GC2M0025120D
Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

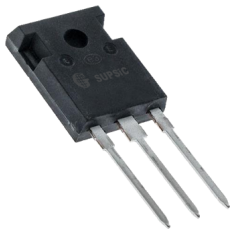
V_{DS}	1200 V
$I_{D\ @\ 25^{\circ}C}$	90 A
$R_{DS(on)}$	25 mΩ

Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

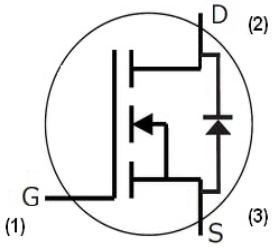
Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC converters
- Battery Chargers
- Motor Drive
- Pulsed Power Applications



TO-247-3

Package



Part Number	Package
GC2M0025120D	TO-247-3

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	-10/+25	V	Absolute maximum values	
V_{GSop}	Gate - Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	90	A	V_{GS} =20 V, T_C = 25˚C	Fig. 19 Note 1
		60		V_{GS} =20 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	250	A	Pulse width t_P limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	378	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	
M_d	Mounting Torque	1 8.8	Nm lbf-in	M3 or 6-32 screw	

Note (1): Die limits are 90A (25°C) and 60A (100°C)

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	2.0	2.6	4	V	V_{DS} = V_{GS}, I_D = 15mA	Fig. 11
			2.3		V	V_{DS} = V_{GS}, I_D = 15mA, T_J = 150 °C	
I_{DSS}	Zero Gate Voltage Drain Current		2	100	µA	V_{DS} = 1200 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current			250	nA	V_{GS} = 20 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		25	34	mΩ	V_{GS} = 20 V, I_D = 50 A	Fig. 4,5,6
			41			V_{GS} = 20 V, I_D = 50 A, T_J = 150 °C	
g_{fs}	Transconductance		24.6		S	V_{DS}= 20 V, I_{DS}= 50 A	Fig. 7
			24			V_{DS}= 20 V, I_{DS}= 50 A, T_J = 150 °C	
C_{iss}	Input Capacitance		3140		pF	V_{GS} = 0 V V_{DS} = 1000 V f = 1 MHz V_{AC} = 25 mV	Fig. 17,18
C_{oss}	Output Capacitance		224				
C_{rss}	Reverse Transfer Capacitance		9				
E_{oss}	C_{oss} Stored Energy		128		µJ		Fig 16
E_{ON}	Turn-On Switching Energy (Body Diode)		2.18		mJ	V_{DS} = 800 V, V_{GS} = -5/20 V, I_D = 50A, $R_{G(ext)}$ = 2.5Ω,L= 99 µH FWD = Internal Body Diode of MOSFET	Fig. 25
E_{OFF}	Turn Off Switching Energy (Body Diode)		0.68				
E_{ON}	Turn-On Switching Energy (External SiC Diode)		1.14		mJ	V_{DS} = 800 V, V_{GS} = -5/20 V, I_D = 50A, $R_{G(ext)}$ = 2.5Ω,L= 99 µH FWD = External SiC Diode	Fig. 25
E_{OFF}	Turn Off Switching Energy (External SiC Diode)		0.8				
$t_{d(on)}$	Turn-On Delay Time		15		ns	V_{DD} = 800 V, V_{GS} = -5/20 V I_D = 50 A, $R_{G(ext)}$ = 2.5 Ω, Inductive Load Timing relative to V_{DS} Per IEC60747-8-4 pg 83	Fig. 27
t_r	Rise Time		58				
$t_{d(off)}$	Turn-Off Delay Time		33				
t_f	Fall Time		17				
$R_{G(int)}$	Internal Gate Resistance		1.0		Ω	f = 1 MHz, V_{AC} = 25 mV, ESR of C_{ISS}	
Q_{gs}	Gate to Source Charge		46		nC	V_{DS} = 800 V, V_{GS} = -5/20 V I_D = 50 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		71.5				
Q_g	Total Gate Charge		194				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.1		V	V_{GS} = - 5 V, I_{SD} = 25 A	Fig. 8, 9, 10
		3.5		V	V_{GS} = - 5 V, I_{SD} = 25 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		90	A	V_{GS} = - 5 V, T_C = 25 °C	Note 2
$I_{S, pulse}$	Diode Pulse Current		250	A	V_{GS} = - 5 V, Pulse width t_P limited by T_{jmax}	
t_{rr}	Reverse Recovery Time	33		ns	V_{GS} = - 5 V, I_{SD} = 50 A ,T_J = 25 °C VR = 800 V dif/dt = 2180 A/µs	Note 2
Q_{rr}	Reverse Recovery Charge	487		nC		
I_{rrm}	Peak Reverse Recovery Current	24		A		
t_{rr}	Reverse Recovery Time	67		ns	V_{GS} = - 5 V, I_{SD} = 50 A ,T_J = 25 °C VR = 800 V dif/dt = 1320 A/µs	Note 2
Q_{rr}	Reverse Recovery Charge	386		nC		
I_{rrm}	Peak Reverse Recovery Current	15		A		

Note (2): When using SiC Body Diode the maximum recommended V_{GS} = -5V

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.24	0.33	°C/W		Fig. 21
$R_{\theta JC}$	Thermal Resistance from Junction to Ambient		40			

Typical Performance

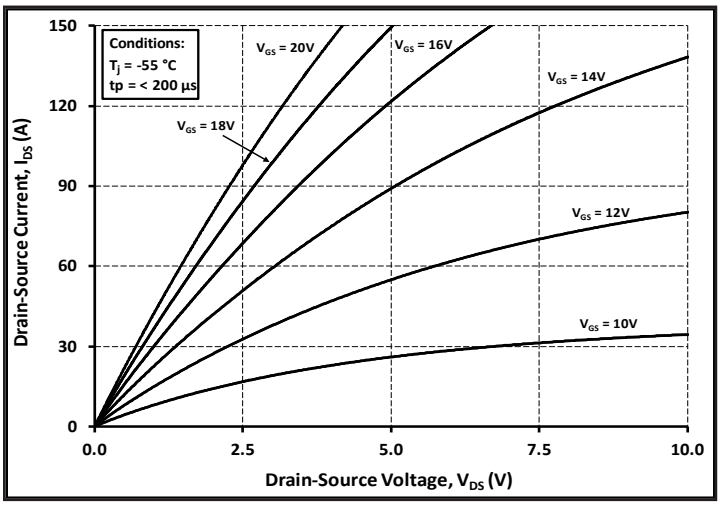


Figure 1. Output Characteristics T_J = -55 °C

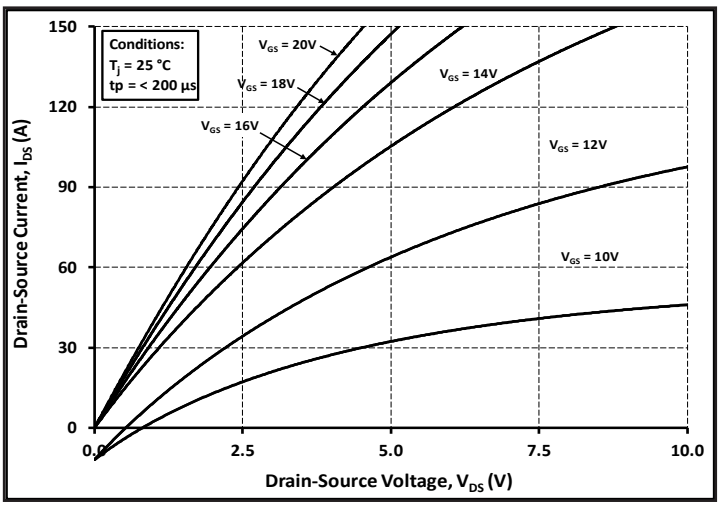


Figure 2. Output Characteristics T_J = 25 °C

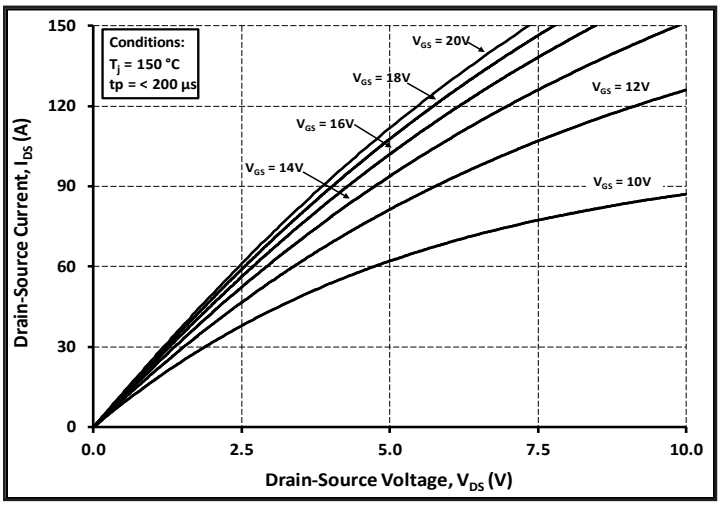


Figure 3. Output Characteristics T_J = 150 °C

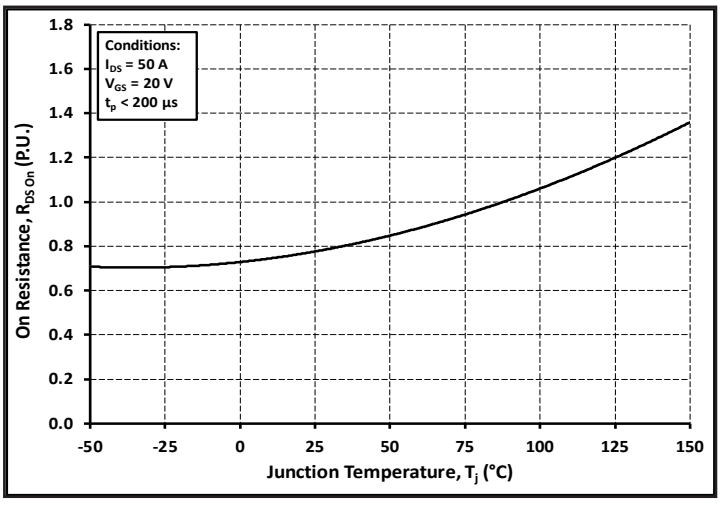


Figure 4. Normalized On-Resistance vs. Temperature

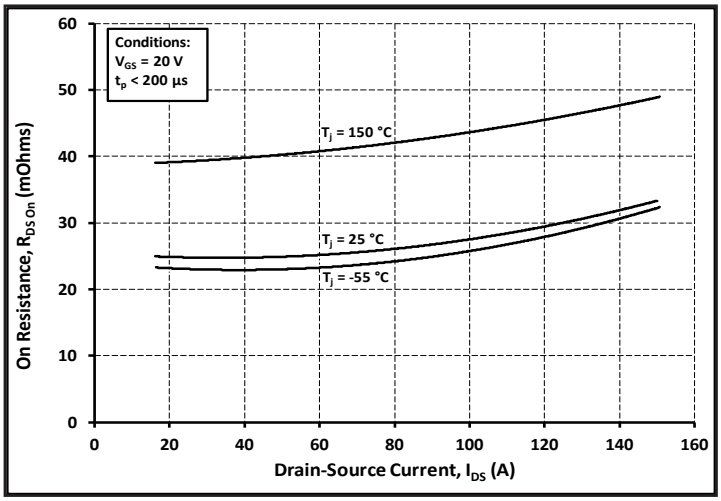


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

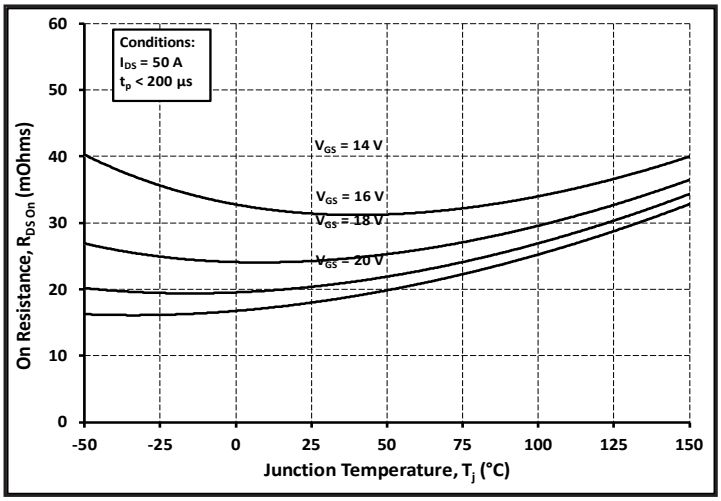


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

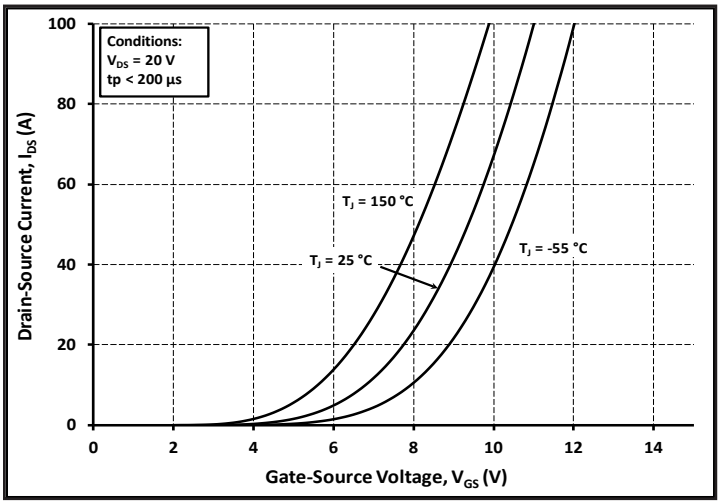


Figure 7. Transfer Characteristic For Various Junction Temperatures

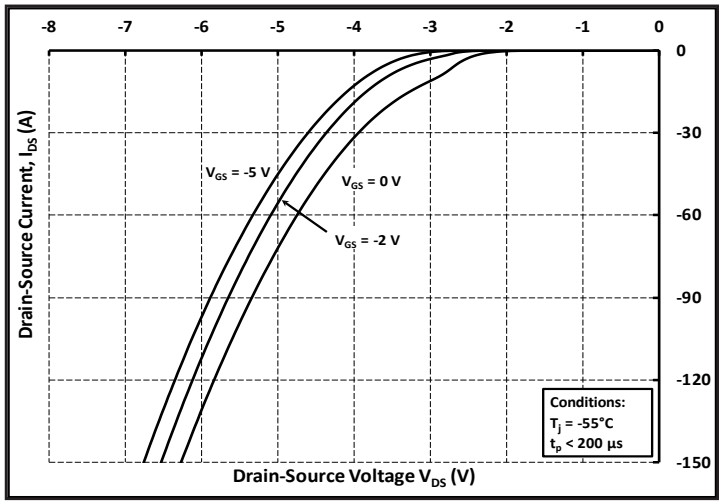


Figure 8. Body Diode Characteristic at -55 ºC

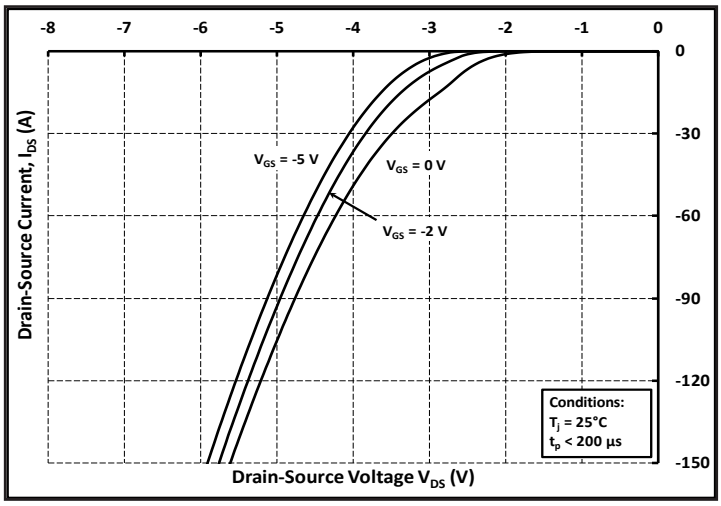


Figure 9. Body Diode Characteristic at 25 ºC

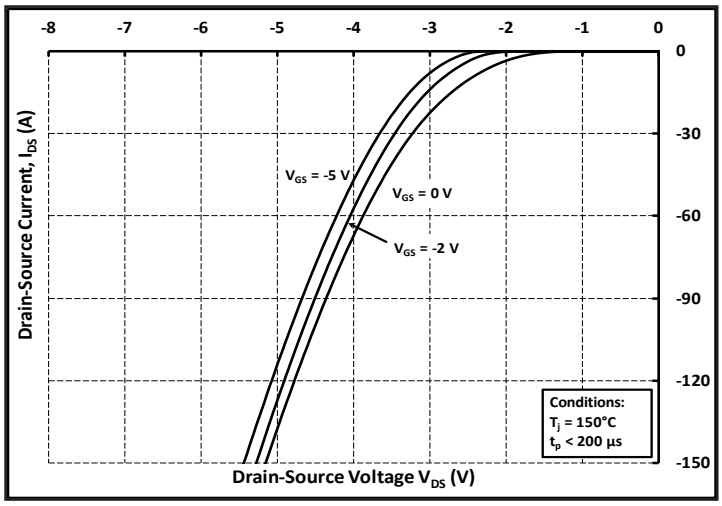


Figure 10. Body Diode Characteristic at 150 ºC

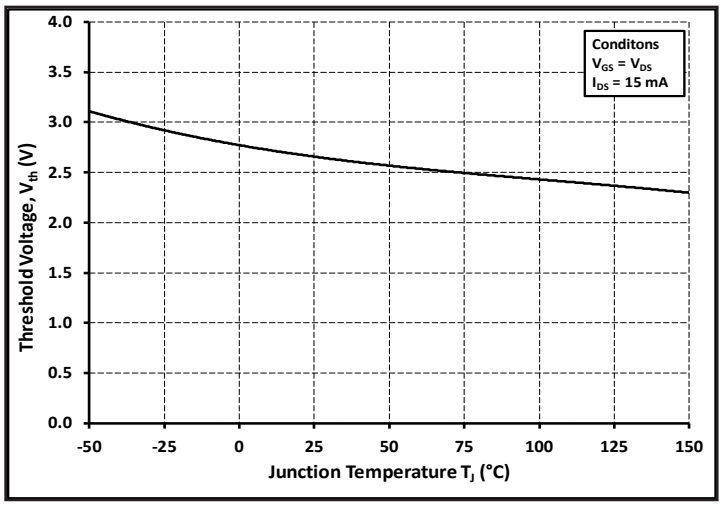


Figure 11. Threshold Voltage vs. Temperature

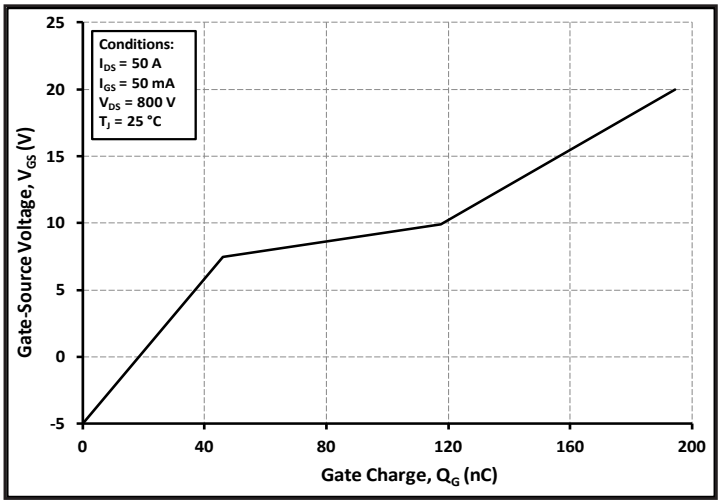


Figure 12. Gate Charge Characteristic

Typical Performance

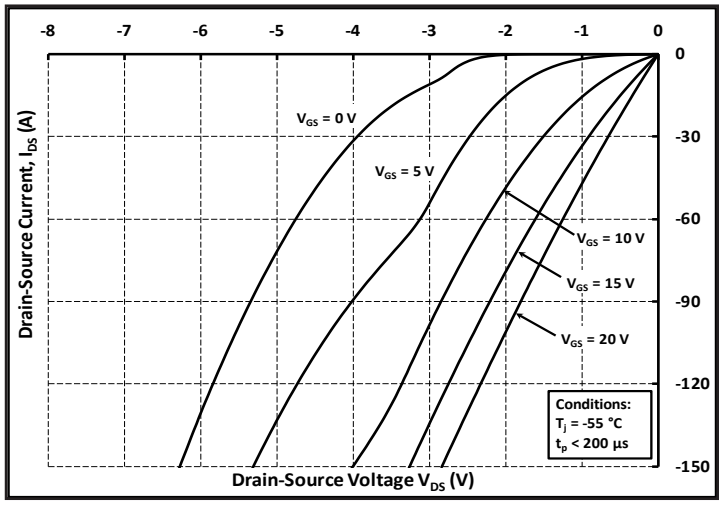


Figure 13. 3rd Quadrant Characteristic at -55 ºC

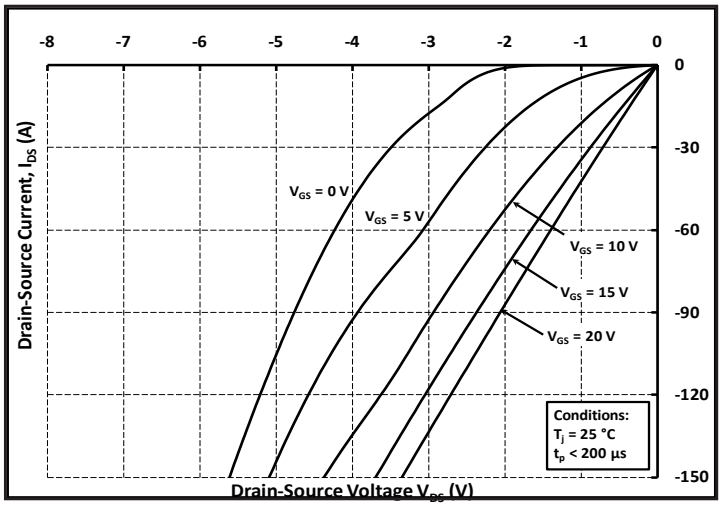


Figure 14. 3rd Quadrant Characteristic at 25 ºC

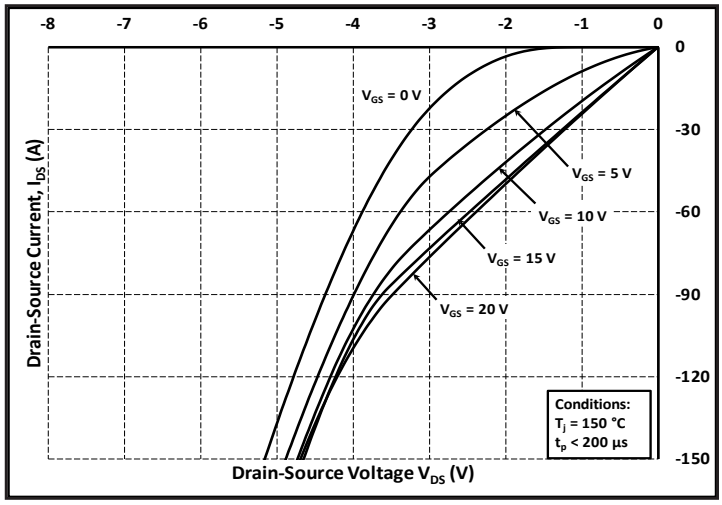


Figure 15. 3rd Quadrant Characteristic at 150 ºC

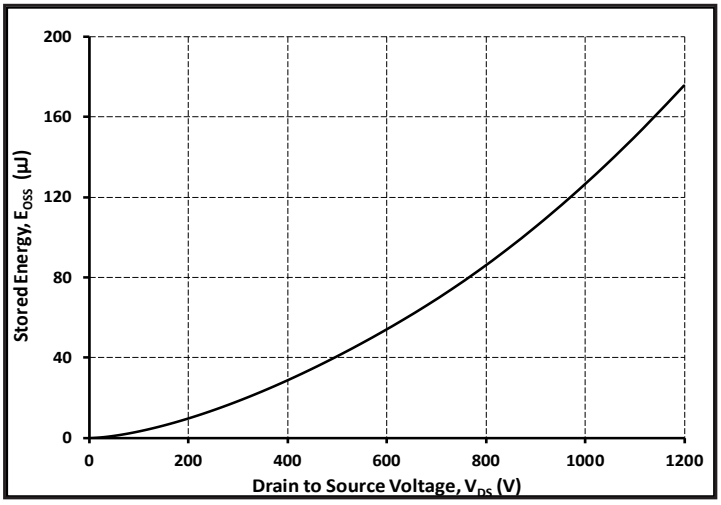


Figure 16. Output Capacitor Stored Energy

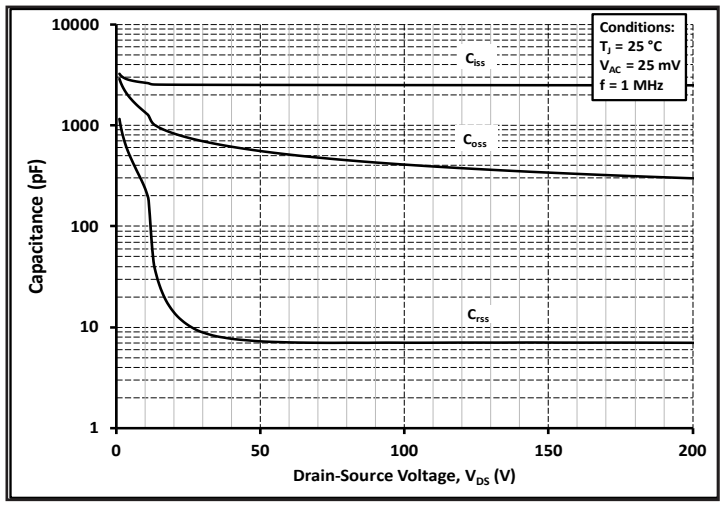


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

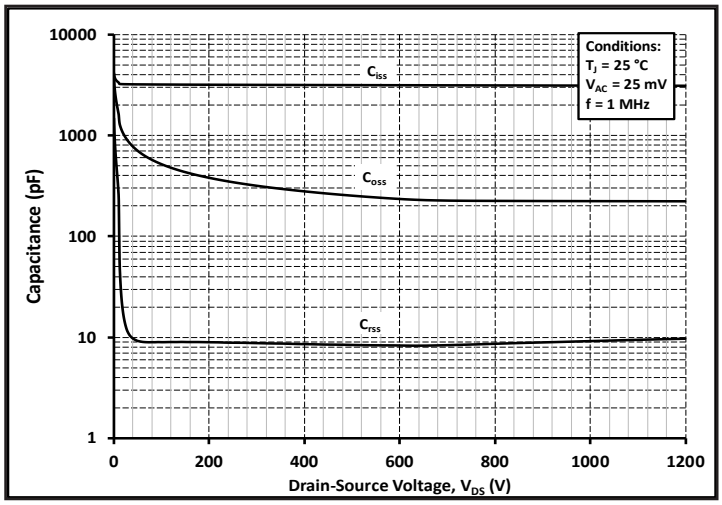


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)

Typical Performance

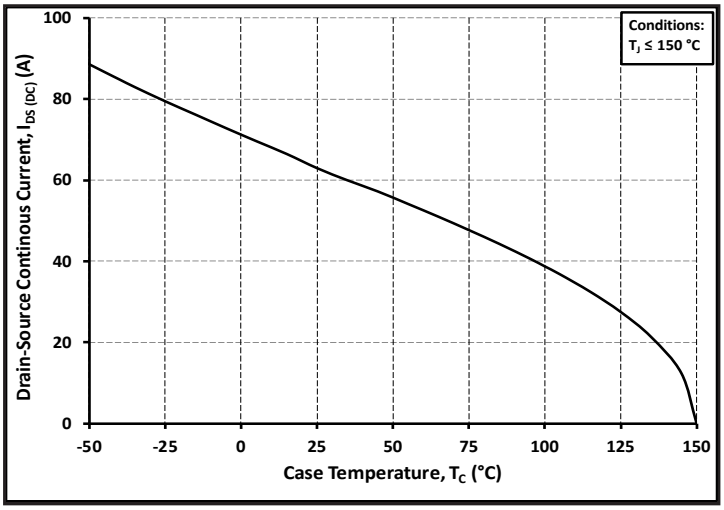


Figure 19. Continuous Drain Current Derating vs. Case Temperature

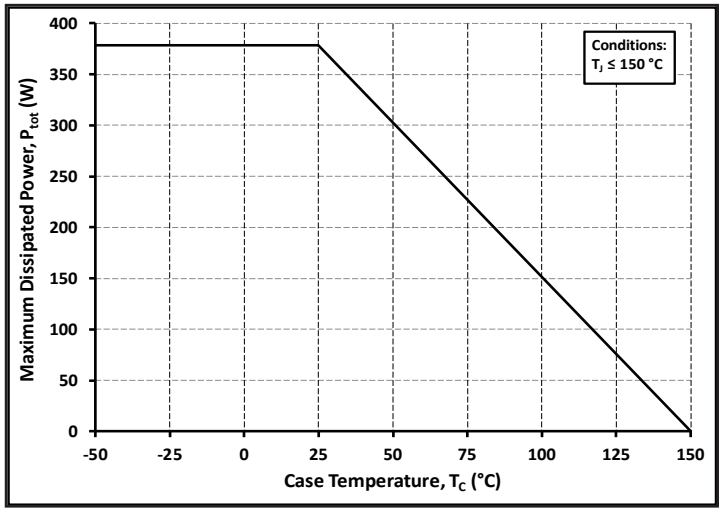


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

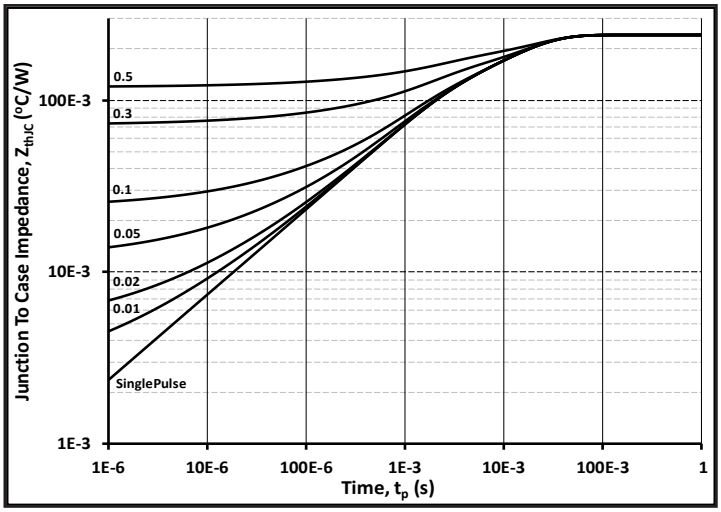


Figure 21. Transient Thermal Impedance (Junction - Case)

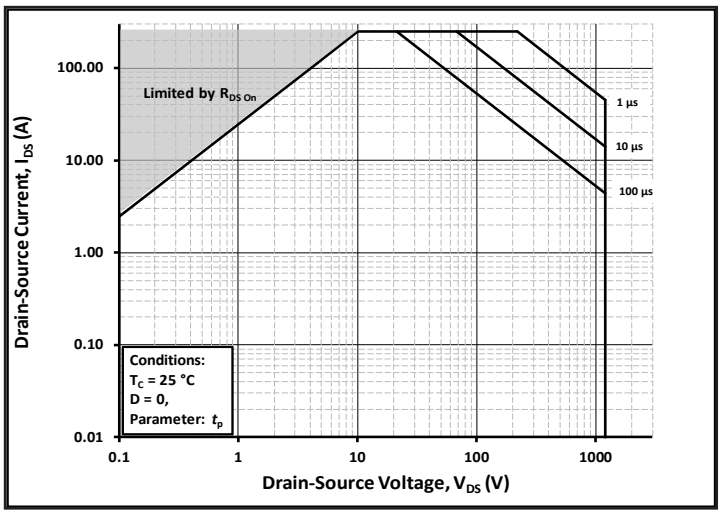


Figure 22. Safe Operating Area

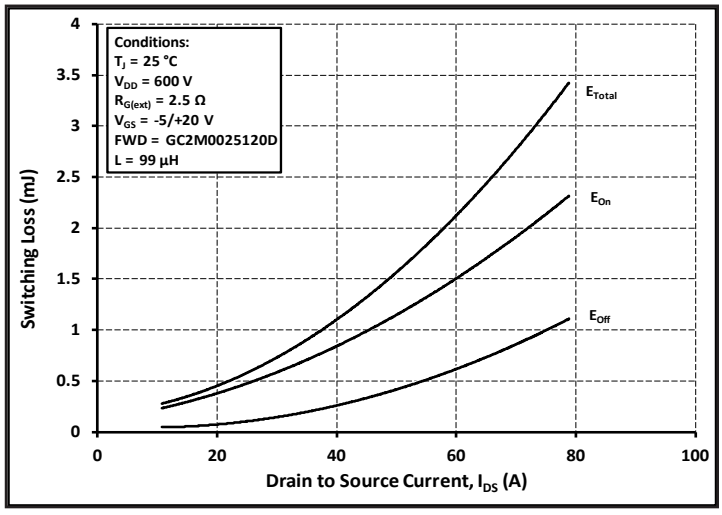


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

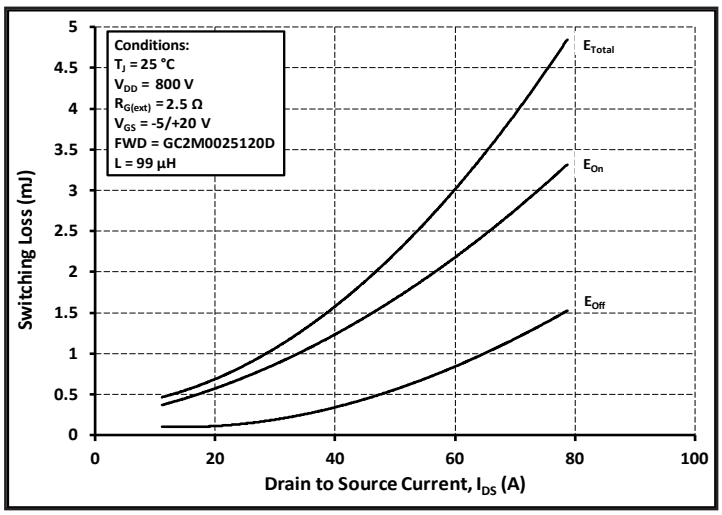


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

Typical Performance

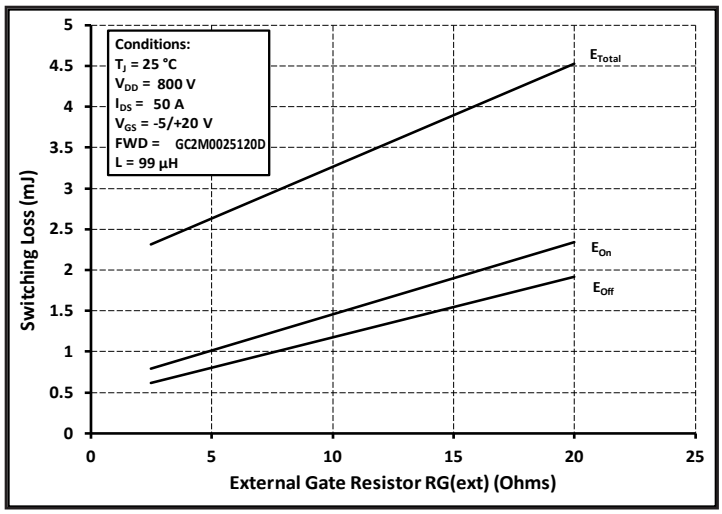


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

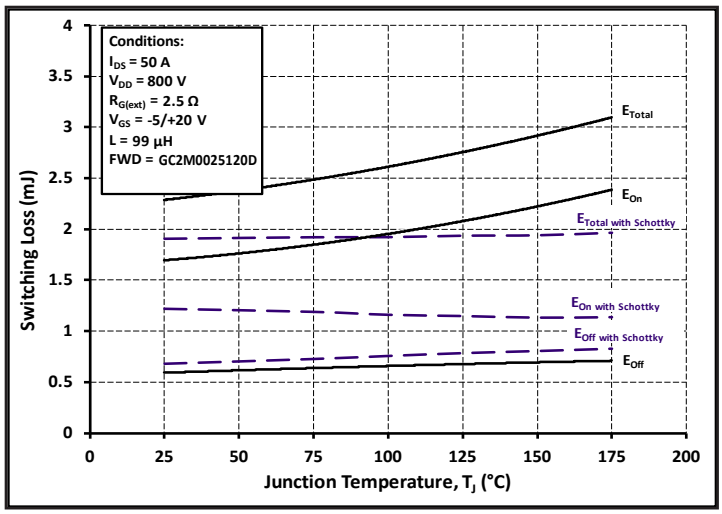


Figure 26. Clamped Inductive Switching Energy vs. Temperature

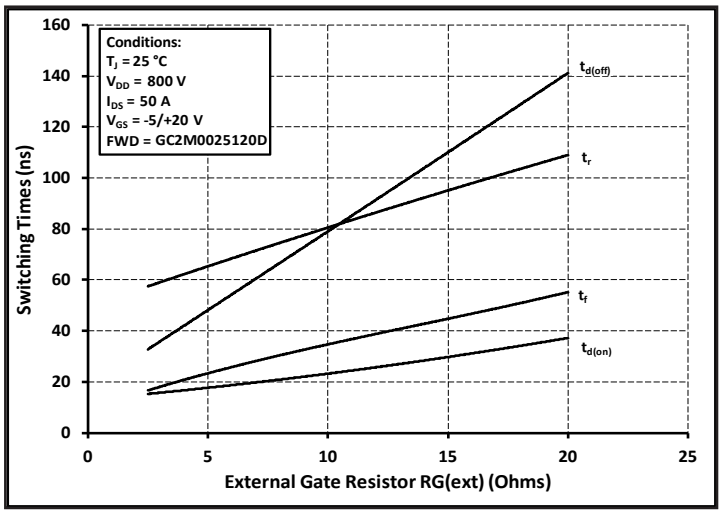


Figure 27. Switching Times vs. $R_{G(ext)}$

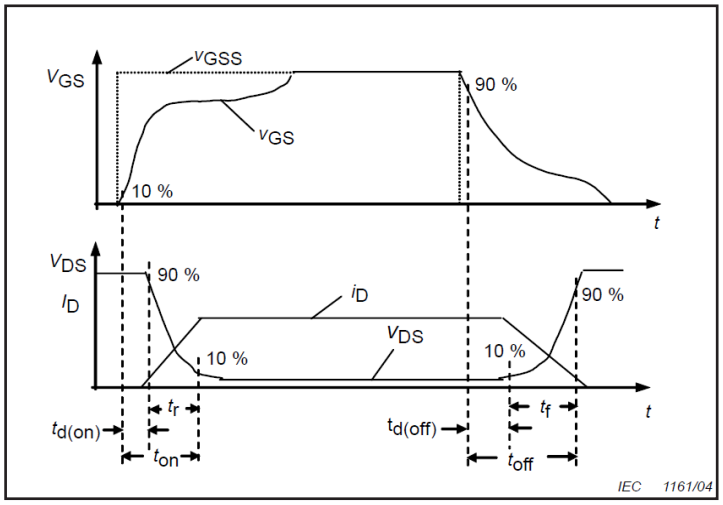


Figure 28. Switching Times Definition

Test Circuit Schematic

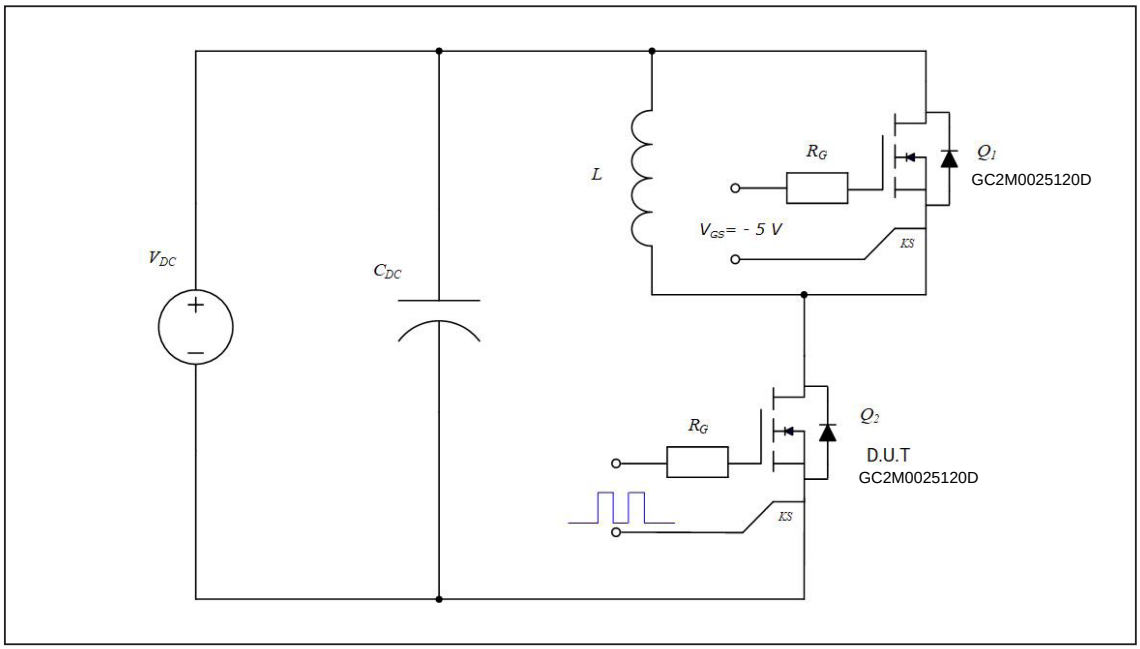


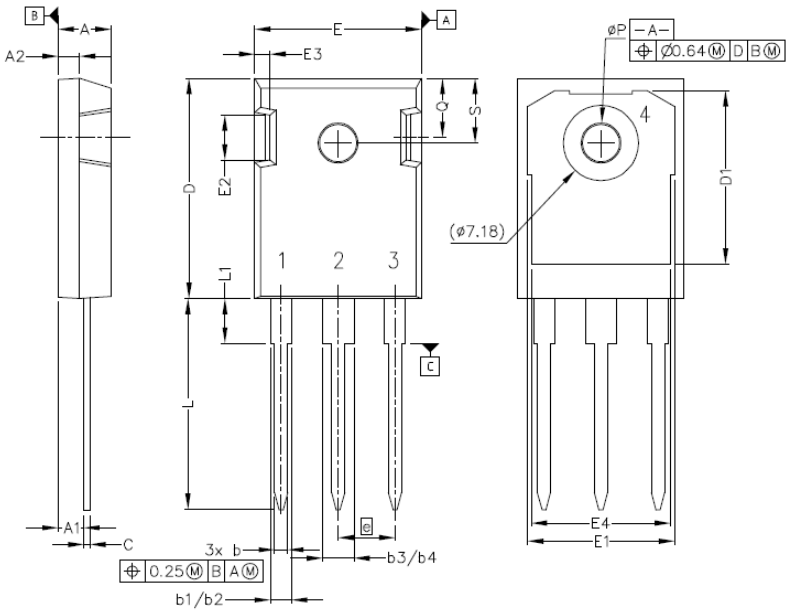
Figure 29. Clamped Inductive Switching
Waveform Test Circuit

ESD Ratings

ESD Test	Resulting Classification
ESD-HBM	3A (4000V - 8000V)
ESD-CDM	C3 (>=1000V)

Package Dimensions

Package TO-247-3

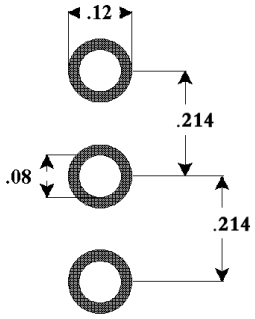


POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.049	0.95	1.25
E	.620	.635	15.75	16.13
E1	.516	.557	13.10	14.15
E2	.145	.201	3.68	5.10
E3	.039	.075	1.00	1.90
E4	.487	.529	12.38	13.43
e	.214 BSC		5.44 BSC	
N	3		3	
L	.780	.800	19.81	20.32
L1	.161	.173	4.10	4.40
ØP	.138	.144	3.51	3.65
Q	.216	.236	5.49	6.00
S	.238	.248	6.04	6.30
T	9°	11°	9°	11°
U	9°	11°	9°	11°
V	2°	8°	2°	8°
W	2°	8°	2°	8°

Pinout Information:

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

Recommended Solder Pad Layout



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