CREE

C3M0350120J

Silicon Carbide Power MOSFET
C3M™ MOSFET Technology

N-Channel Enhancement Mode

V_{DS}	1200 V
$I_{D\ @\ 25^{\circ}C}$	7.2 A
$R_{DS(on)}$	350 mΩ

Features

- 3rd generation SiC MOSFET technology
- Low impedance package with driver source pin
- 7mm of creepage distance between drain and source
- 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

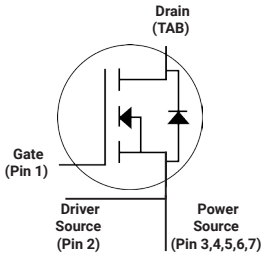
Package

Halogen-Free

RoHS

Benefits

- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency



Applications

- Renewable energy
- High voltage DC/DC converters
- Switch Mode Power Supplies
- UPS

Part Number	Package	Marking
C3M0350120J	TO-263-7	C3M0350120J

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V	V_{GS} = 0 V, I_D = 100 µA	
V_{GSmax}	Gate - Source Voltage (dynamic)	-8/+19	V	AC (f >1 Hz)	Note: 1
V_{GSop}	Gate - Source Voltage (static)	-4/+15	V	Static	Note: 2
I_D	Continuous Drain Current	7.2	A	V_{GS} = 15 V, T_C = 25˚C	Fig. 19
		5		V_{GS} = 15 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	20	A	Pulse width t_P limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	40.8	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): When using MOSFET Body Diode V_{GSmax} = -4V/+19V
Note (2): 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	1200			V	V_{GS} = 0 V, I_D = 100 µA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.5	3.6	V	V_{DS} = V_{GS}, I_D = 1 mA	Fig. 11
			2.0		V	V_{DS} = V_{GS}, I_D = 1 mA, T_J = 150ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	50	µA	V_{DS} = 1200 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		350	455	mΩ	V_{GS} = 15 V, I_D = 3.6 A	Fig. 4, 5, 6
			525			V_{GS} = 15 V, I_D = 3.6 A, T_J = 150ºC	
g_{fs}	Transconductance		2.9		S	V_{DS}= 20 V, I_{DS}= 3.6 A	Fig. 7
			2.6			V_{DS}= 20 V, I_{DS}= 3.6 A, T_J = 150ºC	
C_{iss}	Input Capacitance		345		pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 1 MHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		20				
C_{rss}	Reverse Transfer Capacitance		3.4				
E_{oss}	C_{oss} Stored Energy		10.6		µJ		Fig. 16
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		46		µJ	V_{DS} = 800 V, V_{GS} = -4 V/15 V, I_D = 3.6 A, $R_{G(ext)}$ = 2.5 Ω, L= 716 µH	Fig. 26, 29
E_{OFF}	Turn-Off Switching Energy (Body Diode FWD)		8				
$t_{d(on)}$	Turn-On Delay Time		6		ns	V_{DD} = 800 V, V_{GS} = -4 V/15 V I_D = 3.6 A, $R_{G(ext)}$ = 0 Ω, Timing relative to V_{DS} Inductive load	Fig. 27, 28, 29
t_r	Rise Time		7				
$t_{d(off)}$	Turn-Off Delay Time		9				
t_f	Fall Time		11				
$R_{G(int)}$	Internal Gate Resistance		7		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		5.1		nC	V_{DS} = 800 V, V_{GS} = -4 V/15 V I_D = 3.6 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		4.6				
Q_g	Total Gate Charge		13				

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

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.5		V	V_{GS} = -4 V, I_{SD} = 1.8 A	Fig. 8, 9, 10
		4.0		V	V_{GS} = -4 V, I_{SD} = 1.8 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		7.3	A	V_{GS} = -4 V	Note 1
$I_{S, pulse}$	Diode pulse Current		20	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	Note 1
t_{rr}	Reverse Recover time	5		ns	V_{GS} = -4 V, I_{SD} = 3.6 A, V_R = 800 V dif/dt = 3550 A/µs, T_J = 25 °C	Note 1, Fig. 29
Q_{rr}	Reverse Recovery Charge	23		nC		
I_{rrm}	Peak Reverse Recovery Current	8		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	2.9	°C/W		Fig. 21

Typical Performance

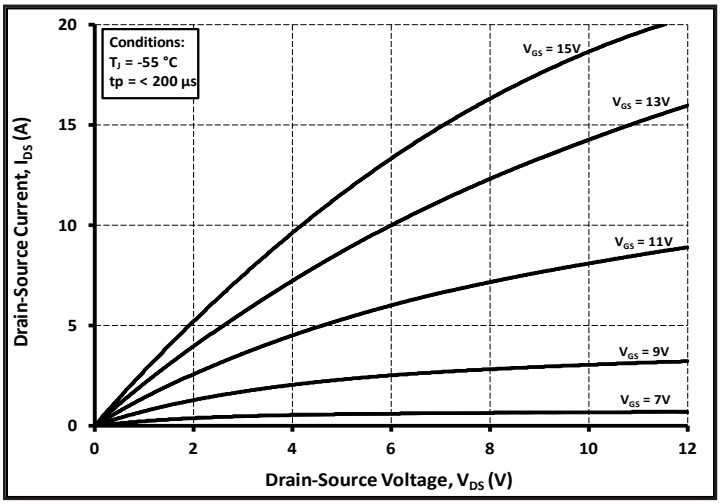


Figure 1. Output Characteristics T_J = -55 °C

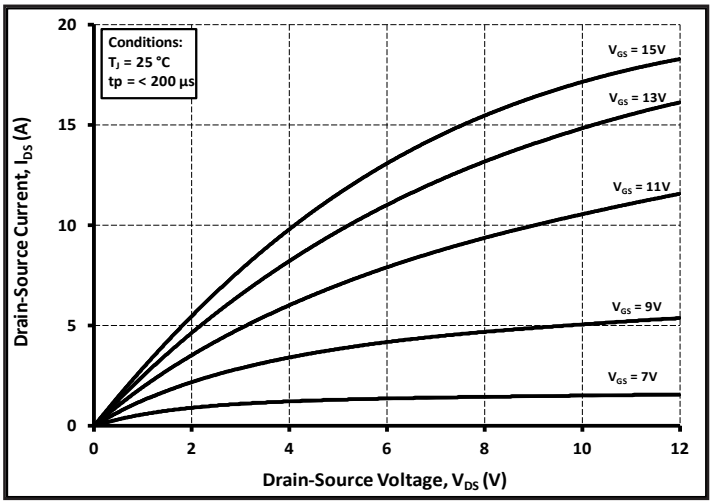


Figure 2. Output Characteristics T_J = 25 °C

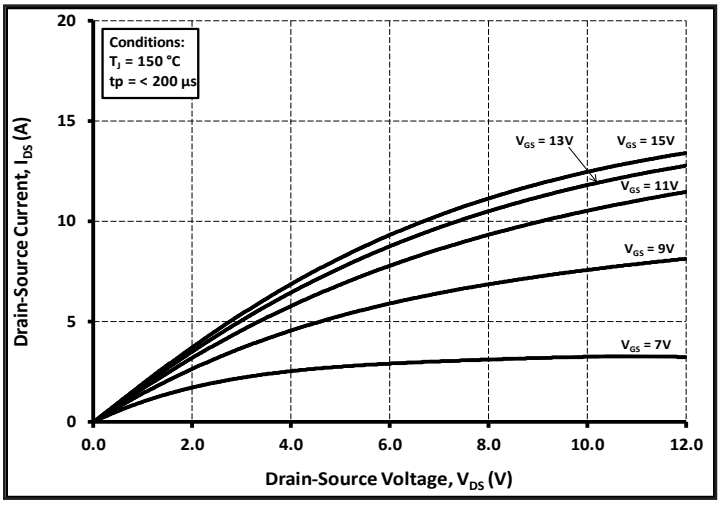


Figure 3. Output Characteristics T_J = 150 °C

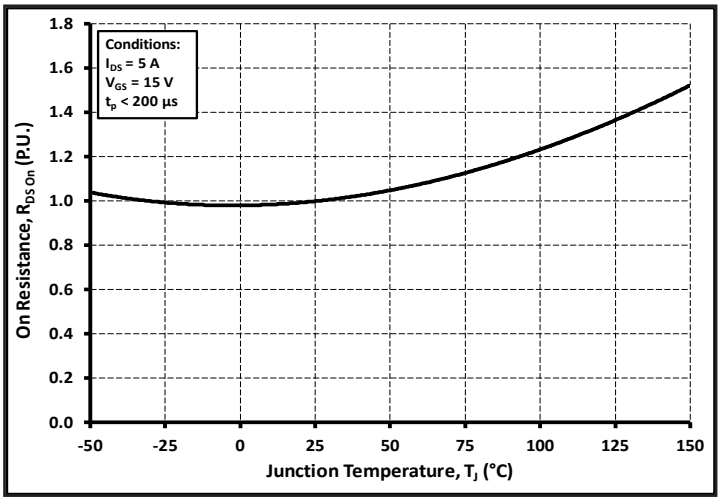


Figure 4. Normalized On-Resistance vs. Temperature

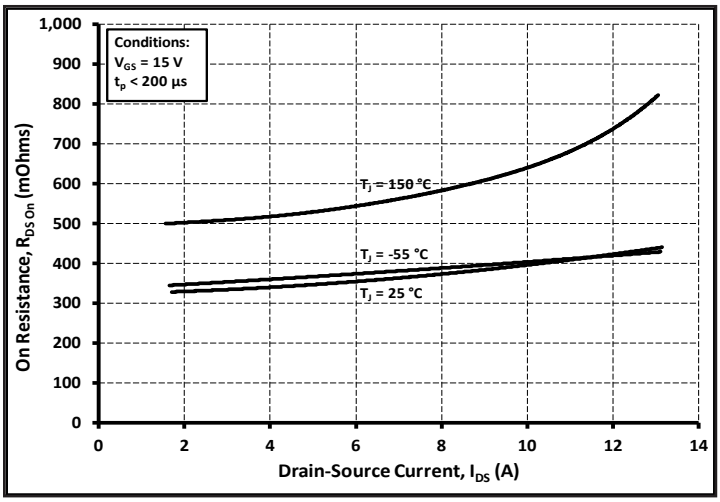


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

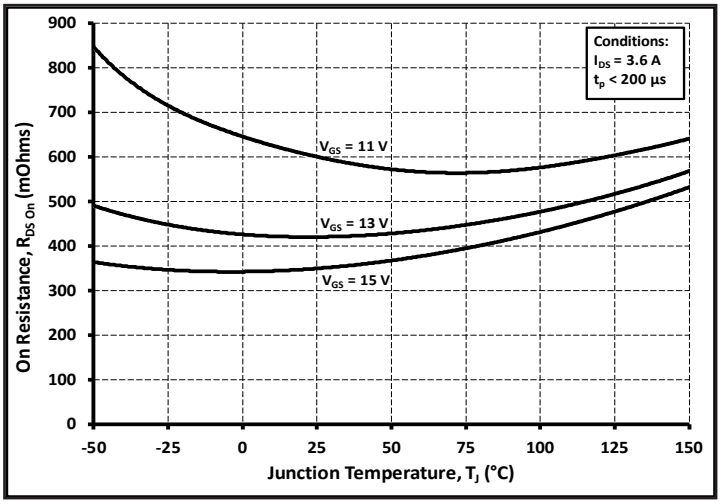


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

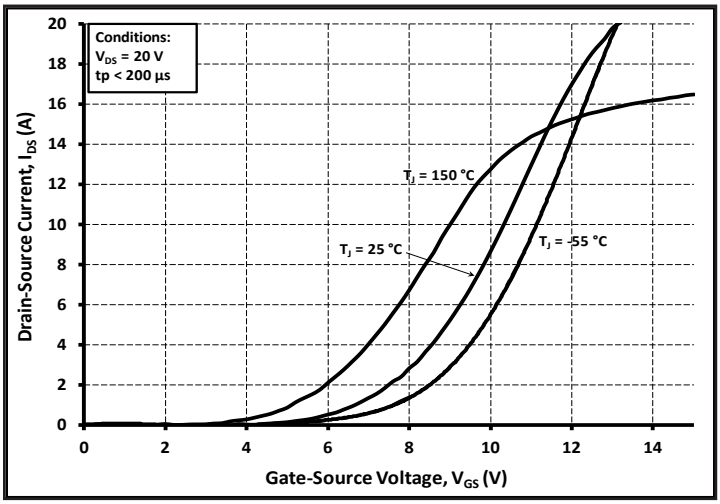


Figure 7. Transfer Characteristic for Various Junction Temperatures

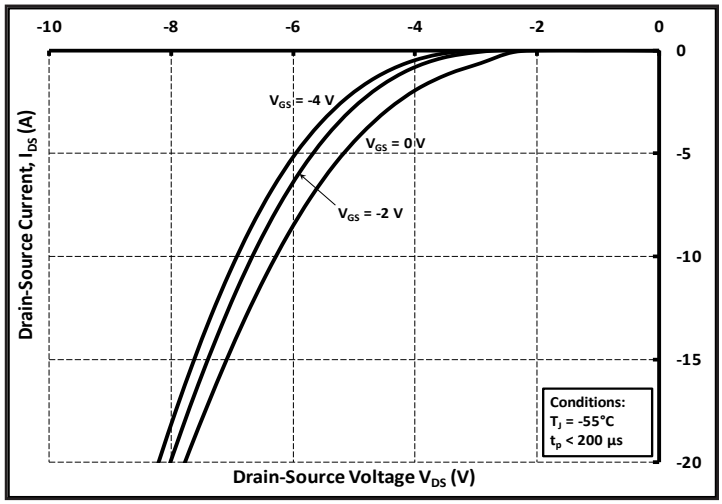


Figure 8. Body Diode Characteristic at -55 ºC

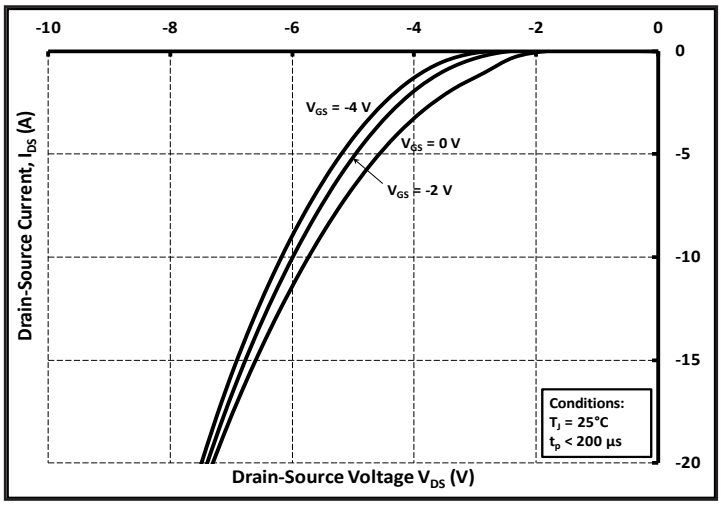


Figure 9. Body Diode Characteristic at 25 ºC

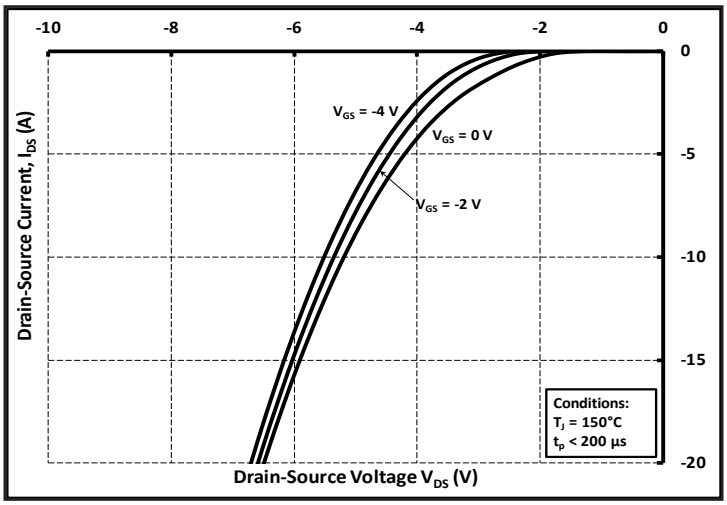


Figure 10. Body Diode Characteristic at 150 ºC

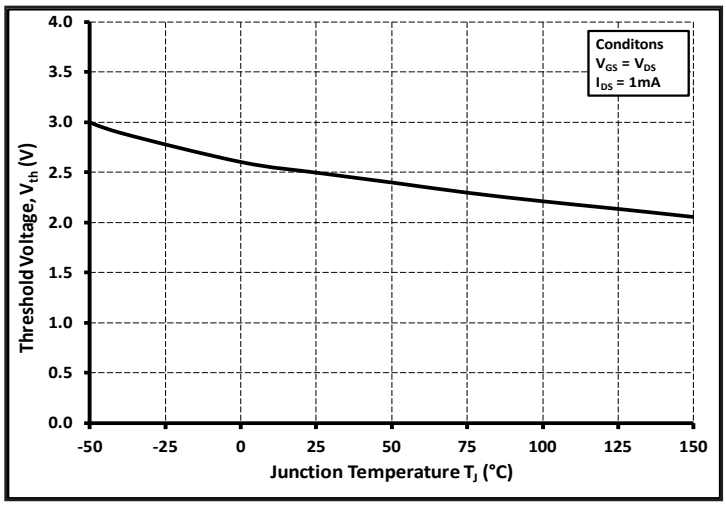


Figure 11. Threshold Voltage vs. Temperature

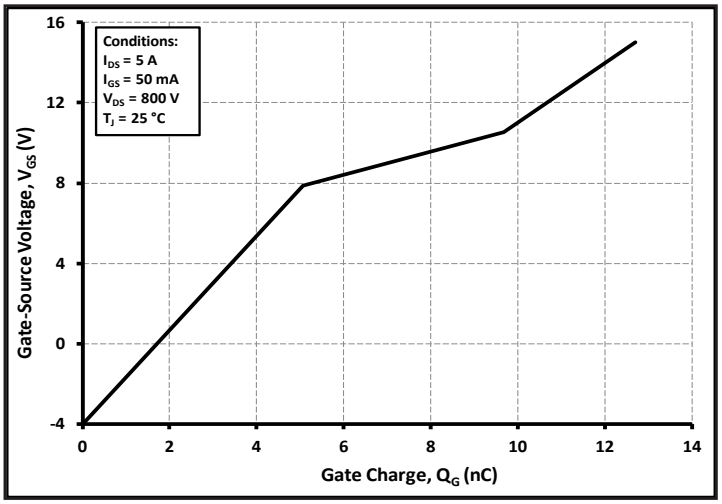


Figure 12. Gate Charge Characteristics

Typical Performance

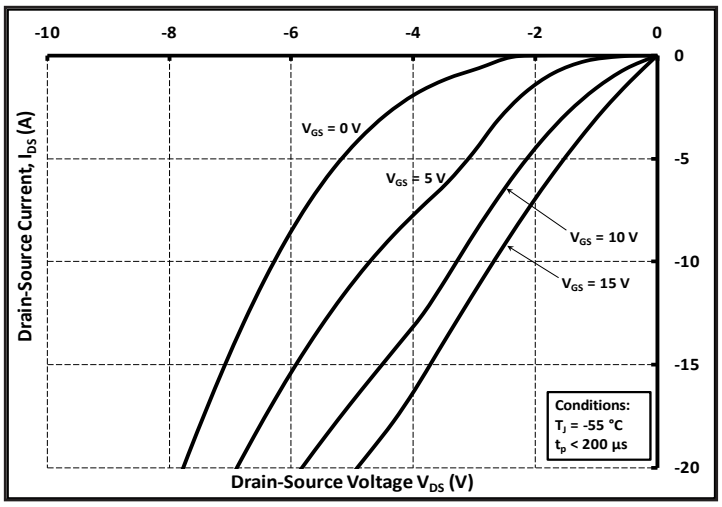


Figure 13. 3rd Quadrant Characteristic at -55 ºC

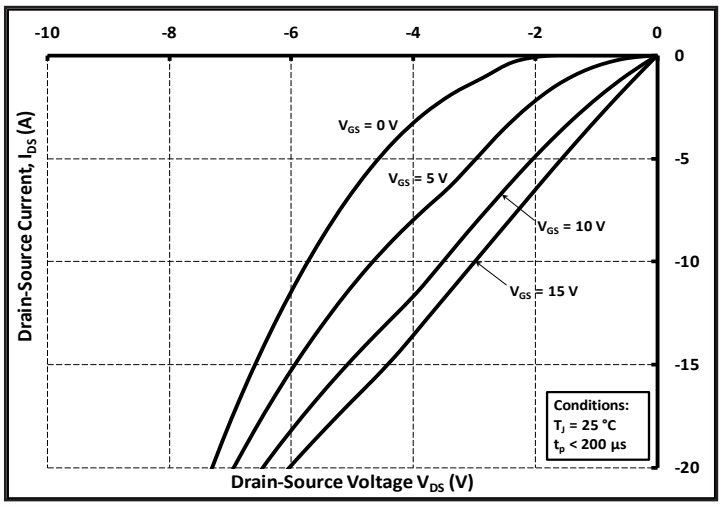


Figure 14. 3rd Quadrant Characteristic at 25 ºC

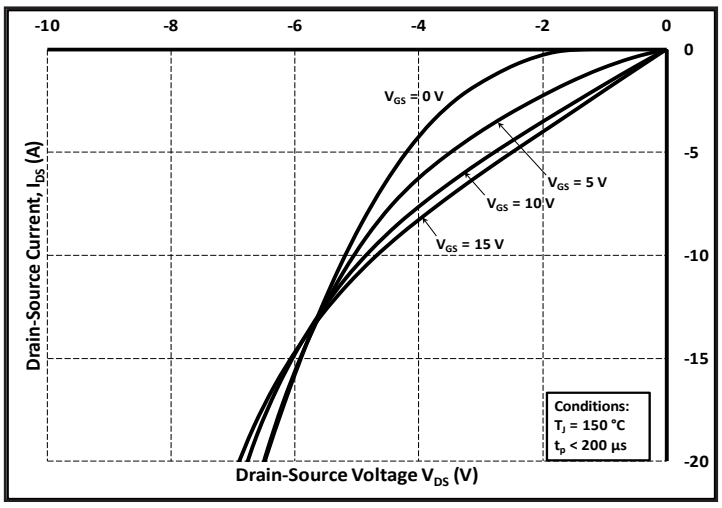


Figure 15. 3rd Quadrant Characteristic at 150 ºC

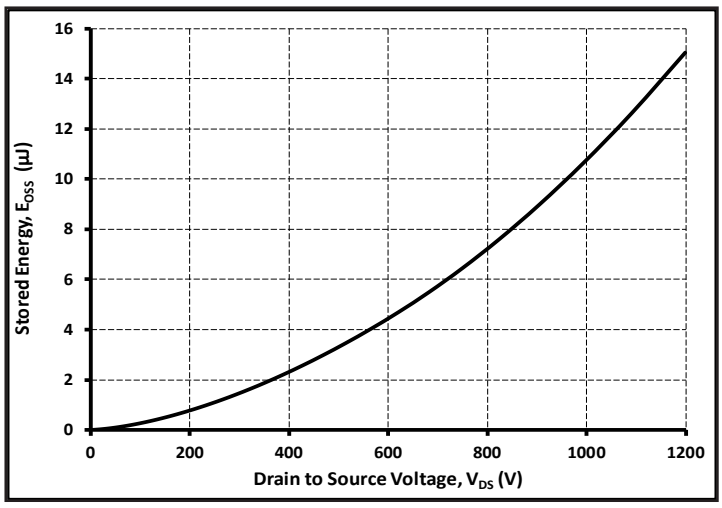


Figure 16. Output Capacitor Stored Energy

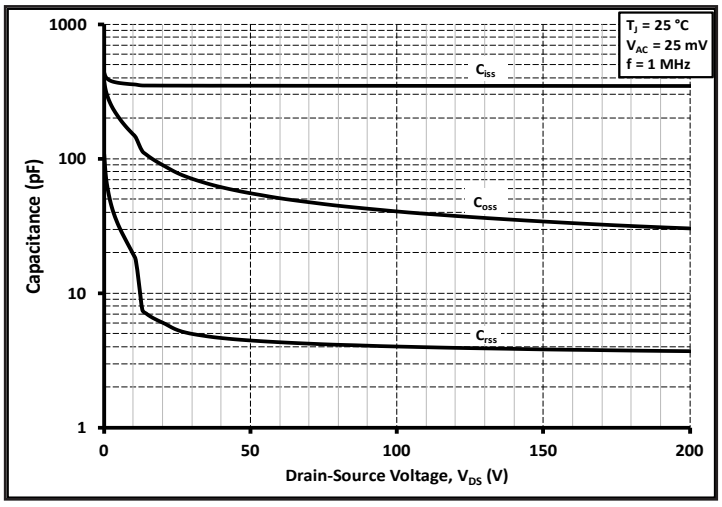


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

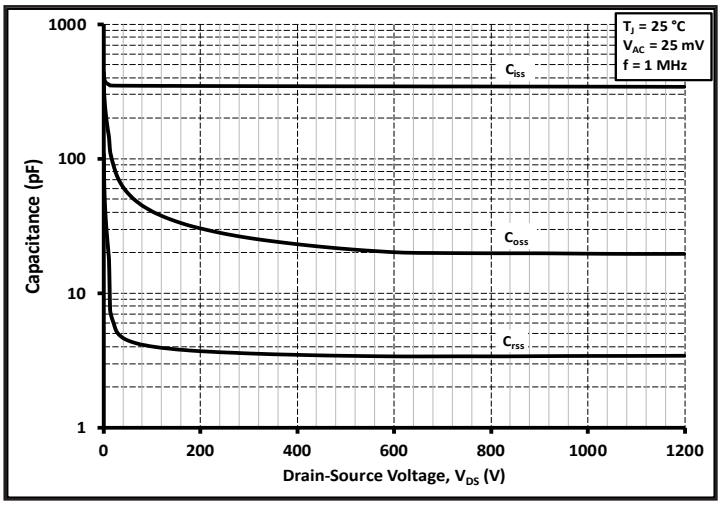


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)

Typical Performance

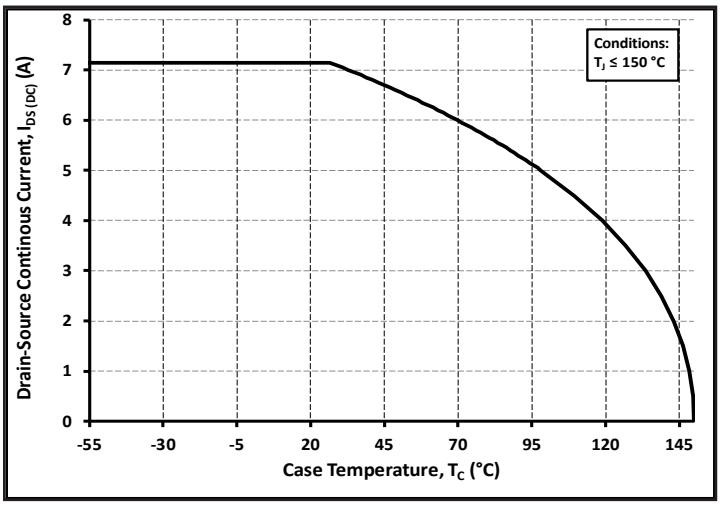


Figure 19. Continuous Drain Current Derating vs. Case Temperature

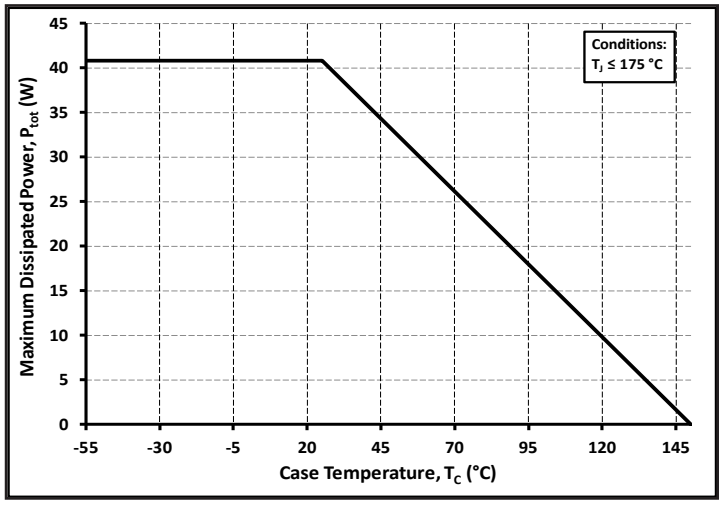


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

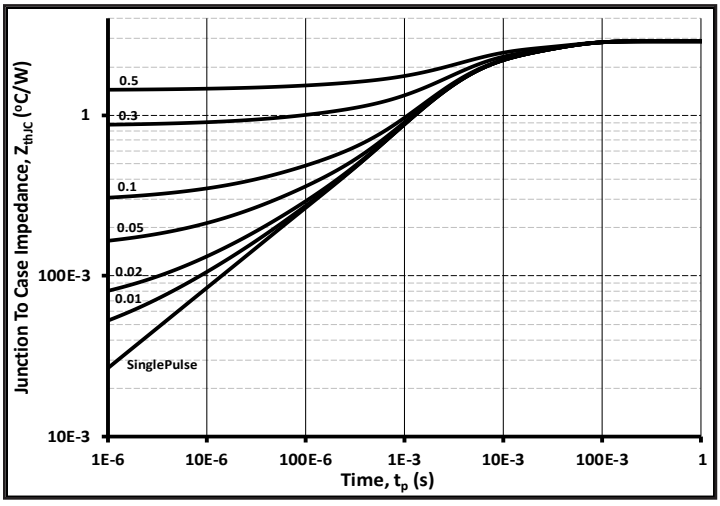


Figure 21. Transient Thermal Impedance (Junction - Case)

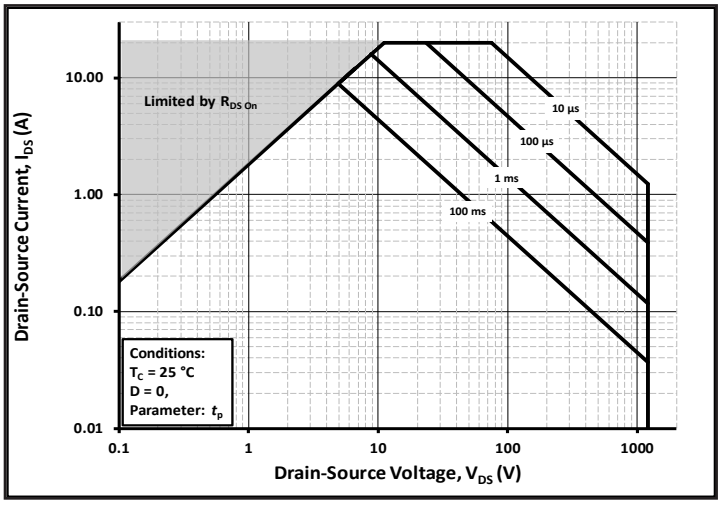


Figure 22. Safe Operating Area

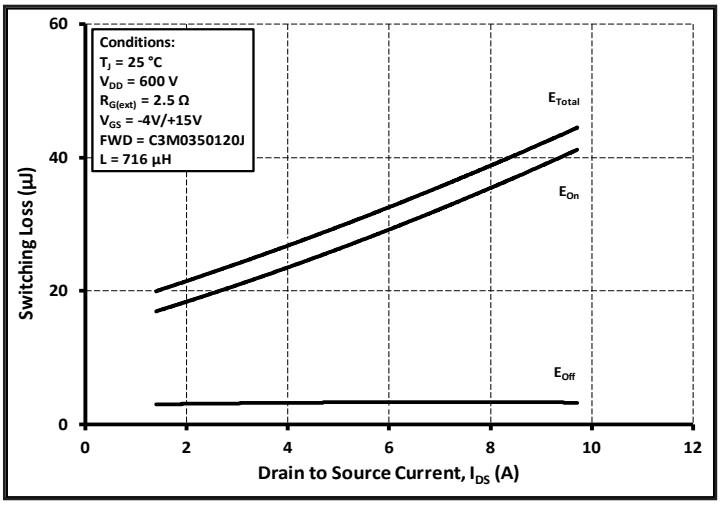


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

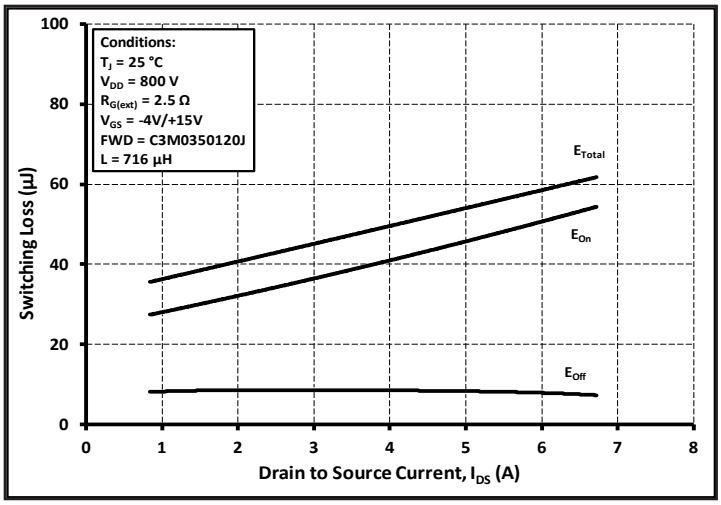


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

Typical Performance

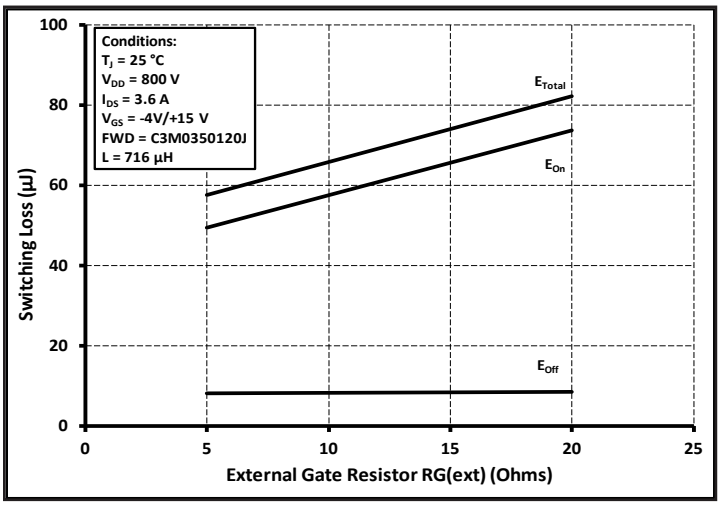


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

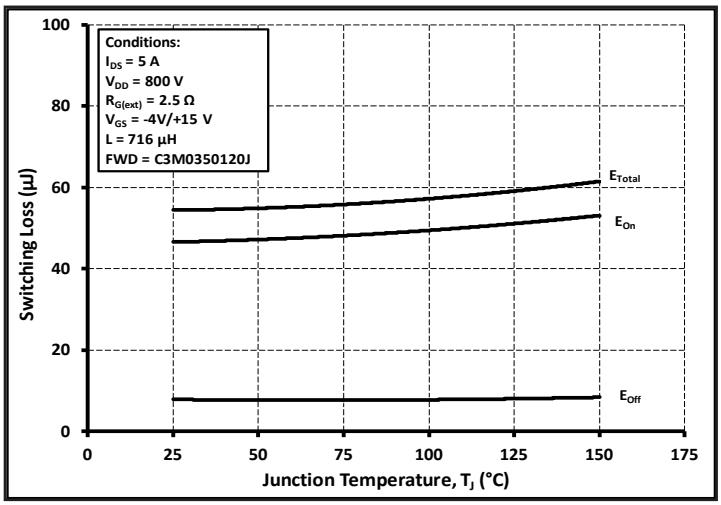


Figure 26. Clamped Inductive Switching Energy vs. Temperature

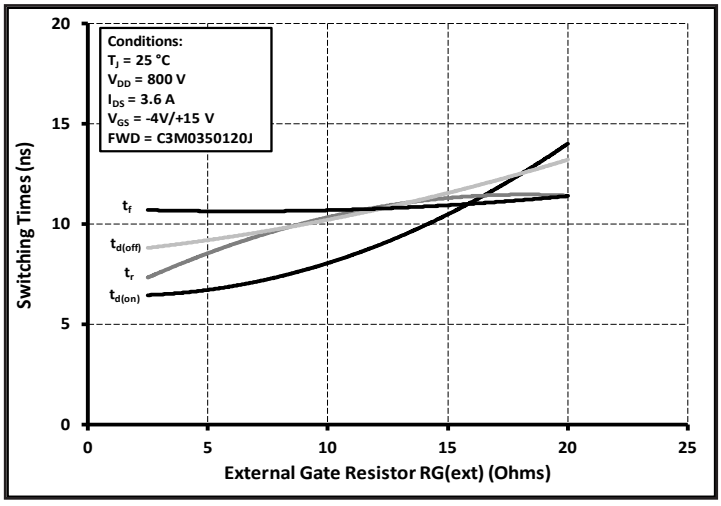


Figure 27. Switching Times vs. $R_{G(ext)}$

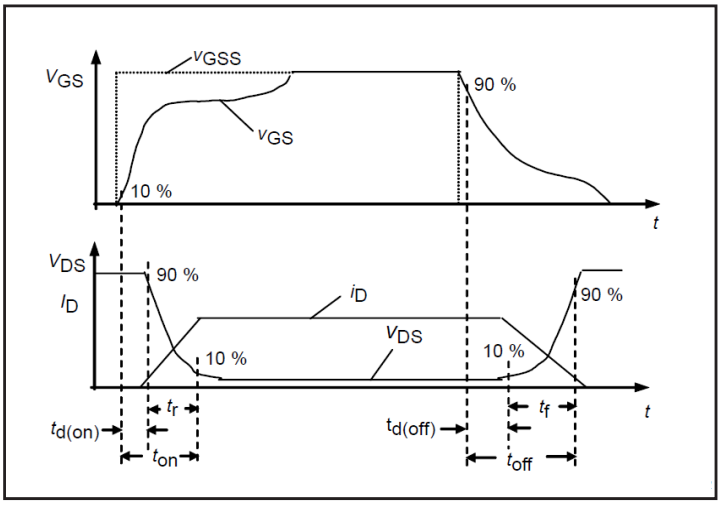


Figure 28. Switching Times Definition

Test Circuit Schematic

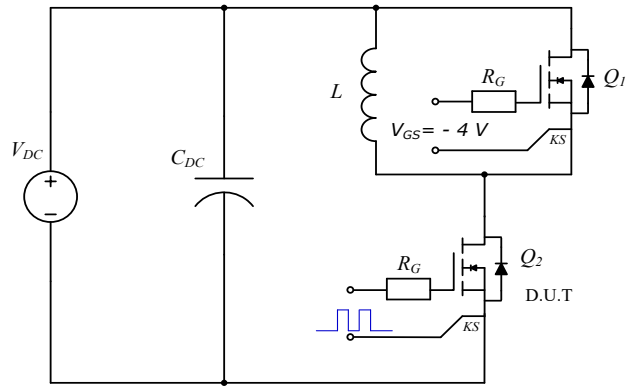
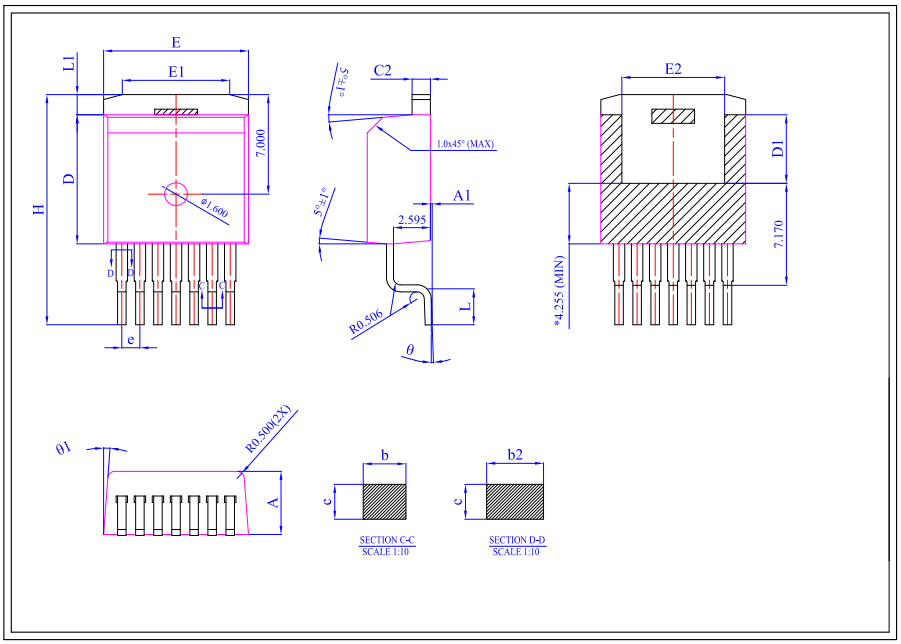


Figure 29. Clamped Inductive Switching
Waveform Test Circuit

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

Package Dimensions

Package 7L D2PAK



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°