C3M0900170J

1700V 900mΩ Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

Features

- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- 12V..18V / 0V V_{GS} compatible with most flyback controllers
- Ultra-low drain-gate capacitance
- Qualified to operate under high humidity and high temperature environmental conditions
- Halogen free, RoHS compliant

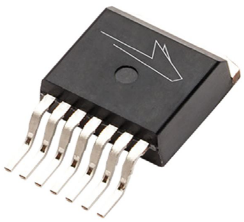
Benefits

- Smooth switching waveforms
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Increases system switching frequency
- Increases system reliability

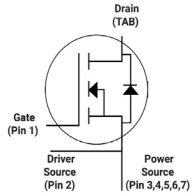
Typical Applications

- Auxillary power supplies
- Switch Mode Power Supplies
- High-Voltage capacitive loads

Package



TO-263-7



Orderable Part Number	Package	Marking
C3M0900170J-TR	TO-263-7L	C3M0900170J

Key Parameters

Parameter	Symbol	Min.	Typ.	Max	Unit	Conditions	Note
Drain - Source Voltage	V_{DS}			1700	V	$T_C = 25°C$	
Maximum Gate - Source Voltage (Transient)	$V_{GS(max)}$	-8		+20		Transient	
Operational Turn-On Gate-Source Voltage			+12...+18			Static	
Operational Turn-Off Gate-Source Voltage			-4...0				
DC Continuous Drain Current	I_D			4.4	A	V_{GS} =15 V, T_C = 25 °C, T_J ≤175 °C	Note 2
				3.3		V_{GS} =15 V, T_C = 100 °C, T_J ≤175°C	
Pulsed Drain Current	I_{DM}			15		t_{Pmax} limited by T_{jmax} V_{GS} = 15V, T_C = 25 °C	Fig. 22
Power Dissipation	P_D			41	W	T_C = 25˚C, T_J = 175 °C	Fig. 20
Operating Junction and Storage Temperature	T_J, T_{stg}			-55 to +175	°C		
Solder Temperature	T_L			260			

Note (1): Review 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)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700			V	V_{GS} = 0 V, I_D = 100 μA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	3.1	4.2	V	V_{DS} = V_{GS}, I_D = 0.55 mA	Fig. 11
			2.6		V	V_{DS} = V_{GS}, I_D = 0.55 mA, T_J = 175ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	μA	V_{DS} = 1700 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current		10	250	nA	V_{GS} = 15 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		900	1250	mΩ	V_{GS} = 15 V, I_D = 1.99 A	Fig. 4, 5, 6
			1938			V_{GS} = 15 V, I_D = 1.99 A, T_J = 175ºC	
g_{fs}	Transconductance		1		S	V_{DS}= 20 V, I_{DS}= 1.99 A	Fig. 7
			1			V_{DS}= 20 V, I_{DS}= 1.99 A, T_J = 175ºC	
C_{iss}	Input Capacitance		202		pF	V_{GS} = 0 V, V_{DS} = 0V to 1200 V F = 100 kHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		8				
C_{rss}	Reverse Transfer Capacitance		1.4				
E_{oss}	C_{oss} Stored Energy		8		μJ		Fig. 16
$C_{o(er)}$	Effective Output Capacitance (Energy Related)		10		pF	V_{GS} = 0 V, V_{DS} = 0V to 1200V	Note: 3
$C_{o(tr)}$	Effective Output Capacitance (Time Related)		13		pF		
E_{ON}	Turn-On Switching Energy (External Diode)		128		μJ	V_{DS}= 1200 V, V_{GS}= -4 V/15 V, I_D= 1.99 A, $R_{G(ext)}$ = 2.5 Ω, L= 1707 μH, T_J = 175ºC FWD = External SiC DIODE	Fig. 26, 28
E_{OFF}	Turn Off Switching Energy (External Diode)		13				
$t_{d(on)}$	Turn-On Delay Time		20		ns	V_{DD} = 1200 V, V_{GS} = -4 V/15 V I_D = 1.99 A, $R_{G(ext)}$ = 2.5 Ω, Tj=175⁰C, L=1707 μH Timing relative to V_{DS} Inductive load	Fig. 27, 28
t_r	Rise Time		16				
$t_{d(off)}$	Turn-Off Delay Time		20				
t_f	Fall Time		42				
$R_{G(int)}$	Internal Gate Resistance		31		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		4		nC	V_{DS} = 1200 V, V_{GS} = -4 V/15 V I_D = 1.99 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		2				
Q_g	Total Gate Charge		8				

Note (3): $C_{o(er)}$, a lumped capacitance that gives same stored energy as Coss while Vds is rising from 0 to 1200V
$C_{o(tr)}$, a lumped capacitance that gives same charging time as Coss while Vds is rising from 0 to 1200V

Reverse Diode Characteristics (T_c = 25˚C unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.7		V	V_{GS} = -4 V, I_{SD} = 1 A, T_J = 25 °C	Fig. 8, 9, 10
		4.2		V	V_{GS} = -4 V, I_{SD} = 1 A, T_J = 175 °C	
I_S	Continuous Diode Forward Current	5.8		A	V_{GS} = -4 V, T_C = 25˚C	
I_{SM}	Diode pulse Current		15	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	
t_{rr}	Reverse Recover time	22		ns	V_{GS} = -4 V, I_{SD} = 1.99 A, V_R = 1200 V dif/dt = 546 A/µs, T_J = 25 °C	
Q_{rr}	Reverse Recovery Charge	50		nC		
I_{rrm}	Peak Reverse Recovery Current	5		A		
t_{rr}	Reverse Recover time	28		ns	V_{GS} = -4 V, I_{SD} = 1.99 A, V_R = 1200 V dif/dt = 246 A/µs, T_J = 25 °C	
Q_{rr}	Reverse Recovery Charge	46		nC		
I_{rrm}	Peak Reverse Recovery Current	3		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	3.0	3.6	°C/W		Fig. 21

Typical Performance

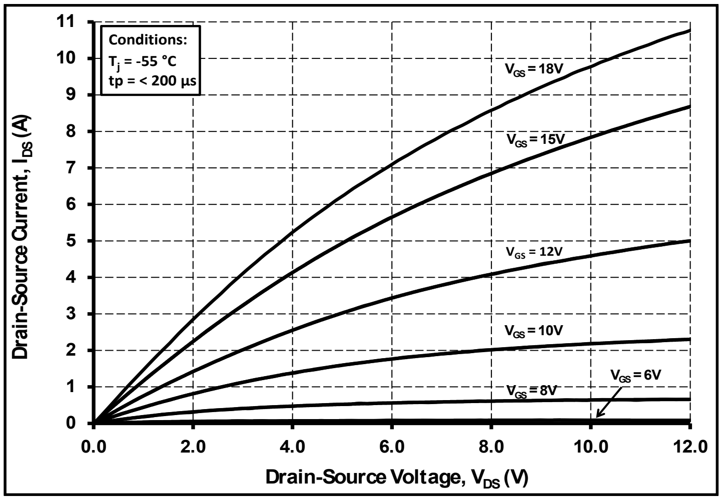


Figure 1. Output Characteristics T_J = -55 °C

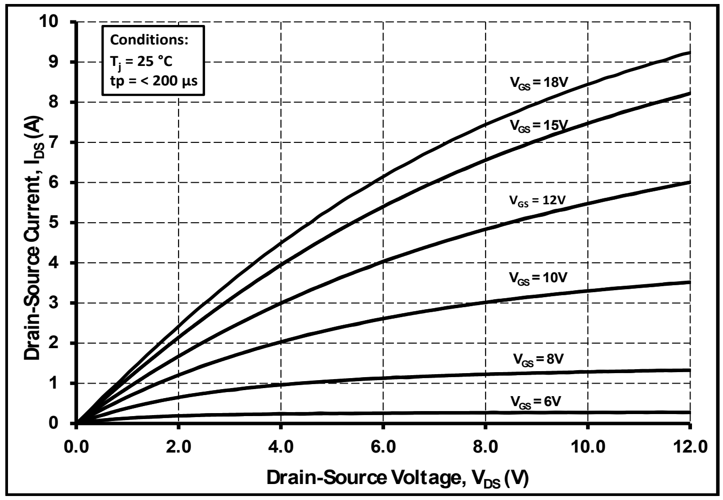


Figure 2. Output Characteristics T_J = 25 °C

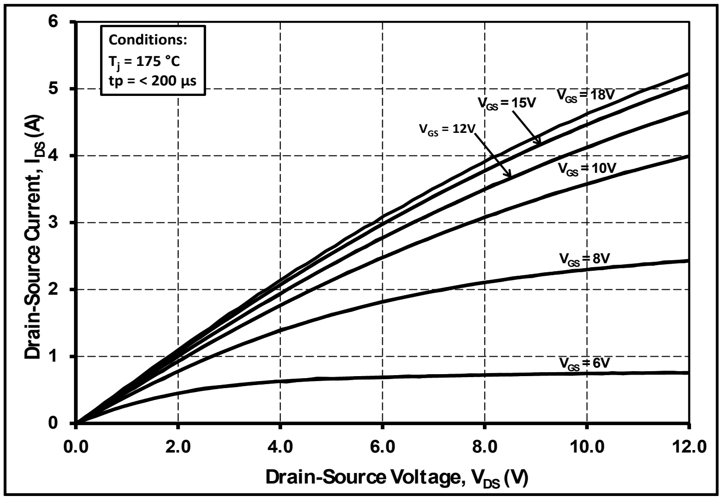


Figure 3. Output Characteristics T_J = 175 °C

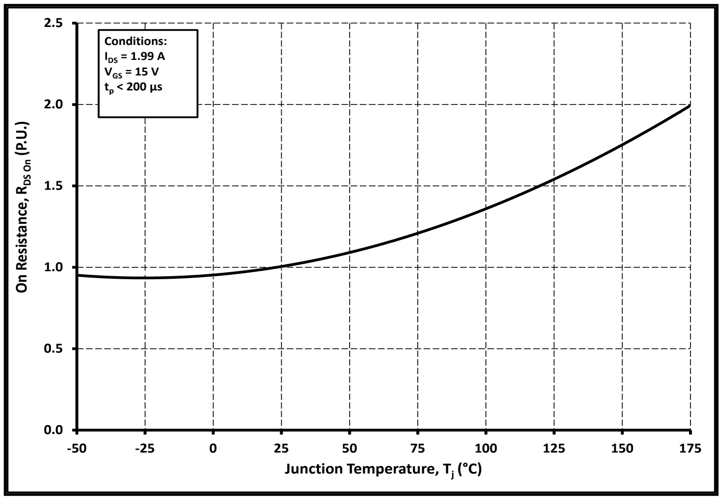


Figure 4. Normalized On-Resistance vs. Temperature

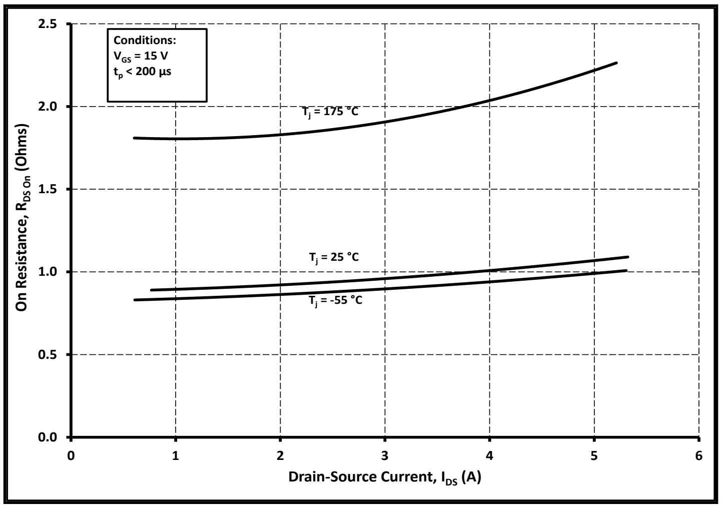


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

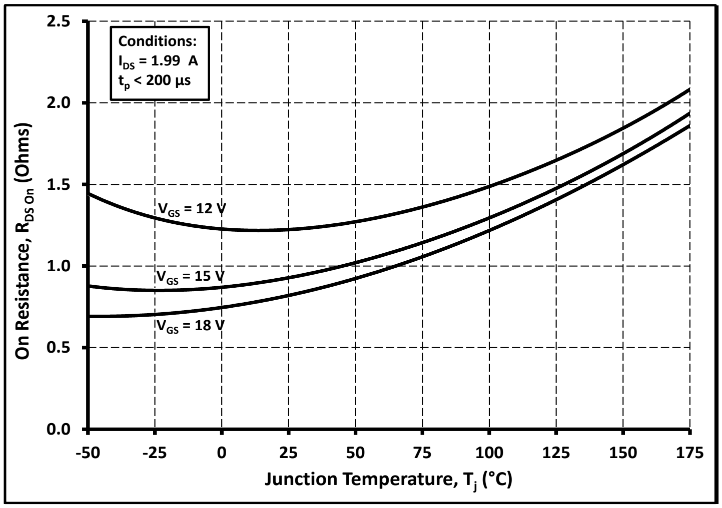


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

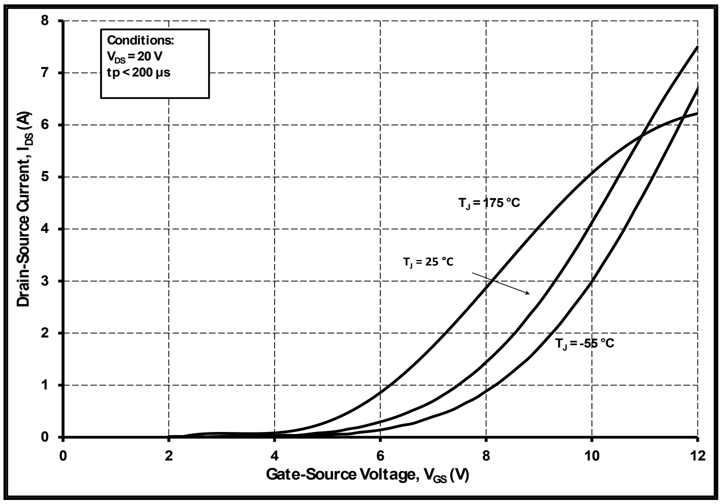


Figure 7. Transfer Characteristic for Various Junction Temperatures

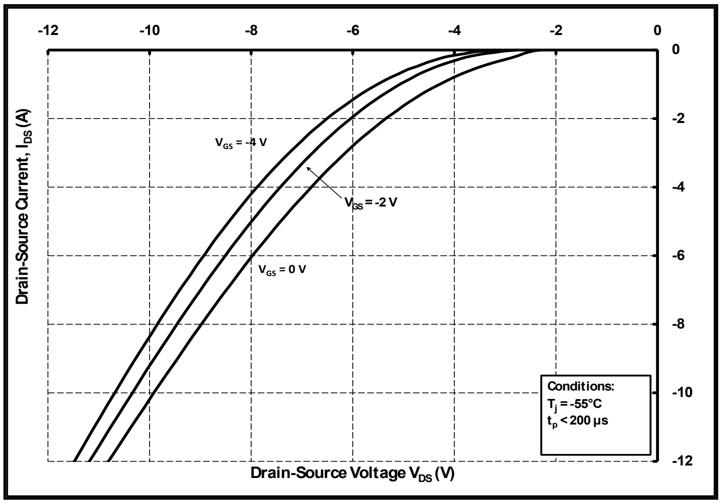


Figure 8. Body Diode Characteristic at -55 °C

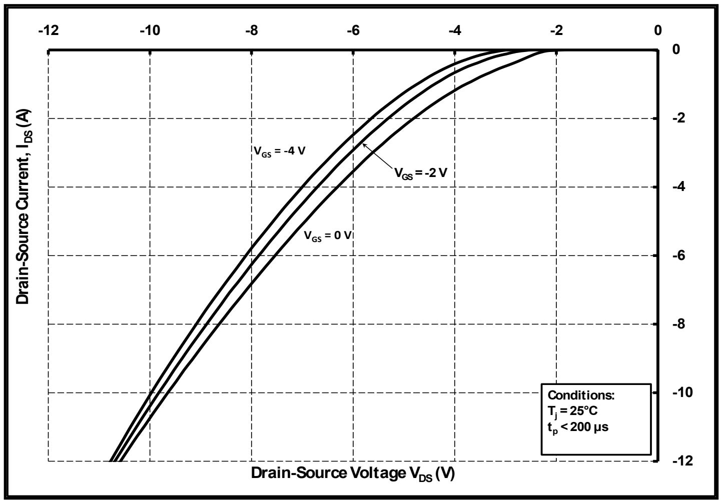


Figure 9. Body Diode Characteristic at 25 °C

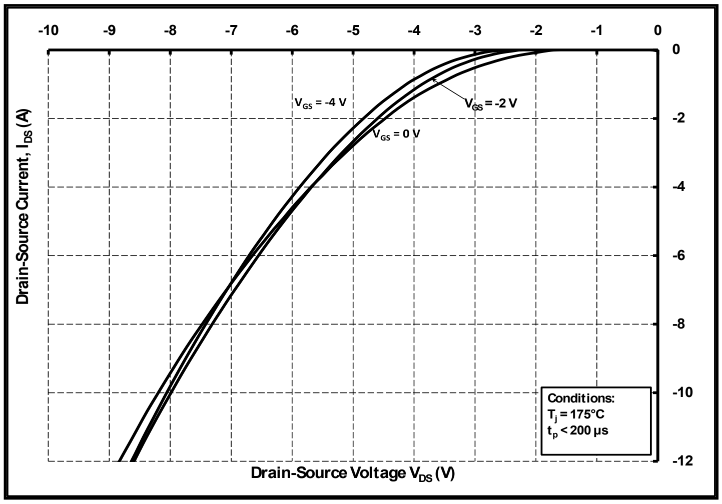


Figure 10. Body Diode Characteristic at 175 °C

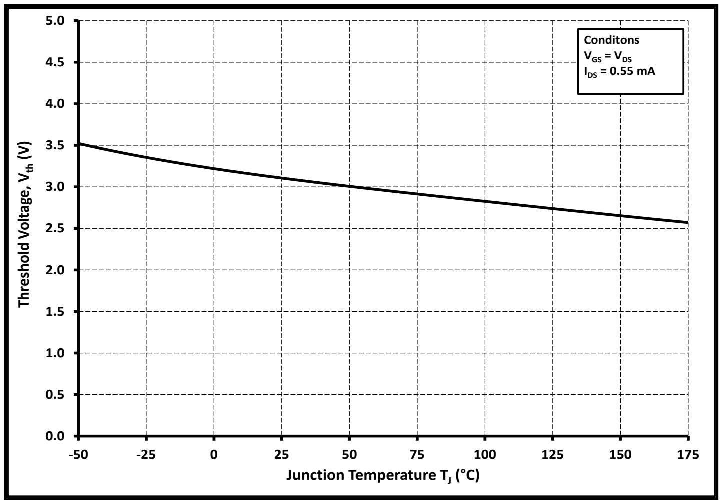


Figure 11. Threshold Voltage vs. Temperature

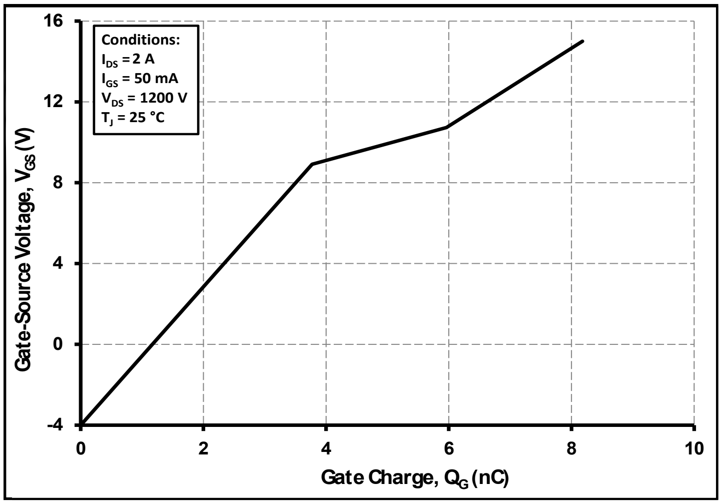


Figure 12. Gate Charge Characteristics

Typical Performance

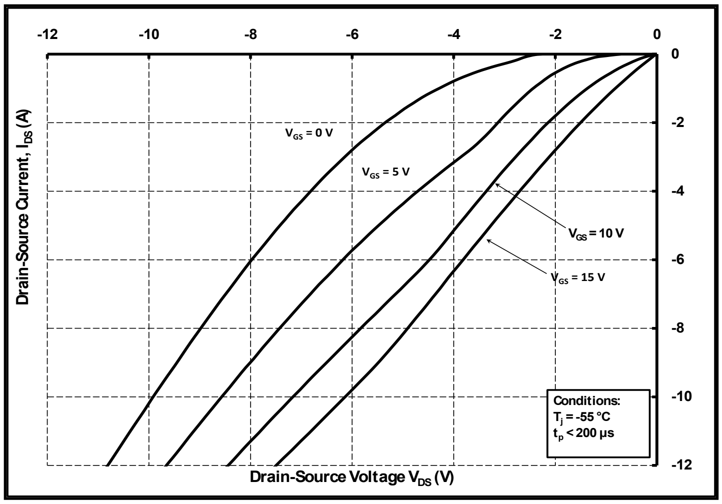


Figure 13. 3rd Quadrant Characteristic at -55 °C

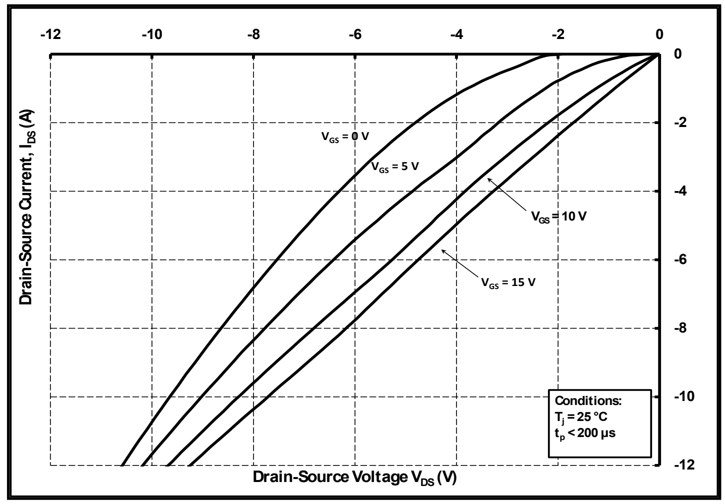


Figure 14. 3rd Quadrant Characteristic at 25 °C

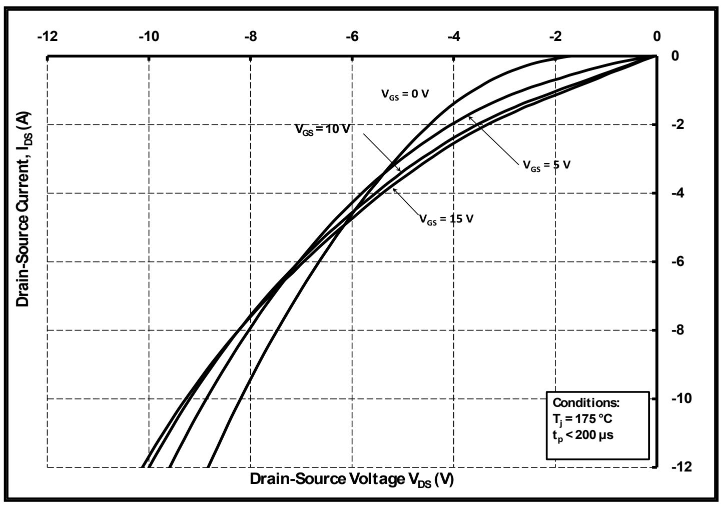


Figure 15. 3rd Quadrant Characteristic at 175 °C

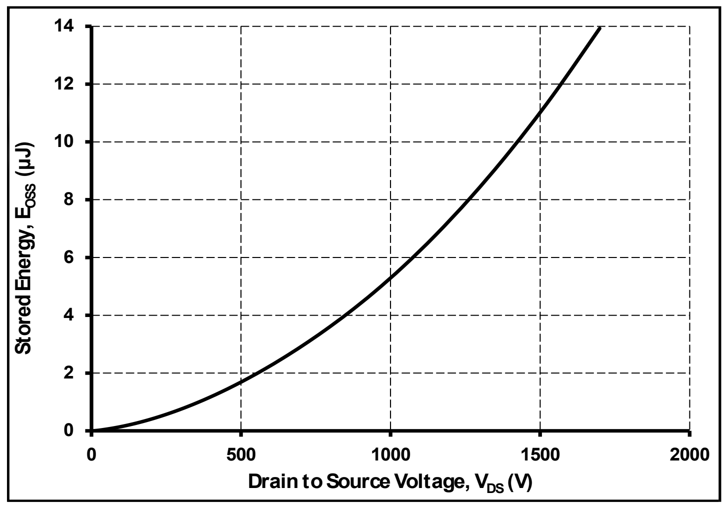


Figure 16. Output Capacitor Stored Energy

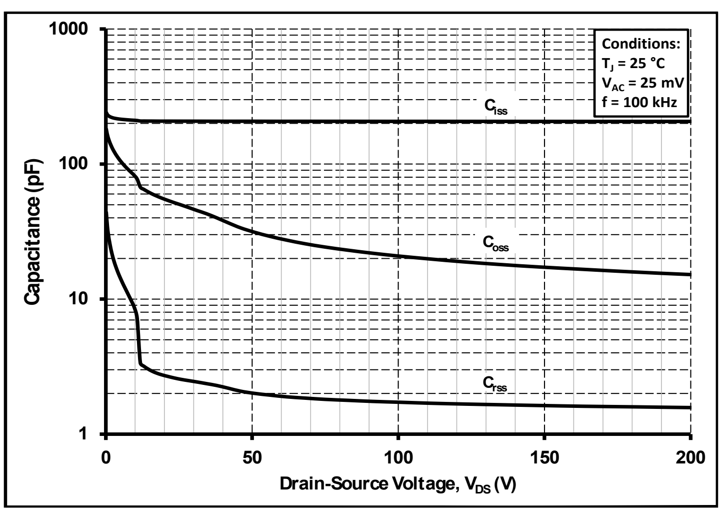


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

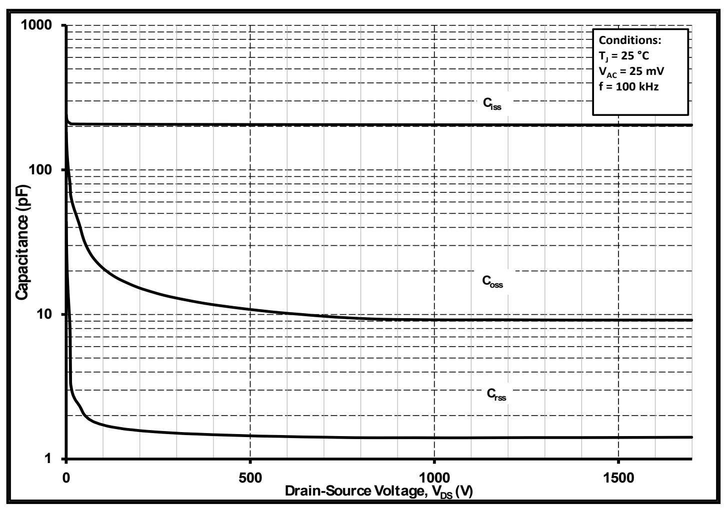


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1700V)

Typical Performance

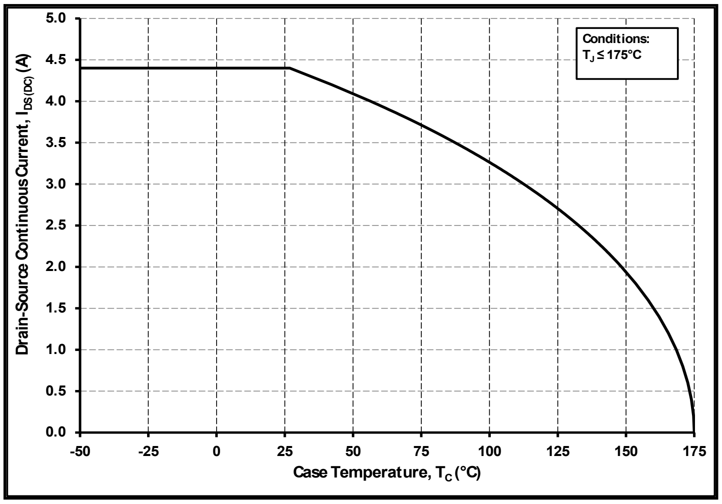


Figure 19. Continuous Drain Current Derating vs. Case Temperature

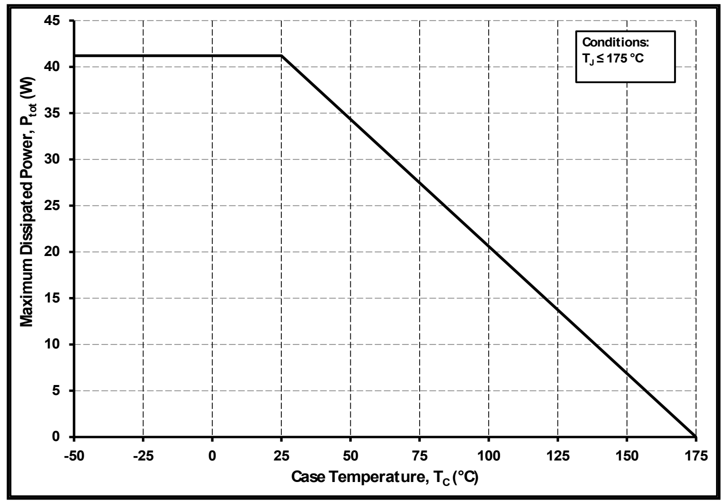


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

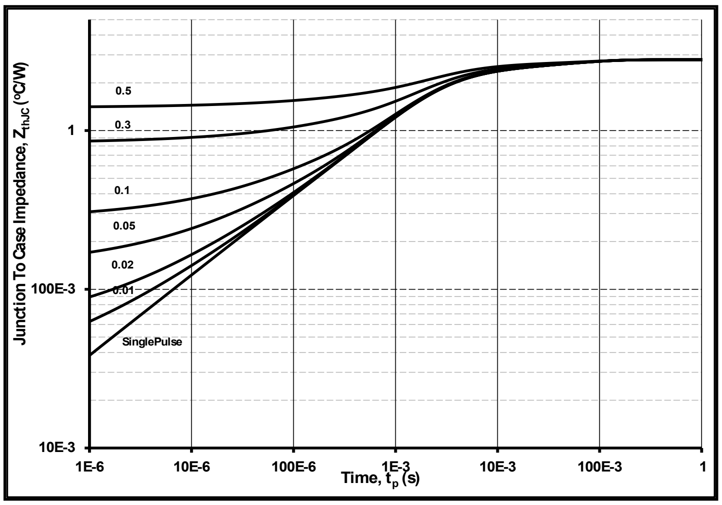


Figure 21. Transient Thermal Impedance (Junction - Case)

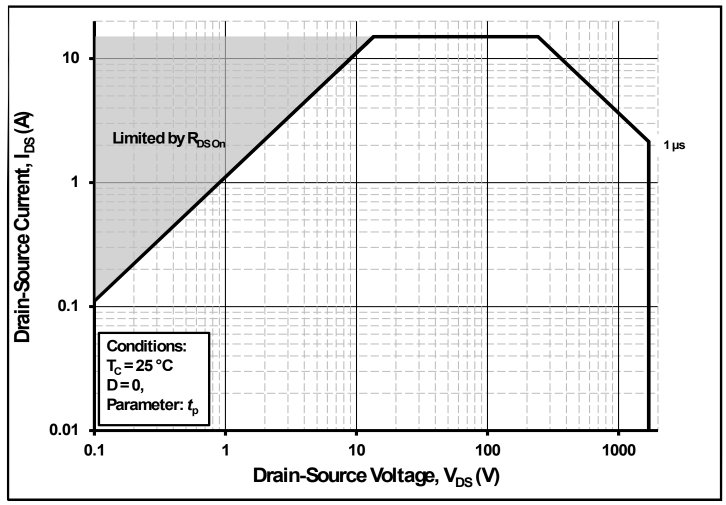


Figure 22. Safe Operating Area

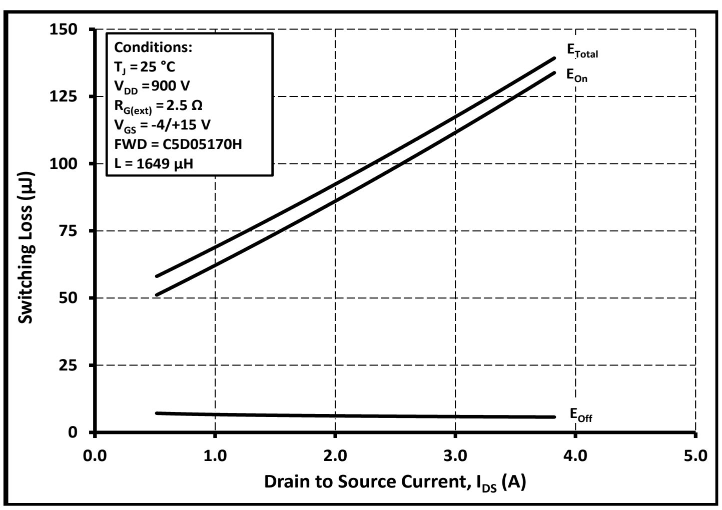


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 900V)

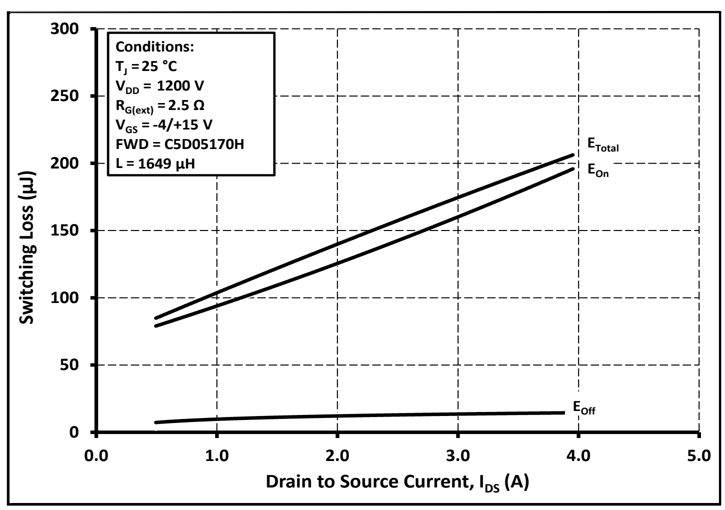


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 1200V)

Typical Performance

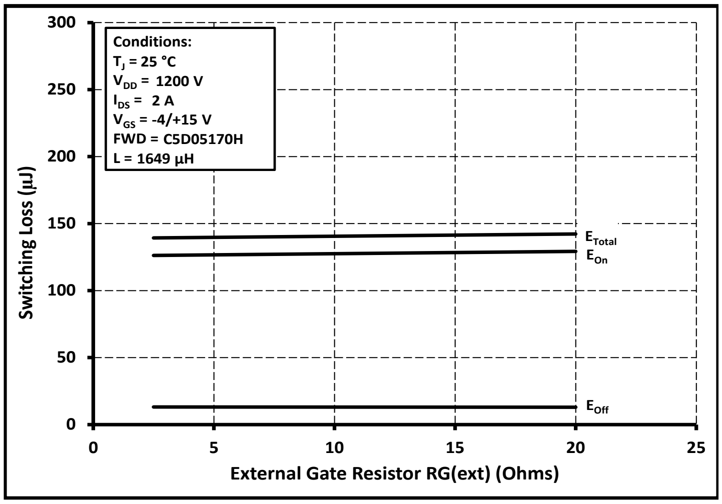


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

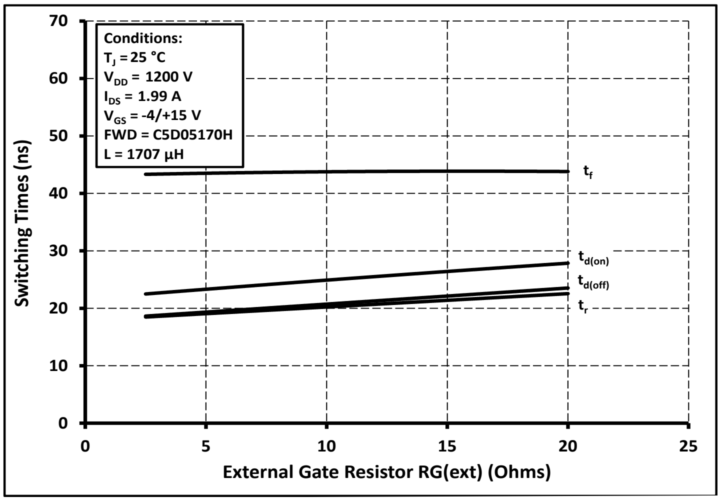


Figure 26. Switching Times vs. $R_{G(ext)}$

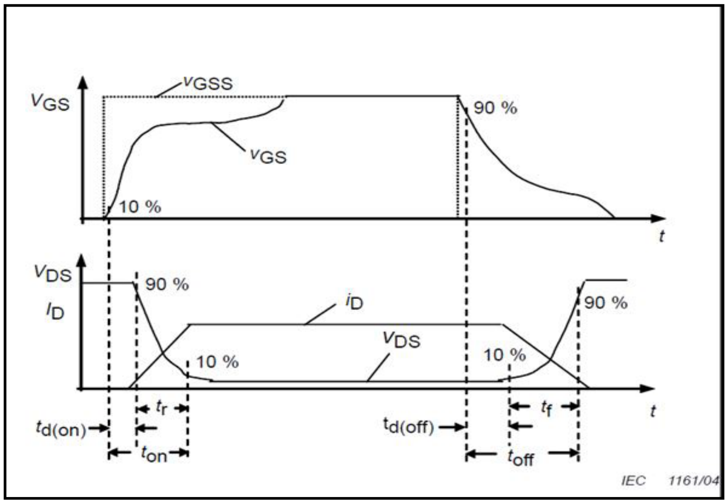


Figure 27. Switching Times Definition

Test Circuit Schematic

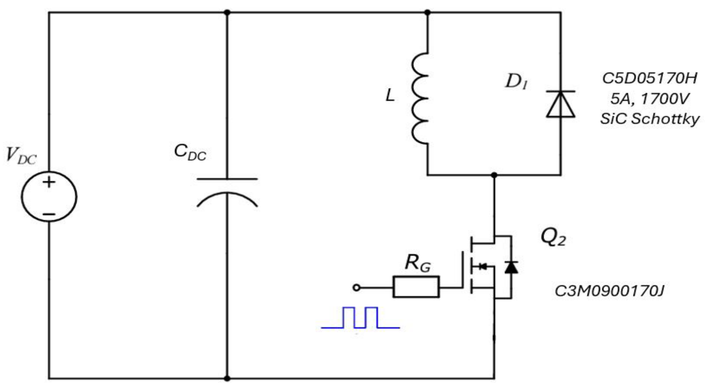
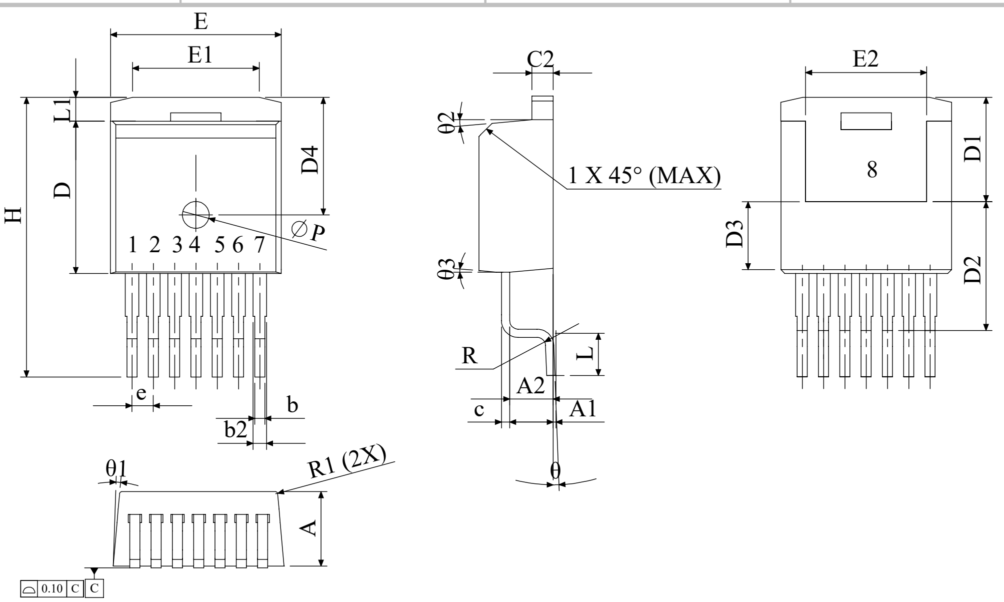


Figure 28. Clamped Inductive Switching
Waveform Test Circuit

Package Dimensions



SYMBOL	MIN (mm)	MAX (mm)
A	4.30	4.57
A1	0.00	0.25
b	0.50	0.70
b2	0.60	1.00
c	0.33	0.65
C2	1.17	1.40
D	9.025	9.125
D1	4.70	4.90
D2	7.170 REF	
D3	4.000 REF	
D4	7.000 REF	
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	
θ	0°	8°
θ1	4.5°	5.5°
θ2	4°	6°
θ3	4°	6°

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

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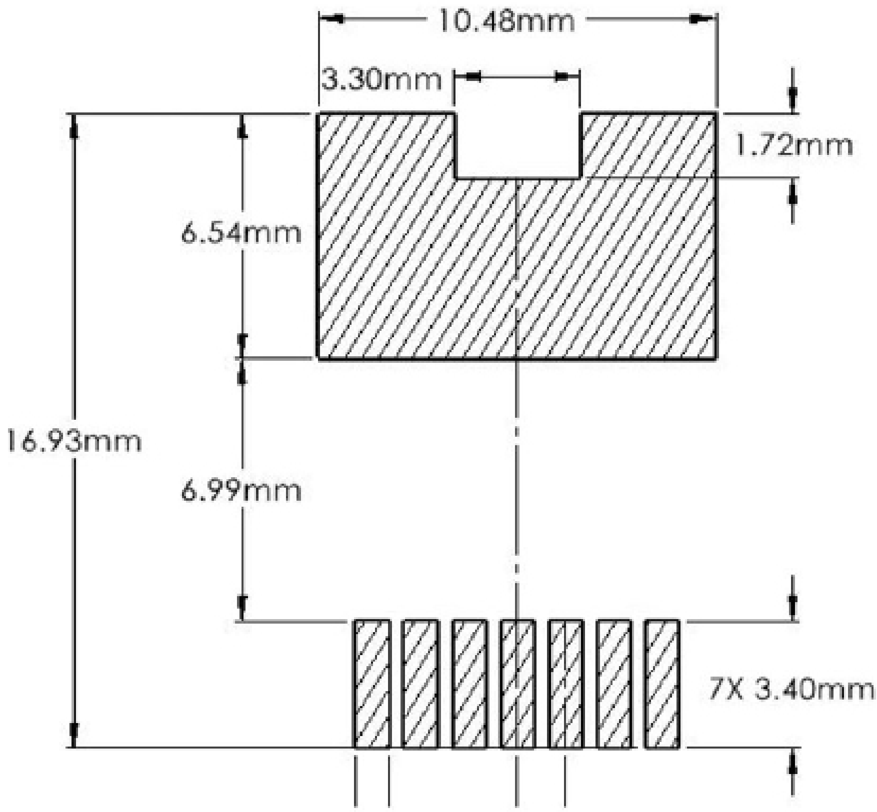
TITLE: PACKAGE OUTLINE DRAWING: TO 263-7L J

REVISION NO. 01 | A4

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

Recommended Solder Pad Layout

All dimensions in mm



Revision history

Document Version	Date of release	Descriptiion of changes
1.0	December-2024	Initial datasheet
2.0	February-2025	Updated with latest characterization data

Notes & Disclaimer

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REACh Compliance

REACh substances of high concern (SVHCs) information is available for this product. Since the European Chemical Agency (ECHA) has published notice of their intent to frequently revise the SVHC listing for the foreseeable future, please contact your Wolfspeed representative to ensure you get the most up-to-date REACh SVHC Declaration. REACh banned substance information (REACh Article 67) is also available upon request.

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