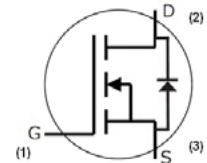


C2M0080120D

Silicon Carbide Power MOSFET C2M™ MOSFET Technology N-Channel Enhancement Mode

Features

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



Wolfspeed, Inc. is in the process of rebranding its products and related materials pursuant to the entity name change from Cree, Inc. to Wolfspeed, Inc. During this transition period, products received may be marked with either the Cree name and/or logo or the Wolfspeed name and/or logo.

Ordering Part Number	Package	Marking
C2M0080120D	TO-247-3	C2M0080120D

Typical Applications

- Solar inverters
- Switch Mode Power Supplies
- High voltage DC/DC converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications

Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increase system switching frequency

Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain - Source Voltage	V_{DS}			1200	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			36	A	$V_{GS} = 20\text{ V}, T_c = 25^\circ\text{C}, T_J \leq 150^\circ\text{C}$	Fig. 19 Note 2
				24		$V_{GS} = 20\text{ V}, T_c = 100^\circ\text{C}, T_J \leq 150^\circ\text{C}$	
Pulsed Drain Current	I_{DM}			80		t_{Pmax} limited by T_{Jmax} $V_{GS} = 20\text{ V}, T_c = 25^\circ\text{C}$	Fig. 22
Power Dissipation	P_D			192	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	$V_{(BR)DSS}$	1200	—	—	V	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	Fig. 11
Gate Threshold Voltage	$V_{GS(th)}$	2.0	2.9	4		$V_{DS} = V_{GS}, I_D = 5\text{ mA}$	
		—	2.4	—		$V_{DS} = V_{GS}, I_D = 5\text{ mA}, T_J = 150^\circ\text{C}$	
Zero Gate Voltage Drain Current	I_{DSS}	—	1	100	μA	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	
Gate-Source Leakage Current	I_{GSS}	—	—	250	nA	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	
Drain-Source On-State Resistance	$R_{DS(on)}$	—	80	98	m Ω	$V_{GS} = 20\text{ V}, I_D = 20\text{ A}$	Fig. 4, 5, 6
		—	144	—		$V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 150^\circ\text{C}$	
Transconductance	g_{fs}	—	10	—	S	$V_{DS} = 20\text{ V}, I_{DS} = 20\text{ A}$	Fig. 7
			9			$V_{DS} = 20\text{ V}, I_{DS} = 20\text{ A}, T_J = 150^\circ\text{C}$	
Input Capacitance	C_{iss}	—	1130	—	pF	$V_{GS} = 0\text{ V}$	Fig. 17, 18
Output Capacitance	C_{oss}	—	92	—		$V_{DS} = 1000\text{ V}$	
Reverse Transfer Capacitance	C_{rss}	—	7.5	—		$f = 1\text{ MHz}$	
C_{oss} Stored Energy	E_{oss}	—	50	—	μJ	$V_{AC} = 25\text{ mV}$	Fig. 16
Avalanche Energy, Single Pluse	E_{AS}	—	1	—	J	$I_D = 20\text{ A}, V_{DD} = 50\text{ V}$	Fig. 29
Turn-On Switching Energy	E_{on}	—	523	—	μJ	$V_{DS} = 800\text{ V}, V_{GS} = -5\text{ V}/20\text{ V},$ $I_D = 20\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega, L = 156\text{ }\mu\text{H}$	Fig. 25
Turn-Off Switching Energy	E_{off}	—	72	—			
Turn-On Delay Time	$t_{d(on)}$	—	15	—	ns	$V_{DD} = 800\text{ V}, V_{GS} = -5\text{ V}/20\text{ V}$ $I_D = 20\text{ A}, R_{G(ext)} = 2.5\text{ }\Omega, R_L = 40\text{ }\Omega,$ Timing relative to V_{DS} Per IEC60747-8-4 pg 83	Fig. 27
Rise Time	t_r	—	22	—			
Turn-Off Delay Time	$t_{d(off)}$	—	24	—			
Fall Time	t_f	—	14	—			
Internal Gate Resistance	$R_{G(int)}$	—	3.9	—	Ω	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	
Gate to Source Charge	Q_{GS}	—	17	—	nC	$V_{DS} = 800\text{ V}, V_{GS} = -5/20\text{ V}$ $I_D = 20\text{ A}$ Per IEC60747-8-4 pg 21	Fig. 12
Gate to Drain Charge	Q_{gd}	—	29	—			
Total Gate Charge	Q_g	—	71	—			

Reverse Diode Characteristics

Parameter	Symbol	Typ.	Max.	Unit	Test Conditions	Notes
Diode Forward Voltage	V_{SD}	4.3	—	V	$V_{GS} = -5\text{ V}, I_{SD} = 10\text{ A}$	Fig. 8, 9, 10
Diode Forward Voltage		3.8	—		$V_{GS} = -5\text{ V}, I_{SD} = 10\text{ A}, T_J = 150^\circ\text{C}$	
Continuous Diode Forward Current ¹	I_S	—	36	A	$T_c = 25^\circ\text{C}$	Note 1
Reverse Recovery Time ¹	t_{rr}	24	—	ns	$V_{GS} = -5\text{ V}, I_{SD} = 20\text{ A}, V_R = 800\text{ V}$ $di_F/dt = 1950\text{ A}/\mu\text{s}$	Note 1
Reverse Recovery Charge ¹	Q_{rr}	152	—	nC		
Peak Reverse Recovery Current ¹	I_{RRM}	10	—	A		

Note:

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

Thermal Characteristics

Parameter	Symbol	Typ	Max.	Unit	Note
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.60	0.65	$^\circ\text{C}/\text{W}$	Fig. 21
Thermal Resistance From Junction to Ambient	$R_{\theta JA}$	—	40		

Typical Performance

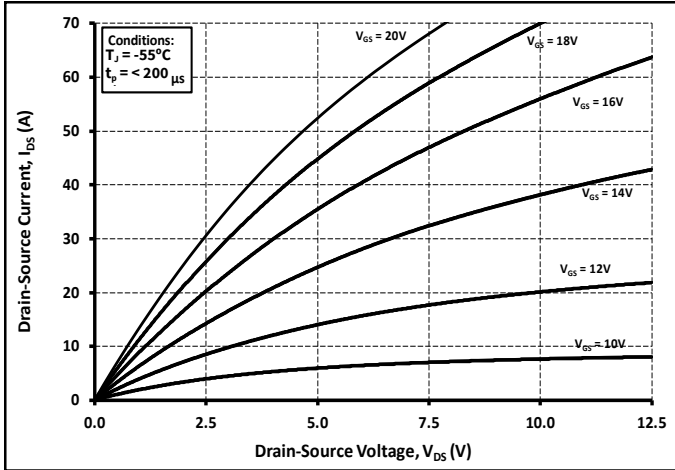


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

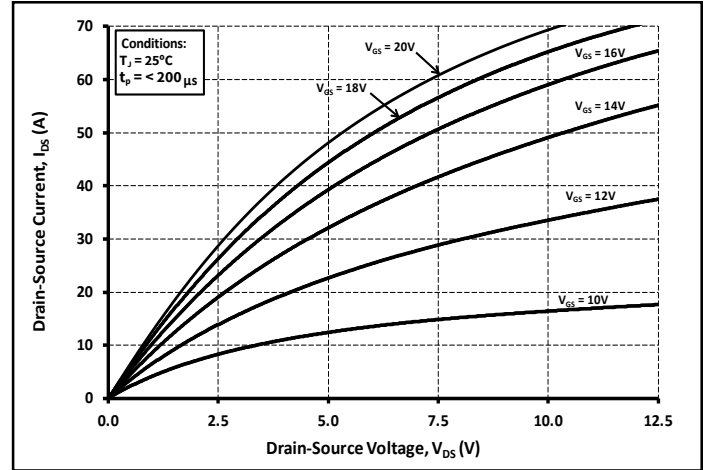


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

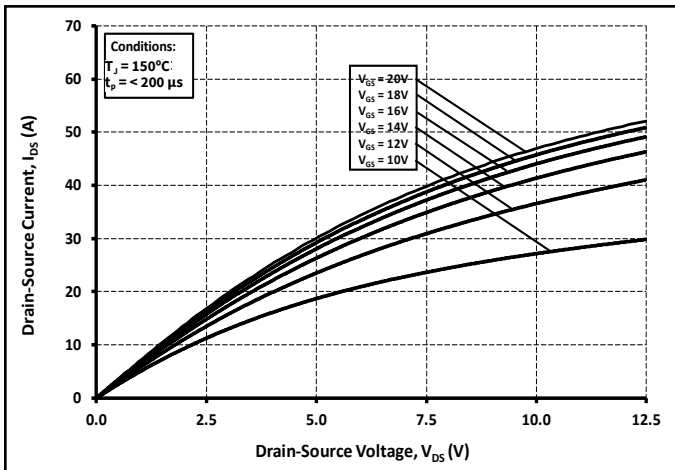


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

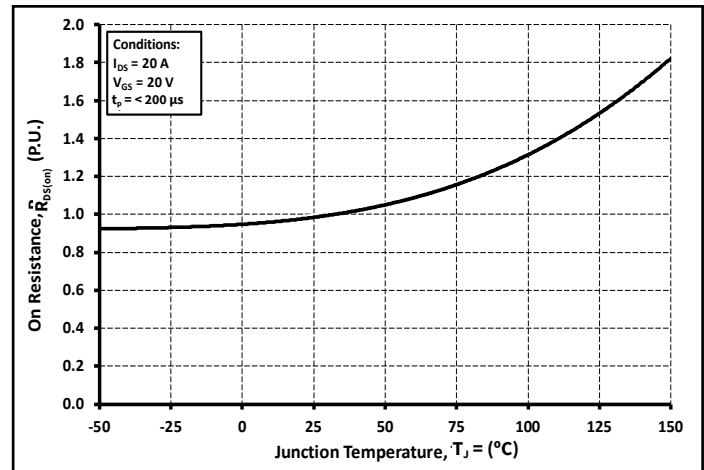


Figure 4. Normalized On-Resistance vs. Temperature

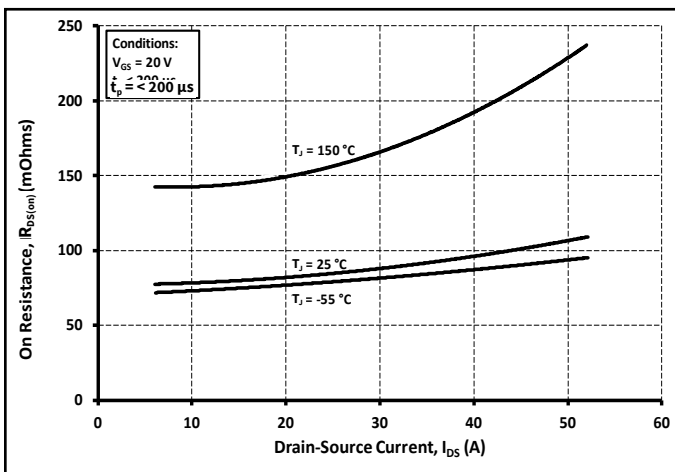


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

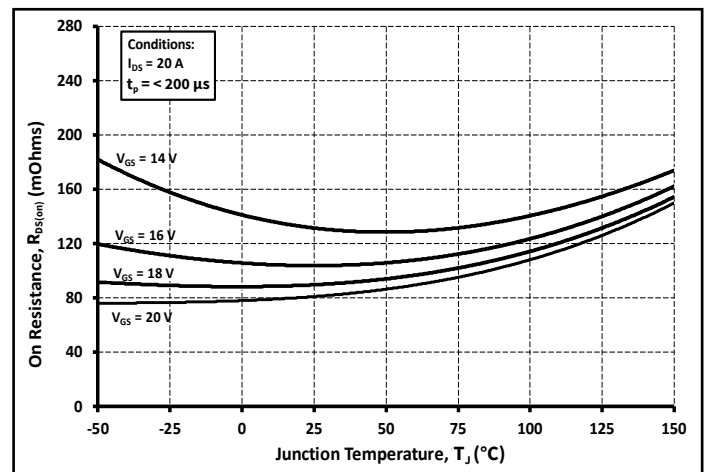


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage

Typical Performance

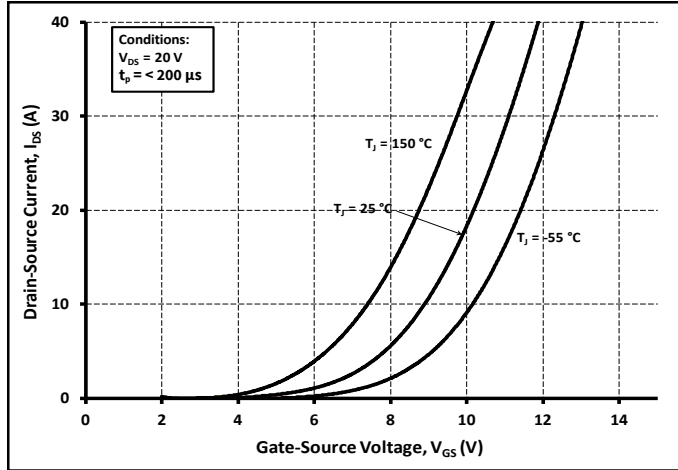


Figure 7. Transfer Characteristic For Various Junction Temperatures

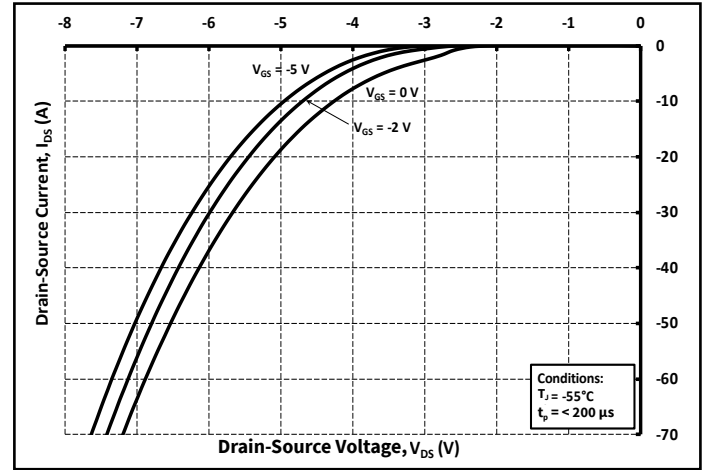


Figure 8. Body Diode Characteristic at -55°C

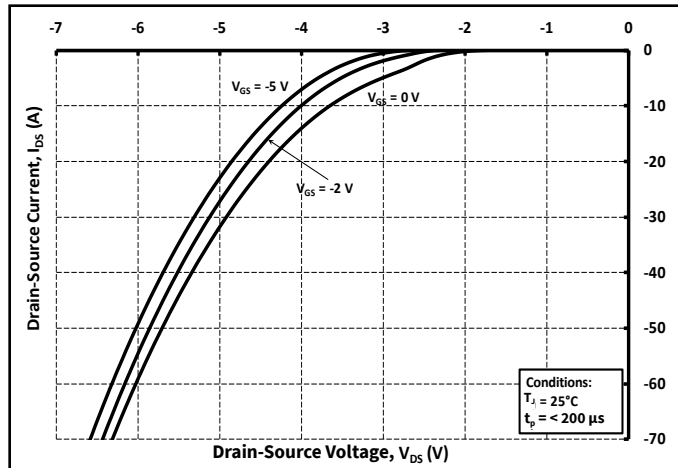


Figure 9. Body Diode Characteristic at 25°C

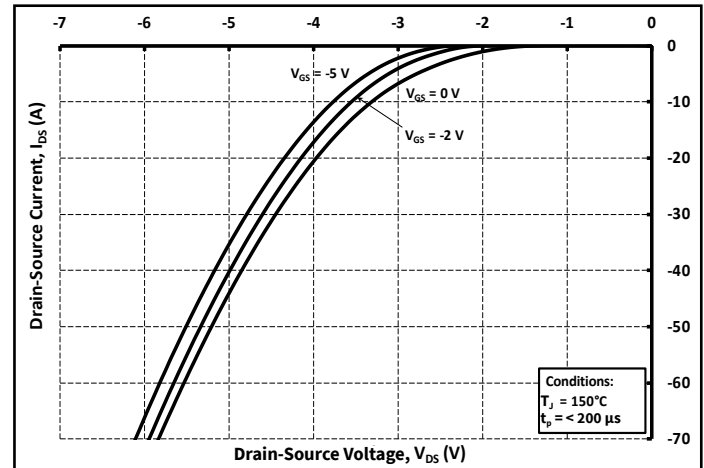


Figure 10. Body Diode Characteristic at 150°C

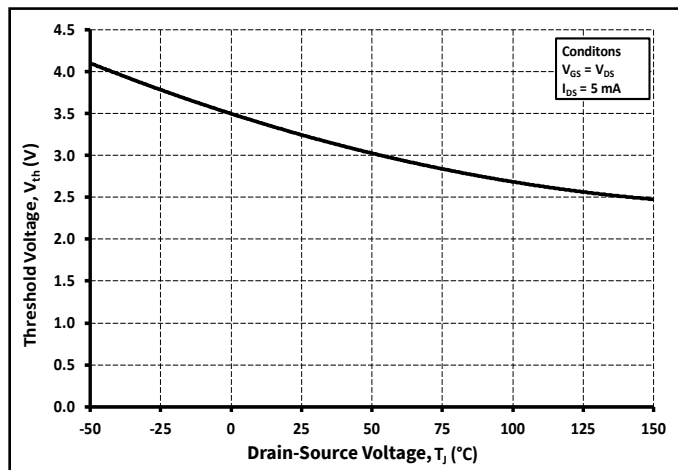


Figure 11. Threshold Voltage vs. Temperature

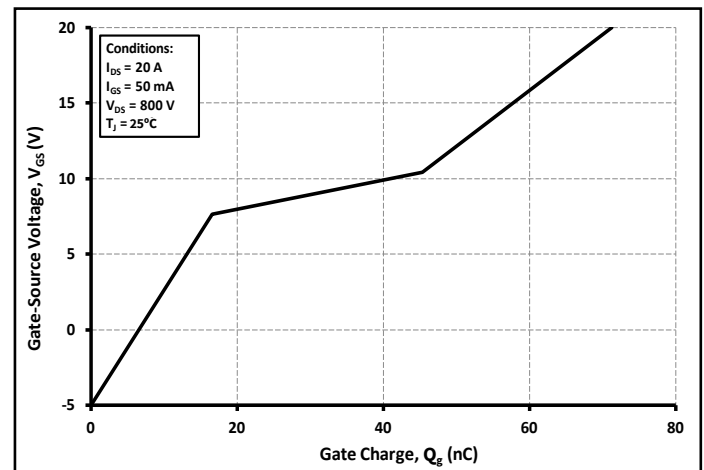


Figure 12. Gate Charge Characteristics

Typical Performance

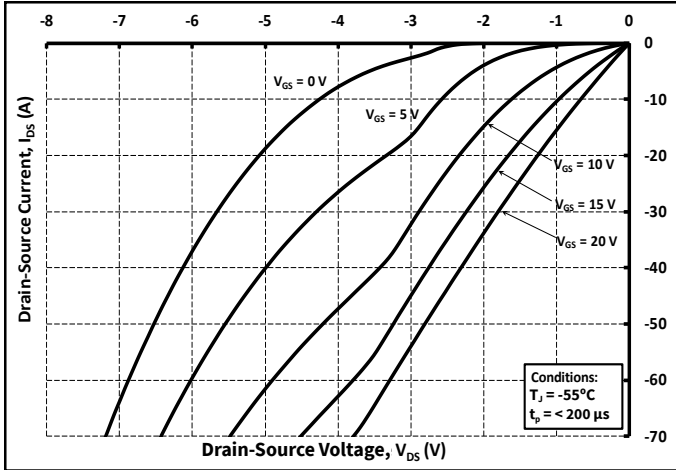


Figure 13. 3rd Quadrant Characteristic at -55°C

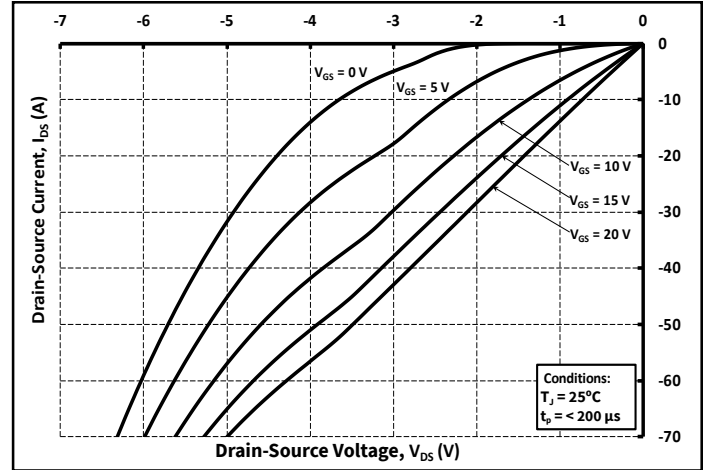


Figure 14. 3rd Quadrant Characteristic at 25°C

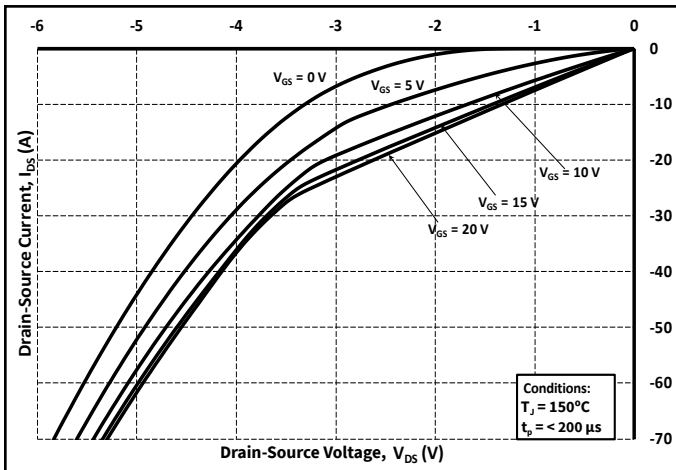


Figure 15. 3rd Quadrant Characteristic at 150°C

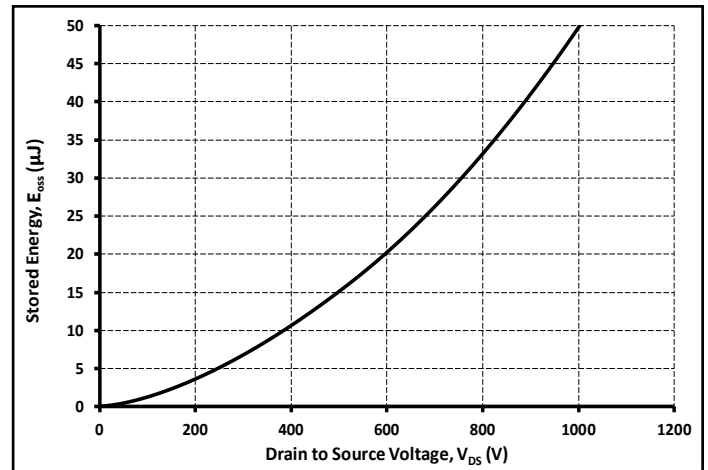


Figure 16. Output Capacitor Stored Energy

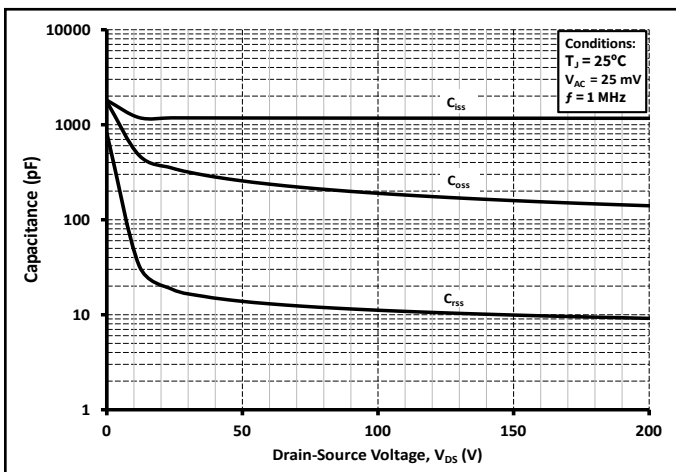


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200 V)

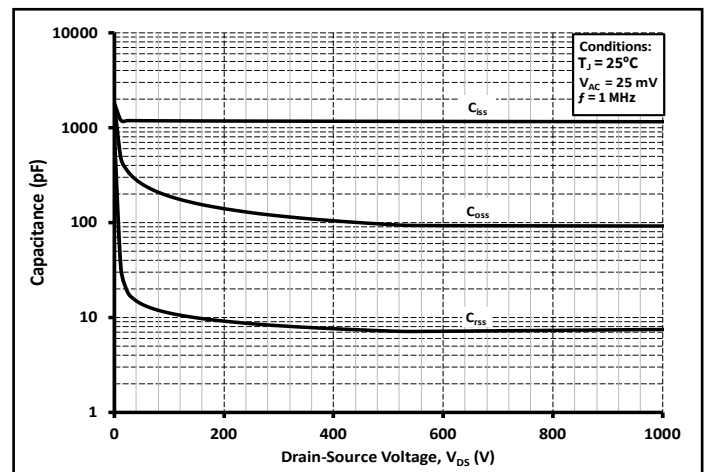


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000 V)



Typical Performance

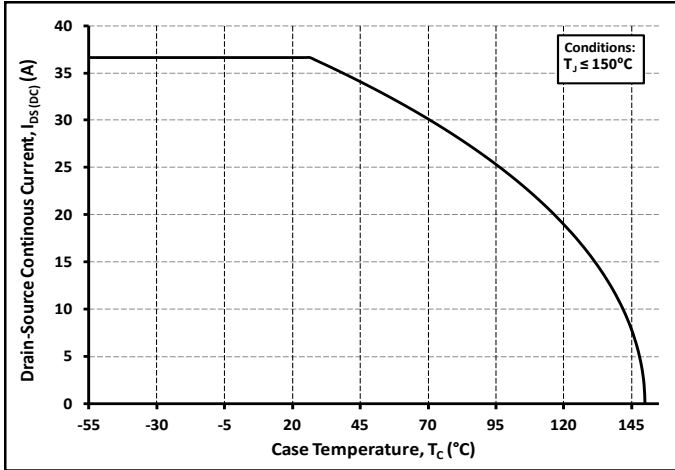


Figure 19. Continuous Drain Current Derating vs. Case Temperature

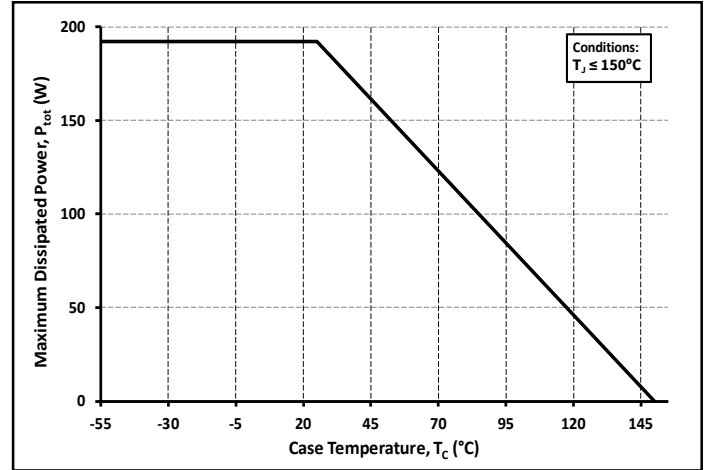


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

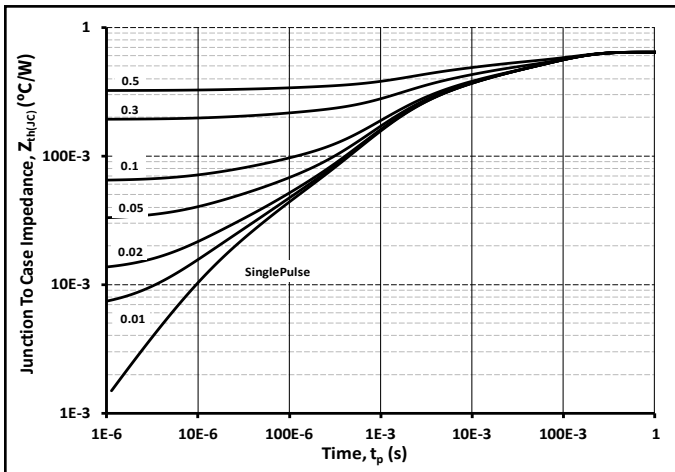


Figure 21. Transient Thermal Impedance (Junction - Case)

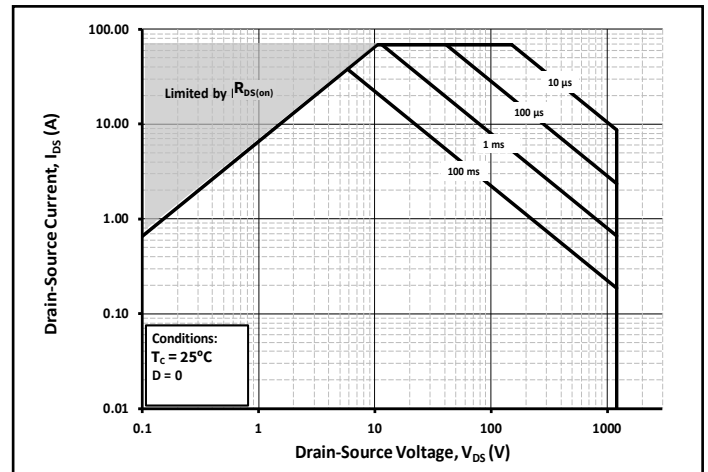


Figure 22. Safe Operating Area

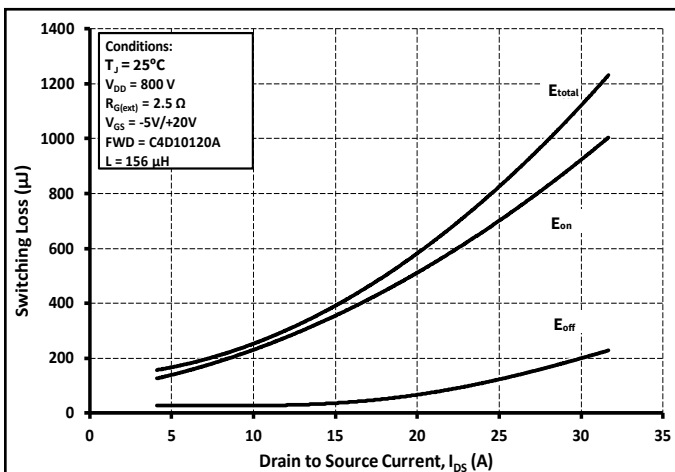


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600\text{ V}$)

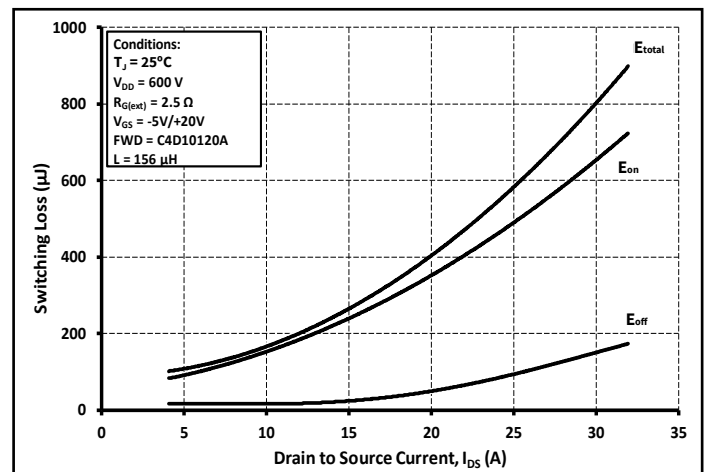


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800\text{ V}$)

Typical Performance

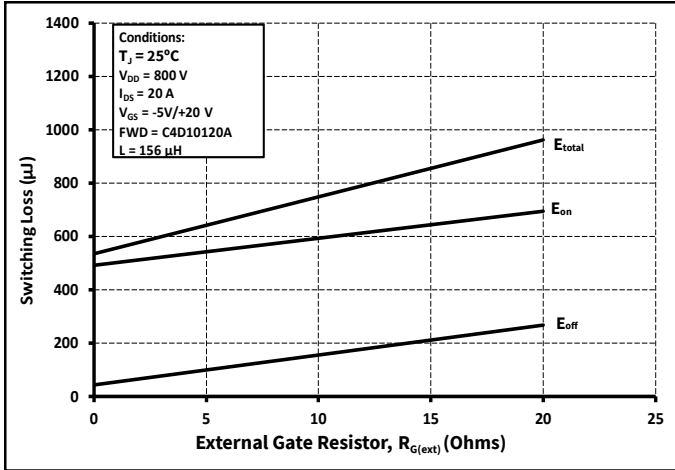


Figure 25. Clamped Inductive Switching Energy vs $R_{G(\text{ext})}$

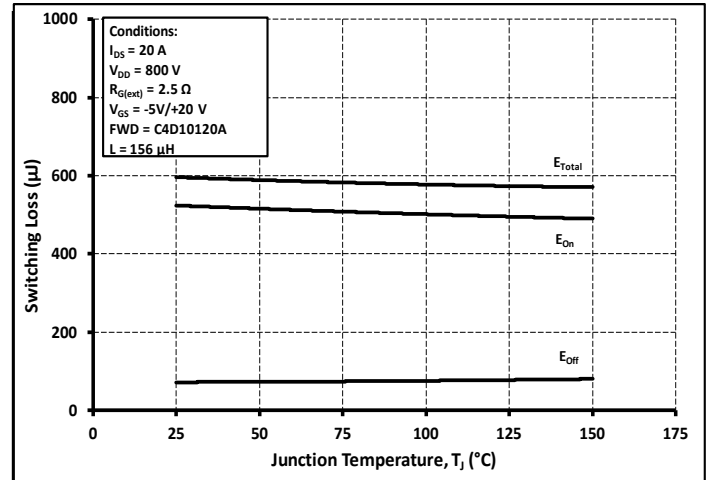


Figure 26. Clamped Inductive Switching Energy vs. Temperature

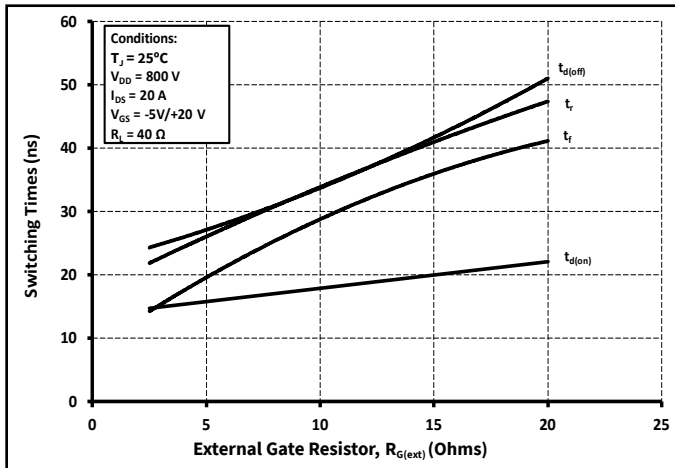


Figure 27. Switching Times vs. $R_{G(\text{ext})}$

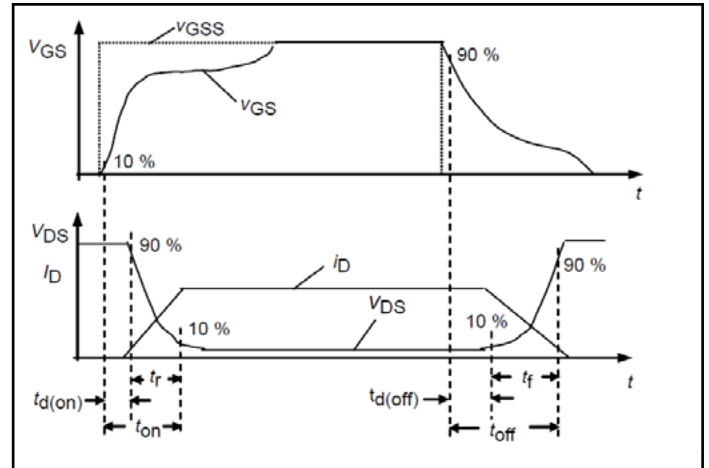


Figure 28. Switching Times Definition

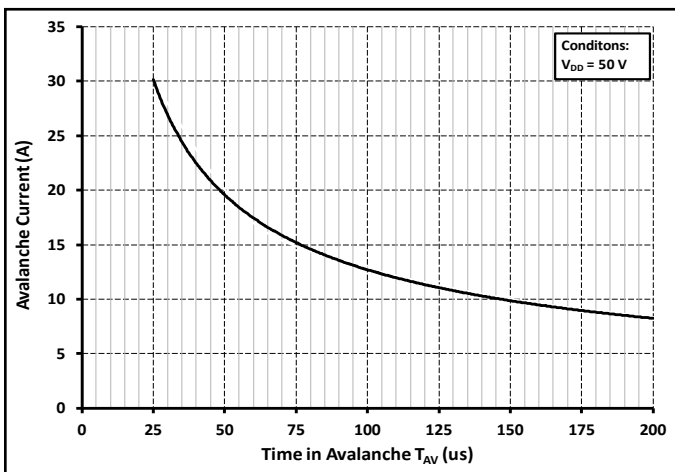
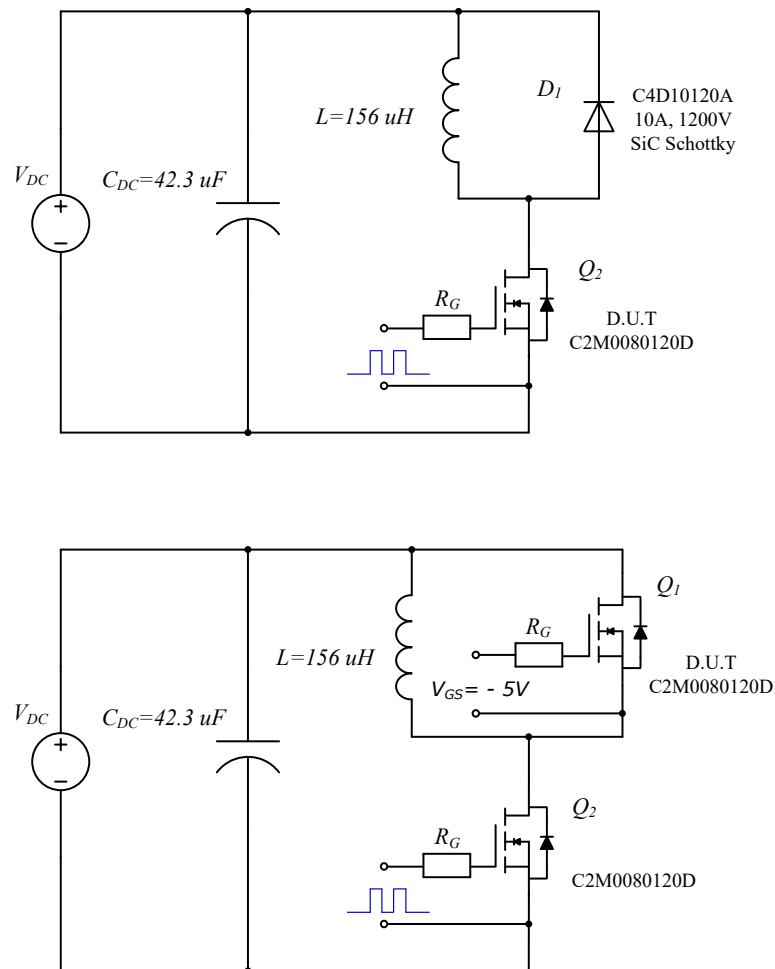
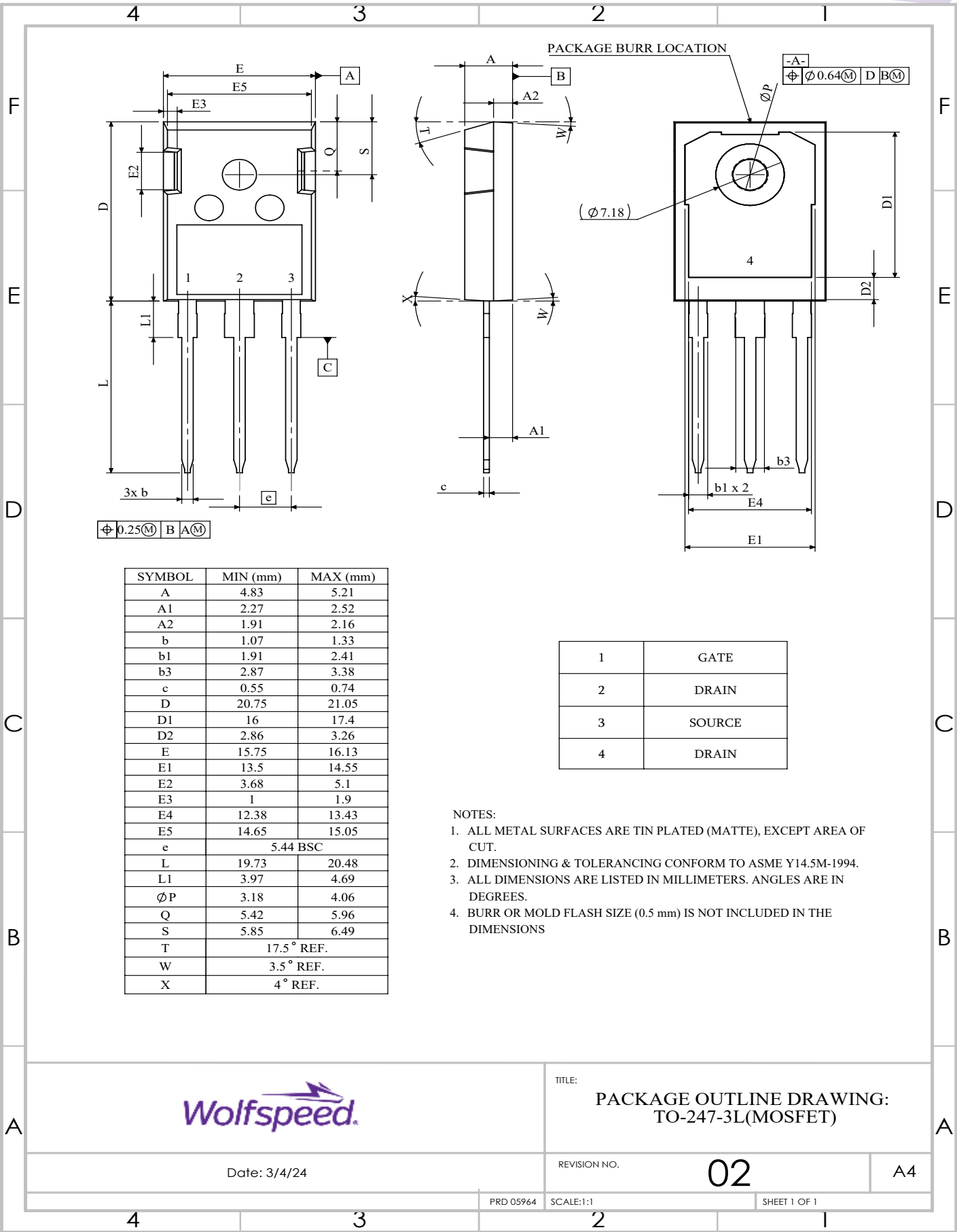


Figure 29. Single Avalanche SOA curve

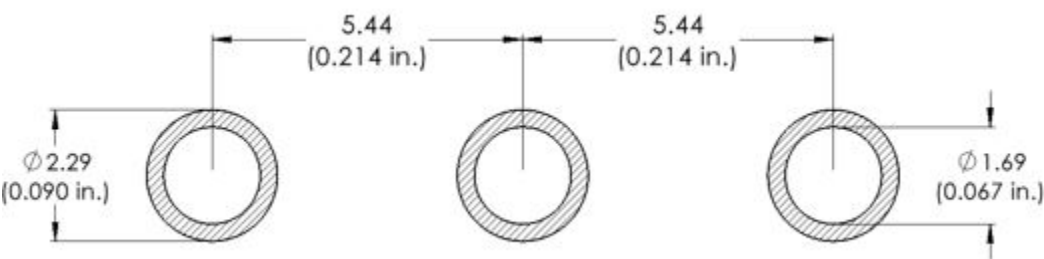
Test Circuit Schematic

**Figure 31.** Body Diode Recovery Test Circuit

Package Dimensions – TO-247-3L



Recommended Solder Pad Layout



Revision History

Current Revision	Date of Release	Description of Changes
D	September-2019	N/A
5	November-2023	Updated Wolfspeed branding, package drawing, package image, and solder pad layout, added Revision History Table
6	October - 2024	Legal Disclaimer, POD, Table 1 Layout

Related Links

- [SPICE Models](http://wolfspeed.com/power/tools-and-support): <http://wolfspeed.com/power/tools-and-support>
- [SiC MOSFET Isolated Gate Driver Reference Design](http://wolfspeed.com/power/tools-and-support): <http://wolfspeed.com/power/tools-and-support>
- [SiC MOSFET Evaluation Board](http://wolfspeed.com/power/tools-and-support): <http://wolfspeed.com/power/tools-and-support>



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