

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
$I_D @ 25^\circ C$	11 A
$R_{DS(on)}$	280 m Ω



TO-247-3

Benefits

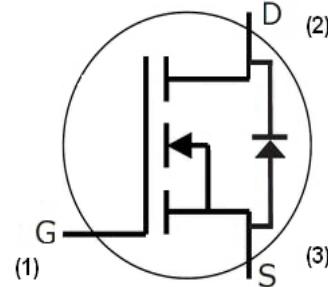
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

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

Part Number	Package	Marking
GC2M0280120D	TO-247-3	GC2M0280120

Package



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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1200	V	$V_{GS} = 0 V, I_D = 100 \mu A$	
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	$V_{GS} = 20 V, T_c = 25^\circ C$	Fig. 19
		7.5		$V_{GS} = 20 V, T_c = 100^\circ C$	
$I_{D(pulse)}$	Pulsed Drain Current	20	A	Pulse width t_p limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	69.4	W	$T_c = 25^\circ C, T_J = 150^\circ C$	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 ($T_c = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	1200			V	$V_{GS} = 0 \text{ V}, I_D = 100 \mu\text{A}$	
$V_{GS(\text{th})}$	Gate Threshold Voltage	2.0	3.1	4	V	$V_{DS} = V_{GS}, I_D = 1.25 \text{ mA}$	Fig. 11
			2.7		V	$V_{DS} = V_{GS}, I_D = 1.25 \text{ mA}, T_J = 150^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	μA	$V_{DS} = 1200 \text{ V}, V_{GS} = 0 \text{ V}$	
I_{GSS}	Gate-Source Leakage Current			250	nA	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$	
$R_{DS(\text{on})}$	Drain-Source On-State Resistance		320	370	$\text{m}\Omega$	$V_{GS} = 20 \text{ V}, I_D = 6 \text{ A}$	Fig. 4,5,6
			540			$V_{GS} = 20 \text{ V}, I_D = 6 \text{ A}, T_J = 150^\circ\text{C}$	
g_{fs}	Transconductance		2.6		S	$V_{DS} = 20 \text{ V}, I_{DS} = 6 \text{ A}$	Fig. 7
			2.5			$V_{DS} = 20 \text{ V}, I_{DS} = 6 \text{ A}, T_J = 150^\circ\text{C}$	
C_{iss}	Input Capacitance		267		pF	$V_{GS} = 0 \text{ V}$	Fig. 17,18
C_{oss}	Output Capacitance		31			$V_{DS} = 1000 \text{ V}$	
C_{rss}	Reverse Transfer Capacitance		4			$f = 1 \text{ MHz}$	
E_{oss}	C_{oss} Stored Energy		17		μJ	$V_{AC} = 25 \text{ mV}$	Fig 16
E_{ON}	Turn-On Switching Energy (Body Diode)		111		μJ	$V_{DS} = 800 \text{ V}, V_{GS} = -5/20 \text{ V}, I_D = 6 \text{ A}, R_{G(\text{ext})} = 2.5 \Omega, L = 404 \mu\text{H}$	Fig. 25
E_{OFF}	Turn Off Switching Energy (Body Diode)		10			FWD = Internal Body Diode of MOSFET	
E_{ON}	Turn-On Switching Energy (External Diode)		95		μJ	$V_{DS} = 800 \text{ V}, V_{GS} = -5/20 \text{ V}, I_D = 6 \text{ A}, R_{G(\text{ext})} = 2.5 \Omega, L = 404 \mu\text{H}$	Fig. 25
E_{OFF}	Turn Off Switching Energy (External Diode)		9.8			FWD = External SiC Diode	
$t_{d(on)}$	Turn-On Delay Time		6		ns	$V_{DD} = 800 \text{ V}, V_{GS} = -5/20 \text{ V}, I_D = 6 \text{ A}, R_{G(\text{ext})} = 2.5 \Omega, \text{ Inductive Load}$ 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				
$R_{G(\text{int})}$	Internal Gate Resistance		10		Ω	$f = 1 \text{ MHz}, V_{AC} = 25 \text{ mV}, \text{ESR of } C_{iss}$	
Q_{gs}	Gate to Source Charge		6		nC	$V_{DS} = 800 \text{ V}, V_{GS} = -5/20 \text{ V}, I_D = 6 \text{ A}$ 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	$V_{GS} = -5\text{ V}$, $I_{SD} = 3\text{ A}$	Fig. 8, 9, 10
		3.8		V	$V_{GS} = -5\text{ V}$, $I_{SD} = 3\text{ A}$, $T_J = 150\text{ }^\circ\text{C}$	
I_S	Continuous Diode Forward Current		12	A	$V_{GS} = -5\text{ V}$, $T_c = 25\text{ }^\circ\text{C}$	Note 1
$I_{S,pulse}$	Diode Pulse Current		20		$V_{GS} = -5\text{ V}$, Pulse width t_p limited by T_{jmax}	
t_{rr}	Reverse Recovery time	17		ns	$V_{GS} = -5\text{ V}$, $I_{SD} = 6\text{ A}$, $V_R = 800\text{ V}$ dif/dt = 2985 A/ μs	Note 1
Q_{rr}	Reverse Recovery Charge	48		nC		
I_{rrm}	Peak Reverse Recovery Current	5		A	$V_{GS} = -5\text{ V}$, $I_{SD} = 6\text{ A}$, $V_R = 800\text{ V}$ dif/dt = 1000 A/ μs	Note 1
t_{rr}	Reverse Recovery time	25		ns		
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 $V_{GS} = -5\text{ V}$

Thermal Characteristics

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

Typical Performance

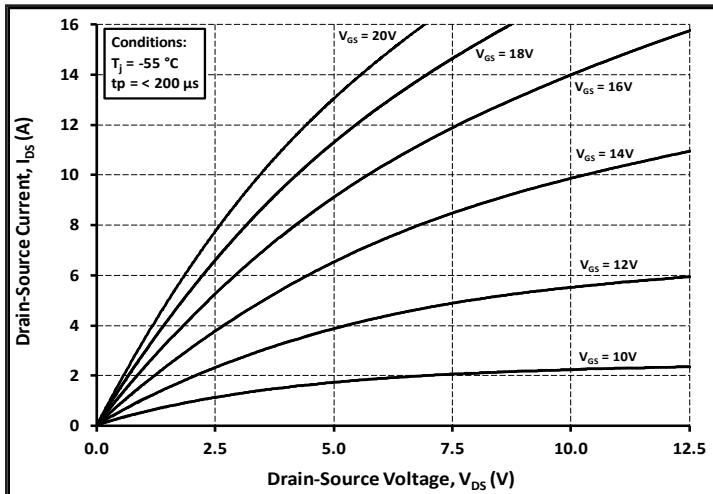


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

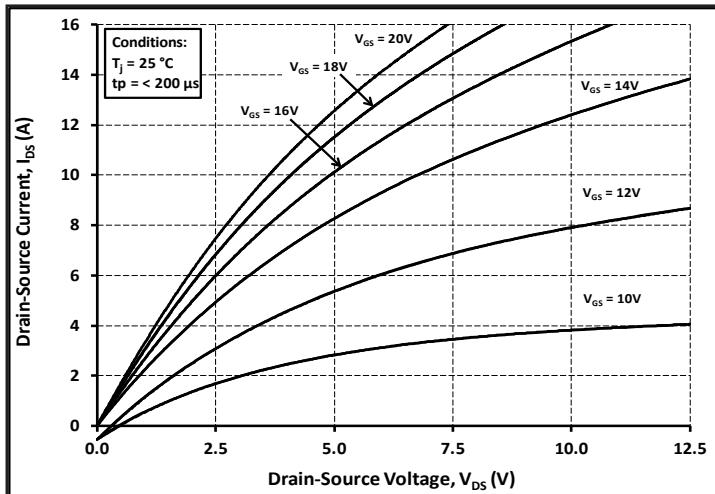


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

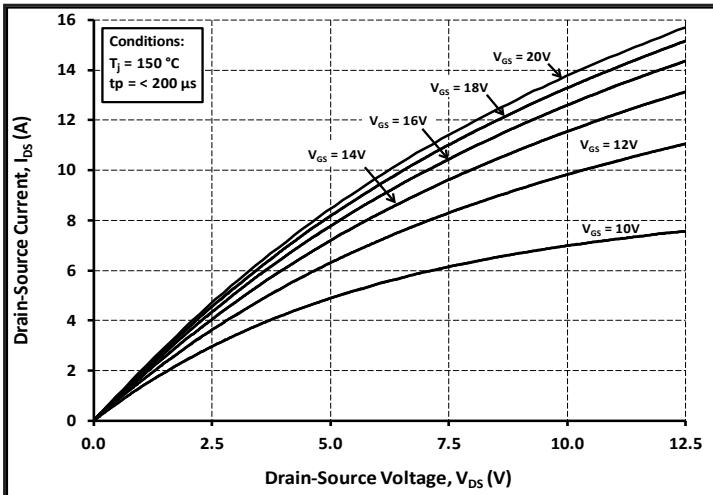


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

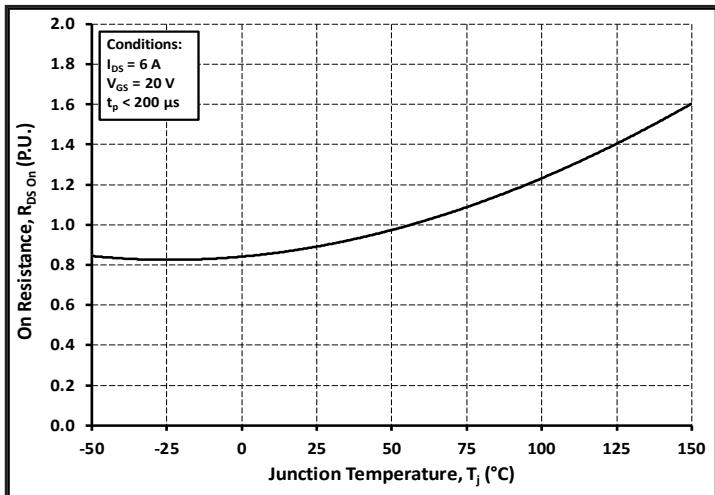


Figure 4. Normalized On-Resistance vs. Temperature

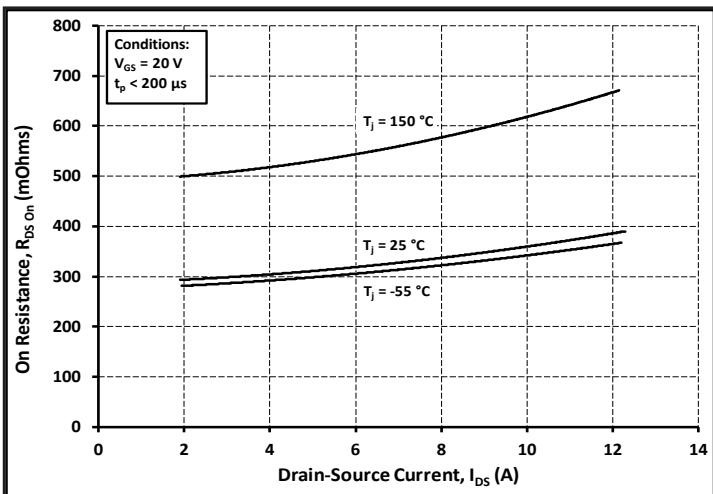


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

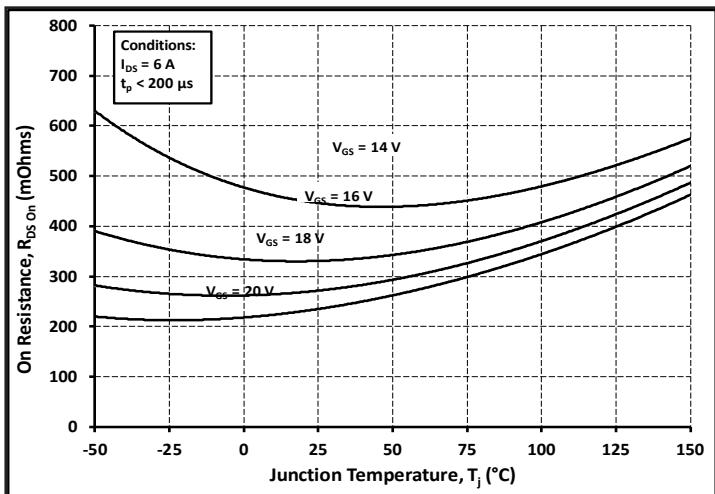


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

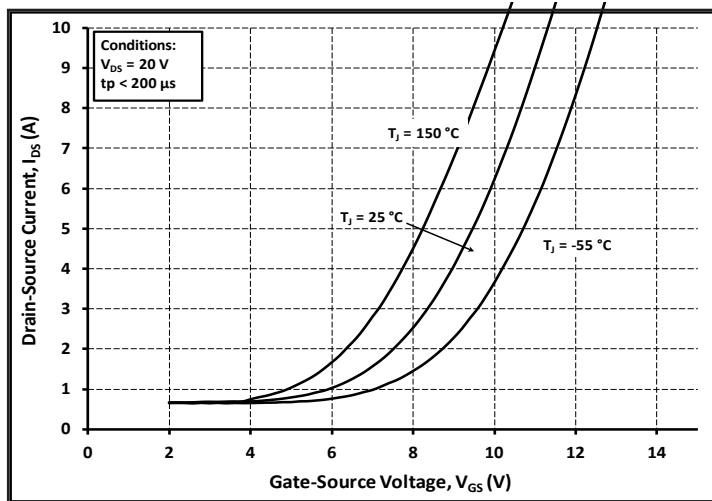


Figure 7. Transfer Characteristic For Various Junction Temperatures

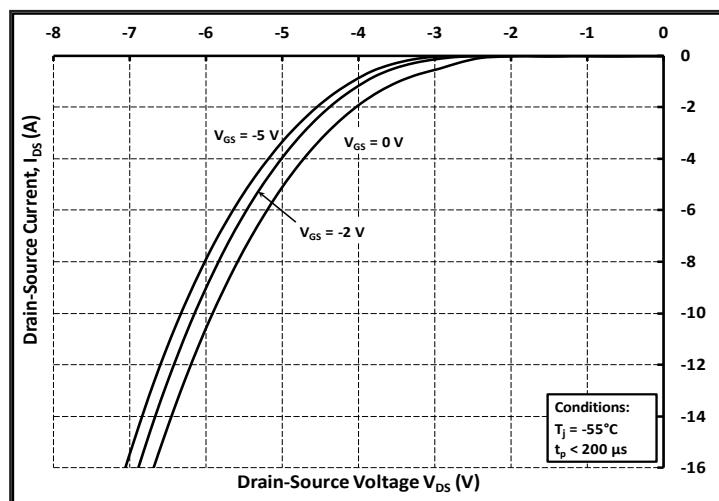


Figure 8. Body Diode Characteristic at -55 °C

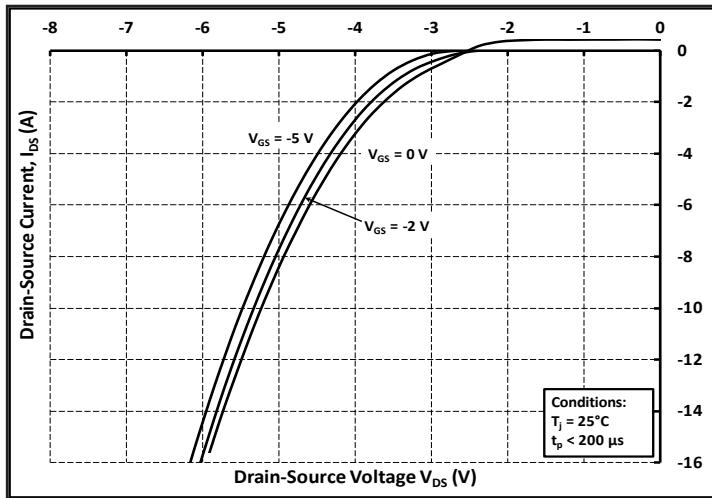


Figure 9. Body Diode Characteristic at 25 °C

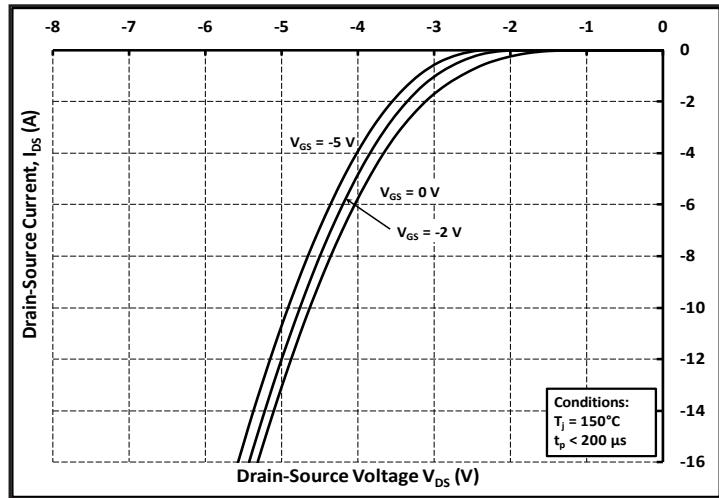


Figure 10. Body Diode Characteristic at 150 °C

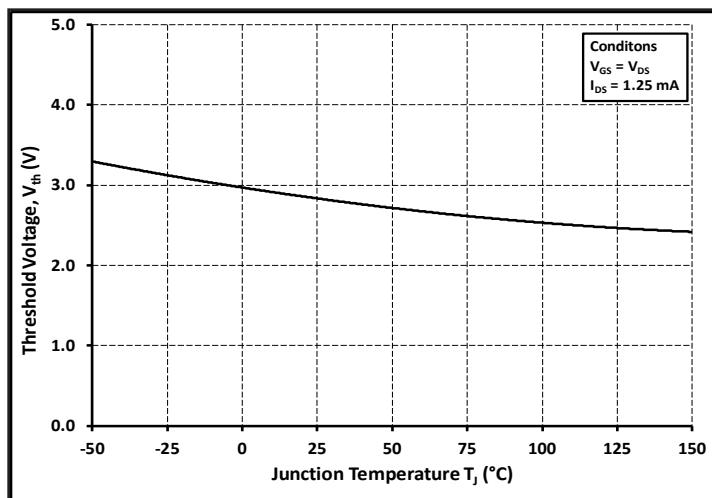


Figure 11. Threshold Voltage vs. Temperature

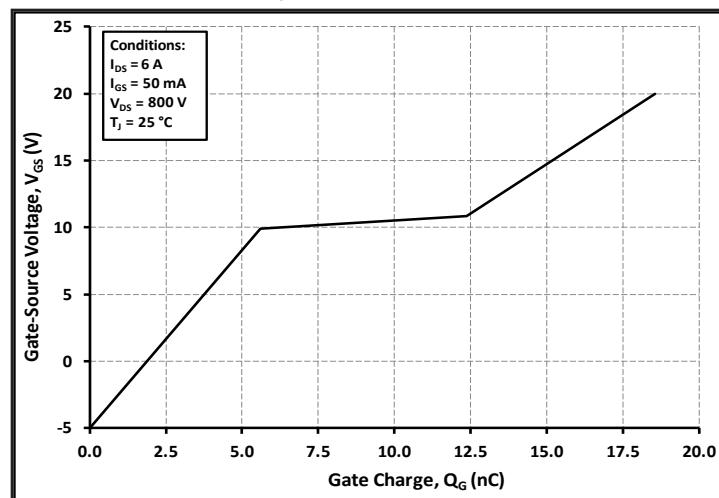


Figure 12. Gate Charge Characteristics

Typical Performance

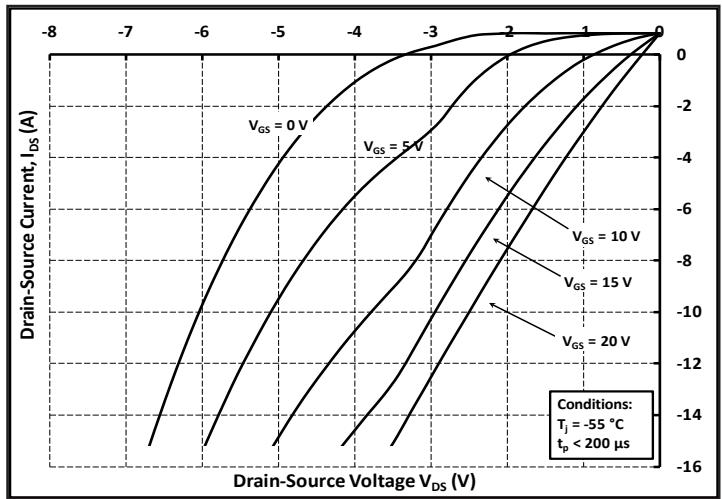


Figure 13. 3rd Quadrant Characteristic at $-55\text{ }^{\circ}\text{C}$

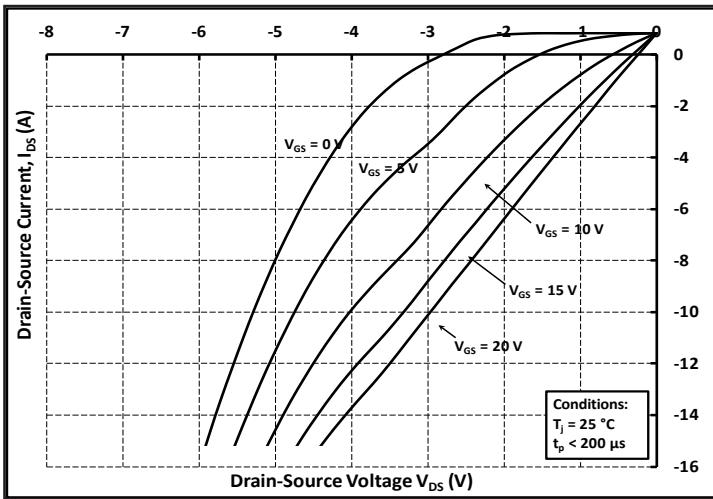


Figure 14. 3rd Quadrant Characteristic at $25\text{ }^{\circ}\text{C}$

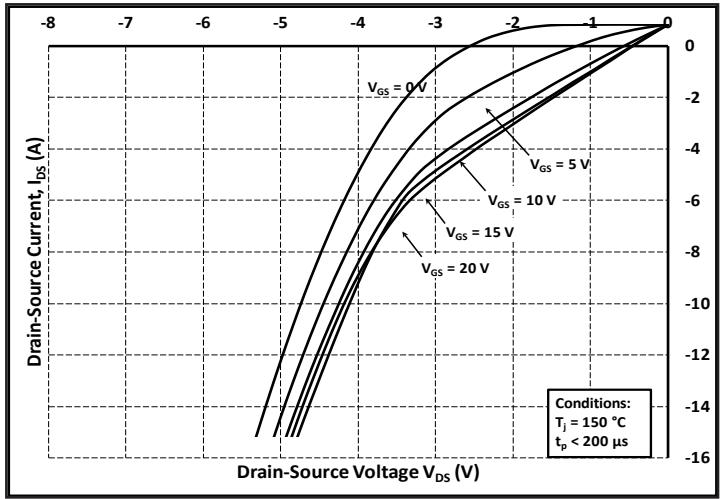


Figure 15. 3rd Quadrant Characteristic at $150\text{ }^{\circ}\text{C}$

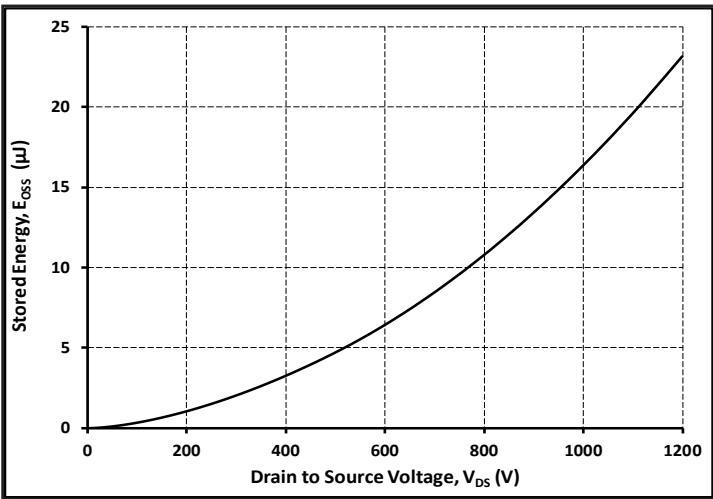


Figure 16. Output Capacitor Stored Energy

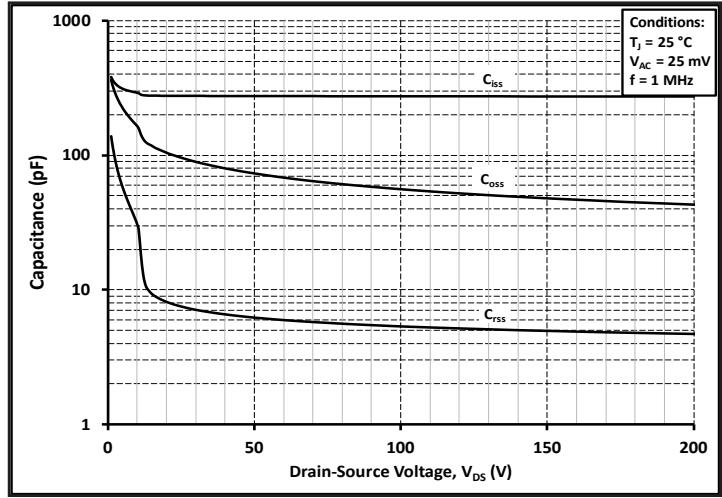


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

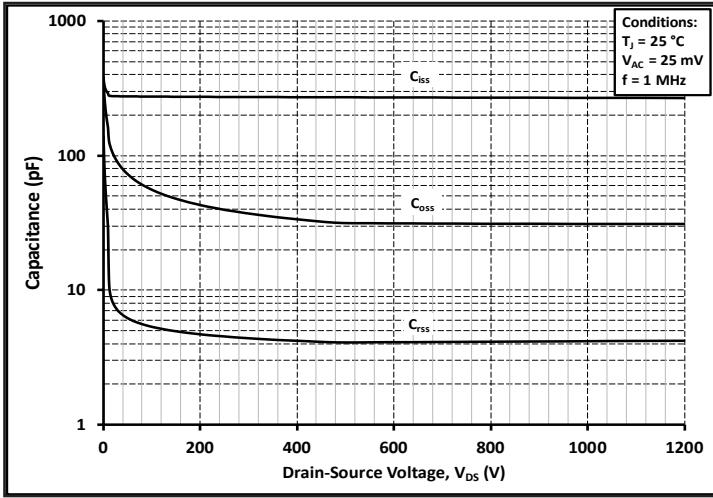


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)

Typical Performance

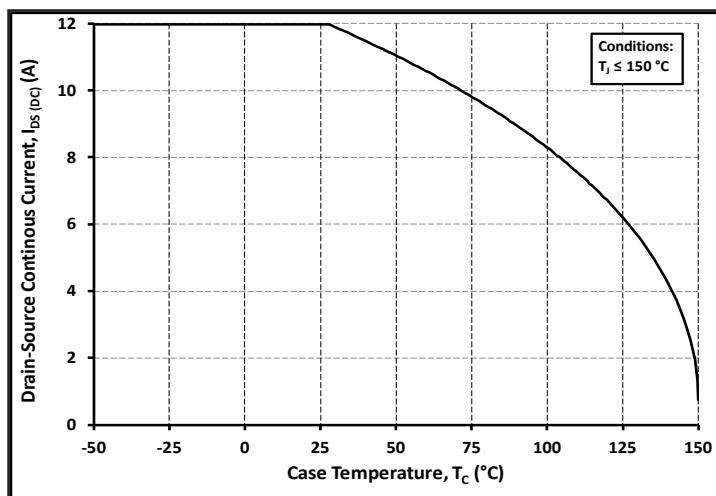


Figure 19. Continuous Drain Current Derating vs. Case Temperature

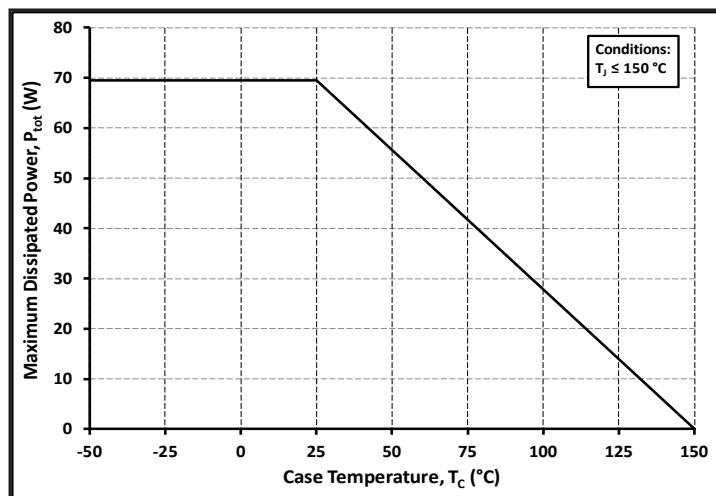


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

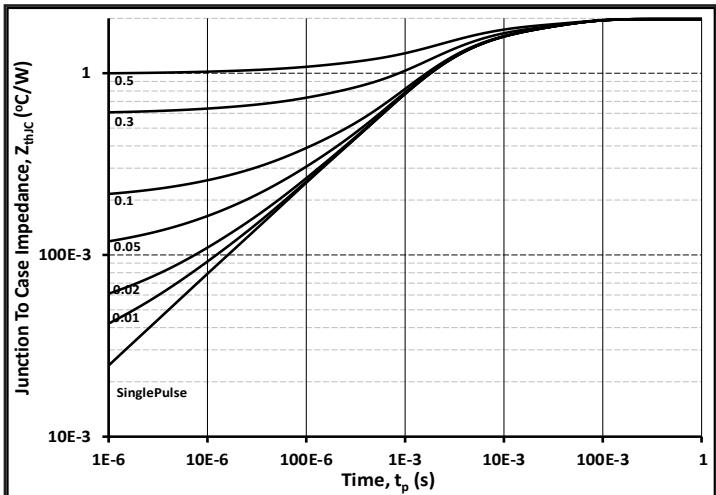


Figure 21. Transient Thermal Impedance (Junction - Case)

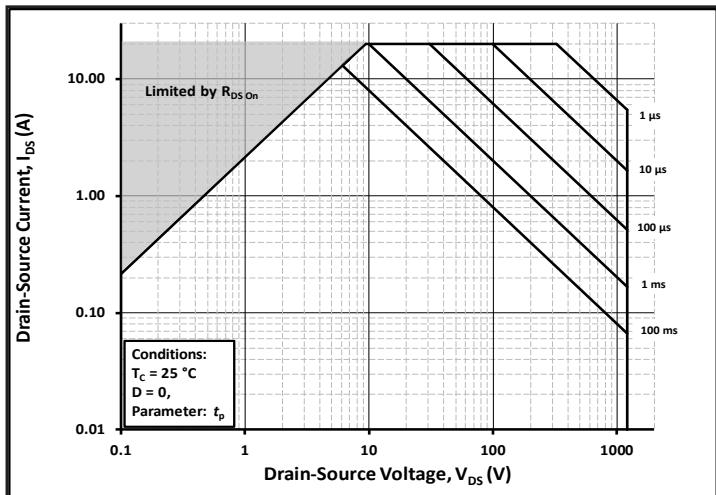


Figure 22. Safe Operating Area

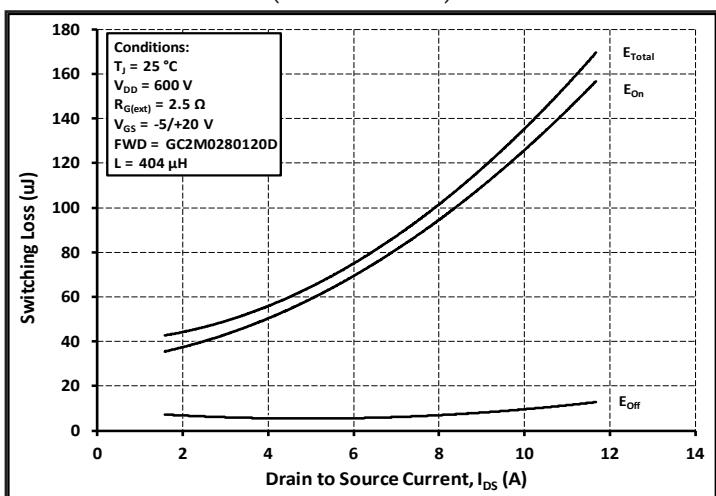


Figure 23. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600V$)

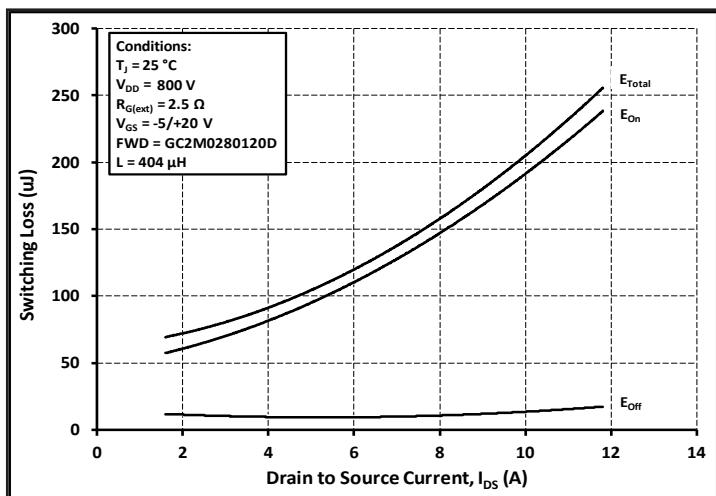
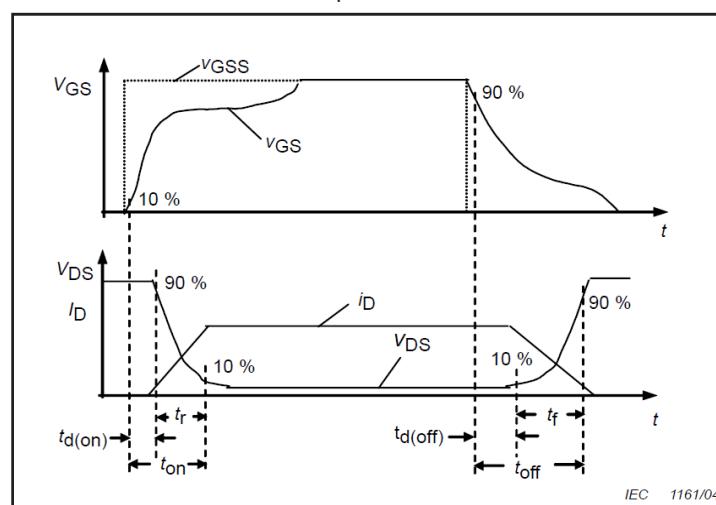
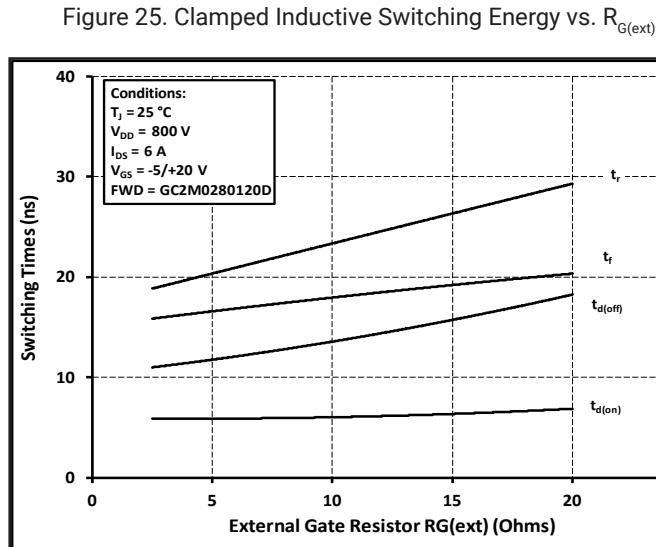
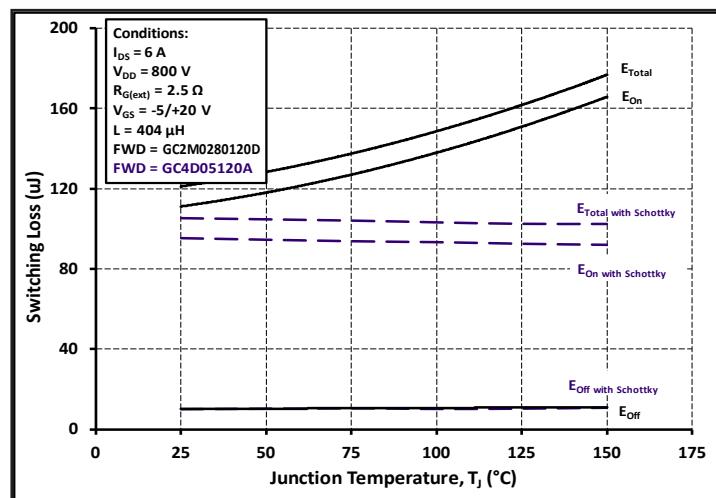
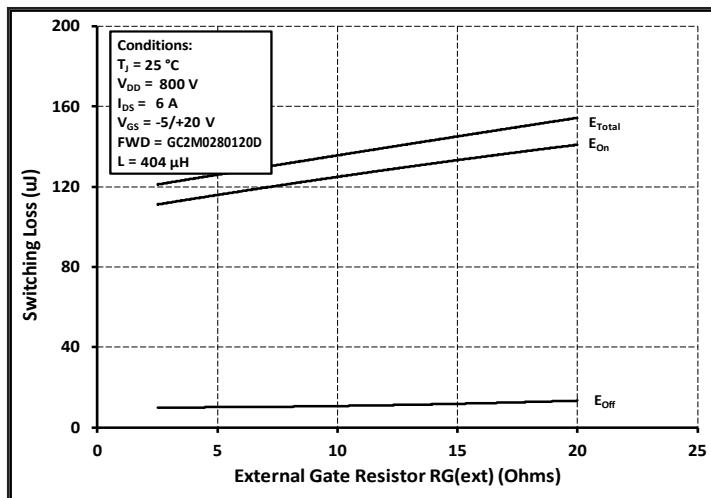


Figure 24. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800V$)

Typical Performance



Test Circuit Schematic

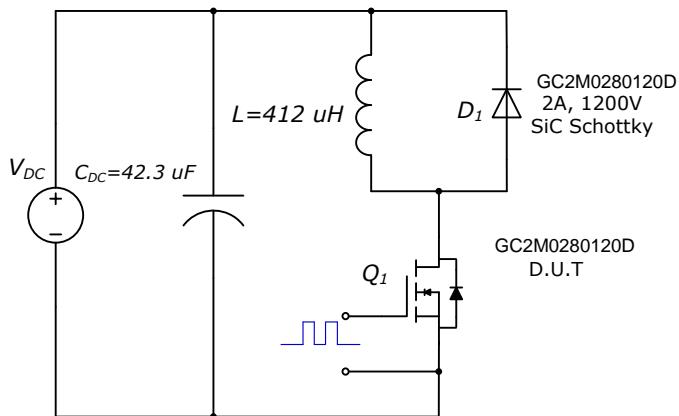


Figure 30. Clamped Inductive Switching
Waveform Test Circuit

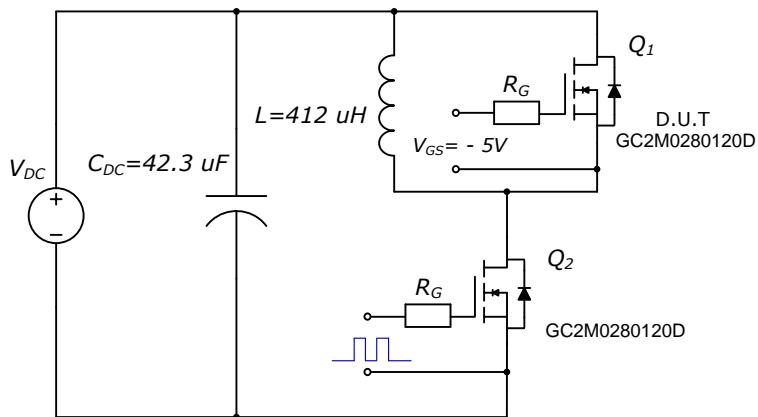


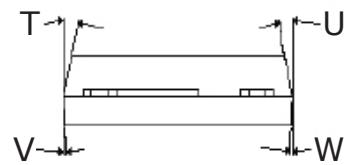
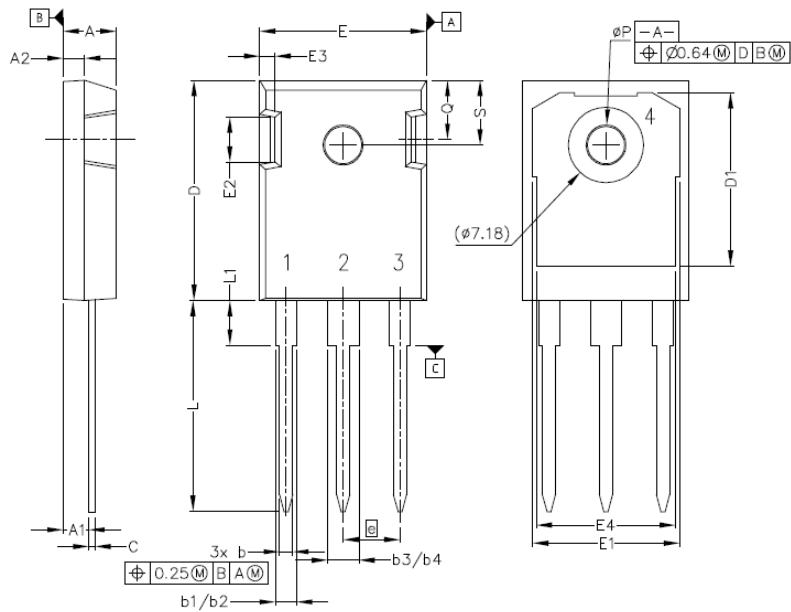
Figure 31. Body Diode Recovery Test Circuit

ESD Ratings

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

Package Dimensions

Package TO-247-3

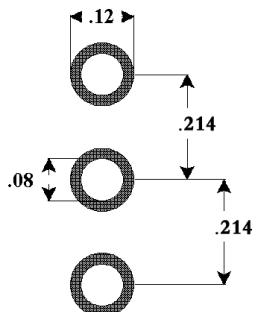


Pinout Information:

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

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°

Recommended Solder Pad Layout



TO-247-3