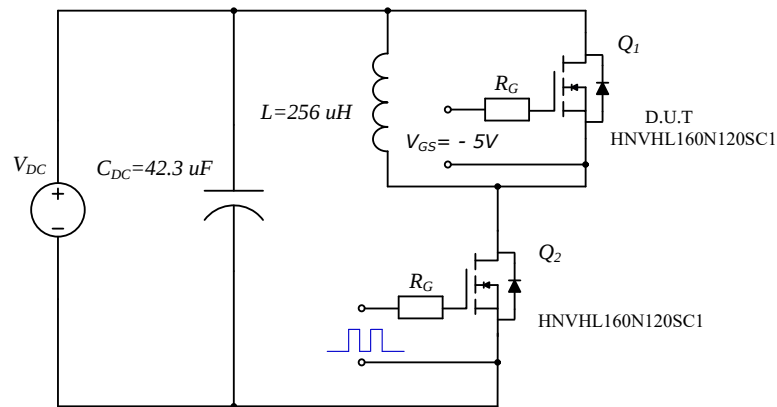


Figure 31. Body Diode Recovery Test Circuit

ESD Ratings

ESD Test	Total Devices Sampled	Resulting Classification
ESD-HBM	All Devices Passed 1000V	2 (>2000V)
ESD-MM	All Devices Passed 400V	C (>400V)
ESD-CDM	All Devices Passed 1000V	IV (>1000V)



Package Dimensions

Package T0247(TO-247-3)

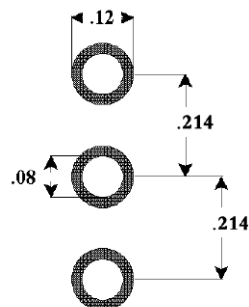


Pinout Information:

- 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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