C3M0120090J

Silicon Carbide Power MOSFET
C3M™ MOSFET Technology

N-Channel Enhancement Mode

V_{DS}	900 V
$I_{D\ @\ 25^{\circ}C}$	22 A
$R_{DS(on)}$	120 mΩ

Features

- New C3M SiC MOSFET technology
- High blocking voltage with low On-resistance
- High speed switching with low capacitances
- New low impedance package with driver source
- Fast intrinsic diode with low reverse recovery (Qrr)
- Halogen free, RoHS compliant
- Wide creepage (~7mm) between drain and source

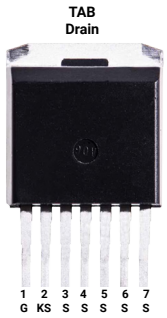
Benefits

- Higher system efficiency
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency

Applications

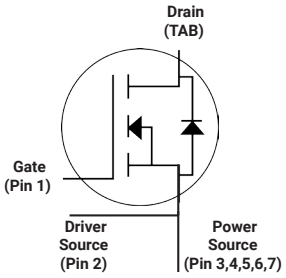
- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies
- Lighting

Package



Halogen-Free

RoHS



Part Number	Package
C3M0120090J	TO-263-7

Maximum Ratings (T_C = 25 ˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	900	V	V_{GS} = 0 V, I_D = 100 µA	
V_{GSmax}	Gate - Source Voltage	-8/+19	V	Absolute maximum values	
V_{GSop}	Gate - Source Voltage	-4/+15	V	Recommended operational values	Note (1)
I_D	Continuous Drain Current	22	A	V_{GS} = 15 V, T_C = 25˚C	Fig. 19
		14		V_{GS} = 15 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	50	A	Pulse width t_P limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	83	W	T_C=25˚C, T_J = 150 ˚C	Fig. 20
T_J , T_{stg}	Operating Junction and Storage Temperature	-55 to +150	˚C		
T_L	Solder Temperature	260	˚C	1.6mm (0.063”) from case for 10s	

Note (1): MOSFET can also safely operate at 0/+15 V

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	900			V	V_{GS} = 0 V, I_D = 100 µA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.1	3.5	V	V_{DS} = V_{GS}, I_D = 3 mA	Fig. 11
			1.6		V	V_{DS} = V_{GS}, I_D = 3 mA, T_J = 150ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	µA	V_{DS} = 900 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		120	155	mΩ	V_{GS} = 15 V, I_D = 15 A	Fig. 4, 5, 6
			170			V_{GS} = 15 V, I_D = 15 A, T_J = 150ºC	
g_{fs}	Transconductance		8.9		S	V_{DS}= 15 V, I_{DS}= 15 A	Fig. 7
			7.1			V_{DS}= 15 V, I_{DS}= 15 A, T_J = 150ºC	
C_{iss}	Input Capacitance		414		pF	V_{GS} = 0 V, V_{DS} = 600 V f = 1 MHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		48				
C_{rss}	Reverse Transfer Capacitance		3				
E_{oss}	C_{oss} Stored Energy		10.6		µJ		Fig. 16
E_{ON}	Turn-On Switching Energy		32		µJ	V_{DS} = 400 V, V_{GS} = -4 V/15 V, I_D = 15 A, $R_{G(ext)}$ = 2.5Ω, L= 99 µH, T_J = 150ºC	Fig. 26, 29
E_{OFF}	Turn Off Switching Energy		8				
$t_{d(on)}$	Turn-On Delay Time		5		ns	V_{DD} = 400 V, V_{GS} = -4 V/15 V I_D = 15 A, $R_{G(ext)}$ = 2.5 Ω, Timing relative to V_{DS} Inductive load	Fig. 27, 29
t_r	Rise Time		8				
$t_{d(off)}$	Turn-Off Delay Time		13				
t_f	Fall Time		4				
$R_{G(int)}$	Internal Gate Resistance		13		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		6		nC	V_{DS} = 400 V, V_{GS} = -4 V/15 V I_D = 15 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		5				
Q_g	Total Gate Charge		18				

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

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.8		V	V_{GS} = -4 V, I_{SD} = 7.5 A	Fig. 8, 9, 10
		4.4		V	V_{GS} = -4 V, I_{SD} = 7.5 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		15	A	V_{GS} = -4 V	Note (2)
$I_{S, pulse}$	Diode pulse Current		50	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	Note (2)
t_{rr}	Reverse Recover time	10		ns	V_{GS} = -4 V, I_{SD} = 15 A, V_R = 400 V dif/dt = 900 A/µs, T_J = 150 °C	Note (2)
Q_{rr}	Reverse Recovery Charge	72		nC		
I_{rrm}	Peak Reverse Recovery Current	12		A		

Note (2): When using SiC Body Diode the maximum recommended V_{GS} = -4V

Thermal Characteristics

Symbol	Parameter	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	1.5	°C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			

Typical Performance

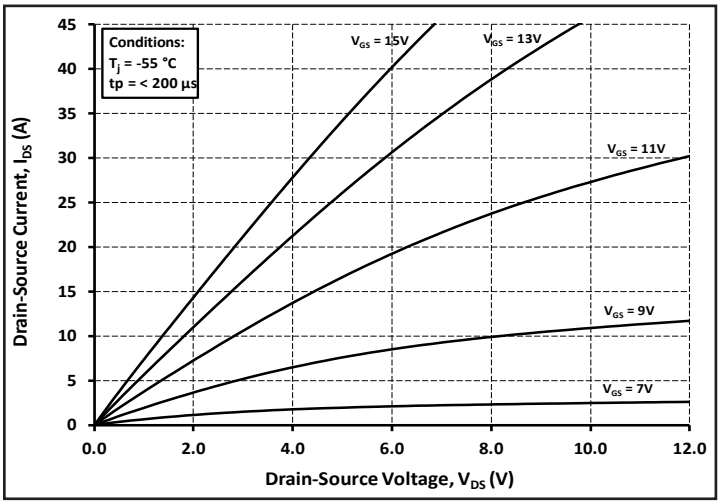


Figure 1. Output Characteristics T_J = -55 ºC

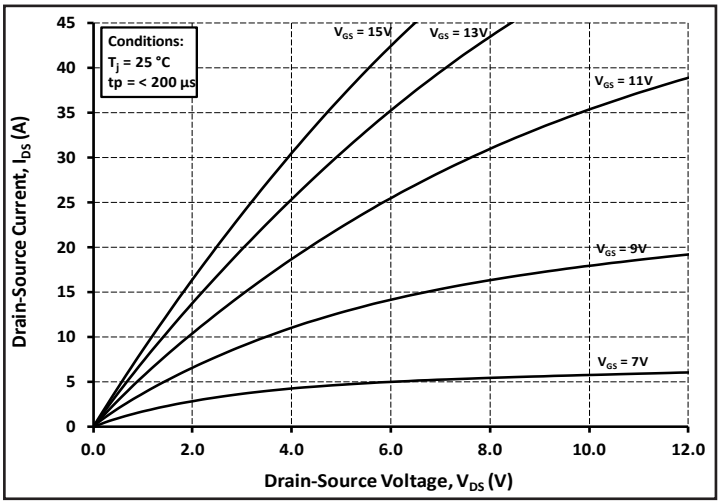


Figure 2. Output Characteristics T_J = 25 ºC

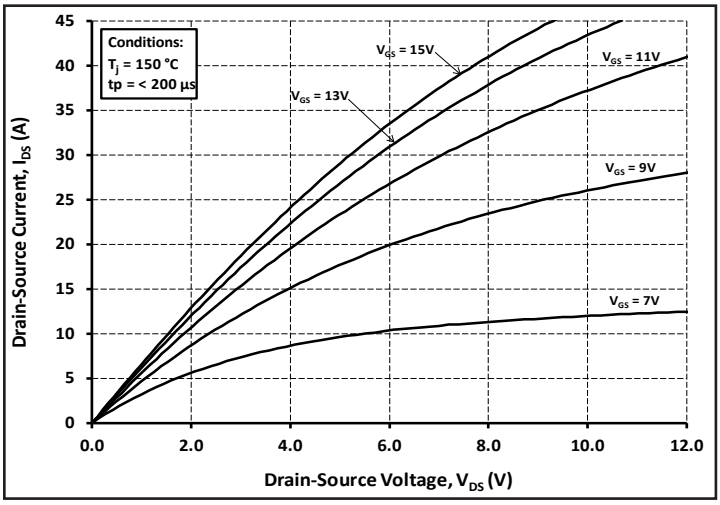


Figure 3. Output Characteristics T_J = 150 ºC

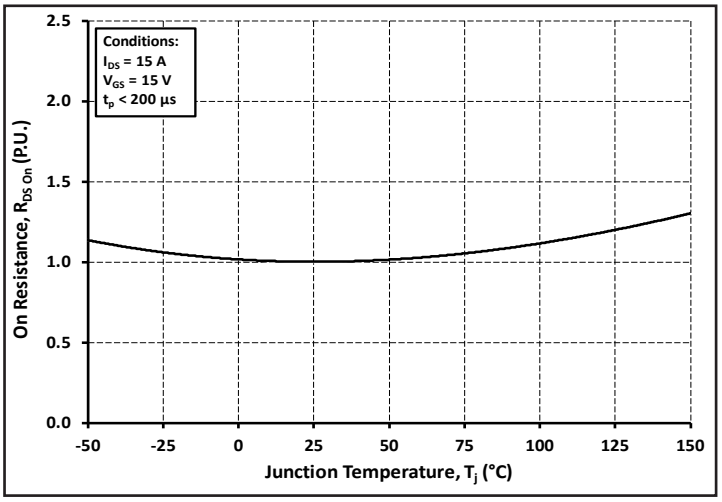


Figure 4. Normalized On-Resistance vs. Temperature

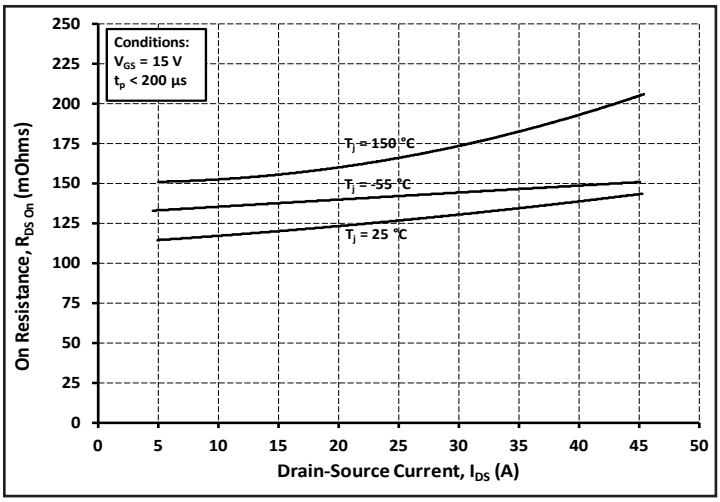


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

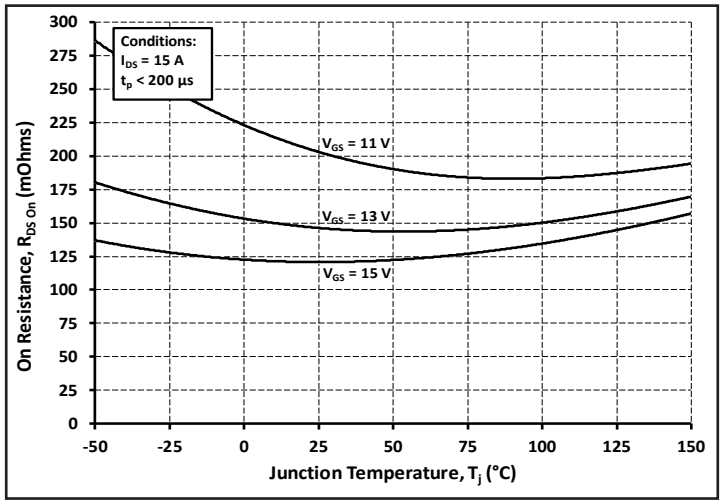


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

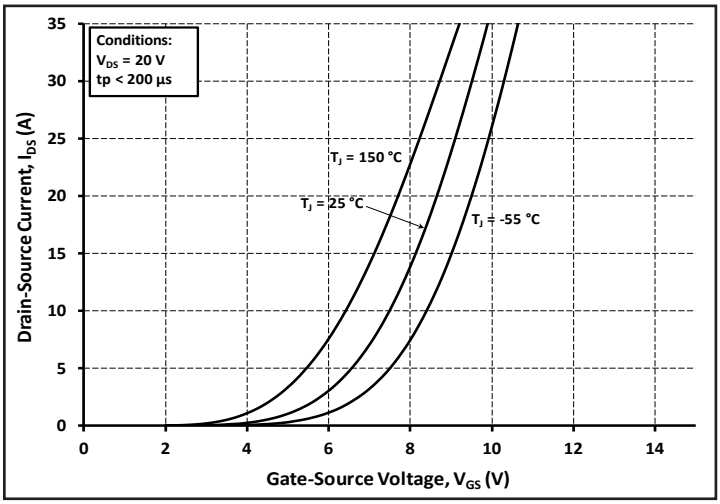


Figure 7. Transfer Characteristic for Various Junction Temperatures

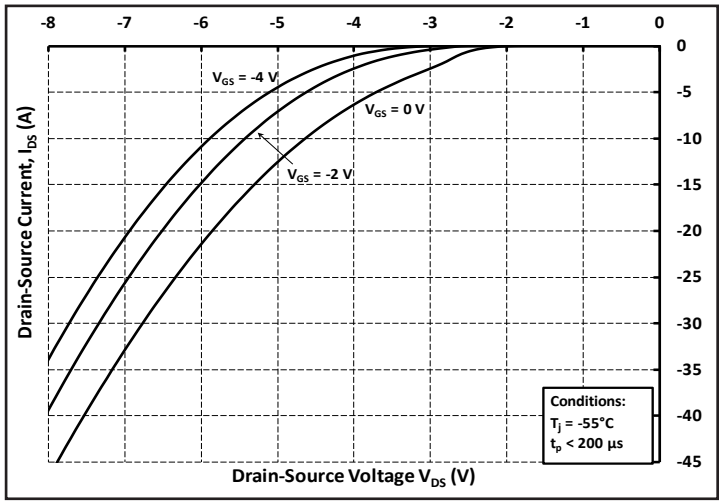


Figure 8. Body Diode Characteristic at -55 °C

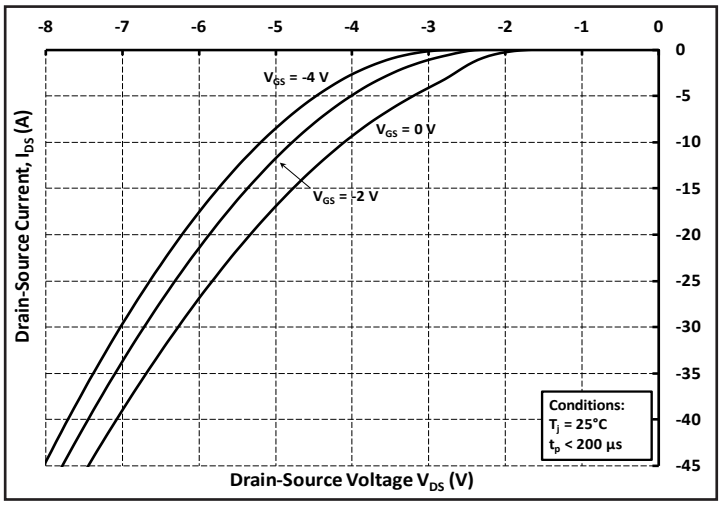


Figure 9. Body Diode Characteristic at 25 °C

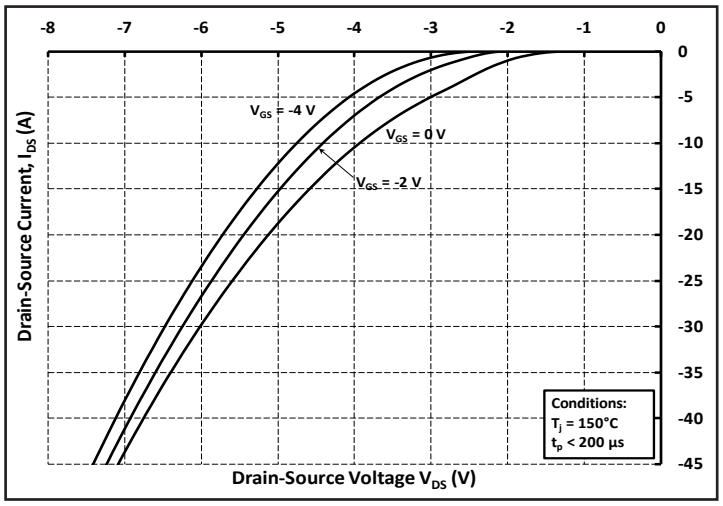


Figure 10. Body Diode Characteristic at 150 °C

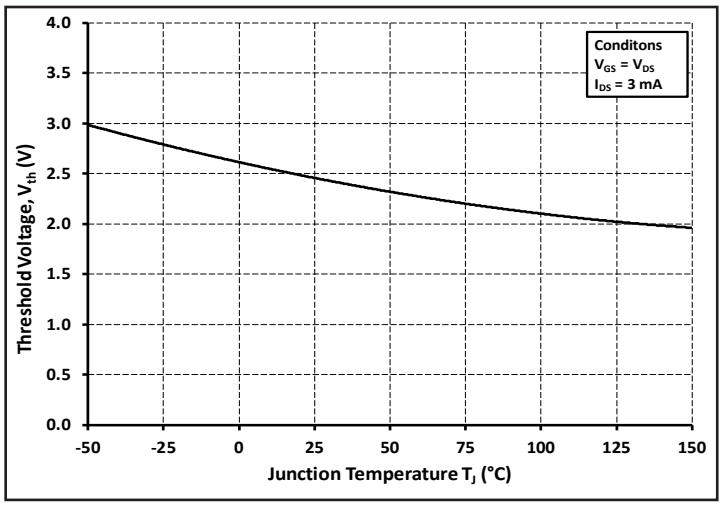


Figure 11. Threshold Voltage vs. Temperature

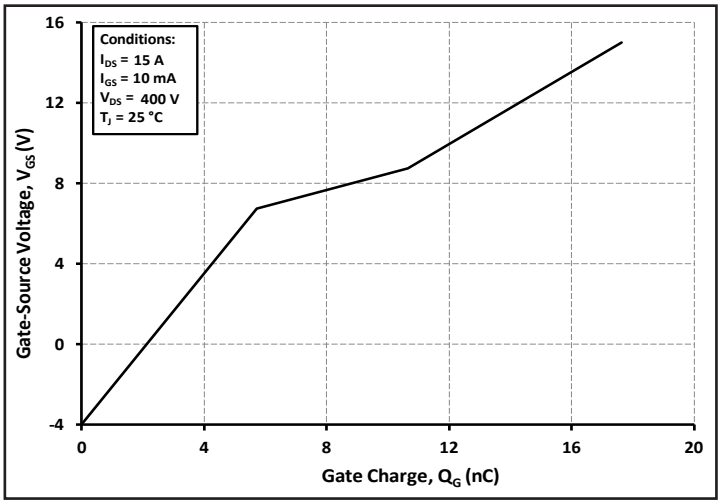


Figure 12. Gate Charge Characteristics

Typical Performance

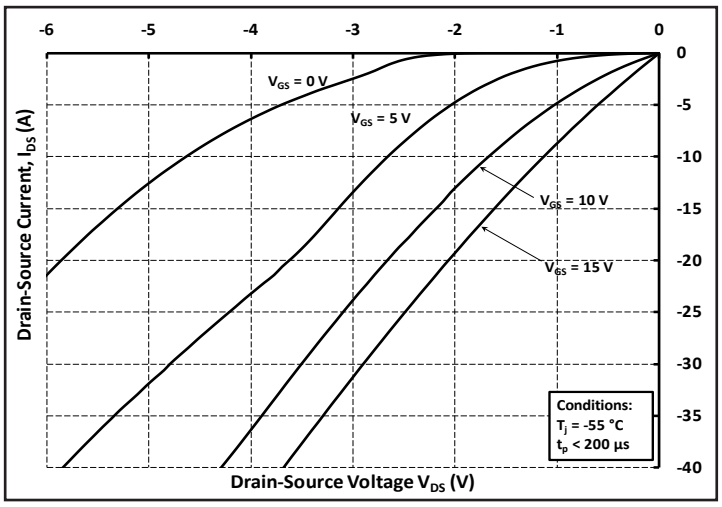


Figure 13. 3rd Quadrant Characteristic at -55 °C

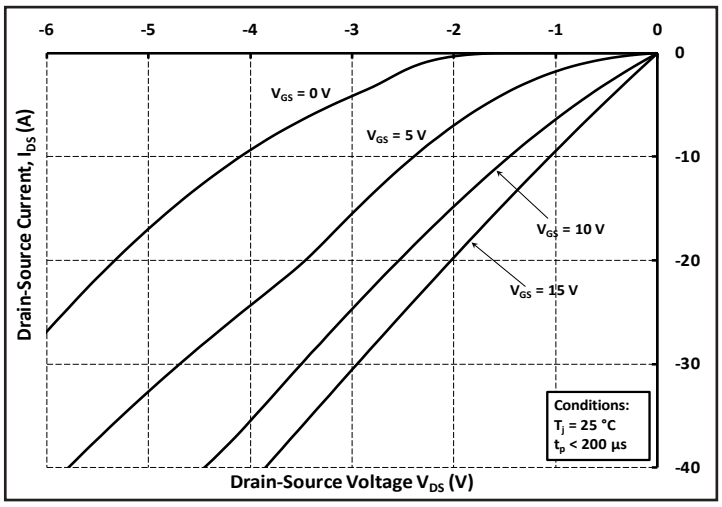


Figure 14. 3rd Quadrant Characteristic at 25 °C

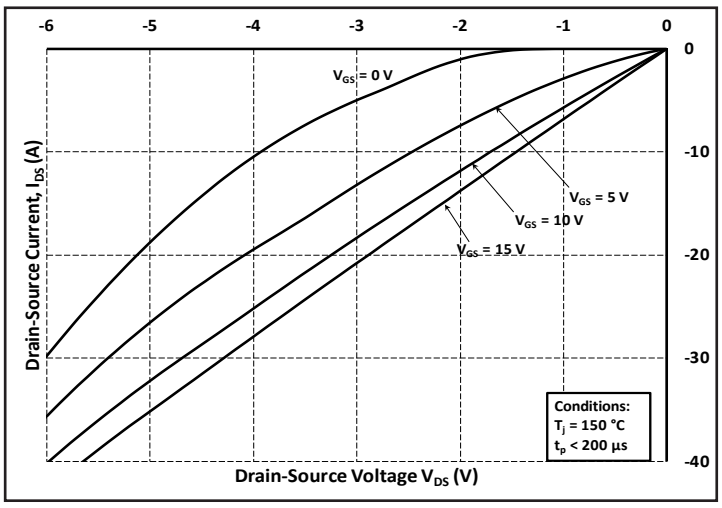


Figure 15. 3rd Quadrant Characteristic at 150 °C

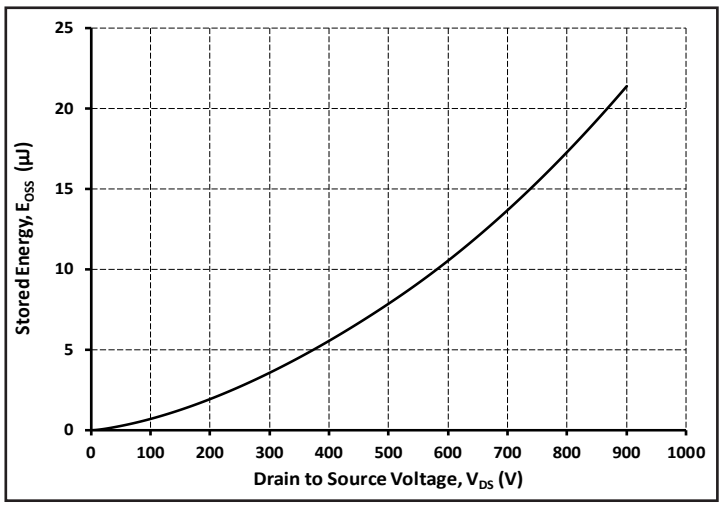


Figure 16. Output Capacitor Stored Energy

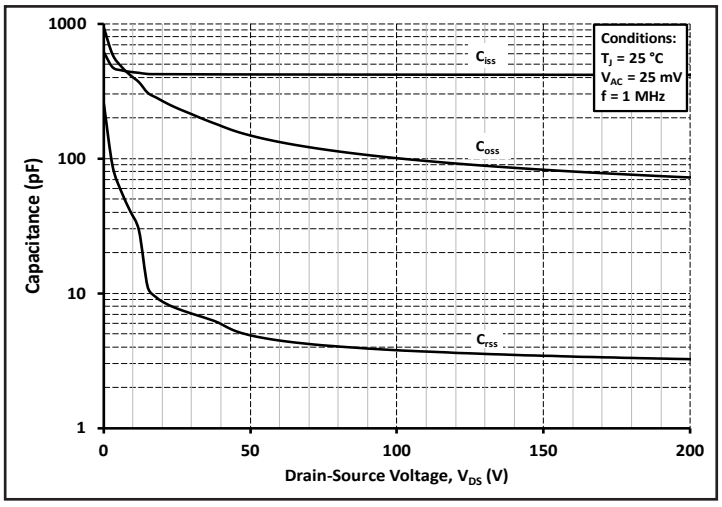


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

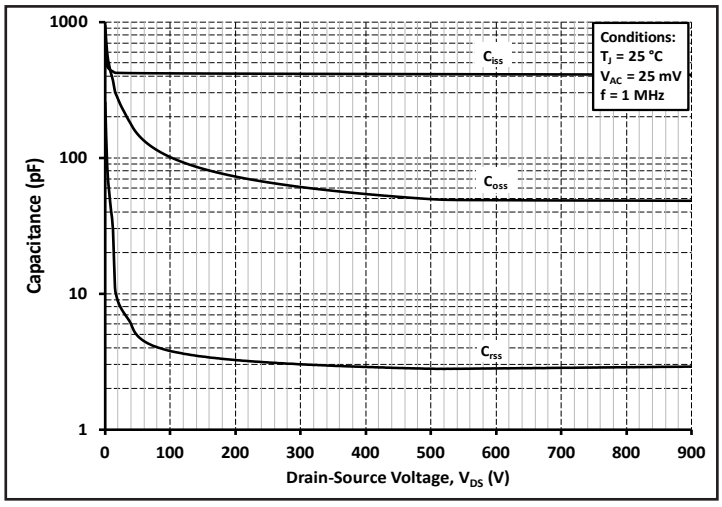


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 900V)

Typical Performance

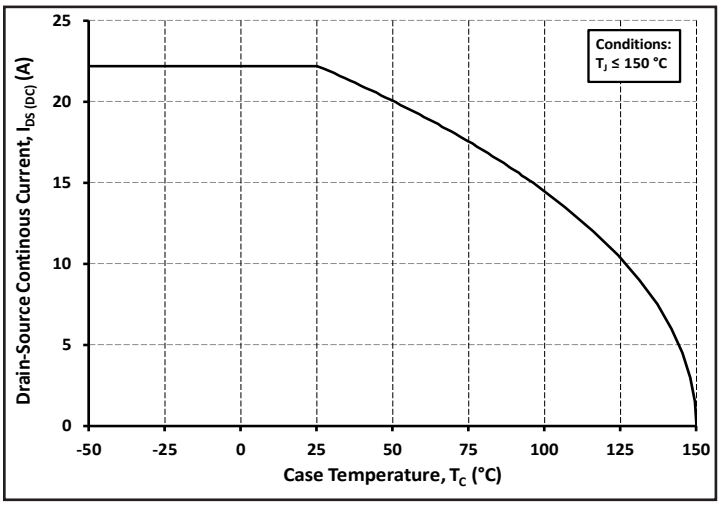


Figure 19. Continuous Drain Current Derating vs. Case Temperature

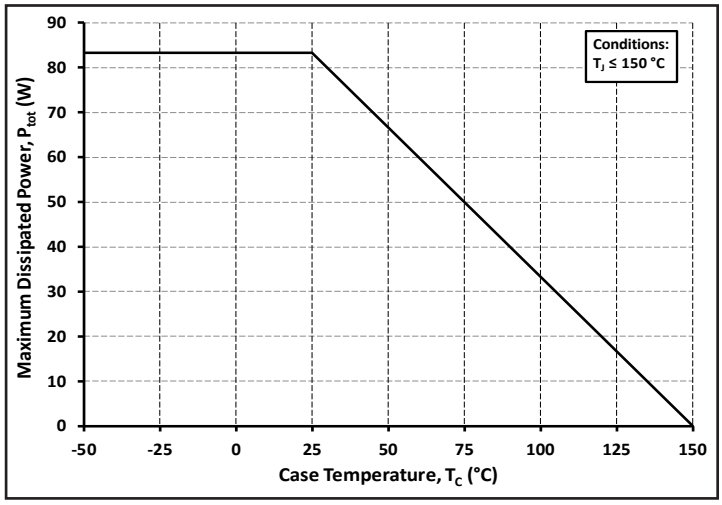


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

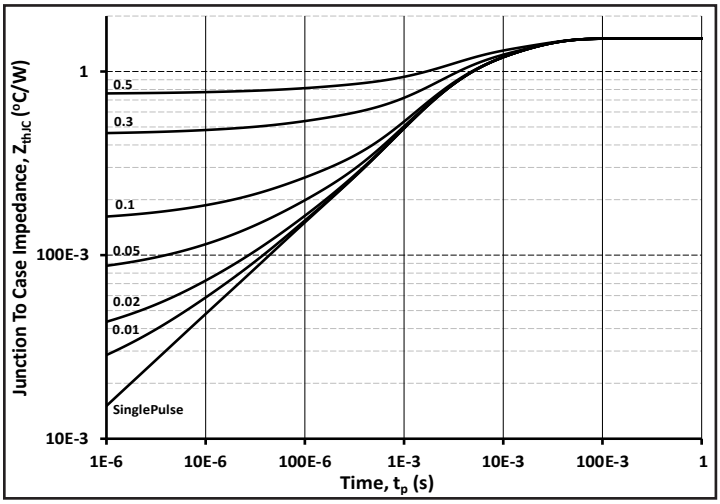


Figure 21. Transient Thermal Impedance (Junction - Case)

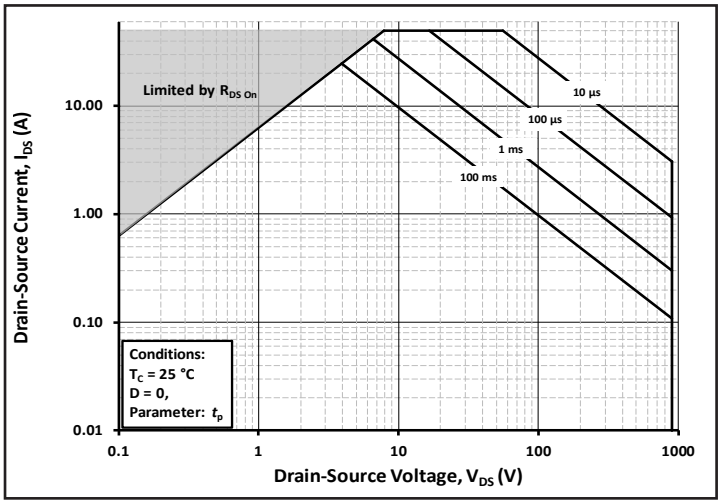


Figure 22. Safe Operating Area

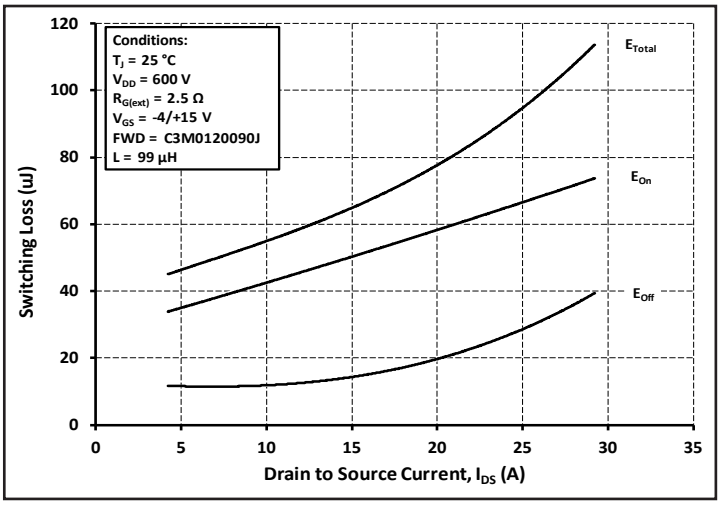


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

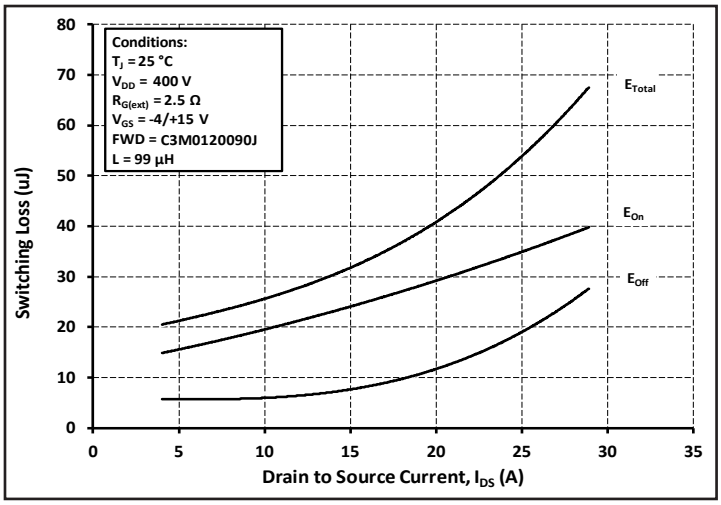


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 400V)

Typical Performance

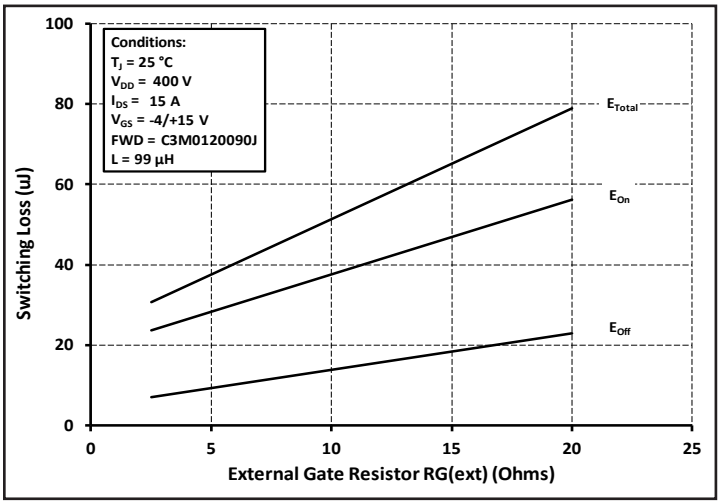


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

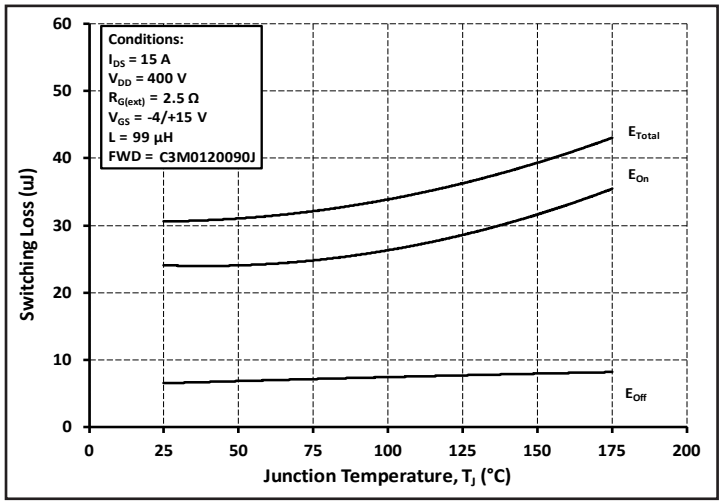


Figure 26. Clamped Inductive Switching Energy vs. Temperature

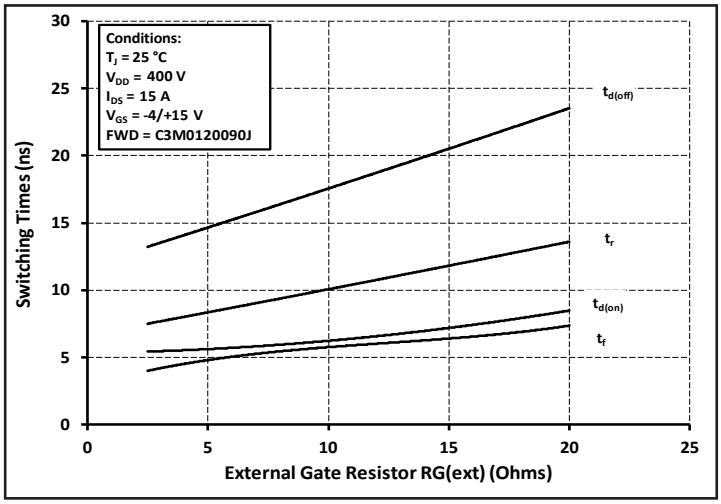


Figure 27. Switching Times vs. $R_{G(ext)}$

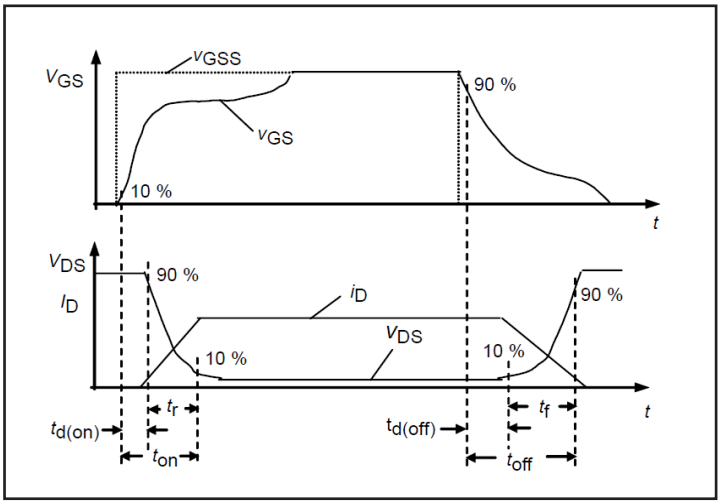


Figure 28. Switching Times Definition

Test Circuit Schematic

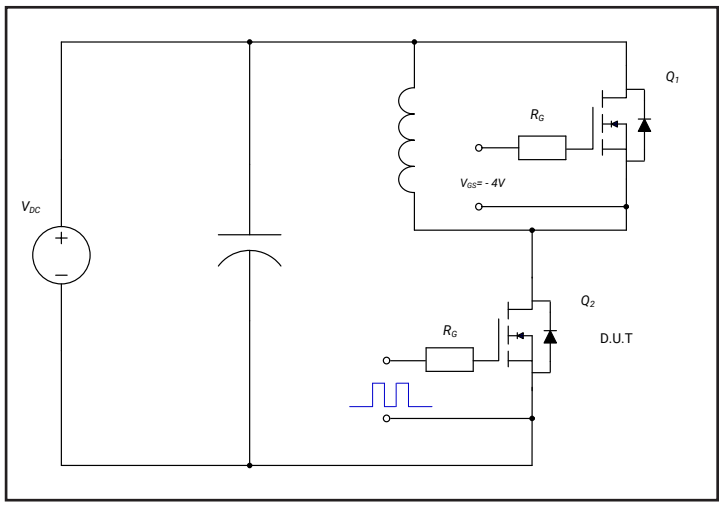
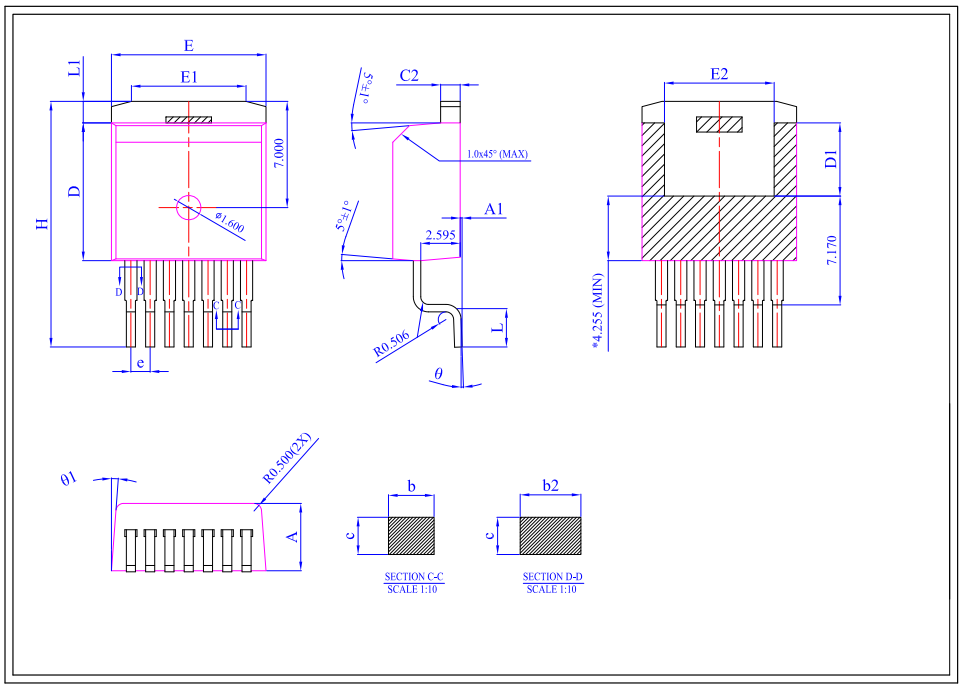


Figure 29. Clamped Inductive Switching Test Circuit

Note (3): Turn-off and Turn-on switching energy and timing values measured using SiC MOSFET Body Diode as shown above.

Package Dimensions

TO-263-7



Dim	All Dimensions in Millimeters		
	Min	typ	Max
A	4.300	4.435	4.570
A1	0.00	0.125	0.25
b	0.500	0.600	0.700
b2	0.600	0.800	1.000
c	0.330	0.490	0.650
C2	1.170	1.285	1.400
D	9.025	9.075	9.125
D1	4.700	4.800	4.900
E	10.130	10.180	10.230
E1	6.500	7.550	8.600
E2	6.778	7.223	7.665
e	1.27		
H	15.043	16.178	17.313
L	2.324	2.512	2.700
L1	0.968	1.418	1.868
Ø	0°	4°	8°
Ø1	4.5°	5°	5.5°