SUPSiC®

无锡国晶微半导体技术有限公司
Wuxi Gwok Semiconductor Co.,Ltd

GC2M0280120D

Silicon Carbide Power MOSFET

N-Channel Enhancement Mode

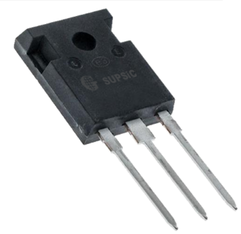
Features

- 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˚C	11 A
$R_{DS(on)}$	280 mΩ

Benefits

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

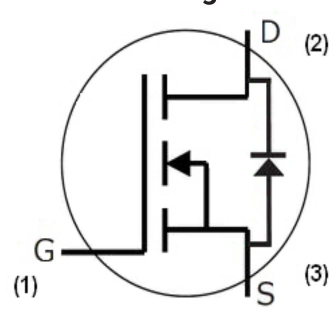


TO-247-3

Applications

- LED Lighting Power Supplies
- High Voltage DC/DC Converters
- Industrial Power Supplies
- HVAC

Package



Part Number	Package	Marking
GC2M0280120D	TO-247-3	GC2M0280120

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	11	A	V_{GS} = 20 V, T_C = 25 °C	Fig. 19
		7.5		V_{GS} = 20 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	69.4	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	1.6 mm (0.063”) from case for 10s	
M_d	Mounting Torque	1 8.8	Nm lbf-in	M3 or 6-32 screw	

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	3.1	4	V	V_{DS} = V_{GS}, I_D = 1.25mA	Fig. 11
			2.7		V	V_{DS} = V_{GS}, I_D = 1.25mA, T_J = 150 °C	
I_{DSS}	Zero Gate Voltage Drain Current		1	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		320	370	mΩ	V_{GS} = 20 V, I_D = 6 A	Fig. 4,5,6
			540			V_{GS} = 20 V, I_D = 6 A, T_J = 150 °C	
g_{fs}	Transconductance		2.6		S	V_{DS}= 20 V, I_{DS}= 6 A	Fig. 7
			2.5			V_{DS}= 20 V, I_{DS}= 6 A, T_J = 150 °C	
C_{iss}	Input Capacitance		267		pF	V_{GS} = 0 V V_{DS} = 1000 V f = 1 MHz V_{AC} = 25 mV	Fig. 17,18
C_{oss}	Output Capacitance		31				
C_{rss}	Reverse Transfer Capacitance		4				
E_{oss}	C_{oss} Stored Energy		17		μJ		Fig 16
E_{ON}	Turn-On Switching Energy (Body Diode)		111		μJ	V_{DS} = 800 V, V_{GS} = -5/20 V, I_D = 6A, $R_{G(ext)}$ = 2.5Ω, L= 404 μH FWD = Internal Body Diode of MOSFET	Fig. 25
E_{OFF}	Turn Off Switching Energy (Body Diode)		10				
E_{ON}	Turn-On Switching Energy (External Diode)		95		μJ	V_{DS} = 800 V, V_{GS} = -5/20 V, I_D = 6A, $R_{G(ext)}$ = 2.5Ω, L= 404 μH FWD = External SiC Diode	Fig. 25
E_{OFF}	Turn Off Switching Energy (External Diode)		9.8				
$t_{d(on)}$	Turn-On Delay Time		6		ns	V_{DD} = 800 V, V_{GS} = -5/20 V I_D = 6 A, $R_{G(ext)}$ = 2.5 Ω, Inductive Load Timing relative to V_{DS} Per IEC60747-8-4 pg 21	Fig. 27
t_r	Rise Time		19				
$t_{d(off)}$	Turn-Off Delay Time		10				
t_f	Fall Time		16				
$R_{G(int)}$	Internal Gate Resistance		10		Ω	f = 1 MHz, V_{AC} = 25 mV, ESR of C_{ISS}	
Q_{gs}	Gate to Source Charge		6		nC	V_{DS} = 800 V, V_{GS} = -5/20 V I_D = 6 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		7				
Q_g	Gate Charge Total		19				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.3		V	V_{GS} = - 5 V, I_{SD} = 3 A	Fig. 8, 9, 10
		3.8		V	V_{GS} = - 5 V, I_{SD} = 3 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		12	A	V_{GS} = - 5 V, T_C= 25 °C	Note 1
$I_{S, pulse}$	Diode Pulse Current		20		V_{GS} = - 5 V, Pulse width t_P limited by T_{jmax}	
t_{rr}	Reverse Recovery time	17		ns	V_{GS} = - 5 V, I_{SD} = 6 A, V_R = 800 V dif/dt = 2985 A/μs	Note 1
Q_{rr}	Reverse Recovery Charge	48		nC		
I_{rrm}	Peak Reverse Recovery Current	5		A		
t_{rr}	Reverse Recovery time	25		ns	V_{GS} = - 5 V, I_{SD} = 6 A, V_R = 800 V dif/dt = 1000 A/μs	Note 1
Q_{rr}	Reverse Recovery Charge	45		nC		
I_{rrm}	Peak Reverse Recovery Current	4		A		

Note (1): When using SiC Body Diode the maximum recommended V_{GS} = -5V

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{θJC}$	Thermal Resistance from Junction to Case	1.53	1.8	°C/W		Fig. 21
$R_{θJC}$	Thermal Resistance from Junction to Ambient		40			

Typical Performance

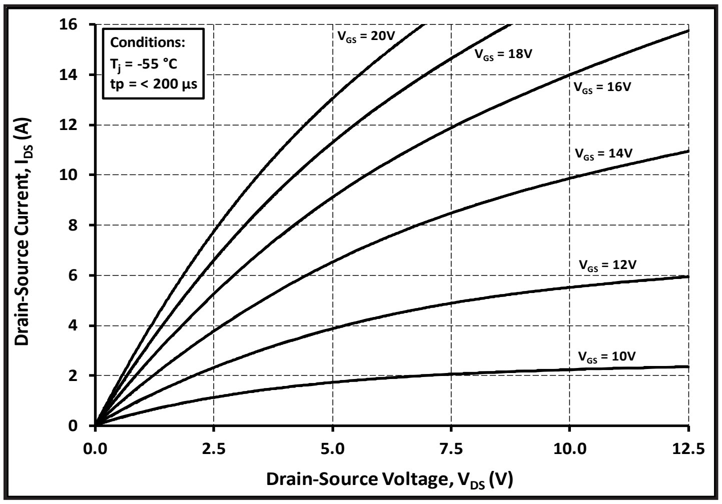


Figure 1. Output Characteristics T_J = -55 °C

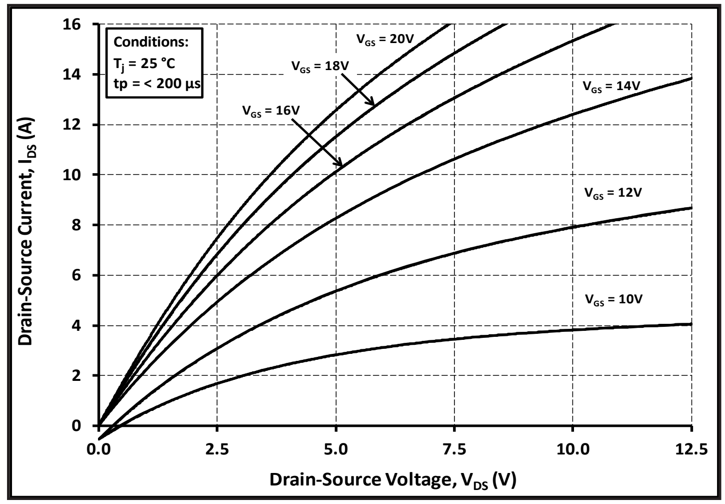


Figure 2. Output Characteristics T_J = 25 °C

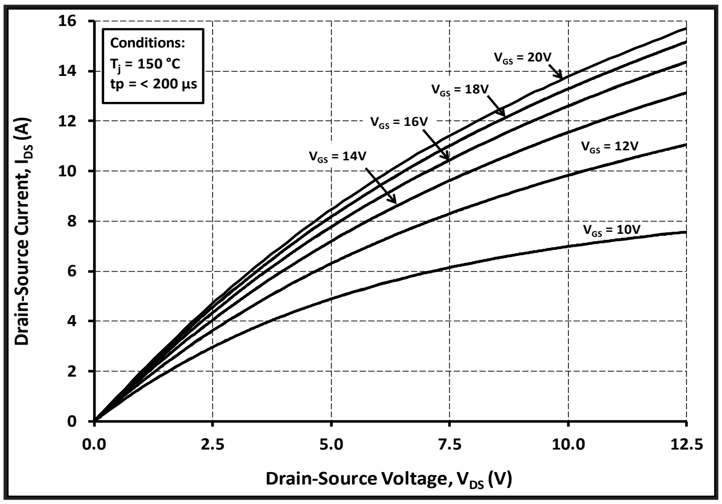


Figure 3. Output Characteristics T^J = 150 °C

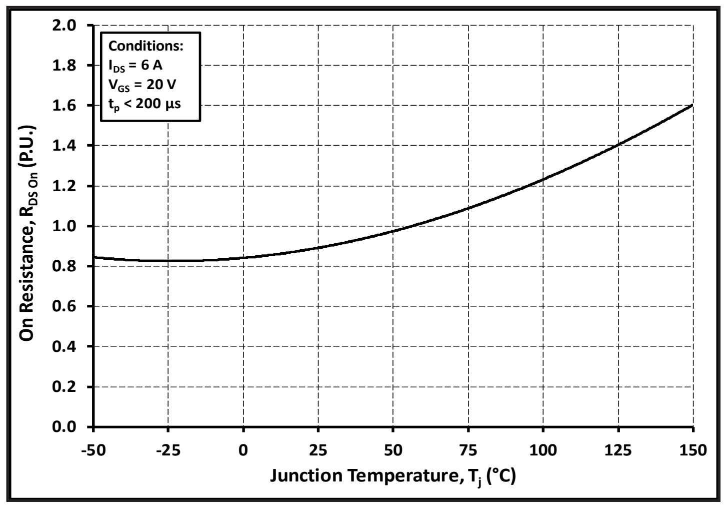


Figure 4. Normalized On-Resistance vs. Temperature

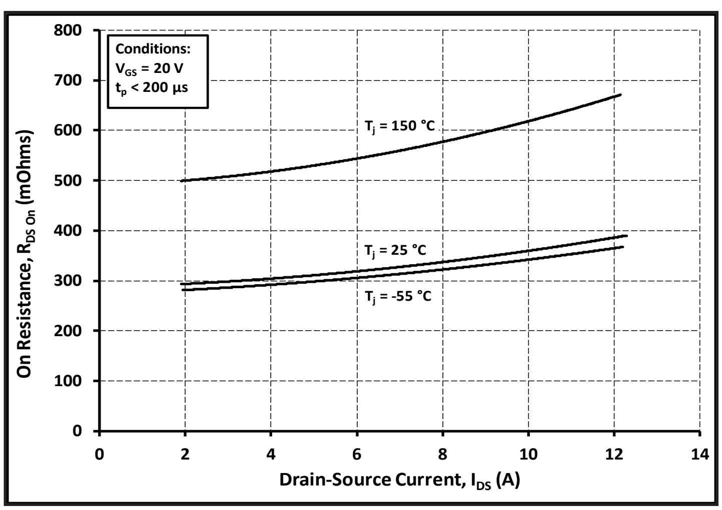


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

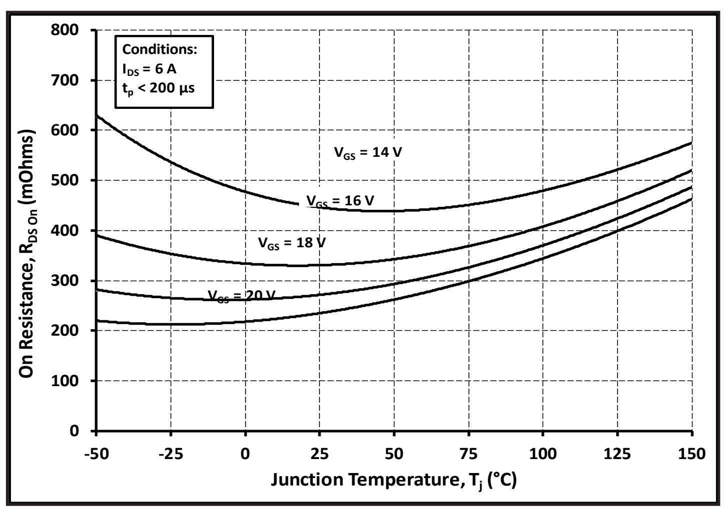


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

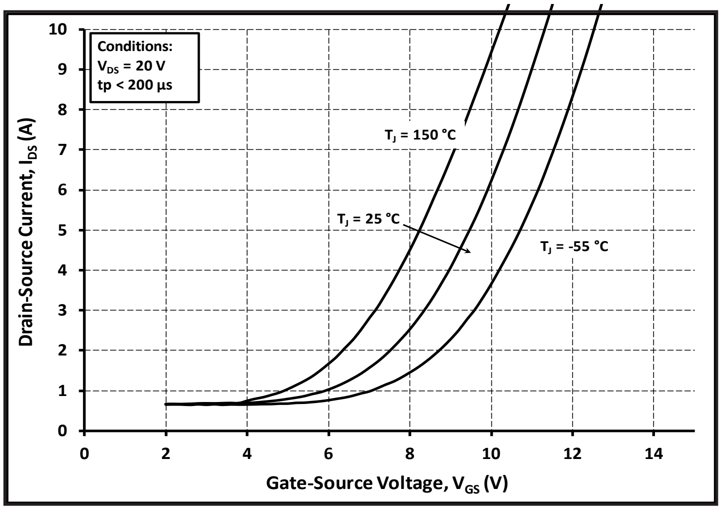


Figure 7. Transfer Characteristic For Various Junction Temperatures

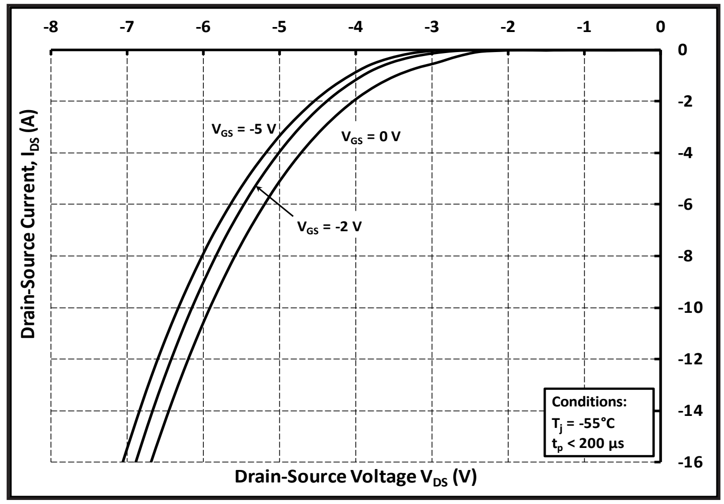


Figure 8. Body Diode Characteristic at -55 °C

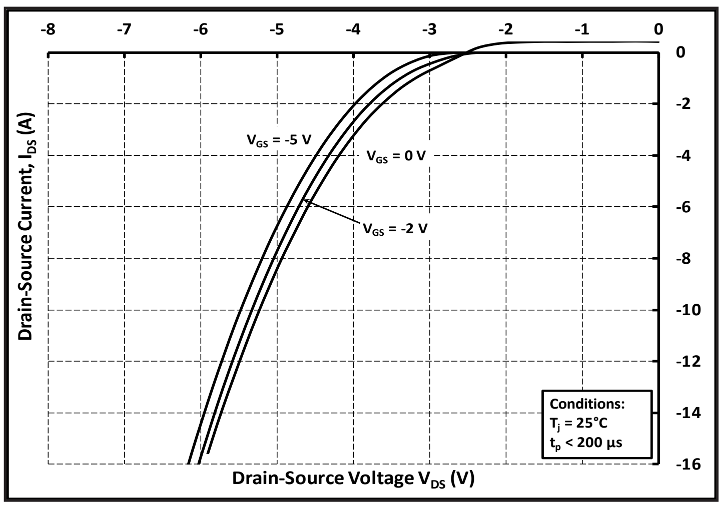


Figure 9. Body Diode Characteristic at 25 °C

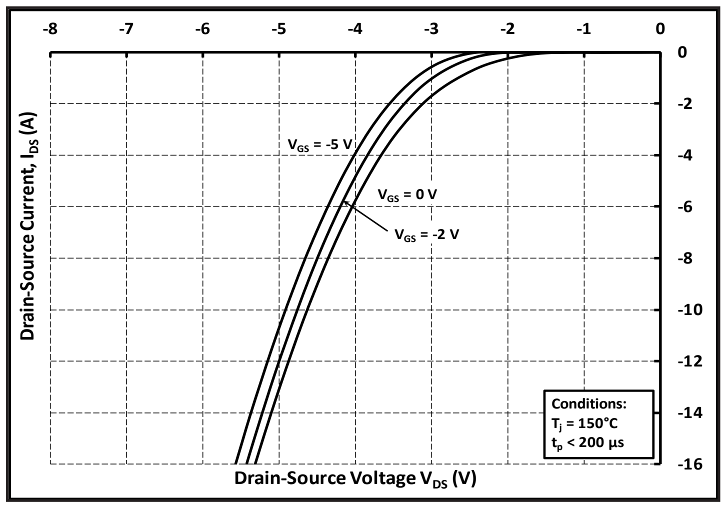


Figure 10. Body Diode Characteristic at 150 °C

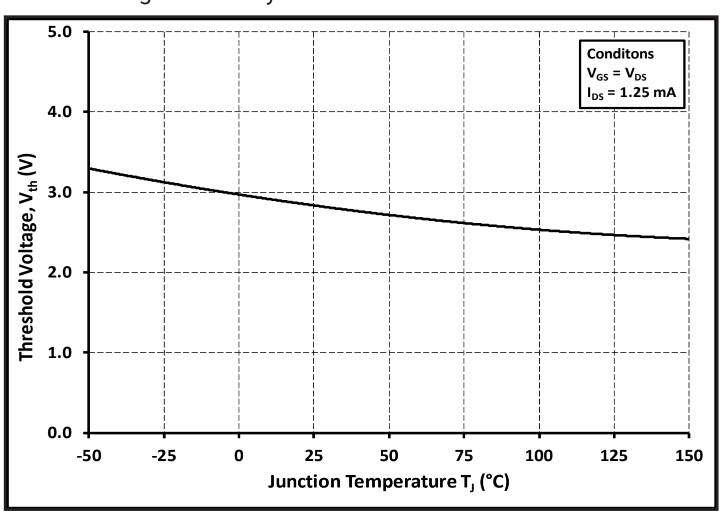


Figure 11. Threshold Voltage vs. Temperature

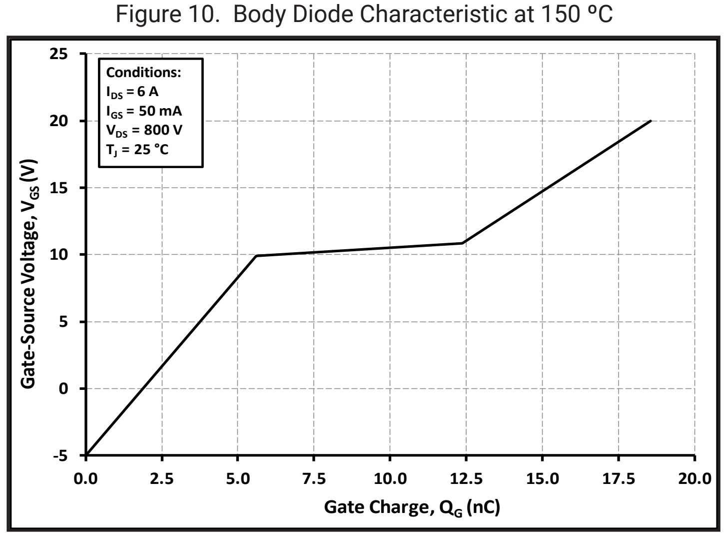


Figure 12. Gate Charge Characteristics

Typical Performance

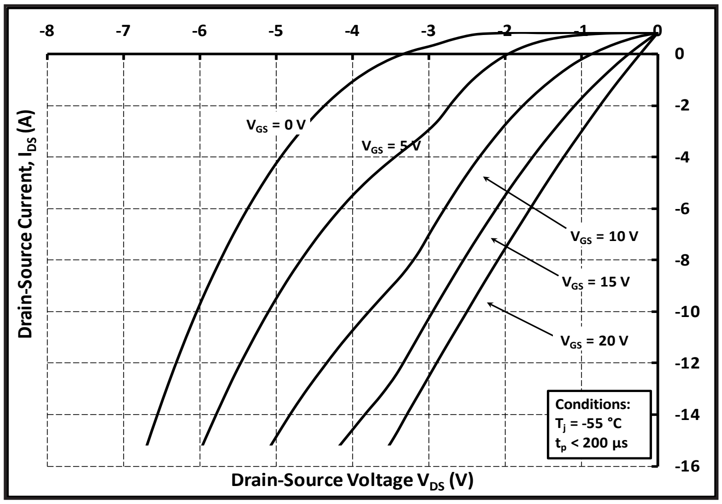


Figure 13. 3rd Quadrant Characteristic at -55 °C

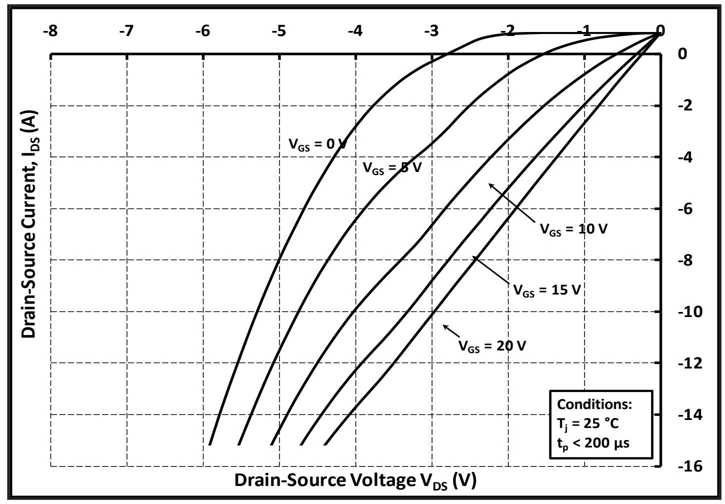


Figure 14. 3rd Quadrant Characteristic at 25 °C

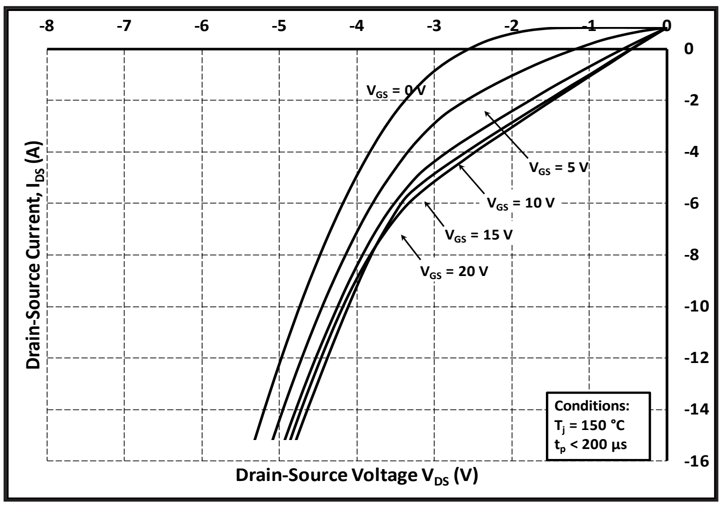


Figure 15. 3rd Quadrant Characteristic at 150 °C

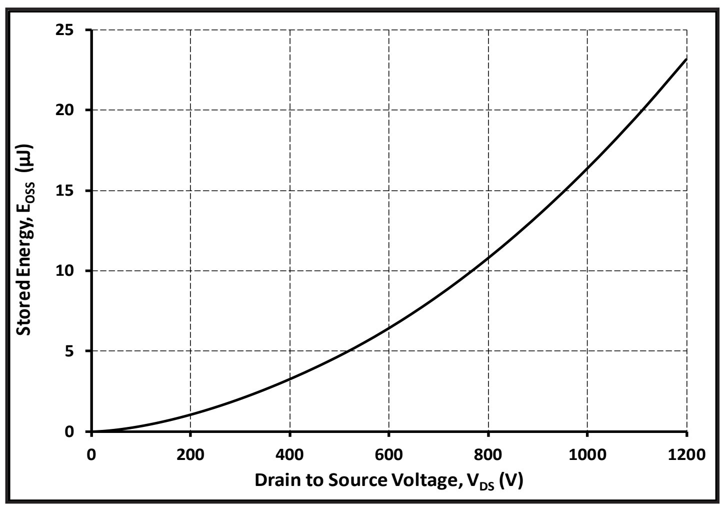


Figure 16. Output Capacitor Stored Energy

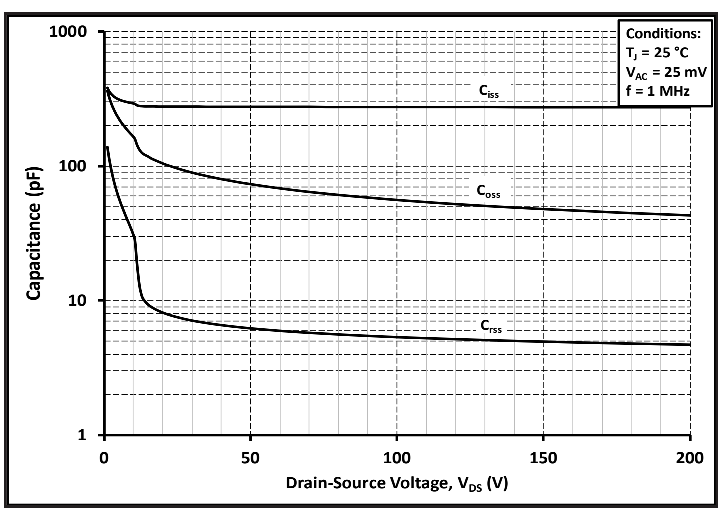


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

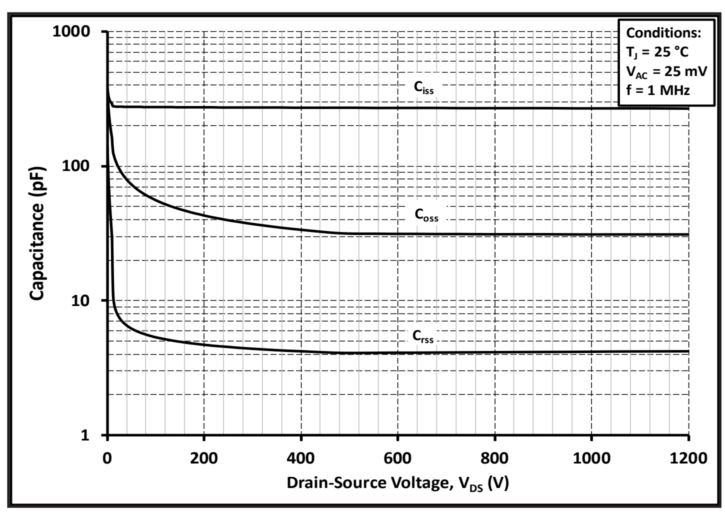


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)

Typical Performance

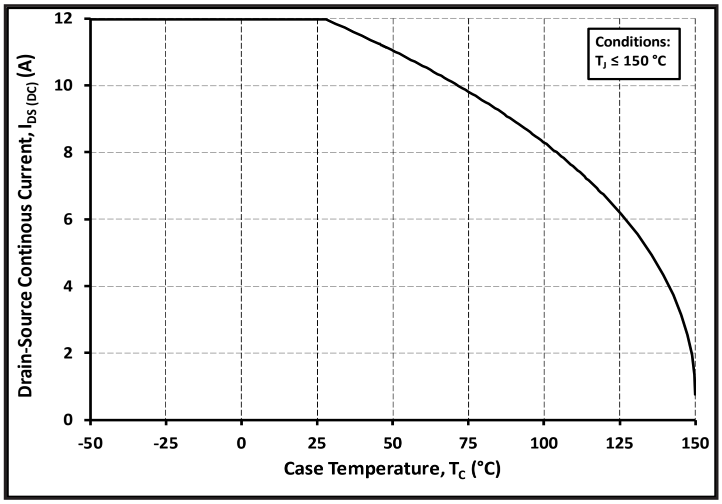


Figure 19. Continuous Drain Current Derating vs. Case Temperature

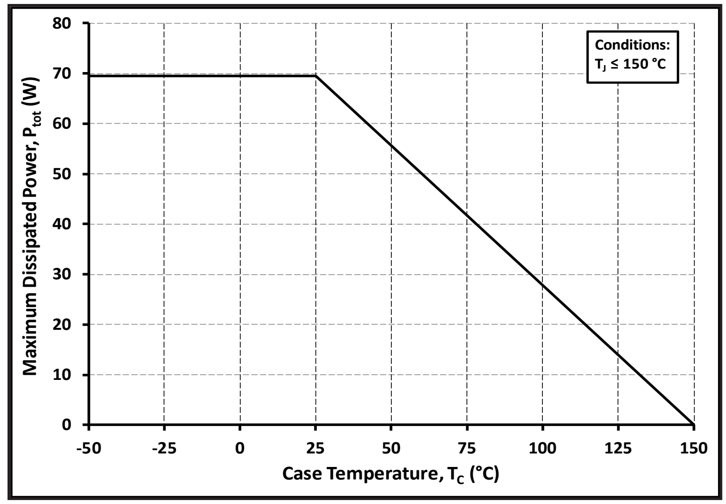


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

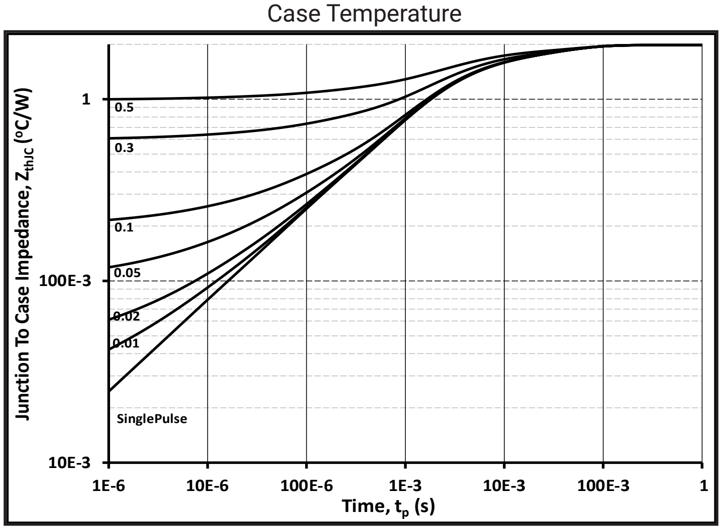


Figure 21. Transient Thermal Impedance (Junction - Case)

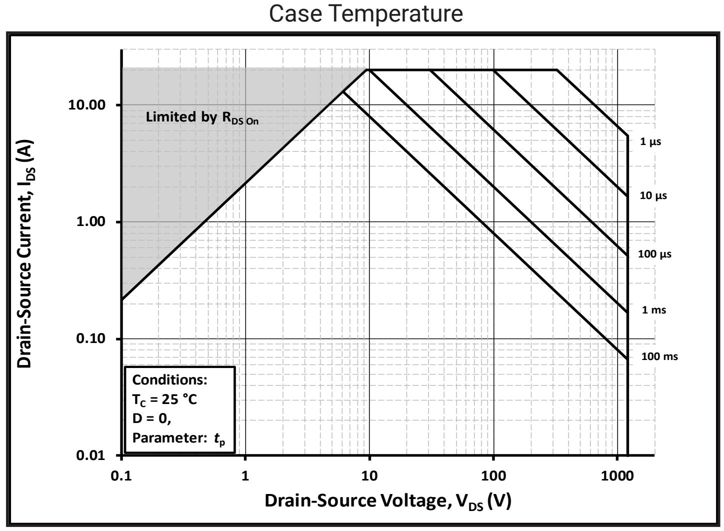


Figure 22. Safe Operating Area

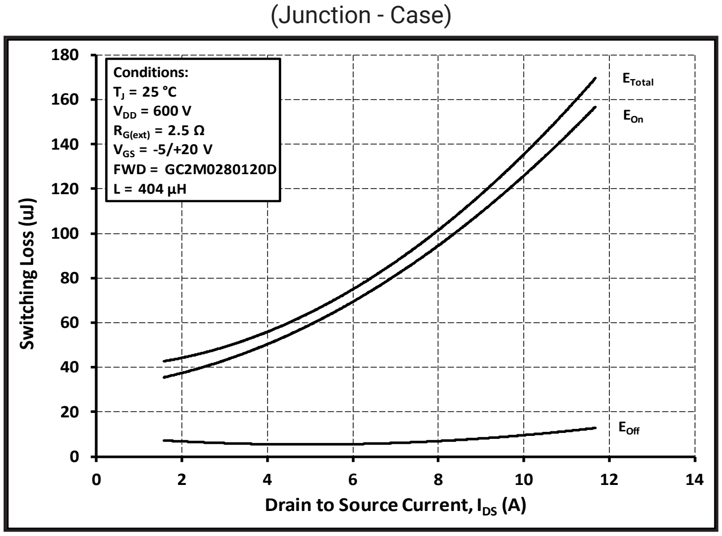


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

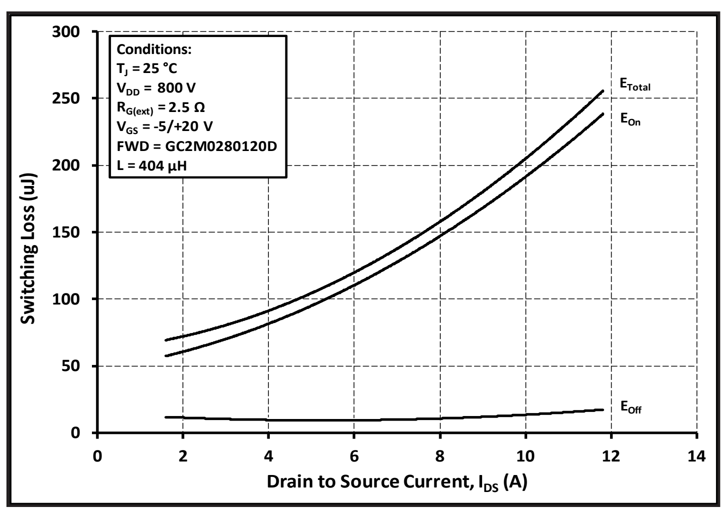


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 800V)

Typical Performance

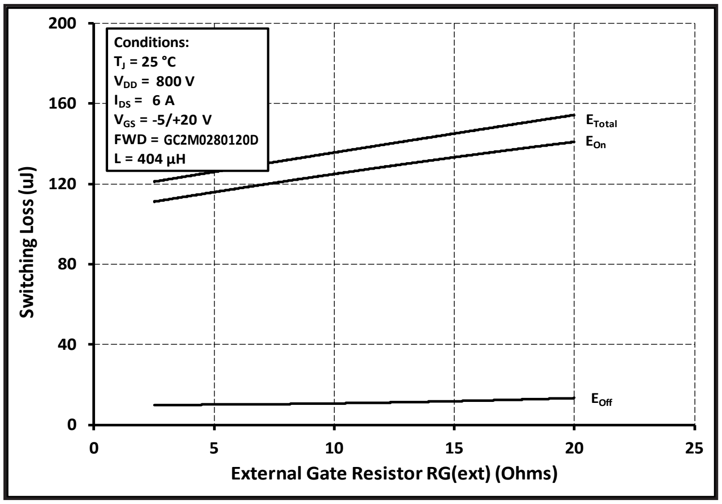


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

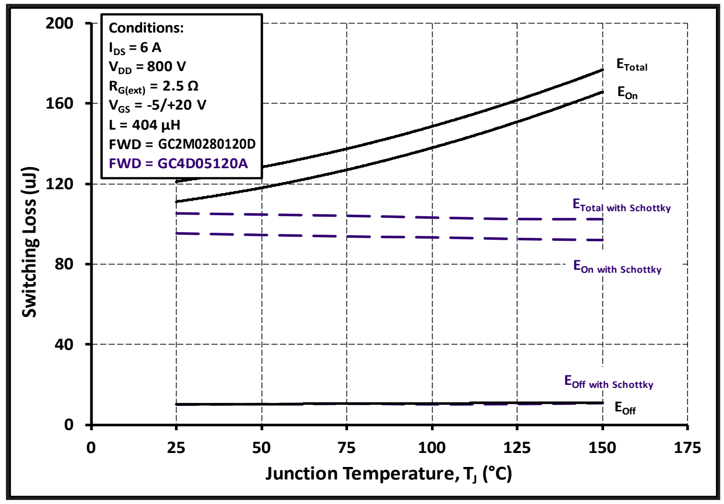


Figure 26. Clamped Inductive Switching Energy vs. Temperature

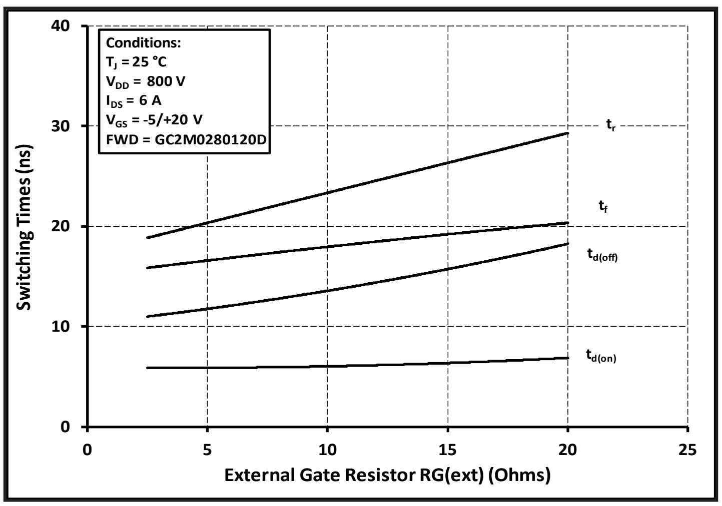


Figure 27. Switching Times vs. $R_{G(ext)}$

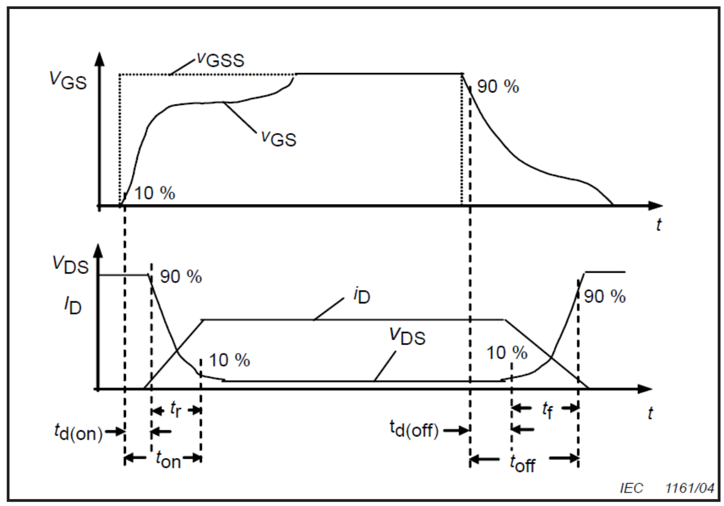


Figure 28. Switching Time Definition

Test Circuit Schematic

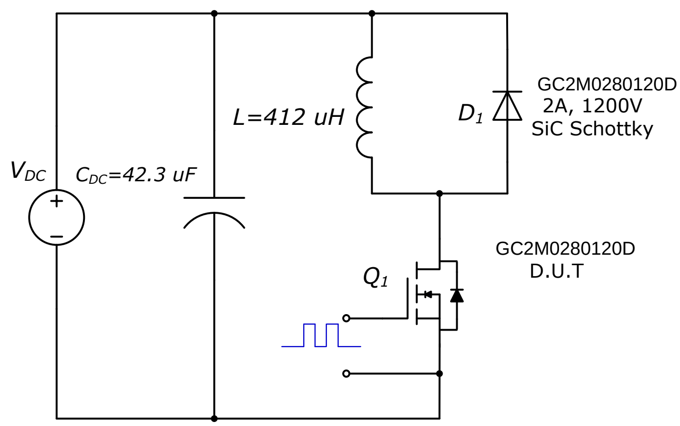


Figure 30. Clamped Inductive Switching Waveform Test Circuit

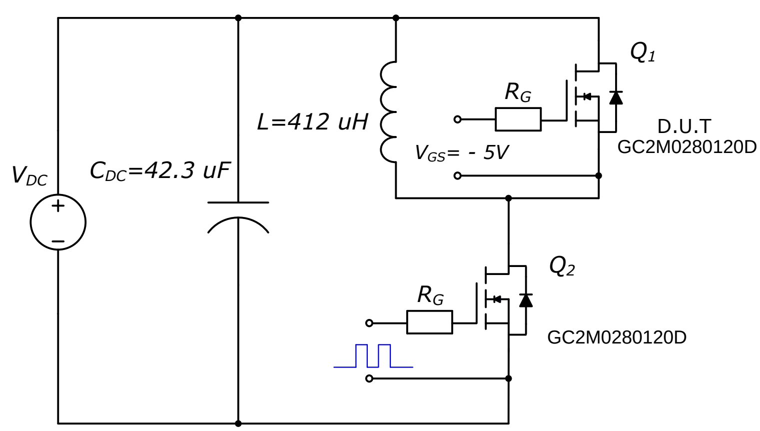


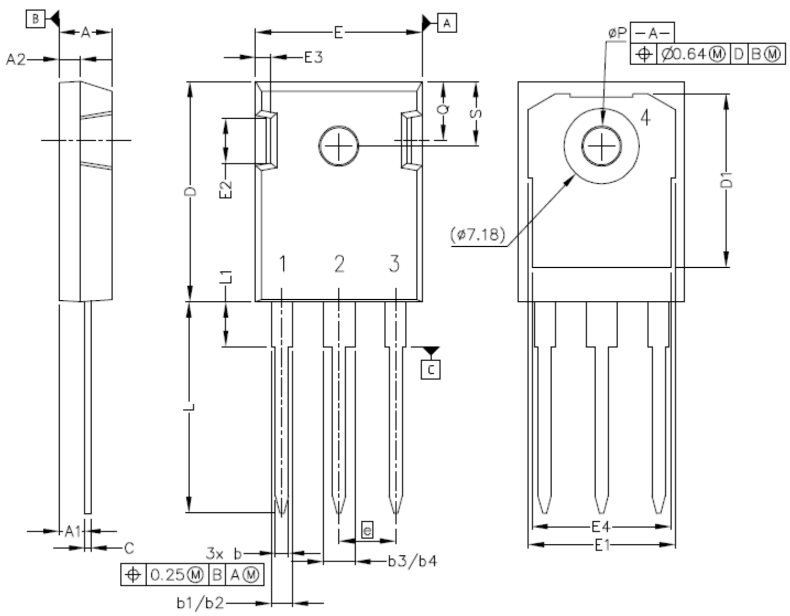
Figure 31. Body Diode Recovery Test Circuit

ESD Ratings

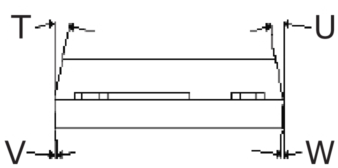
ESD Test	Resulting Classification
ESD-HBM	1A (250V - 500V)
ESD-CDM	C3 (>1000V)

Package Dimensions

Package TO-247-3



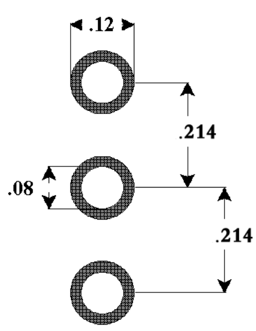
POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.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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