

Features

- High blocking voltage with low On-resistance
- High speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- Halogen free, RoHS compliant

Benefits

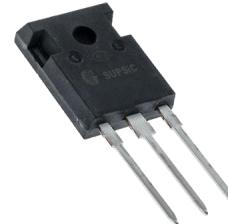
- Higher system efficiency
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency

Applications

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

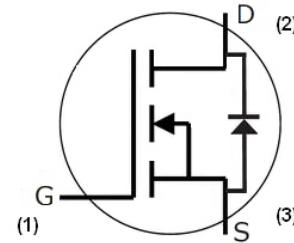
Part Number	Package	Marking
GC3M0120090D	TO-247-3	GC3M0120090

V_{DS}	900 V
$I_D @ 25^\circ C$	23 A
$R_{DS(on)}$	120 mΩ



TO-247-3

Package



Maximum Ratings ($T_c = 25^\circ C$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	900	V	$V_{GS} = 0 \text{ V}, I_D = 100 \mu\text{A}$	
V_{GSmax}	Gate - Source Voltage (dynamic)	-8/+19	V	AC ($f > 1 \text{ Hz}$)	Note: 1
V_{GSop}	Gate - Source Voltage (static)	-4/+15	V	Static	Note: 2
I_D	Continuous Drain Current	23	A	$V_{GS} = 15 \text{ V}, T_c = 25^\circ \text{C}$	Fig. 19
		15		$V_{GS} = 15 \text{ V}, T_c = 100^\circ \text{C}$	
$I_{D(pulse)}$	Pulsed Drain Current	50	A	Pulse width t_p limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	97	W	$T_c = 25^\circ \text{C}, T_j = 150^\circ \text{C}$	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	
M_d	Mounting Torque	1 8.8	Nm lbf-in	M3 or 6-32 screw	

Note (1): When using MOSFET Body Diode $V_{GSmax} = -4V/+19V$

Note (2): MOSFET can also safely operate at 0/+15 V

Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note		
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	900			V	$V_{GS} = 0 \text{ V}, I_D = 100 \mu\text{A}$			
$V_{GS(\text{th})}$	Gate Threshold Voltage	1.8	2.1	3.5	V	$V_{DS} = V_{GS}, I_D = 3 \text{ mA}$	Fig. 11		
			1.6		V	$V_{DS} = V_{GS}, I_D = 3 \text{ mA}, T_J = 150^\circ\text{C}$			
I_{DSS}	Zero Gate Voltage Drain Current		1	100	μA	$V_{DS} = 900 \text{ V}, V_{GS} = 0 \text{ V}$			
I_{GSS}	Gate-Source Leakage Current		10	250	nA	$V_{GS} = 15 \text{ V}, V_{DS} = 0 \text{ V}$			
$R_{DS(\text{on})}$	Drain-Source On-State Resistance		120	155	$\text{m}\Omega$	$V_{GS} = 15 \text{ V}, I_D = 15 \text{ A}$	Fig. 4, 5, 6		
			170			$V_{GS} = 15 \text{ V}, I_D = 15 \text{ A}, T_J = 150^\circ\text{C}$			
g_{fs}	Transconductance		8.9		S	$V_{DS} = 20 \text{ V}, I_{DS} = 15 \text{ A}$	Fig. 7		
			7.1			$V_{DS} = 20 \text{ V}, I_{DS} = 15 \text{ A}, T_J = 150^\circ\text{C}$			
C_{iss}	Input Capacitance		414		pF	$V_{GS} = 0 \text{ V}, V_{DS} = 600 \text{ V}$ $f = 1 \text{ MHz}$ $V_{AC} = 25 \text{ mV}$	Fig. 17, 18		
C_{oss}	Output Capacitance		48						
C_{rss}	Reverse Transfer Capacitance		3						
E_{oss}	C_{oss} Stored Energy		10.6		μJ	$V_{DS} = 400 \text{ V}, V_{GS} = -4 \text{ V}/15 \text{ V}, I_D = 15 \text{ A},$ $R_{G(\text{ext})} = 2.5 \Omega, L = 99 \mu\text{H}, T_J = 150^\circ\text{C}$	Fig. 16		
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		176		μJ				
E_{OFF}	Turn Off Switching Energy (Body Diode FWD)		36						
$t_{d(on)}$	Turn-On Delay Time		6		ns	$V_{DD} = 400 \text{ V}, V_{GS} = -4 \text{ V}/15 \text{ V}$ $I_D = 15 \text{ A}, R_{G(\text{ext})} = 2.5 \Omega,$ Timing relative to V_{DS} Inductive load	Fig. 27, 29		
t_r	Rise Time		32						
$t_{d(off)}$	Turn-Off Delay Time		14						
t_f	Fall Time		7						
$R_{G(\text{int})}$	Internal Gate Resistance		13		Ω	$f = 1 \text{ MHz}, V_{AC} = 25 \text{ mV}$			
Q_{gs}	Gate to Source Charge		5		nC	$V_{DS} = 400 \text{ V}, V_{GS} = -4 \text{ V}/15 \text{ V}$ $I_D = 15 \text{ A}$ Per IEC60747-8-4 pg 21	Fig. 12		
Q_{gd}	Gate to Drain Charge		8						
Q_g	Total Gate Charge		21						

Reverse Diode Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.8		V	$V_{GS} = -4 \text{ V}, I_{SD} = 7.5 \text{ A}$	Fig. 8, 9, 10
		4.4		V	$V_{GS} = -4 \text{ V}, I_{SD} = 7.5 \text{ A}, T_J = 150^\circ\text{C}$	
I_S	Continuous Diode Forward Current		15	A	$V_{GS} = -4 \text{ V}$	Note 1
$I_{S,pulse}$	Diode pulse Current		50	A	$V_{GS} = -4 \text{ V}$, pulse width t_p limited by T_{jmax}	Note 1
t_{rr}	Reverse Recover time	28		ns	$V_{GS} = -4 \text{ V}, I_{SD} = 15 \text{ A}, V_R = 400 \text{ V}$ $dI/dt = 600 \text{ A}/\mu\text{s}, T_J = 150^\circ\text{C}$	Note 1
Q_{rr}	Reverse Recovery Charge	127		nC		
I_{rrm}	Peak Reverse Recovery Current	6		A		

Thermal Characteristics

Symbol	Parameter	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	1.3	°C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient	40			

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

Typical Performance

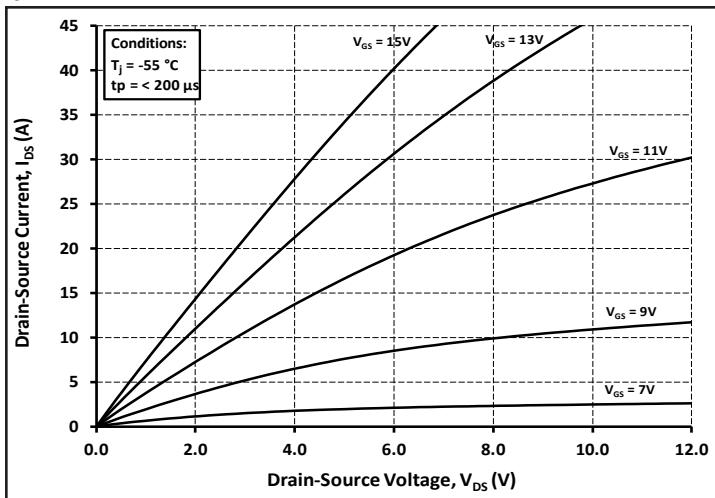


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

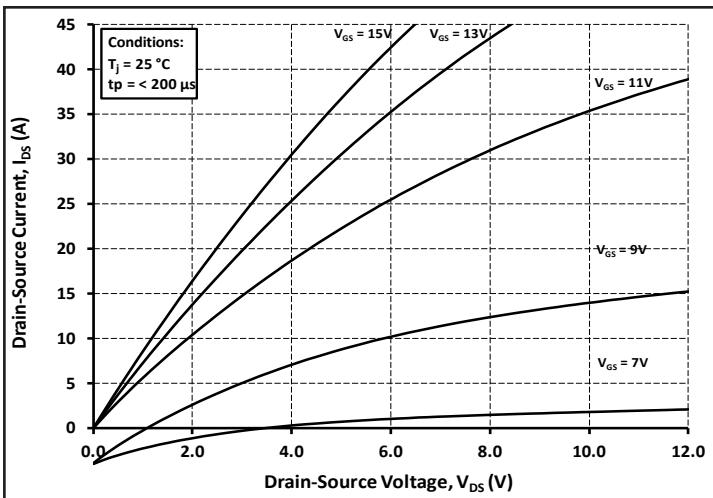


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

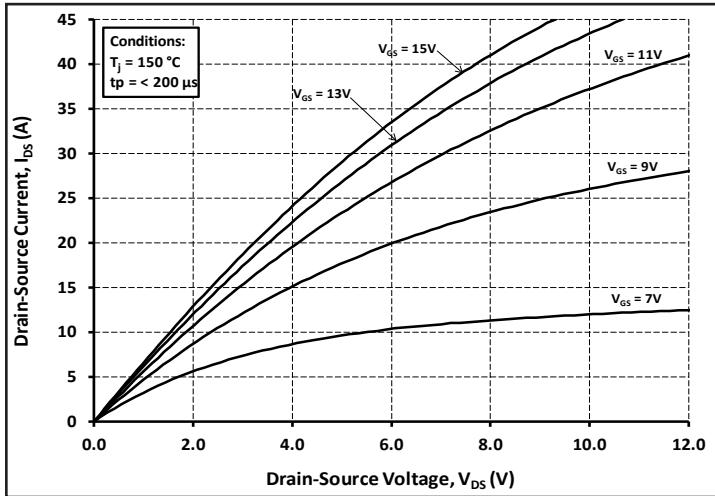


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

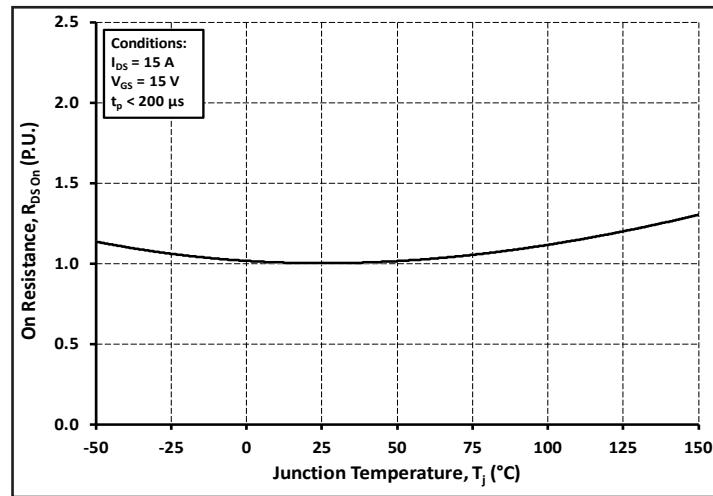


Figure 4. Normalized On-Resistance vs. Temperature

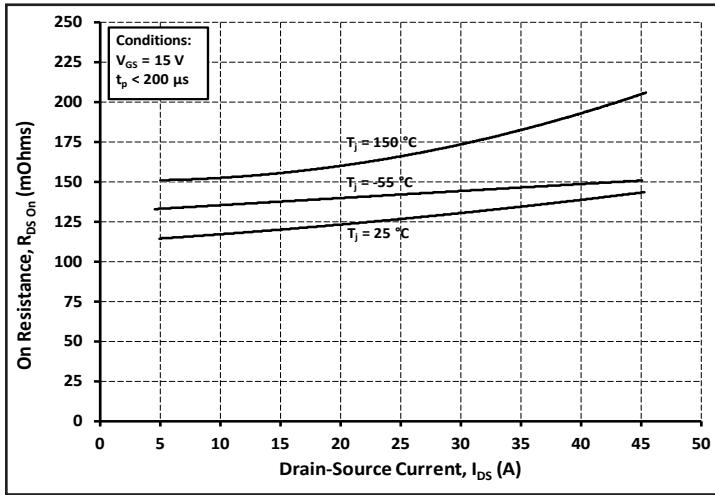


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

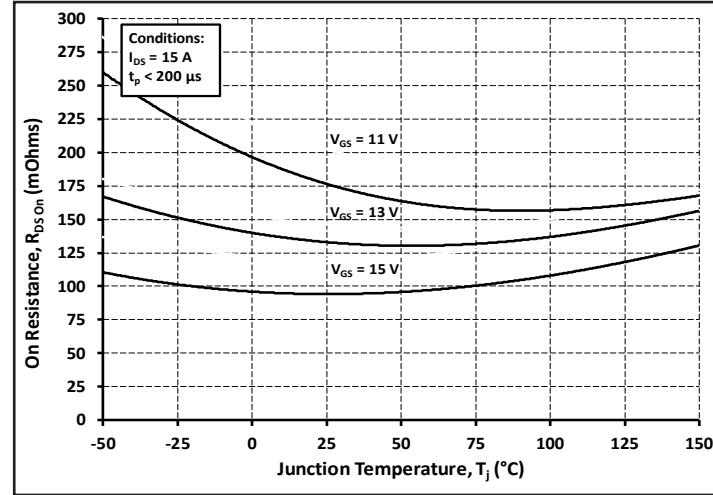


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

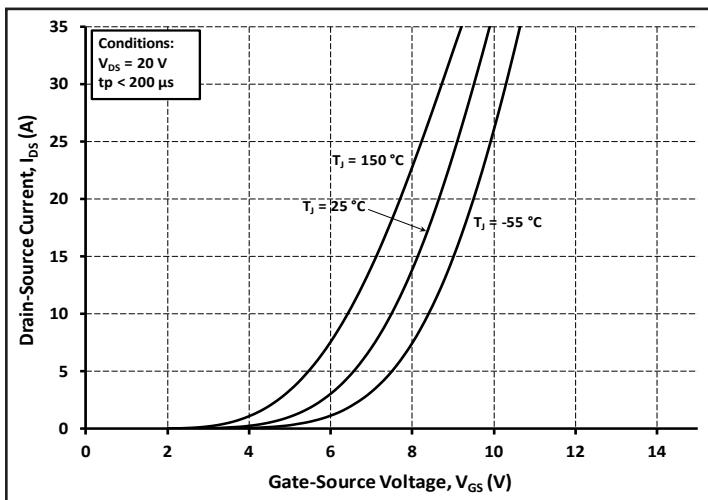


Figure 7. Transfer Characteristic for Various Junction Temperatures

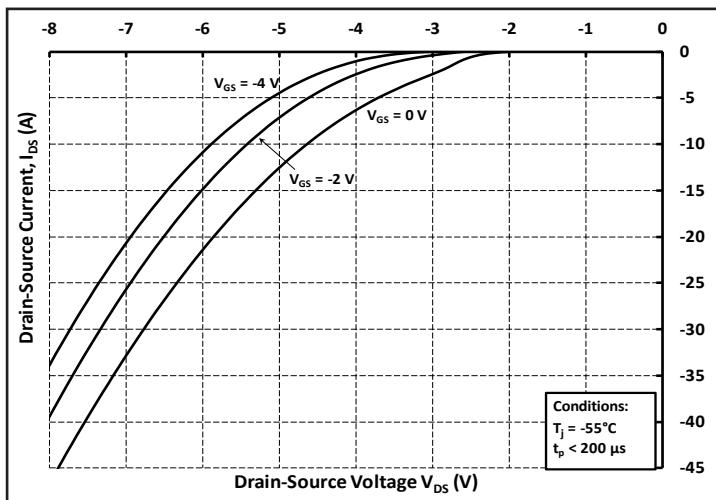


Figure 8. Body Diode Characteristic at -55°C

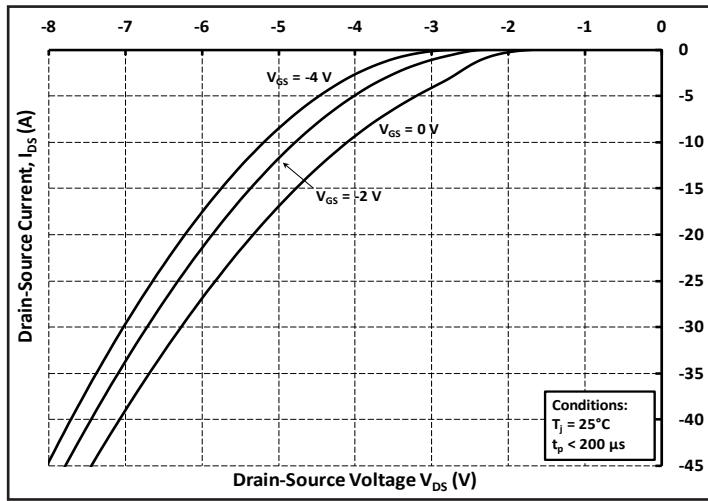


Figure 9. Body Diode Characteristic at 25°C

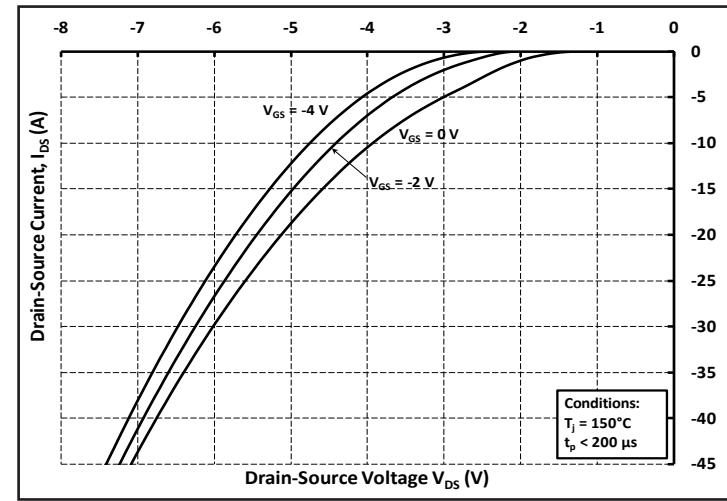


Figure 10. Body Diode Characteristic at 150°C

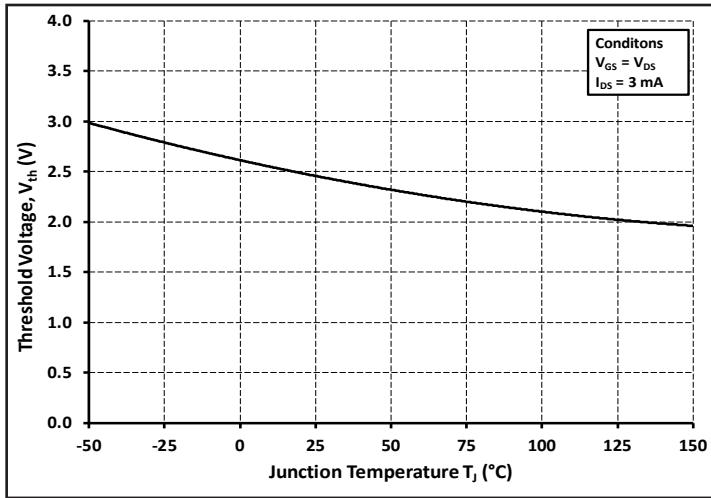


Figure 11. Threshold Voltage vs. Temperature

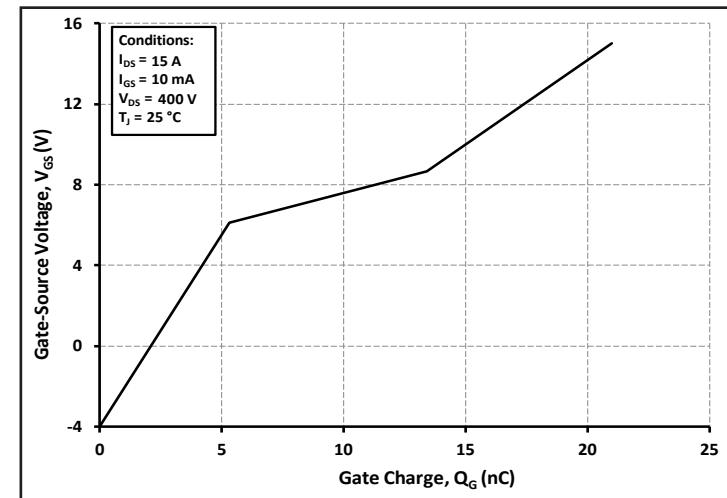


Figure 12. Gate Charge Characteristics

Typical Performance

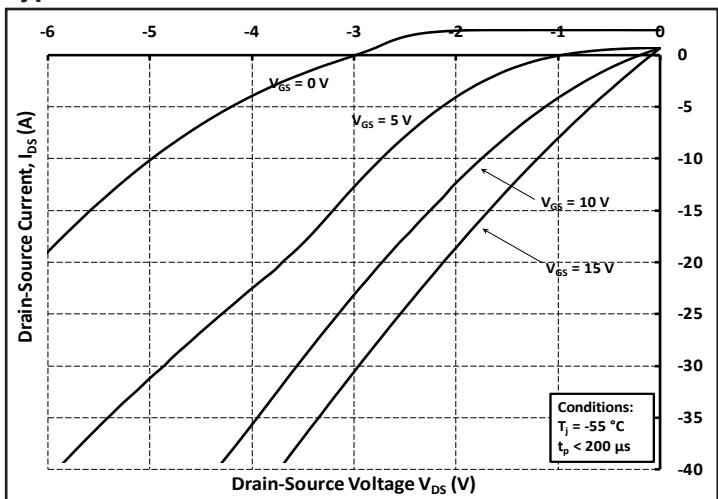


Figure 13. 3rd Quadrant Characteristic at $-55\text{ }^\circ\text{C}$

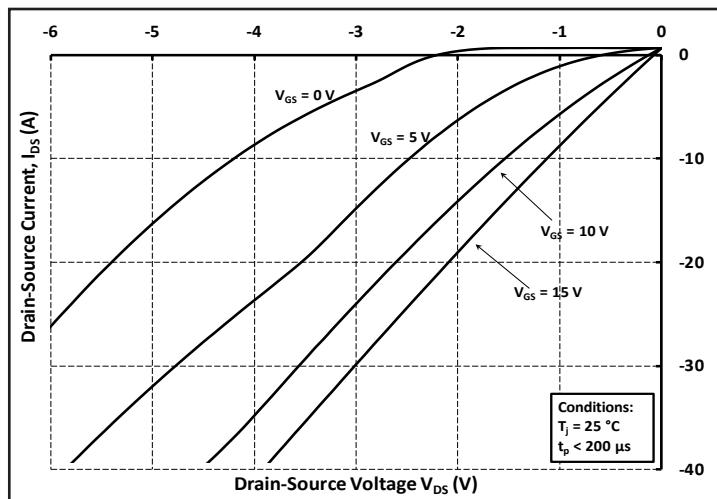


Figure 14. 3rd Quadrant Characteristic at $25\text{ }^\circ\text{C}$

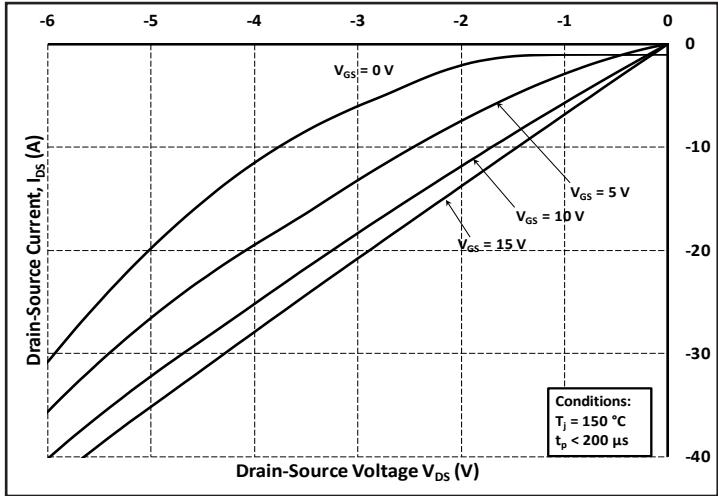


Figure 15. 3rd Quadrant Characteristic at $150\text{ }^\circ\text{C}$

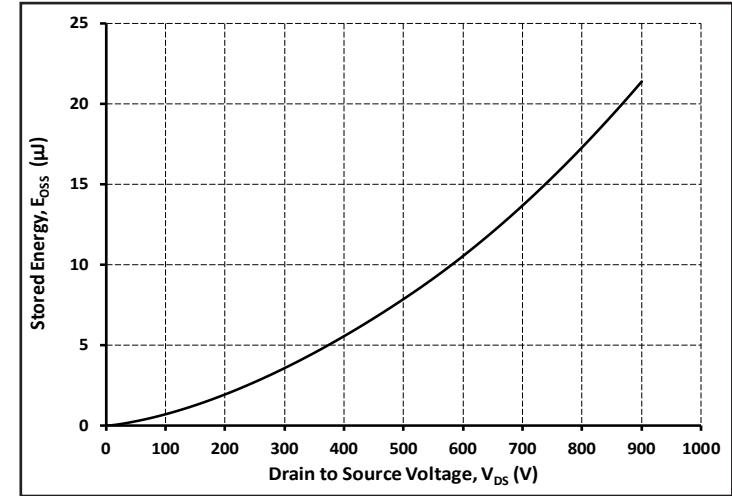


Figure 16. Output Capacitor Stored Energy

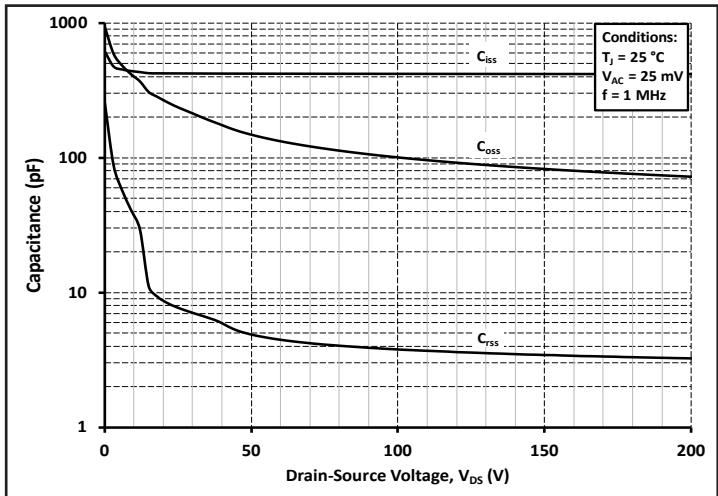


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

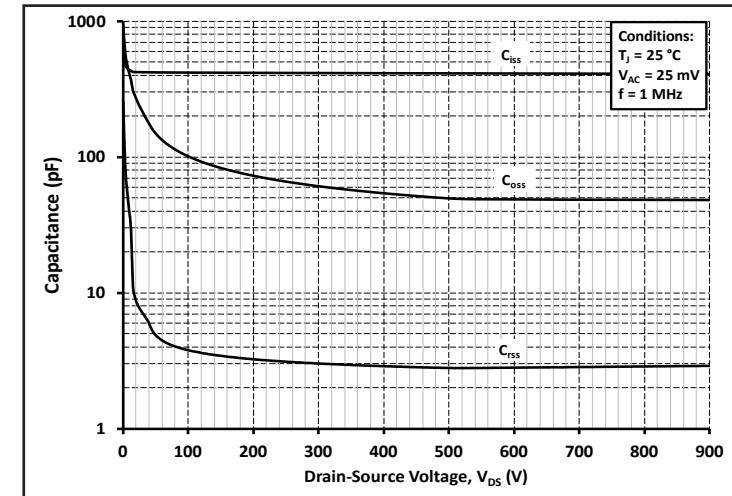


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 900V)

Typical Performance

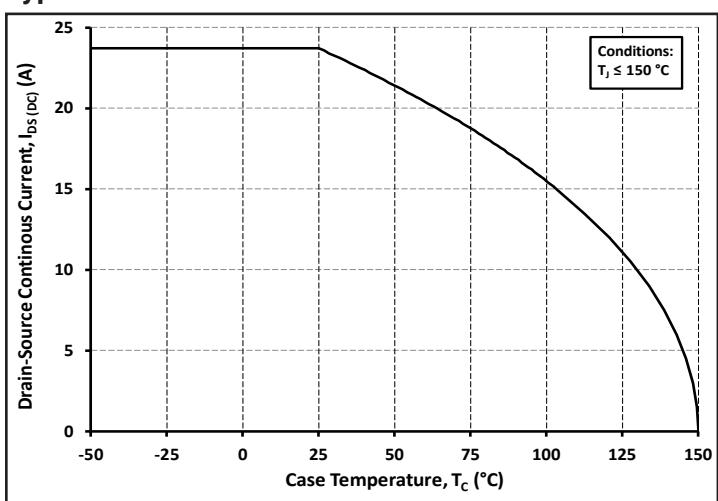


Figure 19. Continuous Drain Current Derating vs.
Case Temperature

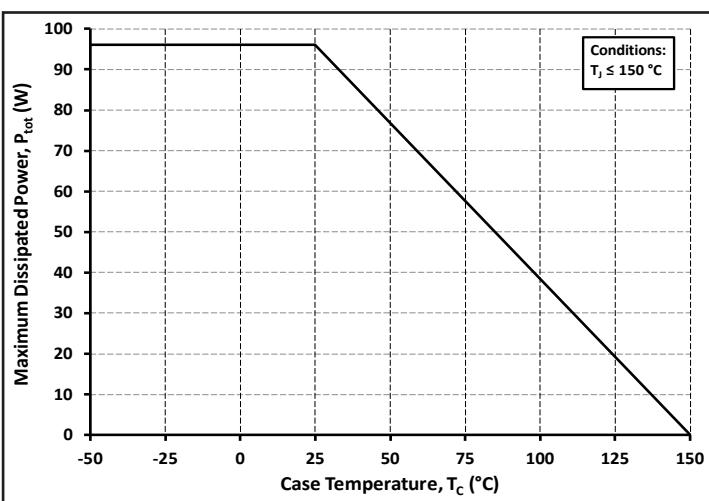


Figure 20. Maximum Power Dissipation Derating vs.
Case Temperature

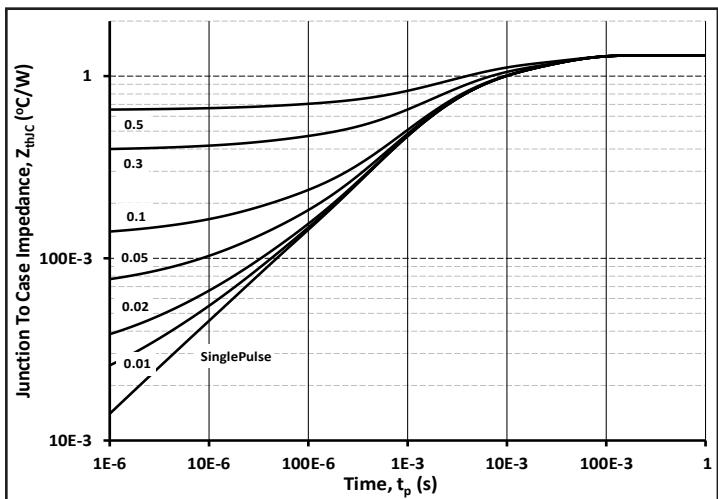


Figure 21. Transient Thermal Impedance
(Junction - Case)

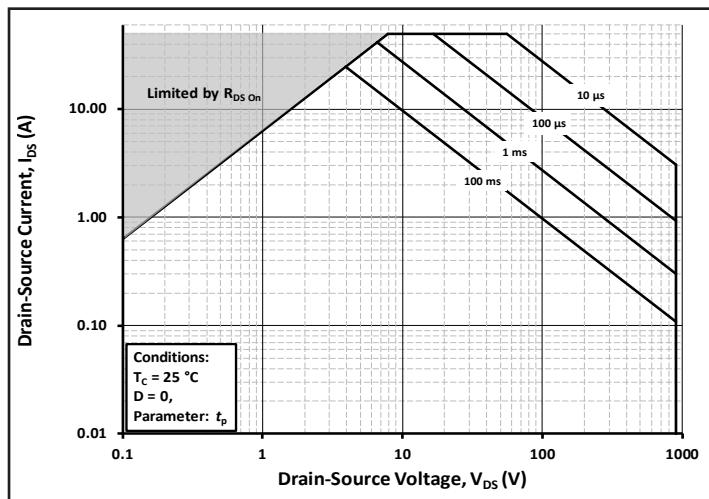


Figure 22. Safe Operating Area

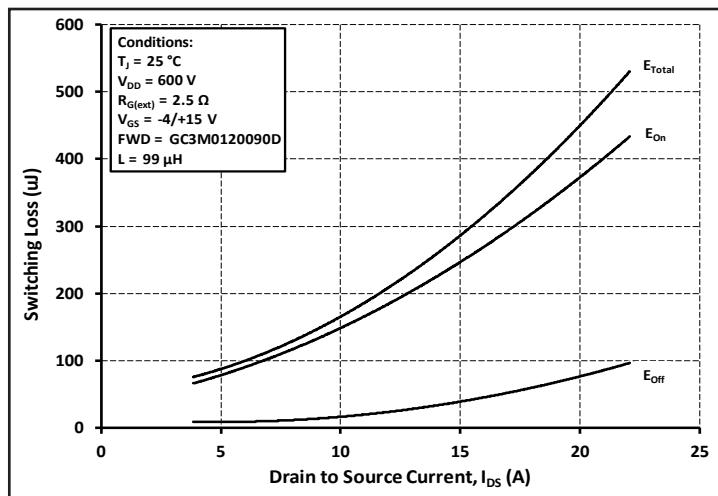


Figure 23. Clamped Inductive Switching Energy vs.
Drain Current ($V_{DD} = 600V$)

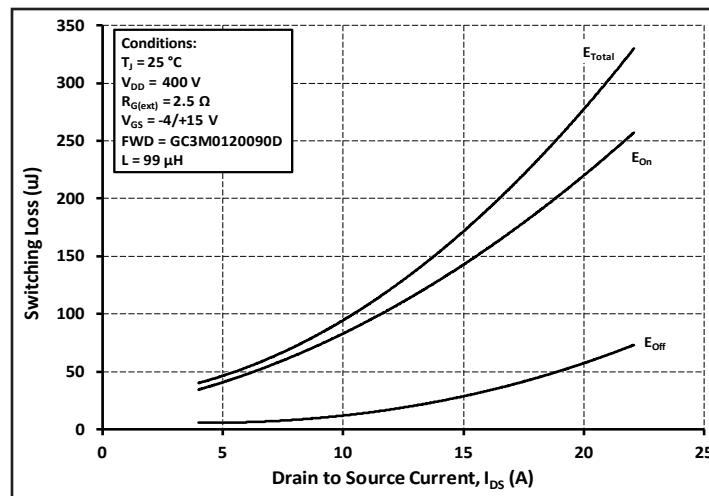


Figure 24. Clamped Inductive Switching Energy vs.
Drain Current ($V_{DD} = 400V$)

Typical Performance

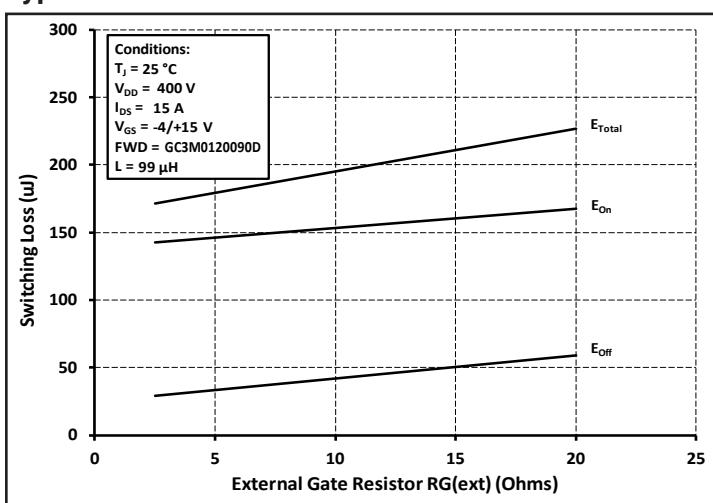


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$

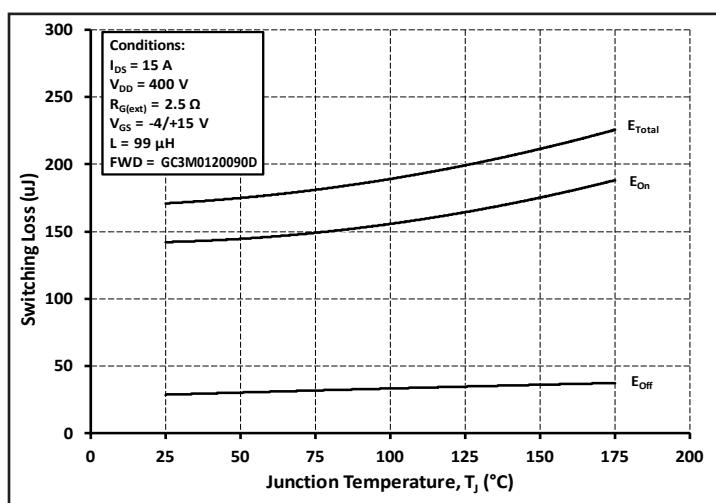


Figure 26. Clamped Inductive Switching Energy vs. Temperature

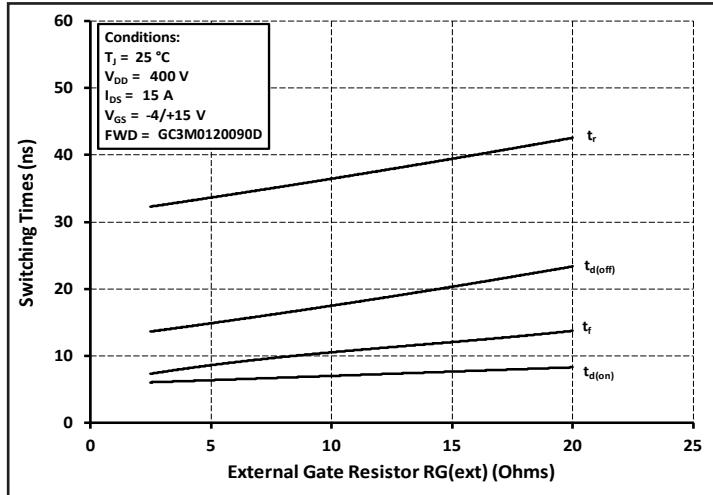


Figure 27. Switching Times vs. $R_{G(\text{ext})}$

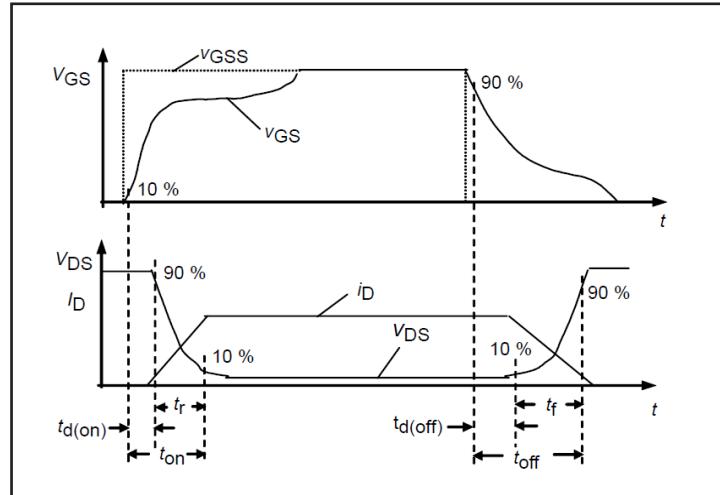


Figure 28. Switching Times Definition

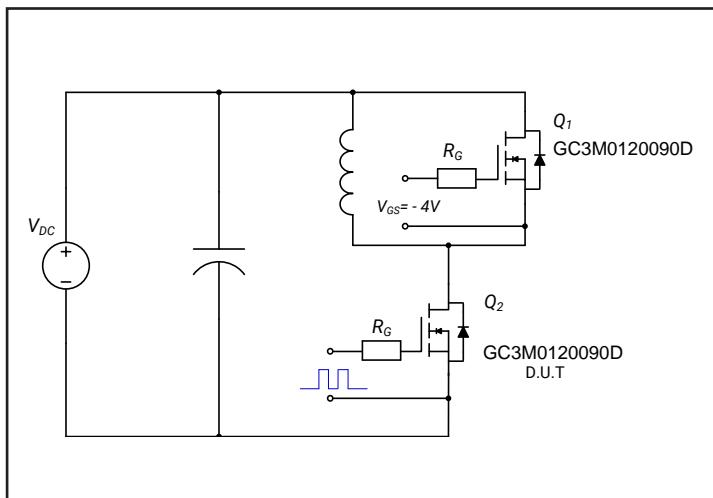
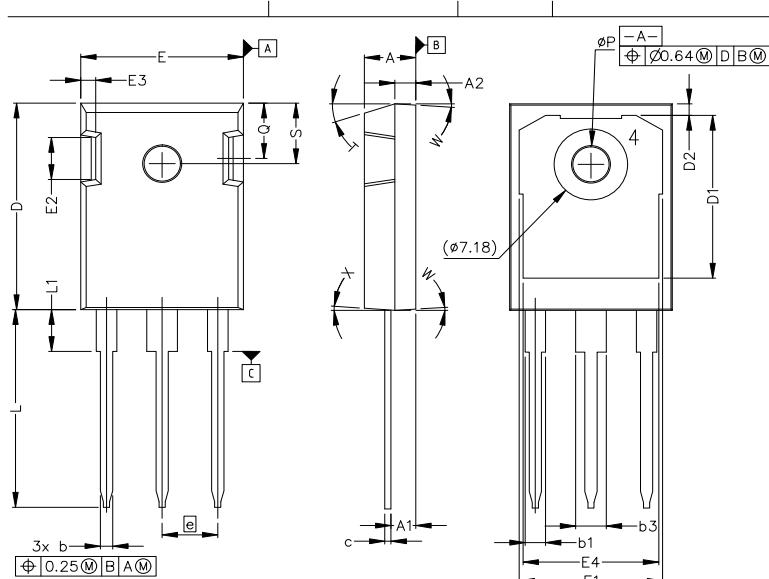
Test Circuit Schematic

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

Package TO-247-3

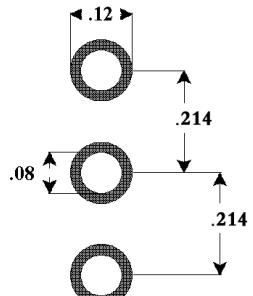


Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

SYM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	.190	.205
A1	2.29	2.54	.090	.100
A2	1.91	2.16	.075	.085
b	1.07	1.33	.042	.052
b1	1.91	2.41	.075	.095
b3	2.87	3.38	.113	.133
c	0.55	0.68	.022	.027
D	20.80	21.10	.819	.831
D1	16.25	17.65	.640	.695
D2	0.95	1.25	.037	.049
E	15.75	16.13	.620	.635
E1	13.10	14.15	.516	.557
E2	3.68	5.10	.145	.201
E3	1.00	1.90	.039	.075
E4	12.38	13.43	.487	.529
e	5.44 BSC		.214 BSC	
N	3		3	
L	19.81	20.32	.780	.800
L1	4.10	4.40	.161	.173
ΦP	3.51	3.65	.138	.144
Q	5.49	6.00	.216	.236
S	6.04	6.30	.238	.248
T	17.5° REF.			
W	3.5° REF.			
X	4° REF.			

Recommended Solder Pad Layout



TO-247-3