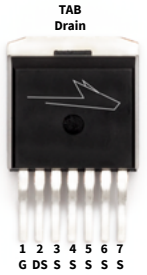
C3M0032120J1

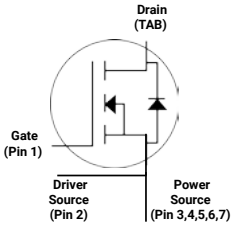
Silicon Carbide Power C3M™ MOSFET Technology
N-Channel Enhancement Mode

Features

- 3rd generation Silicon Carbide (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







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Part Number	Package	Marking
C3M0032120J1	TO 263-7L XL	C3M0032120J1

Typical Applications

- Solar inverters
- EV motor drive
- High voltage DC/DC converters
- Switched mode power supplies
- Load switch

Benefits

- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase 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°C	
Maximum Gate - Source Voltage	$V_{GS(max)}$	-8		+19		Transient	
Operational Gate-Source Voltage	$V_{GS\ op}$		-4/15			Static	Note 1
DC Continuous Drain Current	I_D			68	A	V_{GS} = 15 V, T_C = 25 °C, T_J ≤150 °C	Fig. 19 Note 2
				44		V_{GS} = 15 V, T_C = 100 °C, T_J ≤150 °C	
Pulsed Drain Current	I_{DM}			120		t_{Pmax} limited by T_{jmax} V_{GS} = 15V, T_C = 25 °C	Fig. 22
Power Dissipation	P_D			277	W	T_C = 25 °C, T_J = 150 °C	Fig. 20
Operating Junction Temperature	T_J			-40 to +175	°C		
Case and Storage Temperature	T_c, T_{stg}			-40 to 150			
Solder Temperature	T_L			260		According to JEDEC J-STD-020	

Note (1): Recommended turn-on gate voltage is 15V with ±5% regulation tolerance, see Application Note PRD-04814 for additional details
Note (2): Verified by design

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Electrical Characteristics (T_C = 25°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 V, I_D = 100 µA	
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.7	3.6	V	V_{DS} = V_{GS}, I_D = 11.5 mA, T_J = 25°C	Fig. 11
		—	2.2	—		V_{DS} = V_{GS}, I_D = 11.5 mA, T_J = 150°C	
Zero Gate Voltage Drain Current	I_{DSS}	—	1	50	µA	V_{DS} = 1200 V, V_{GS} = 0 V	
Gate-Source Leakage Current	I_{GSS}	—	10	250	nA	V_{GS} = 15 V, V_{DS} = 0 V	
Drain-Source On-State Resistance	$R_{DS(on)}$	23	32	43	mΩ	V_{GS} = 15 V, I_D = 41.4 A, T_J = 25°C	Fig. 4, 5, 6
		—	55	—		V_{GS} = 15 V, I_D = 41.4 A, T_J = 150°C	
Transconductance	g_{fs}	—	25	—	S	V_{DS} = 20 V, I_{DS} = 41.4 A, T_J = 25°C	Fig. 7
			24			V_{DS} = 20 V, I_{DS} = 41.4 A, T_J = 175°C	
Input Capacitance	C_{iss}	—	3424	—	pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 100 khz V_{AC} = 25 mV	Fig. 17, 18
Output Capacitance	C_{oss}	—	133	—			
Reverse Transfer Capacitance	C_{rss}	—	7	—			
Output Capacitance Stored Energy	E_{oss}	—	72	—	µJ		Fig. 16
Turn-On Switching Energy (Body Diode FWD)	E_{on}	—	360	—	µJ	V_{DS} = 800 V, V_{GS} = -4 V/15 V, I_D = 41.4 A, $R_{G(ext)}$ = 2.5 Ω, L= 99 µH	Fig. 26
Turn-Off Switching Energy (Body Diode FWD)	E_{off}	—	90	—			
Turn-On Delay Time	$t_{d(on)}$	—	15	—	ns	V_{DD} = 800 V, V_{GS} = -4 V/15 V I_D = 41.4 A, $R_{G(ext)}$ = 2.5 Ω, L= 99 µH Timing relative to V_{DS} Inductive load	Fig. 27
Rise Time	t_r	—	16	—			
Turn-Off Delay Time	$t_{d(off)}$	—	25	—			
Fall Time	t_f	—	7	—			
Internal Gate Resistance	$R_{G(int)}$	—	1.6	—	Ω	f = 1 MHz, V_{AC} = 25 mV	
Gate to Source Charge	Q_{gs}	—	40	—	nC	V_{DS} = 800 V, V_{GS} = -4 V/15 V I_D = 41.4 A Per IEC60747-8-4 pg 21	Fig. 12
Gate to Drain Charge	Q_{gd}	—	28	—			
Total Gate Charge	Q_g	—	111	—			

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Reverse Diode Characteristics (T_C = 25°C unless otherwise specified)

Parameter	Symbol	Typ.	Max.	Unit	Test Conditions	Notes
Diode Forward Voltage	V_{SD}	5.0	—	V	V_{GS} = -4 V, I_{SD} = 20 A, T_J = 25°C	Fig. 8, 9, 10
Diode Forward Voltage		4.5	—			
Continuous Diode Forward Current	I_S	—	49	A	V_{GS} = -4 V, T_J = 150°C, I_{SD} = 20 A,	Note 1
Diode Pulse Current	$I_{S, pulse}$	—	120		V_{GS} = -4 V, pulse width t_P limited by $T_{j\,max}$	Note 1
Reverse Recovery Time	t_{rr}	13	—	ns	V_{GS} = -4 V, I_{SD} = 41.4 A, V_R = 800 V, di_F/dt = 7450 A/µs, T_J = 150°C	Note 1
Reverse Recovery Charge	Q_{rr}	323	—	nC		
Peak Reverse Recovery Current	I_{RRM}	45	—	A		
Reverse Recovery Time	t_{rr}	18	—	ns	V_{GS} = -4 V, I_{SD} = 41.4 A, V_R = 800 V, di_F/dt = 2200 A/µs, T_J = 150°C	Note 1
Reverse Recovery Charge	Q_{rr}	164	—	nC		
Peak Reverse Recovery Current	I_{RRM}	16	—	A		

Thermal Characteristics

Parameter	Symbol	Typ	Unit	Note
Thermal Resistance from Junction to Case	$R_{\theta JC}$	0.45	°C/W	Fig. 21
Thermal Resistance From Junction to Ambient	$R_{\theta JA}$	40		

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Typical Performance

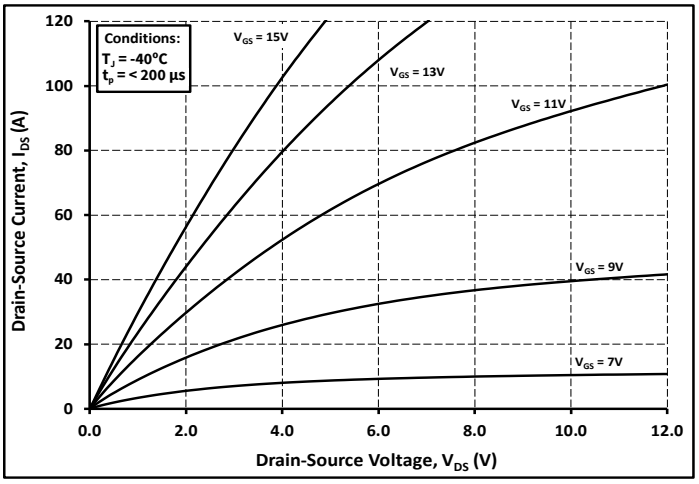


Figure 1. Output Characteristics T_J = -40°C

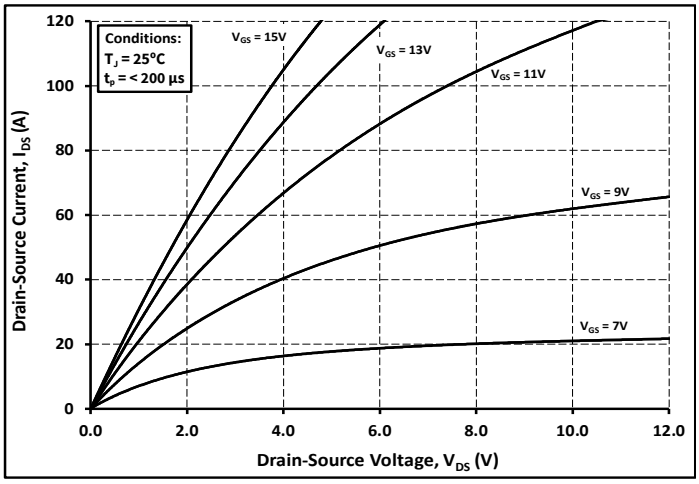


Figure 2. Output Characteristics T_J = 25°C

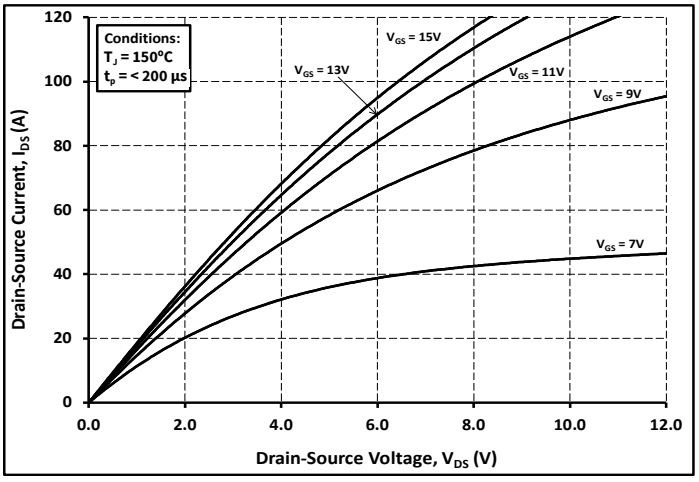


Figure 3. Output Characteristics T_J = 150°C

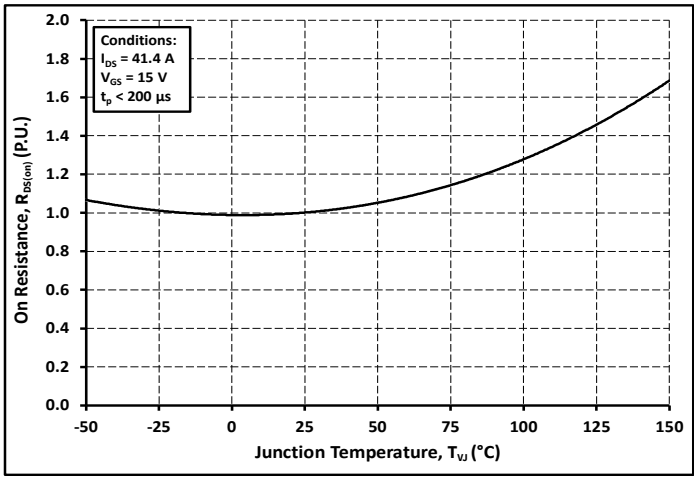


Figure 4. Normalized On-Resistance vs Temperature

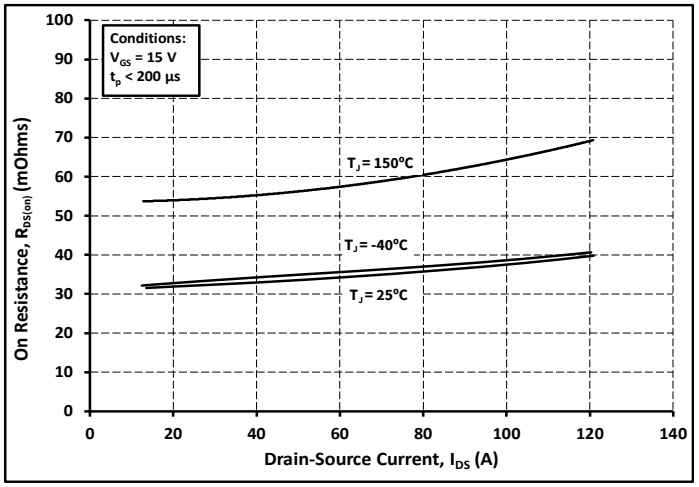


Figure 5. On-Resistance vs Drain Current For Various Temperatures

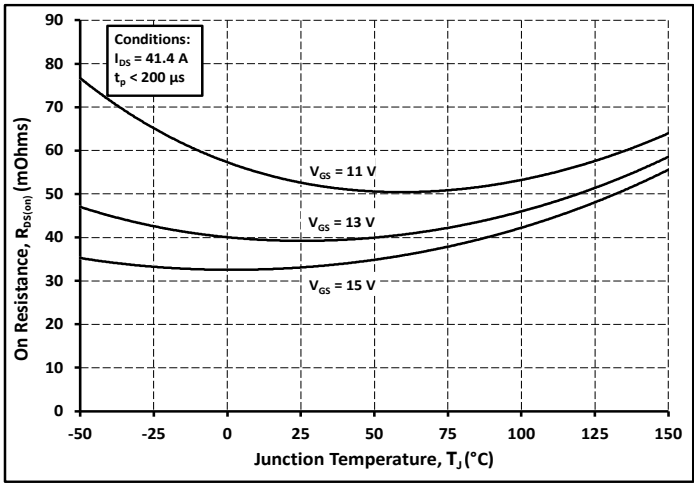


Figure 6. On-Resistance vs Temperature For Various Gate Voltage

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Typical Performance

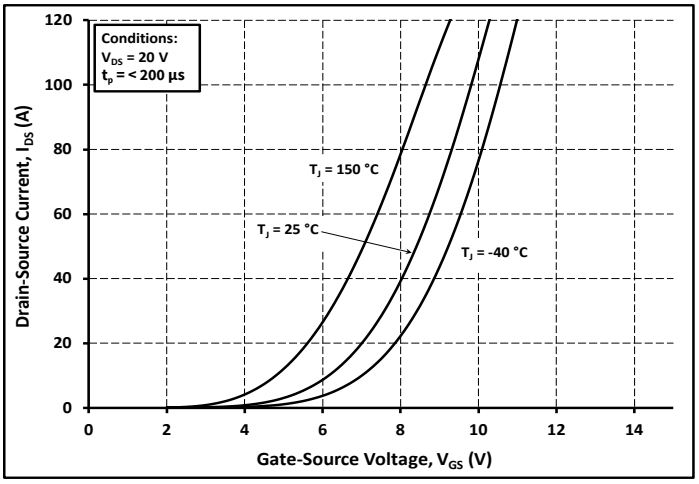


Figure 7. Transfer Characteristic for Various Junction Temperatures

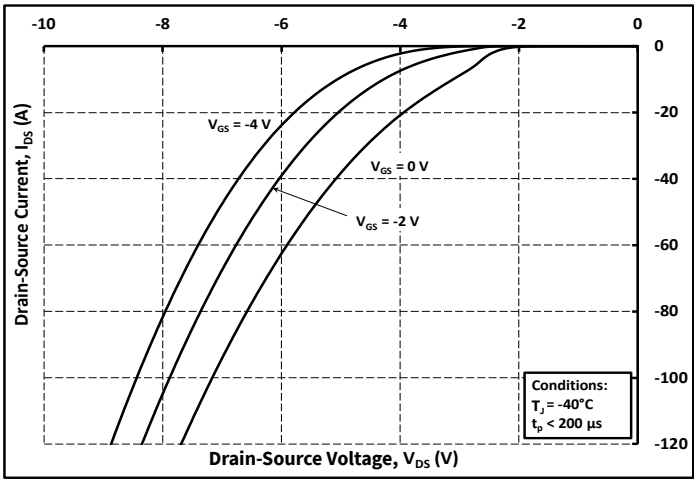


Figure 8. Body Diode Characteristic at -40°C

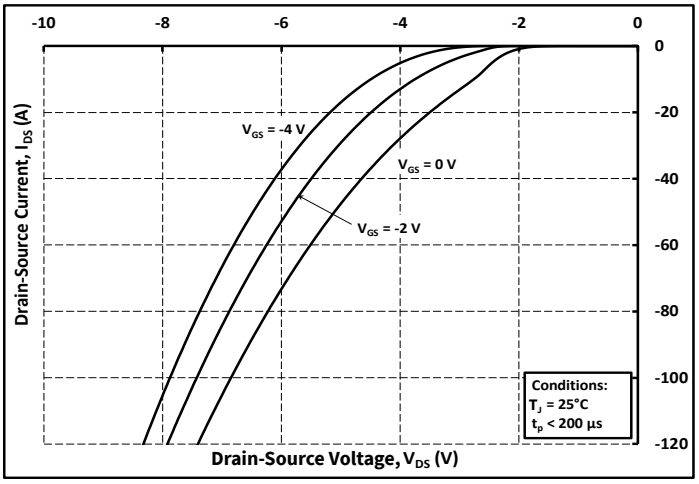


Figure 9. Body Diode Characteristic at 25°C

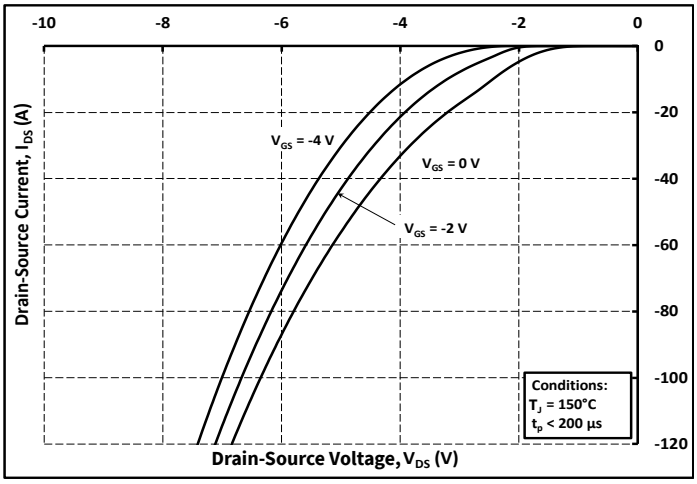


Figure 10. Body Diode Characteristic at 150°C

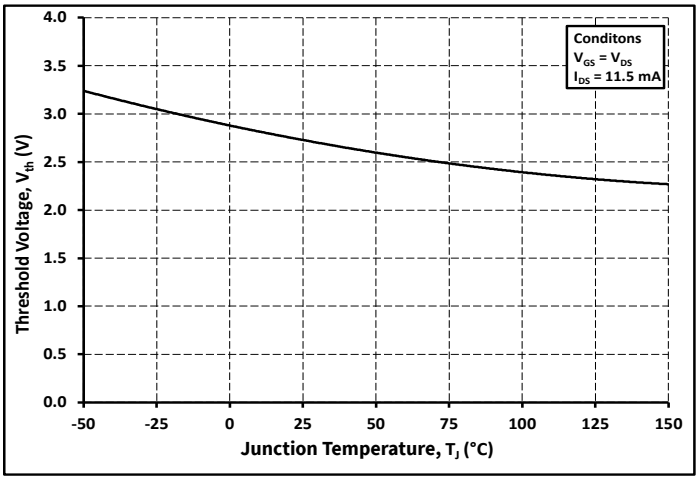


Figure 11. Threshold Voltage vs Temperature

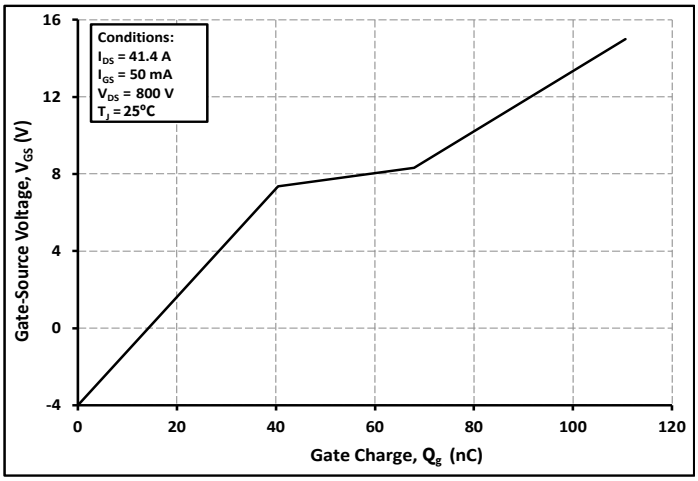


Figure 12. Gate Charge Characteristics

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Typical Performance

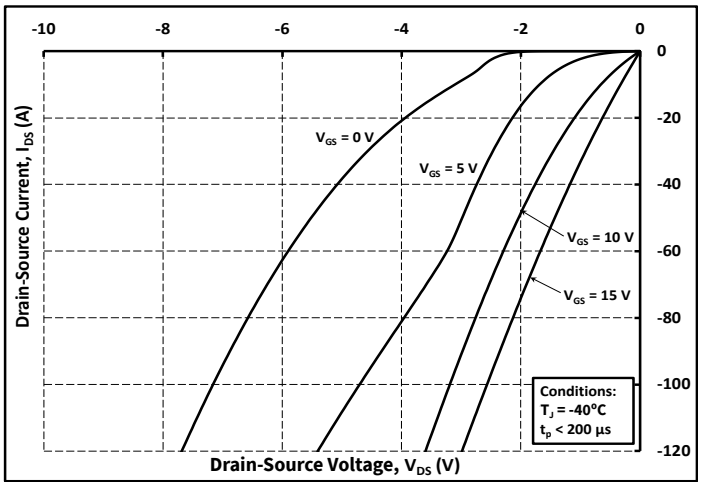


Figure 13. 3rd Quadrant Characteristic at -40°C

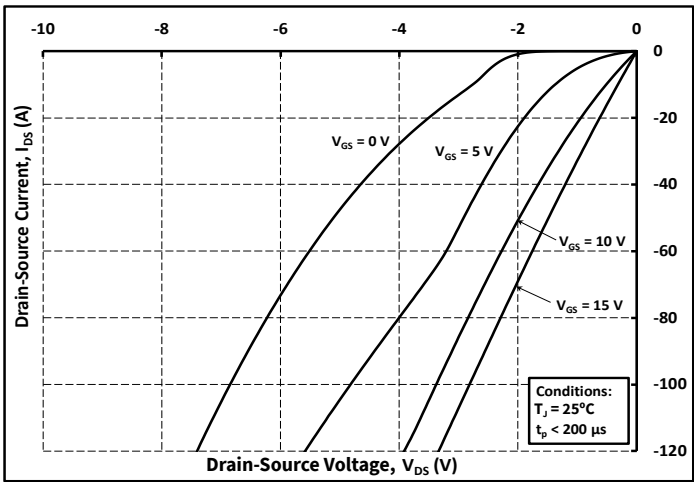


Figure 14. 3rd Quadrant Characteristic at 25°C

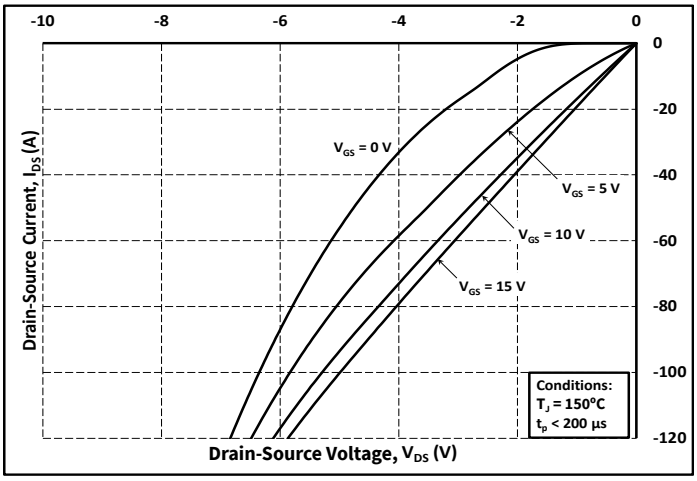


Figure 15. 3rd Quadrant Characteristic at 150°C

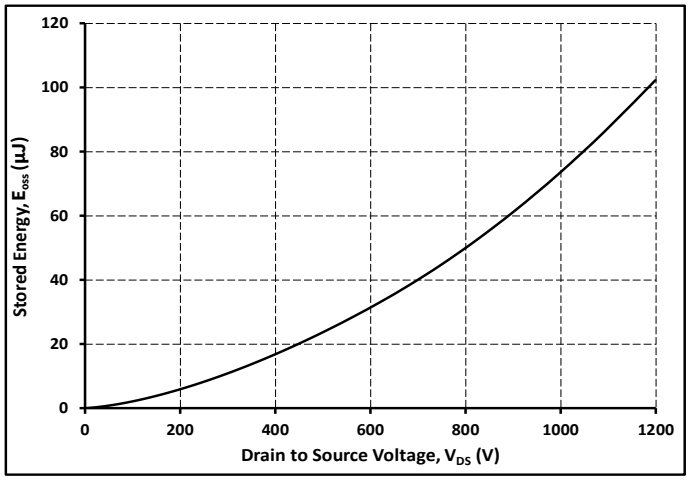


Figure 16. Output Capacitor Stored Energy

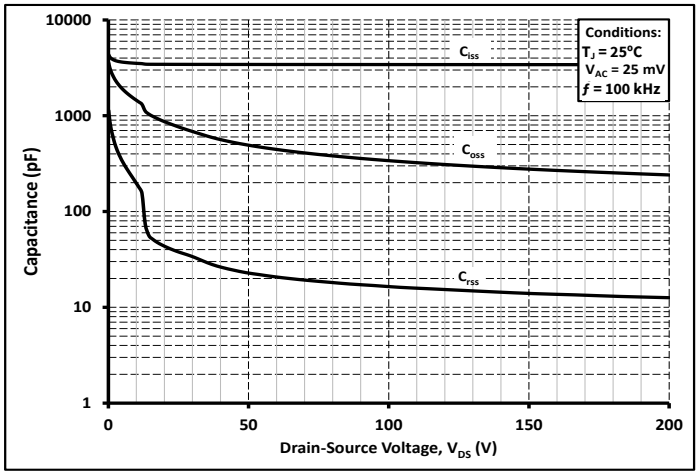


Figure 17. Capacitances vs Drain-Source Voltage (0 - 200 V)

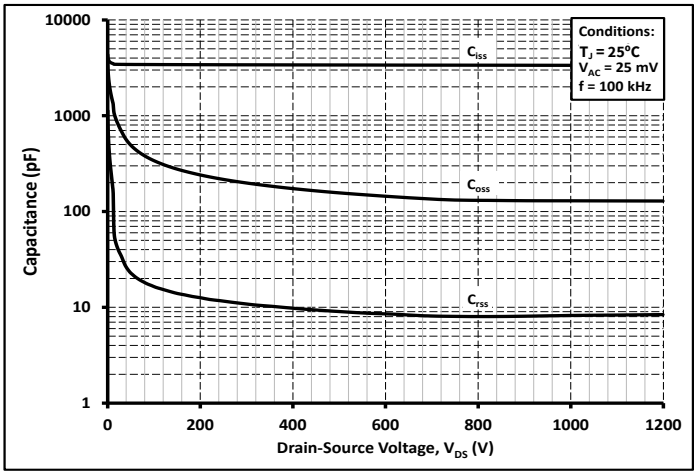


Figure 18. Capacitances vs Drain-Source Voltage (0 - 1200 V)

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Typical Performance

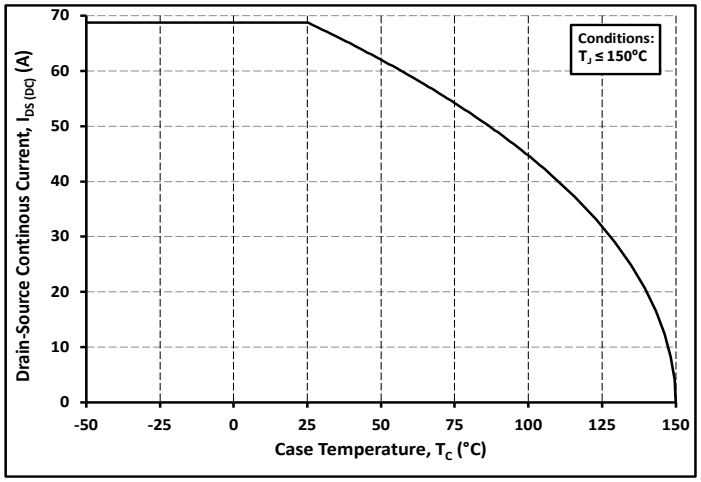


Figure 19. Continuous Drain Current Derating vs Case Temperature

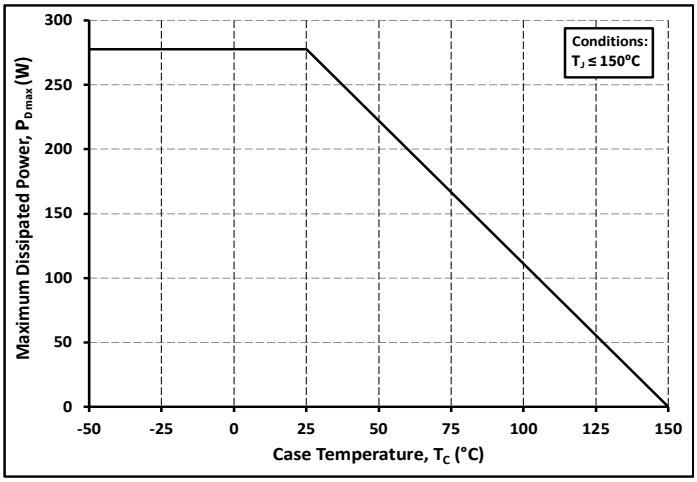


Figure 20. Maximum Power Dissipation Derating vs Case Temperature

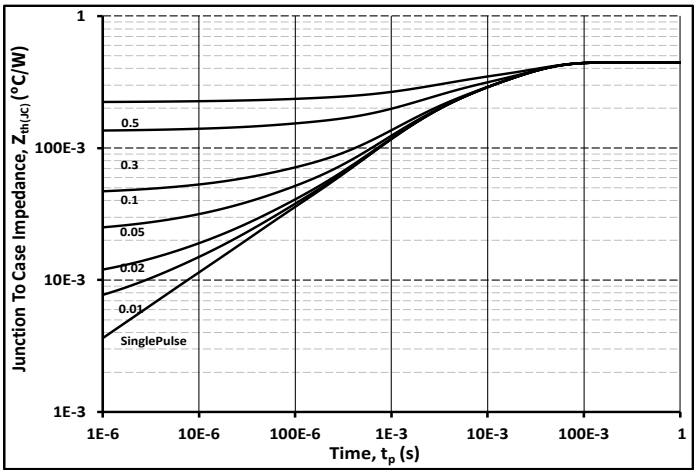


Figure 21. Transient Thermal Impedance (Junction - Case)

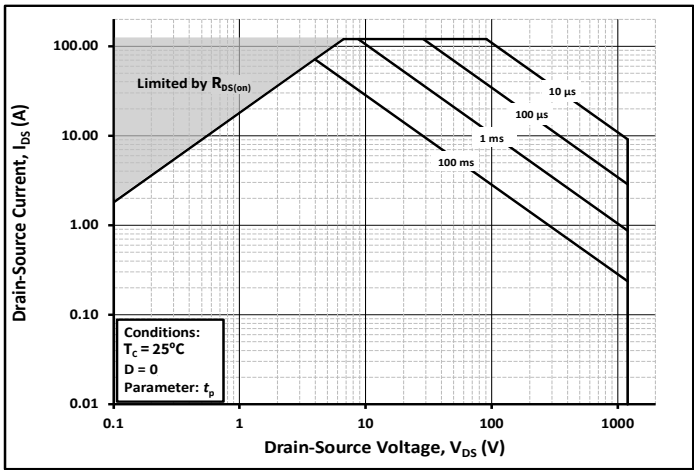


Figure 22. Safe Operating Area

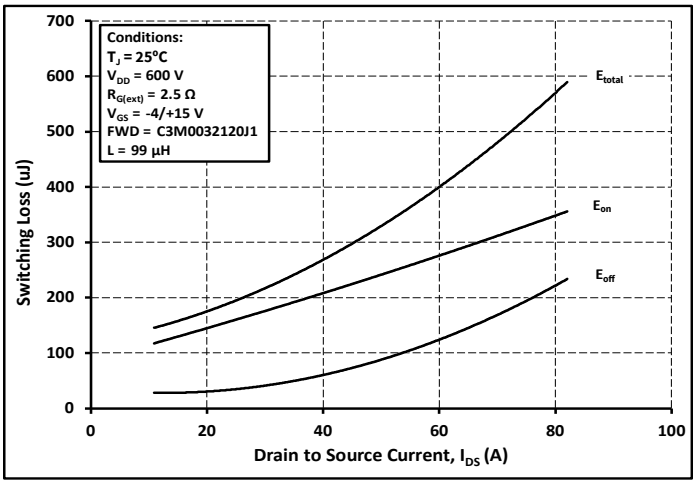


Figure 23. Clamped Inductive Switching Energy vs Drain Current (V_{DD} = 600 V)

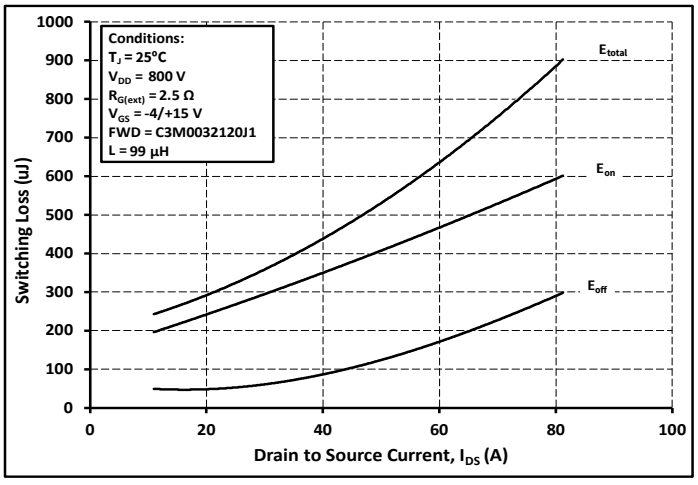


Figure 24. Clamped Inductive Switching Energy vs Drain Current (V_{DD} = 800 V)

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Typical Performance

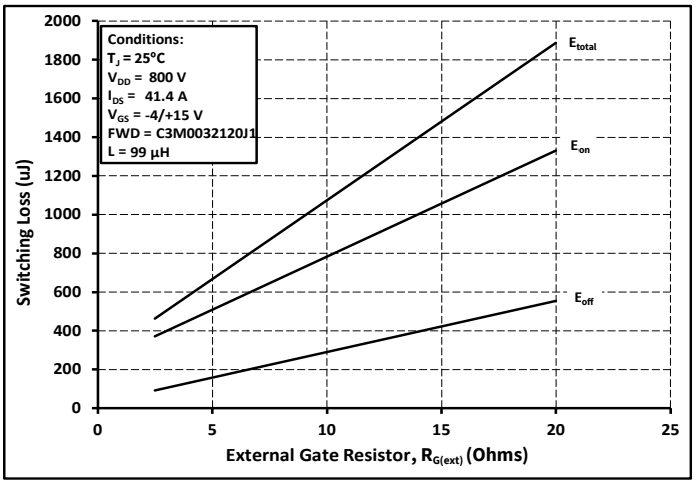


Figure 25. Clamped Inductive Switching Energy vs $R_{G(ext)}$

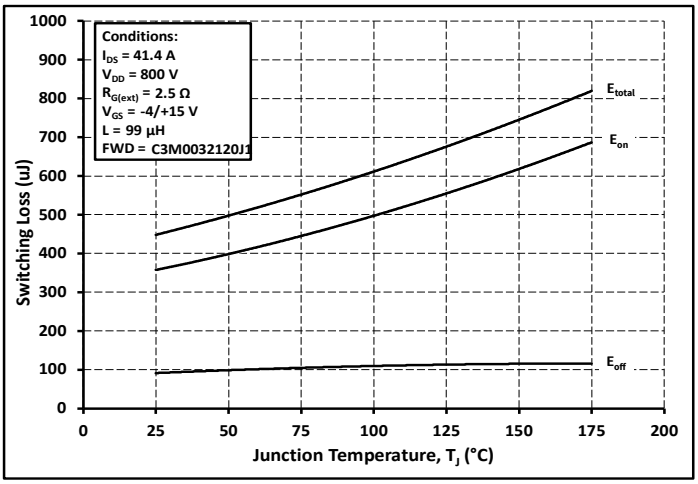


Figure 26. Clamped Inductive Switching Energy vs Temperature

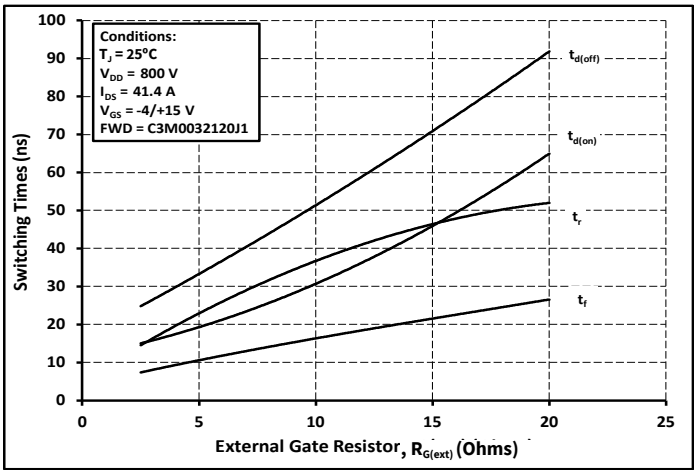


Figure 27. Switching Times vs. $R_{G(ext)}$

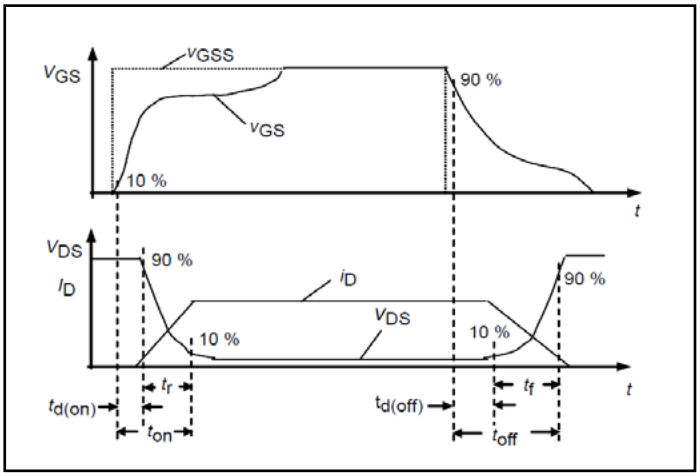


Figure 28. Switching Times Definition

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Test Circuit Schematic

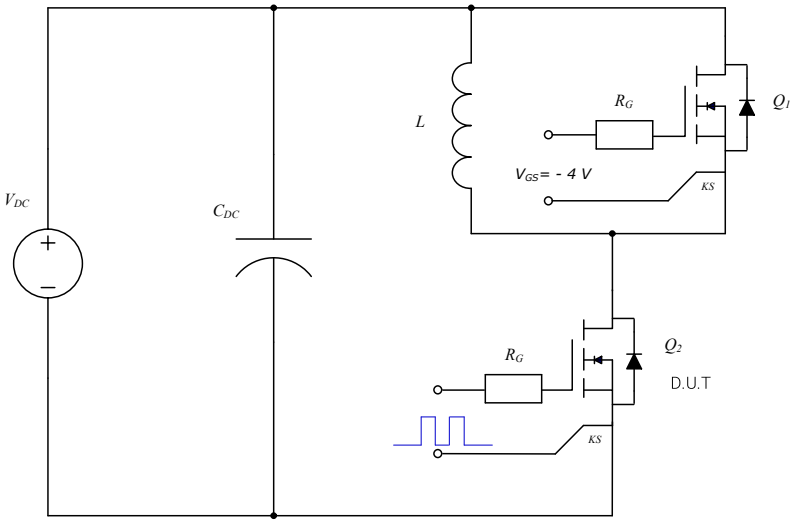
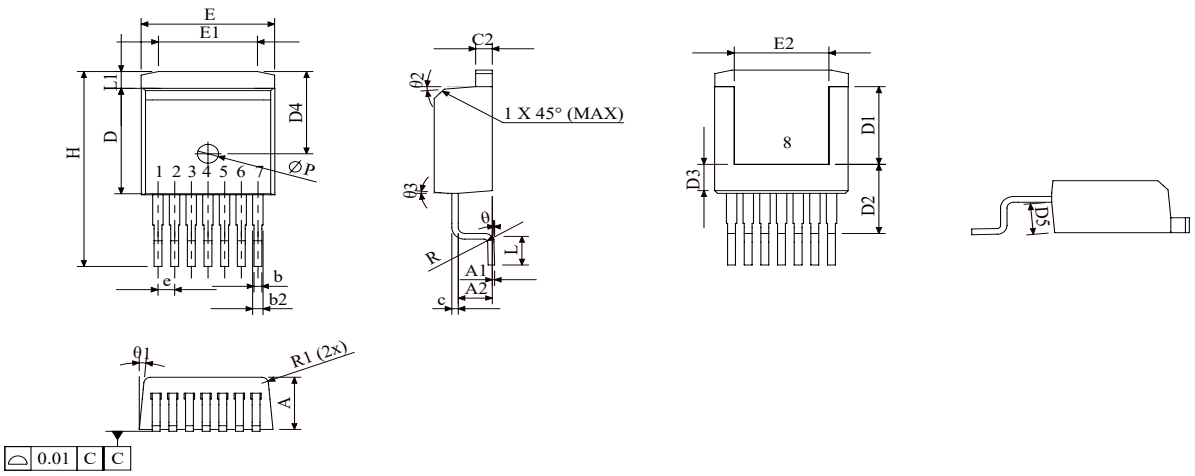


Figure 29. Clamped Inductive Switching Waveform Test Circuit

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

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Package Dimensions – Package TO-263-7L XL



SYMBOL	MIN (mm)	MAX (mm)
A	4.30	4.57
A1	0.00	0.25
A2	2.595 REF	
b	0.50	0.70
b2	0.60	1.00
c	0.281	0.481
C2	1.17	1.37
D	9.025	9.125
D1	6.50	6.70
D2	5.39 REF	
D3	2.148	---
D4	7.000 REF	
D5	2.555	---
A2	2.595 REF	
E	10.13	10.23
E1	6.50	8.60
E2	6.778	7.665
e	1.27 TYP	
H	15.043	17.313
L	2.324	2.700
L1	0.968	1.868
R	0.506 REF	
R1	0.500 REF	
P	1.60 REF	
θ	0°	8°
θ1	4.5°	5.5°
θ2	4°	6°
θ3	4°	6°

1	GATE
2	KELVIN
3	SOURCE
4	
5	
6	
7	
8	DRAIN

NOTE
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. PACKAGE BURR FLASH SIZE (0.5 mm) IS NOT INCLUDED IN THE DIMENSIONS

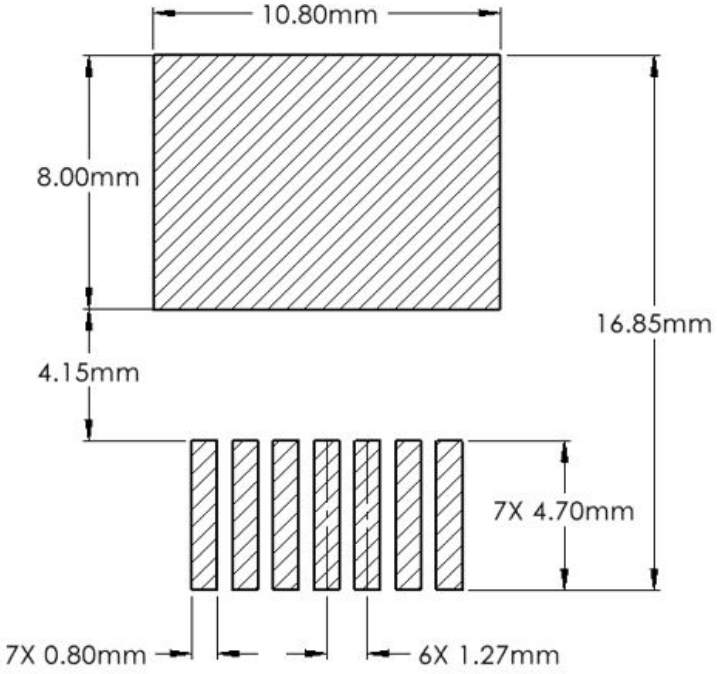
TITLE: PACKAGE OUTLINE DRAWING: TO 263-7L J1

REVISION NO. 01 | A4

Date: 04/13/22 | SCALE:1:1 | SHEET 1 OF 1

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Recommended Solder Pad Layout



Revision History

Current Revision	Date of Release	Description of Changes
2	December-2020	N/A
3	December-2023	Updated Wolfspeed branding, package drawing, package image, solder pad layout, added Rev history, Table 1 layout revised
4	December - 2024	Legal Disclaimer updated, Crss, Fig 17, Fig 18 corrected

Related Links

- SPICE Models
- SiC MOSFET Isolated Gate Driver reference design
- SiC MOSFET Evaluation Board

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