

Silicon Carbide Power MOSFET N-Channel Enhancement Mode

Features

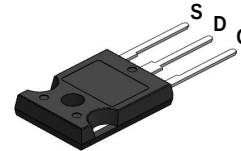
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to Parallel and Simple to Drive
- Ultra-low Drain-gate capacitance
- Halogen Free, RoHS Compliant

Typical Applications

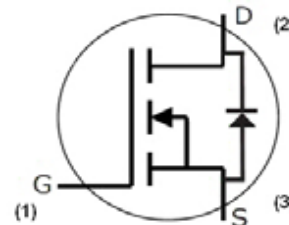
- Auxiliary Power Supplies
- Switch Mode Power Supplies
- Switch Mode Power Supplies

Benefits

- Higher system efficiency
- Increased System Switching Frequency
- Reduced Cooling Requirements
- Increased System Reliability



T0-247-3



ORDERING INFORMATION HT5N1700ADZ

$T_A = -55^\circ$ to 150° C for all packages

Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain - Source Voltage	V_{DS}			1700	V	$T_c = 25^\circ\text{C}$	
Maximum Gate - Source Voltage	$V_{GS(max)}$	-10		+25		Transient	
Operational Gate-Source Voltage	$V_{GS op}$		-5/20			Static	Note 1
DC Continuous Drain Current	I_D			5	A	$V_{GS} = 20\text{ V}, T_c = 25^\circ\text{C}, T_J \leq 150^\circ\text{C}$	Fig. 19 Note 2
				3.5		$V_{GS} = 20\text{ V}, T_c = 100^\circ\text{C}, T_J \leq 150^\circ\text{C}$	
Pulsed Drain Current	I_{DM}			15		t_{pmax} limited by T_{Jmax} $V_{GS} = 20\text{ V}, T_c = 25^\circ\text{C}$	Fig. 22
Power Dissipation	P_D			69	W	$T_c = 25^\circ\text{C}, T_J = 150^\circ\text{C}$	Fig. 20
Operating Junction and Storage Temperature	T_J, T_{stg}			-55 to +150	$^\circ\text{C}$		
Solder Temperature	T_L			260		According to JEDEC J-STD-020	
Mounting Torque	M_D			1 8.8	Nm lbf-in	M3 or 6-32 screw	

Note (1): Recommended turn-on gate voltage is 20V with $\pm 5\%$ regulation tolerance, see Application Note PRD-04814 for additional details

Note (2): Verified by design

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

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	Note
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1700	—	—	V	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	Fig. 11
Gate Threshold Voltage	$V_{GS(th)}$	2.0	2.8	4		$V_{DS} = V_{GS}, I_D = 0.5\text{ mA}$	
		—	2.4	—		$V_{DS} = V_{GS}, I_D = 0.5\text{ mA}, T_J = 150^\circ\text{C}$	
Zero Gate Voltage Drain Current	I_{DSS}	—	1	100	μA	$V_{DS} = 1.7\text{ kV}, V_{GS} = 0\text{ V}$	
Gate-Source Leakage Current	I_{GSS}	—	—	250	nA	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	
Drain-Source On-State Resistance	$R_{DS(on)}$	—	0.80	1.4	Ω	$V_{GS} = 20\text{ V}, I_D = 2\text{ A}$	Fig. 4, 5, 6
		—	1.4	—		$V_{GS} = 20\text{ V}, I_D = 2\text{ A}, T_J = 150^\circ\text{C}$	
Transconductance	g_{fs}	—	1.04	—	S	$V_{DS} = 20\text{ V}, I_{DS} = 2\text{ A}$	Fig. 7
			1.09			$V_{DS} = 20\text{ V}, I_{DS} = 2\text{ A}, T_J = 150^\circ\text{C}$	
Input Capacitance	C_{iss}	—	215	—	pF	$V_{GS} = 0\text{ V}$ $V_{DS} = 1000\text{ V}$ $f = 1\text{ MHz}$ $V_{AC} = 25\text{ mV}$	Fig. 17, 18
Output Capacitance	C_{oss}	—	19	—			
Reverse Transfer Capacitance	C_{rss}	—	2.2	—			
C_{oss} Stored Energy	E_{oss}	—	10.2	—	μJ	$V_{DS} = 1.2\text{ kV}, V_{GS} = -5/20\text{ V}, I_D = 2\text{ A},$ $R_{G(ext)} = 2.5\text{ }\Omega, L = 1478\text{ }\mu\text{H}, T_J = 150^\circ\text{C}$	Fig. 26, 29
Turn-On Switching Energy	E_{on}	—	89	—			
Turn Off Switching Energy	E_{off}	—	14	—			
Turn-On Delay Time	$t_{d(on)}$	—	5	—	ns	$V_{DD} = 1.2\text{ kV}, V_{GS} = -5\text{ V}/20\text{ V}$ $I_D = 2\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega, R_L = 600\text{ }\Omega$ Timing relative to V_{DS} Per IEC60747-8-4 pg 83	Fig. 27, 28
Rise Time	t_r	—	19	—			
Turn-Off Delay Time	$t_{d(off)}$	—	14	—			
Fall Time	t_f	—	63	—			
Internal Gate Resistance	$R_{G(int)}$	—	24.8	—	Ω	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	
Gate to Source Charge	Q_{gs}	—	4	—	nC	$V_{DD} = 1.2\text{ kV}, V_{GS} = -5\text{ V}/20\text{ V}$ $I_D = 2\text{ A}$ Per IEC60747-8-4 pg 21	Fig. 12
Gate to Drain Charge	Q_{gd}	—	12	—			
Total Gate Charge	Q_g	—	22	—			

Reverse Diode Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Typ.	Max.	Unit	Test Conditions	Note
Diode Forward Voltage	V_{SD}	3.8	—	V	$V_{GS} = -5\text{ V}, I_{SD} = 1\text{ A}, T_J = 25^\circ\text{C}$	Fig. 8, 9, 10
		3.3	—		$V_{GS} = -5\text{ V}, I_{SD} = 1\text{ A}, T_J = 150^\circ\text{C}$	
Continuous Diode Forward Current ¹	I_S	—	4	A	$T_c = 25^\circ\text{C}$	Note 1
Reverse Recover Time ¹	t_{rr}	30	—	nS	$V_{GS} = -5\text{ V}, I_{SD} = 2\text{ A}, T_J = 150^\circ\text{C}$ $V_R = 1.2\text{ kV}$ $di_F/dt = 1135\text{ A}/\mu\text{s}$	Note 1
Reverse Recovery Charge ¹	Q_{rr}	31	—	nC		
Peak Reverse Recovery Current ¹	I_{rrm}	3	—	A		

Thermal Characteristics

Parameter	Symbol	Typ.	Max	Unit	Note
Thermal Resistance from Junction to Case	$R_{\theta JC}$	1.7	1.8	$^\circ\text{C}/\text{W}$	Fig. 21
Thermal Resistance From Junction to Ambient	$R_{\theta JA}$		40		

Typical Performance

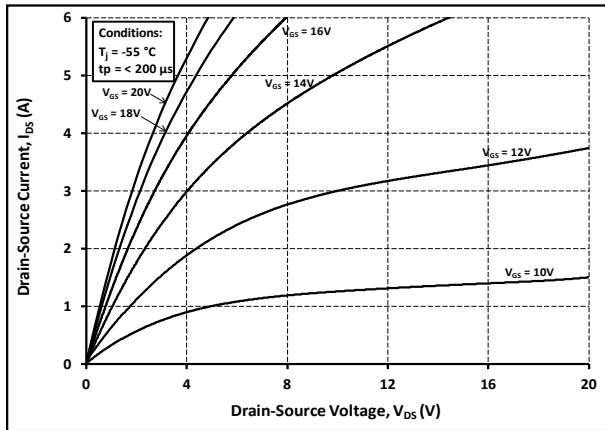


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

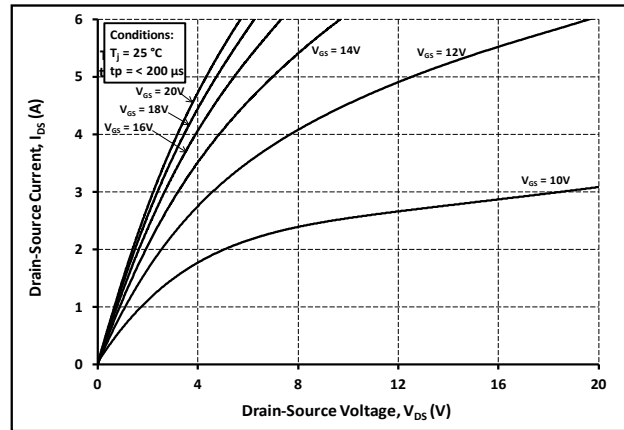


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

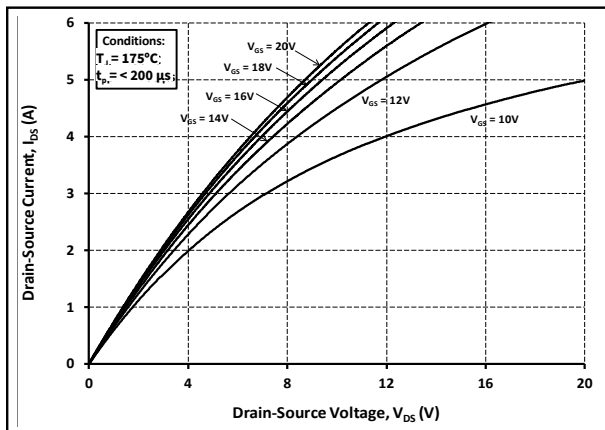


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

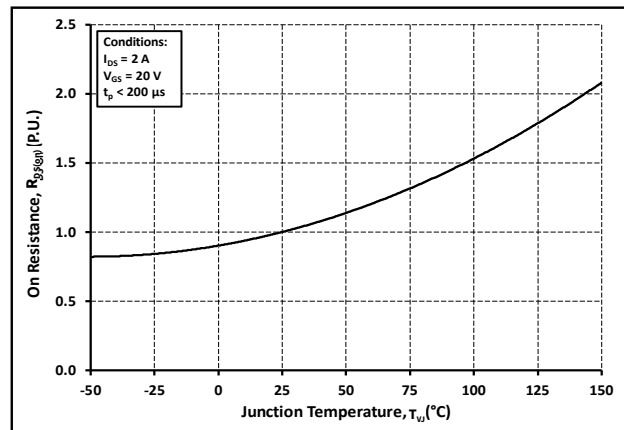


Figure 4. Normalized On-Resistance vs. Temperature

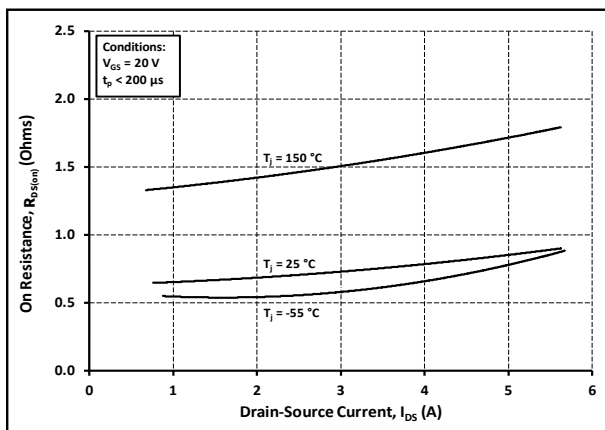


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

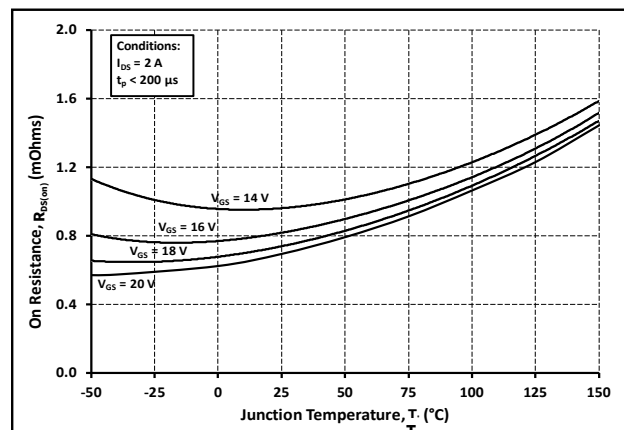


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

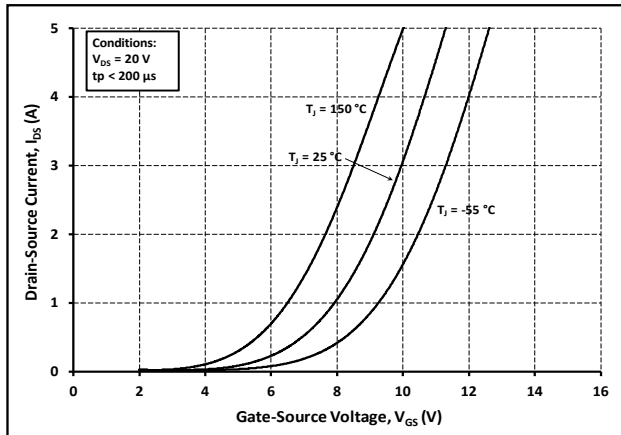


Figure 7. Transfer Characteristic for Various Junction Temperatures

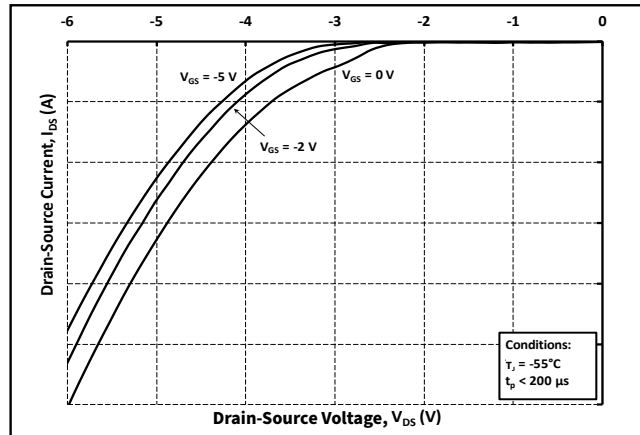


Figure 8. Body Diode Characteristic at -55°C

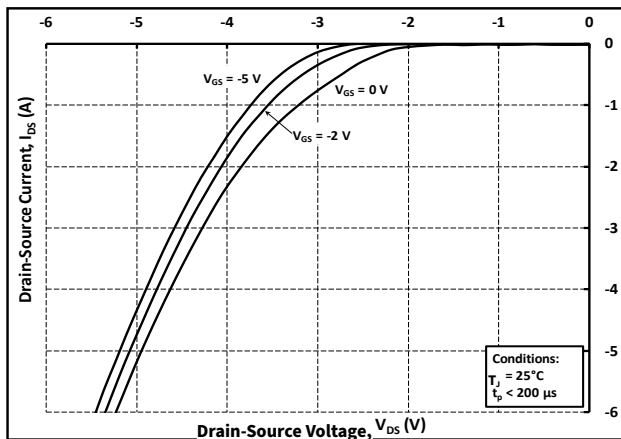


Figure 9. Body Diode Characteristic at 25°C

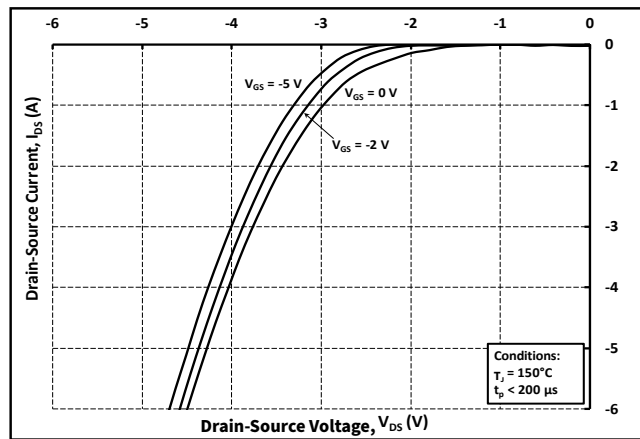


Figure 10. Body Diode Characteristic at 150°C

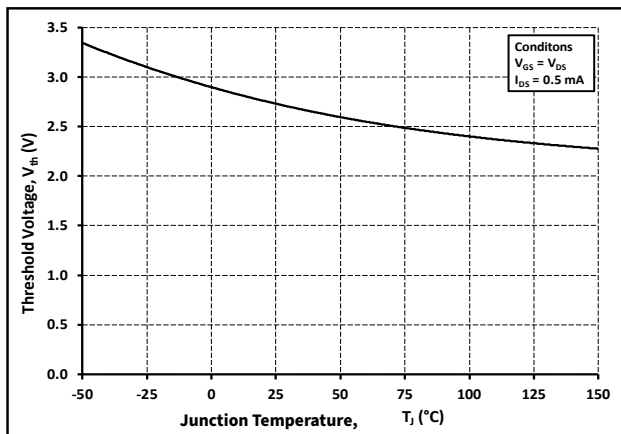


Figure 11. Threshold Voltage vs Temperature

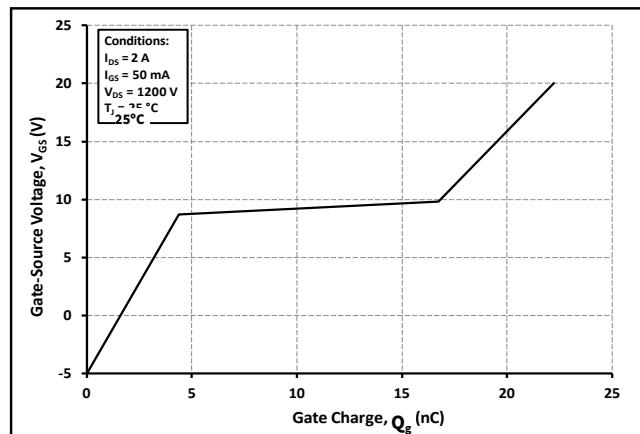


Figure 12. Gate Charge Characteristics

Typical Performance

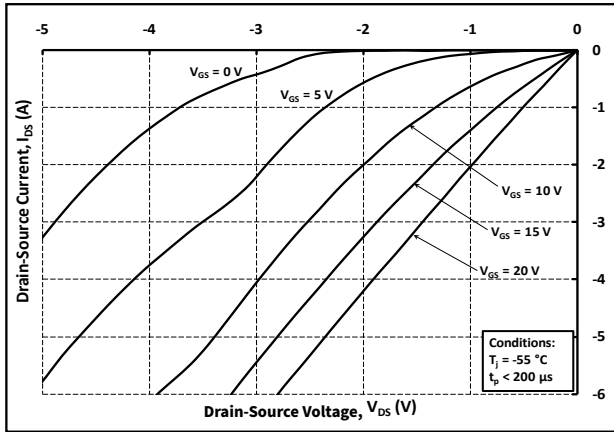


Figure 13. 3rd Quadrant Characteristic at -55°C

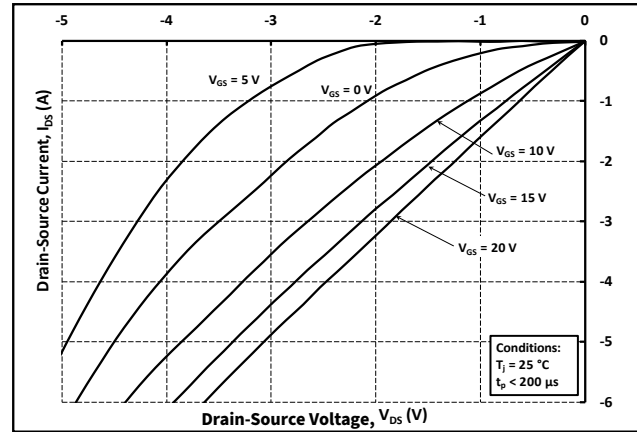


Figure 14. 3rd Quadrant Characteristic at 25°C

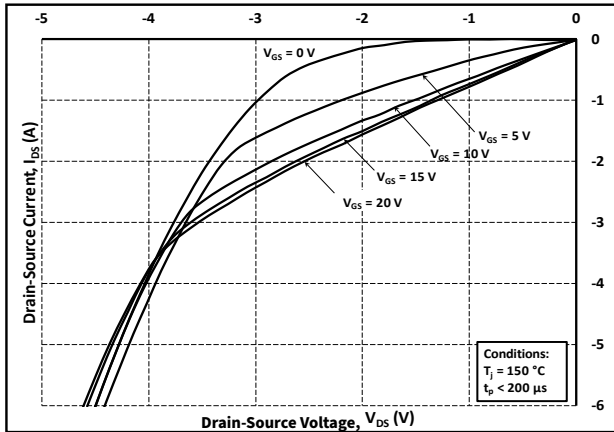


Figure 15. 3rd Quadrant Characteristic at 150°C

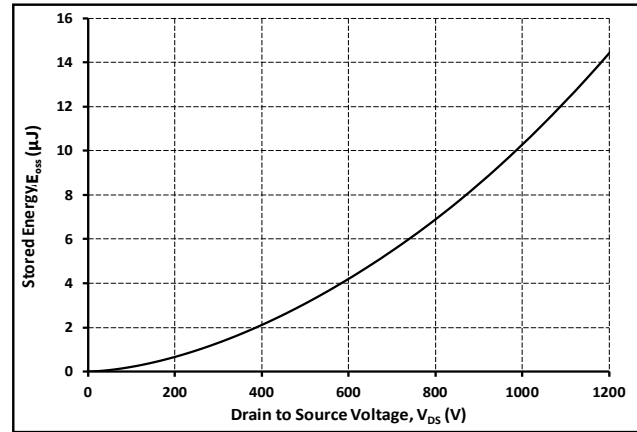


Figure 16. Output Capacitor Stored Energy

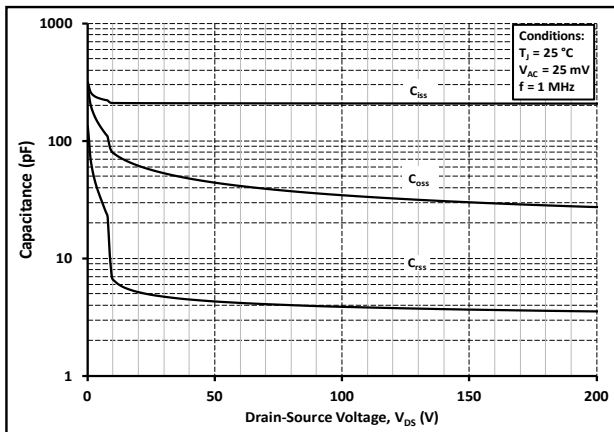


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

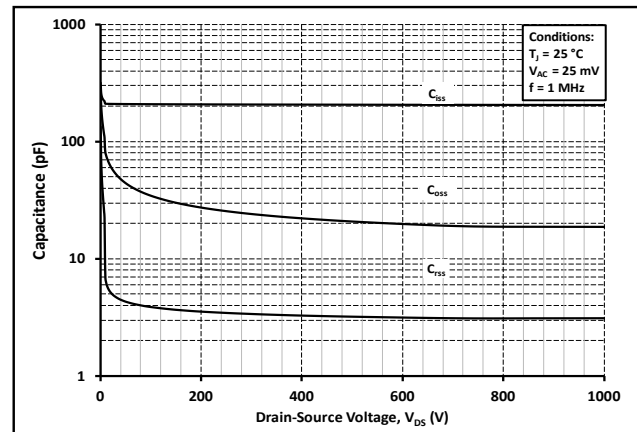


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000 V)

Typical Performance

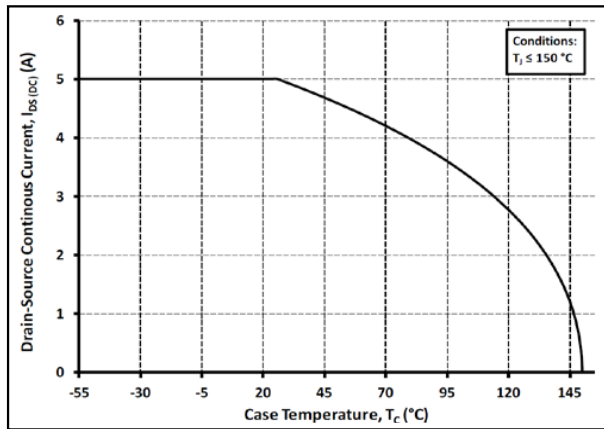


Figure 19. Continuous Drain Current Derating vs. Case Temperature

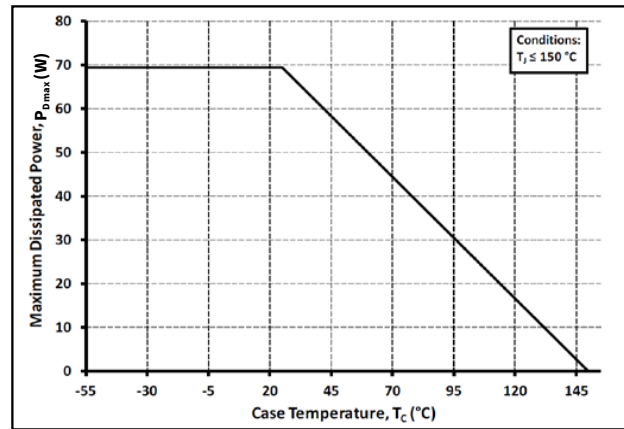


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

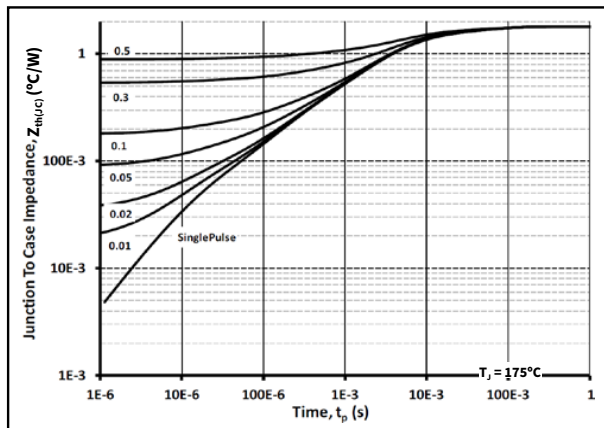


Figure 21. Transient Thermal Impedance (Junction - Case)

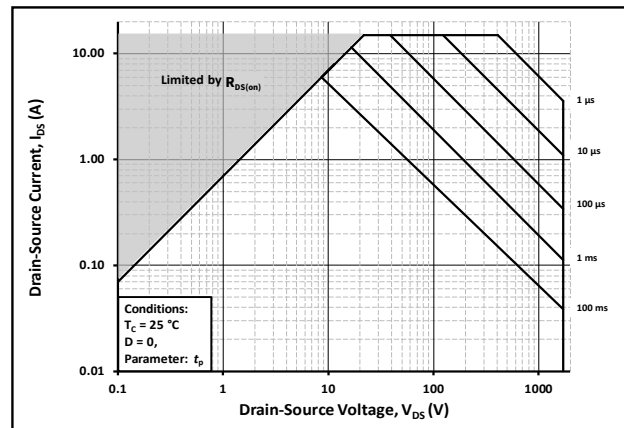


Figure 22. Safe Operating Area

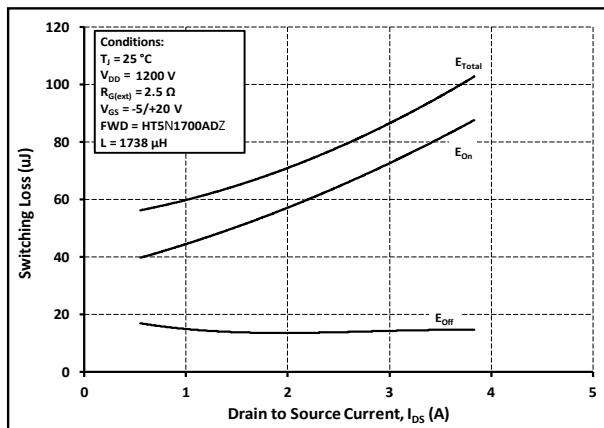


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600\text{ V}$)

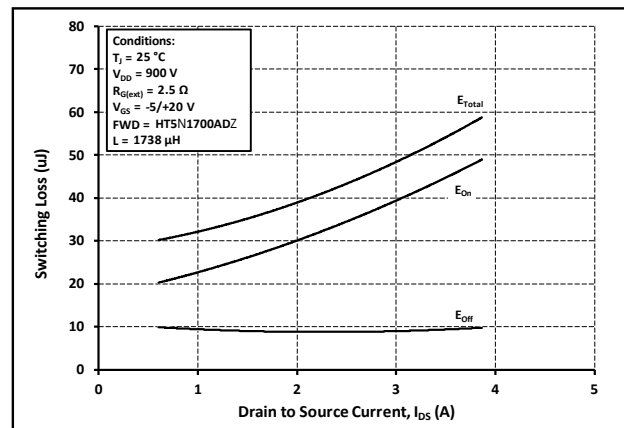


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 900\text{ V}$)

Typical Performance

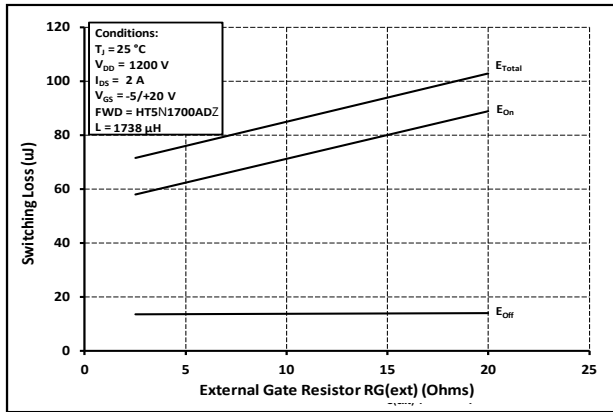


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$

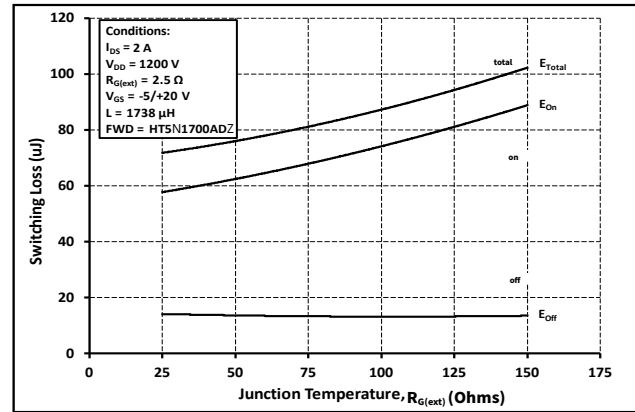


Figure 26. Clamped Inductive Switching Energy vs. Temperature

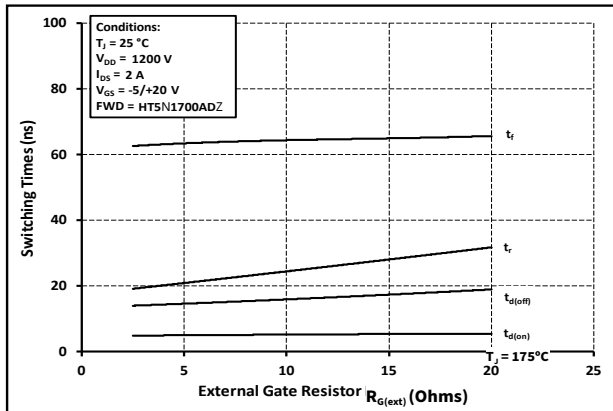


Figure 27. Switching Times vs. $R_{G(\text{ext})}$

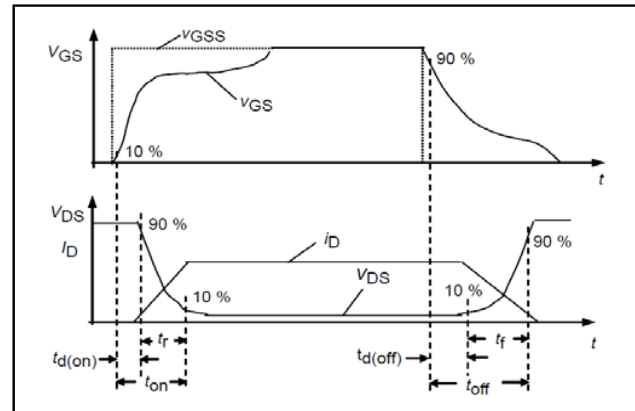


Figure 28. Switching Times Definition

Test Circuit Schematic

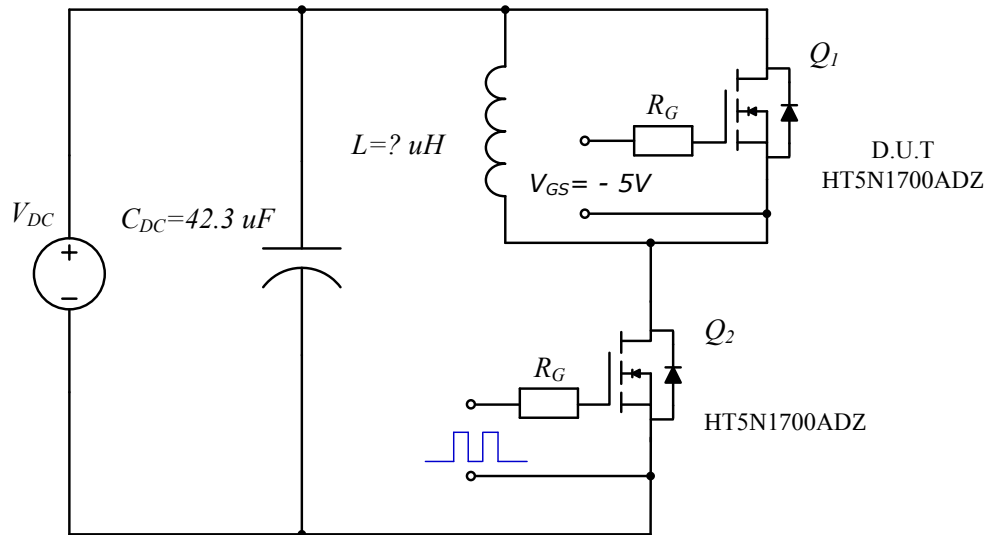
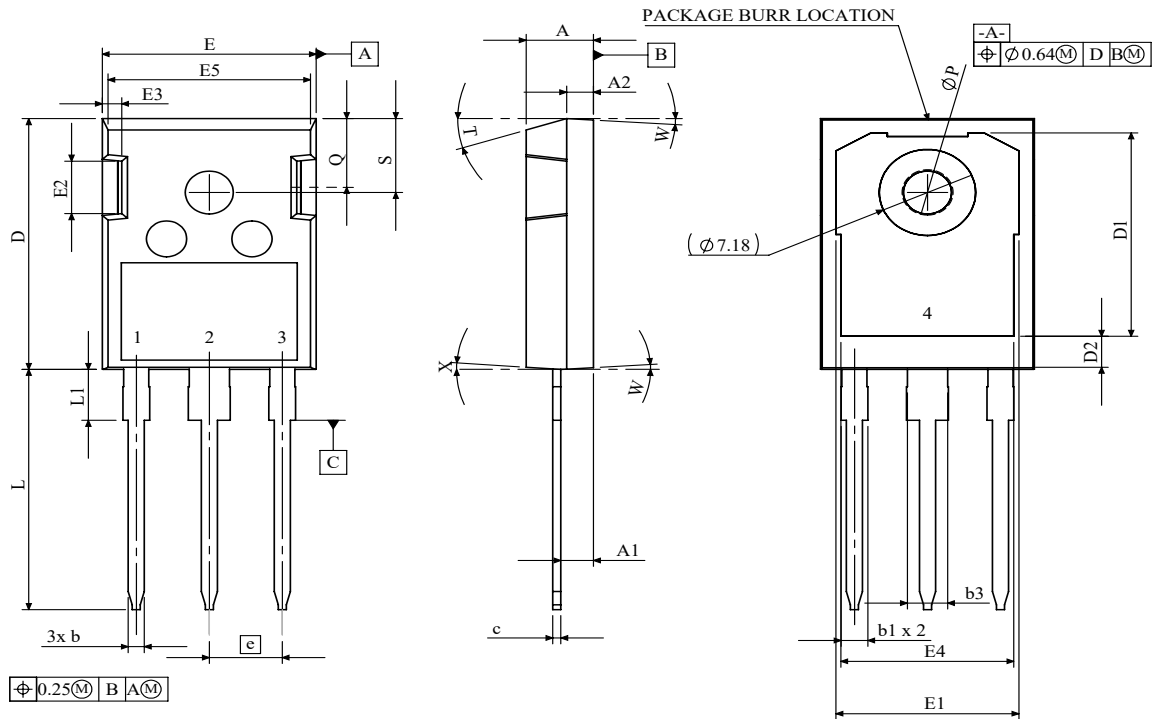


Figure 29. Clamped Inductive Switching Waveform Test Circuit

Note:

Turn-off and Turn-on switching energy and timing values measured using SiC MOSFET Body Diode as shown above.

Package Dimensions – TO-247-3L


1	GATE
2	DRAIN
3	SOURCE
4	DRAIN

NOTES:

1. ALL METAL SURFACES ARE TIN PLATED (MATTE), EXCEPT AREA OF CUT.
2. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE LISTED IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. BURR OR MOLD FLASH SIZE (0.5 mm) IS NOT INCLUDED IN THE DIMENSIONS

Recommended Solder Pad Layout

