GC3M0280090D
Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

Features

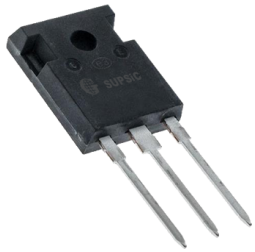
- High blocking voltage with low On-resistance
- High speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- Halogen free, RoHS compliant

Benefits

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

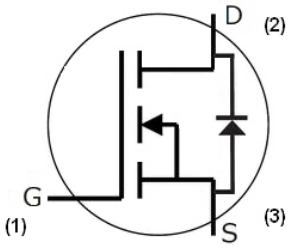
Applications

- Renewable energy
- Lighting
- High voltage DC/DC converters
- Telecom Power Supplies
- Induction Heating



TO-247-3

Package



Part Number	Package	Marking
GC3M0280090D	TO-247-3	GC3M0280090

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	900	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	10.2	A	V_{GS} = 15 V, T_C = 25˚C	Fig. 19
		6.8		V_{GS} = 15 V, T_C = 100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	22	A	Pulse width t_P limited by T_{jmax}	Fig. 22
P_D	Power Dissipation	45	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): 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	900			V	V_{GS} = 0 V, I_D = 100 µA	
$V_{GS(th)}$	Gate Threshold Voltage	1.8	2.7	3.5	V	V_{DS} = V_{GS}, I_D = 1.2 mA	Fig. 11
			2.2		V	V_{DS} = V_{GS}, I_D = 1.2 mA, T_J = 150°C	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	µA	V_{DS} = 900 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		320	360	mΩ	V_{GS} = 15 V, I_D = 7.5 A	Fig. 4, 5, 6
			416			V_{GS} = 15 V, I_D = 7.5 A, T_J = 150°C	
g_{fs}	Transconductance		3.6		S	V_{DS}= 15 V, I_{DS}= 7.5 A	Fig. 7
			3.6			V_{DS}= 15 V, I_{DS}= 7.5 A, T_J = 150°C	
C_{iss}	Input Capacitance		204		pF	V_{GS} = 0 V, V_{DS} = 600 V f = 1 MHz V_{AC} = 25 mV	Fig. 17, 18
C_{oss}	Output Capacitance		26				
C_{rss}	Reverse Transfer Capacitance		3				
E_{oss}	C_{oss} Stored Energy		5.5		µJ		Fig. 16
E_{ON}	Turn-On Switching Energy (Body Diode FWD)		80		µJ	V_{DS} = 400 V, V_{GS} = -4 V/15 V, I_D = 7.5 A, $R_{G(ext)}$ = 2.5Ω, L= 201 µH, T_J = 150°C	Fig. 26, 29 Note 3
E_{OFF}	Turn Off Switching Energy (Body Diode FWD)		6				
$t_{d(on)}$	Turn-On Delay Time		5.3		ns	V_{DD} = 400 V, V_{GS} = -4 V/15 V I_D = 7.5 A, $R_{G(ext)}$ = 2.5 Ω, Timing relative to V_{DS} Inductive load	Fig. 27, 29 Note 3
t_r	Rise Time		25				
$t_{d(off)}$	Turn-Off Delay Time		8.5				
t_f	Fall Time		6.4				
$R_{G(int)}$	Internal Gate Resistance		23.5		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		3.0		nC	V_{DS} = 400 V, V_{GS} = -4 V/15 V I_D = 7.5 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		2.9				
Q_g	Total Gate Charge		9.7				

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

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.8		V	V_{GS} = -4 V, I_{SD} = 4 A	Fig. 8, 9, 10
		4.4		V	V_{GS} = -4 V, I_{SD} = 4 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		9	A	V_{GS} = -4 V	Note 1
$I_{S, pulse}$	Diode pulse Current		22	A	V_{GS} = -4 V, pulse width t_P limited by T_{jmax}	Note 1
t_{rr}	Reverse Recover time	24		ns	V_{GS} = -4 V, I_{SD} = 7.5 A, V_R = 400 V dif/dt = 775 A/µs, T_J = 150 °C	Note 1
Q_{rr}	Reverse Recovery Charge	74		nC		
I_{rrm}	Peak Reverse Recovery Current	4		A		

Thermal Characteristics

Symbol	Parameter	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	2.8	°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

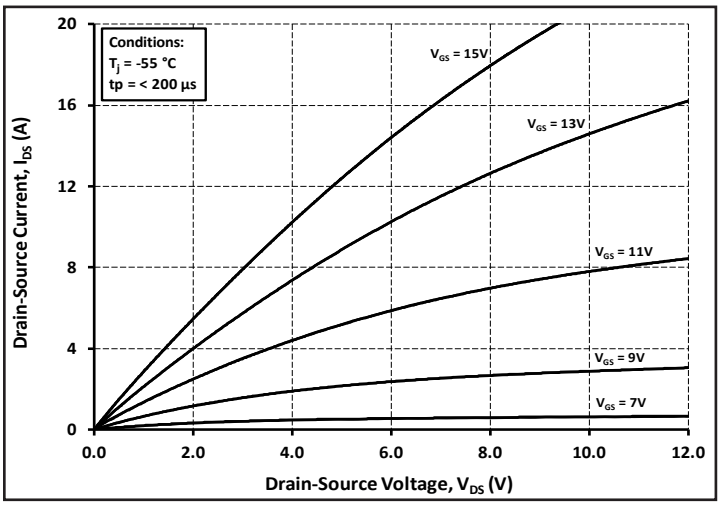


Figure 1. Output Characteristics T_J = -55 ºC

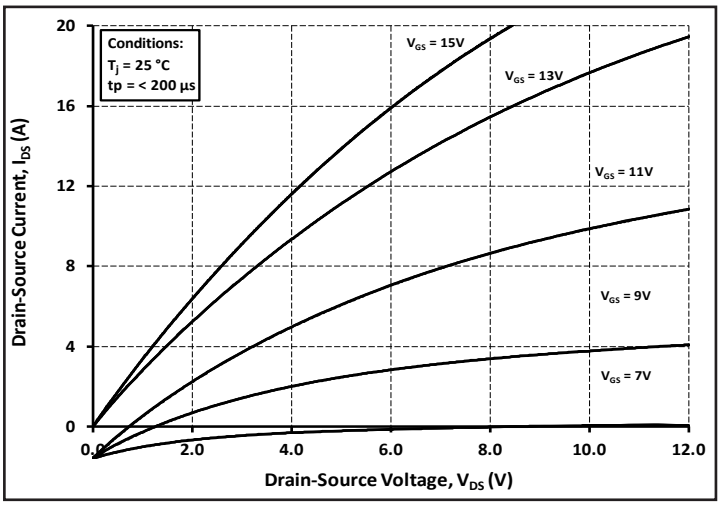


Figure 2. Output Characteristics T_J = 25 ºC

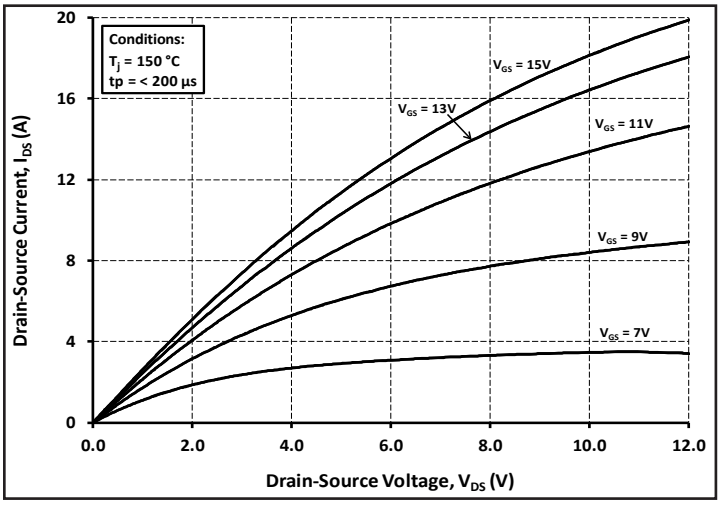


Figure 3. Output Characteristics T_J = 150 ºC

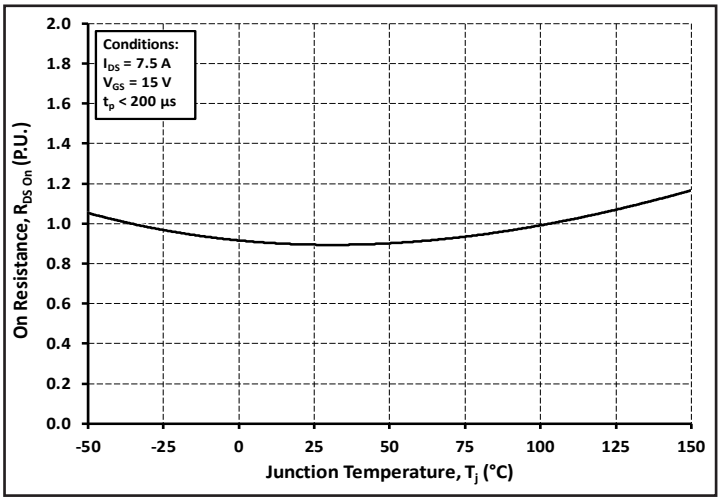


Figure 4. Normalized On-Resistance vs. Temperature

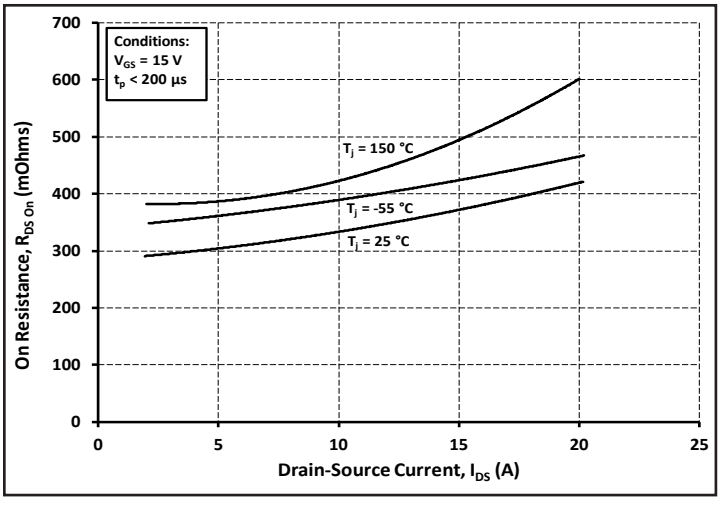


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

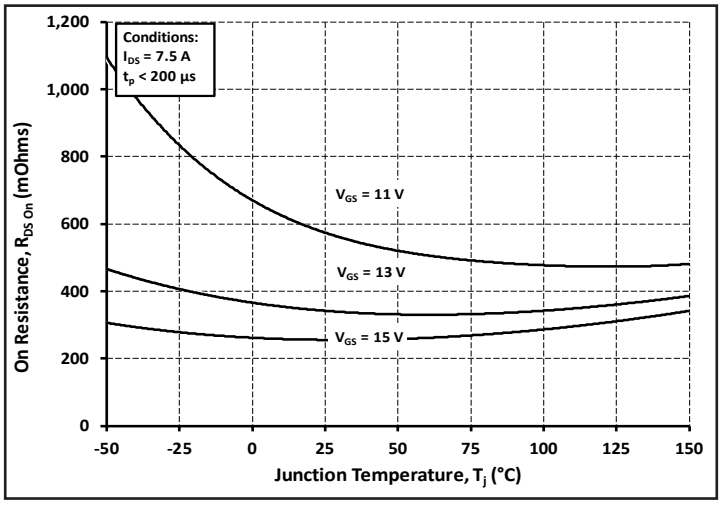


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

Typical Performance

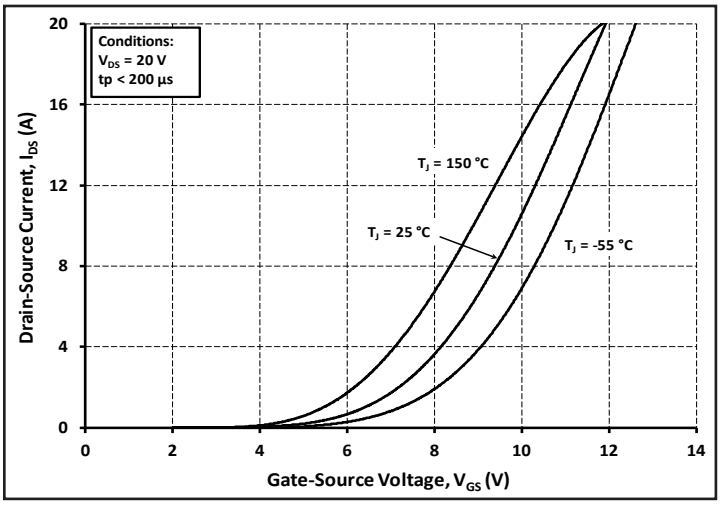


Figure 7. Transfer Characteristic for Various Junction Temperatures

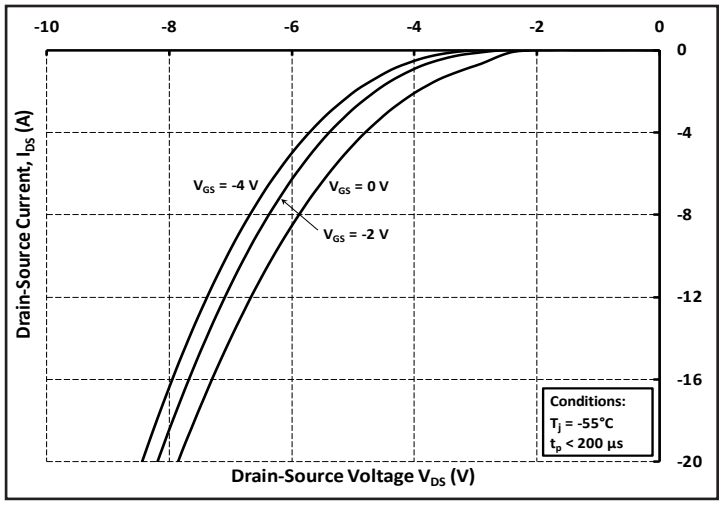


Figure 8. Body Diode Characteristic at -55 °C

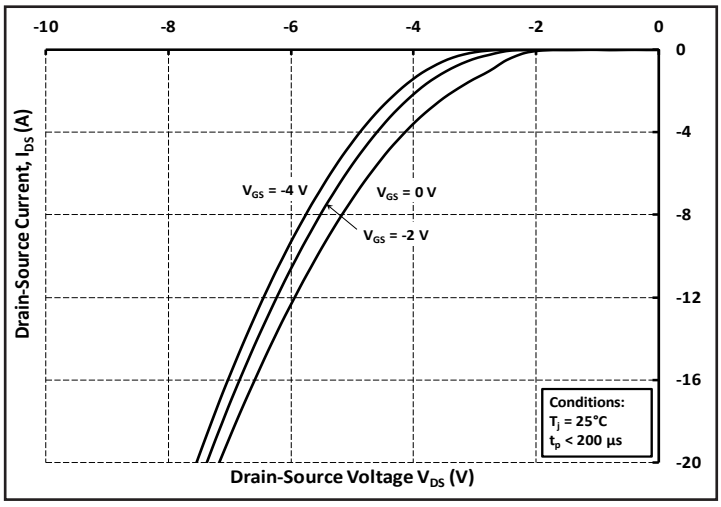


Figure 9. Body Diode Characteristic at 25 °C

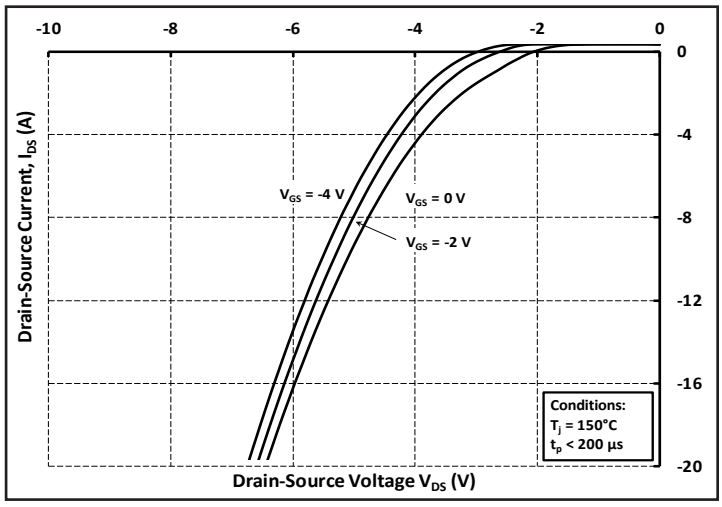


Figure 10. Body Diode Characteristic at 150 °C

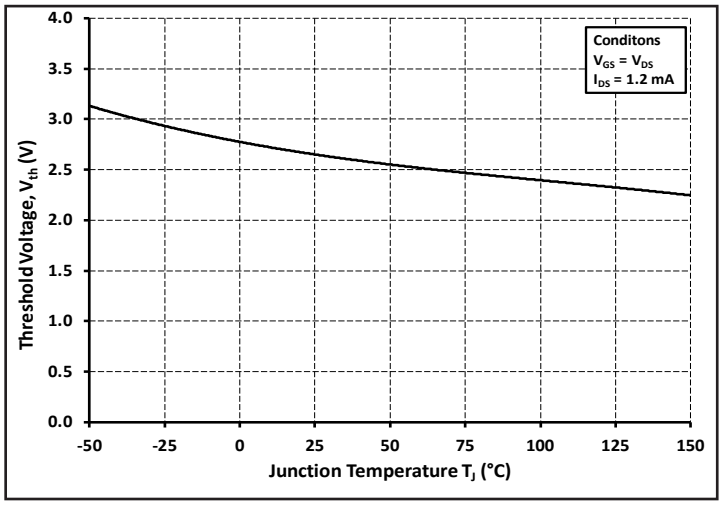


Figure 11. Threshold Voltage vs. Temperature

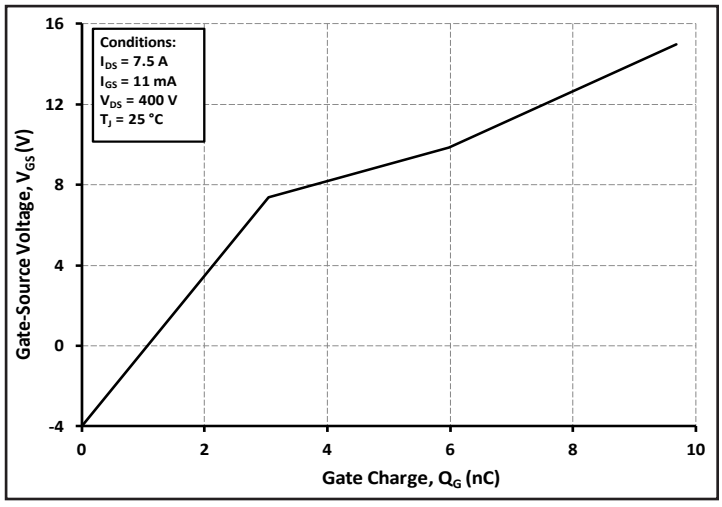


Figure 12. Gate Charge Characteristics

Typical Performance

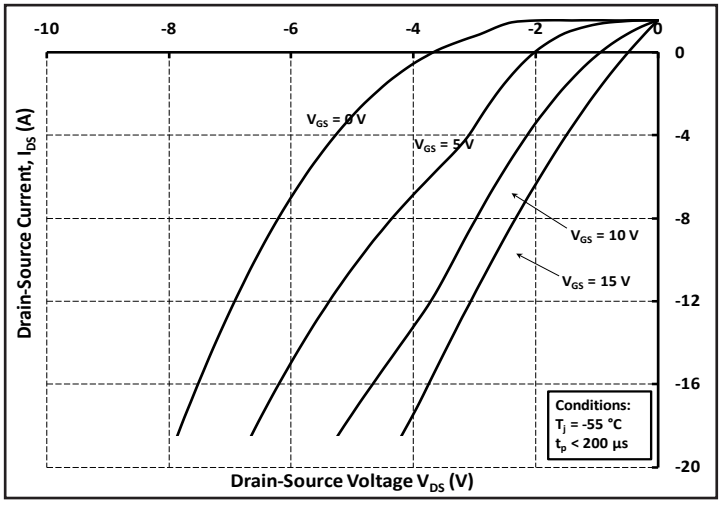


Figure 13. 3rd Quadrant Characteristic at -55 ºC

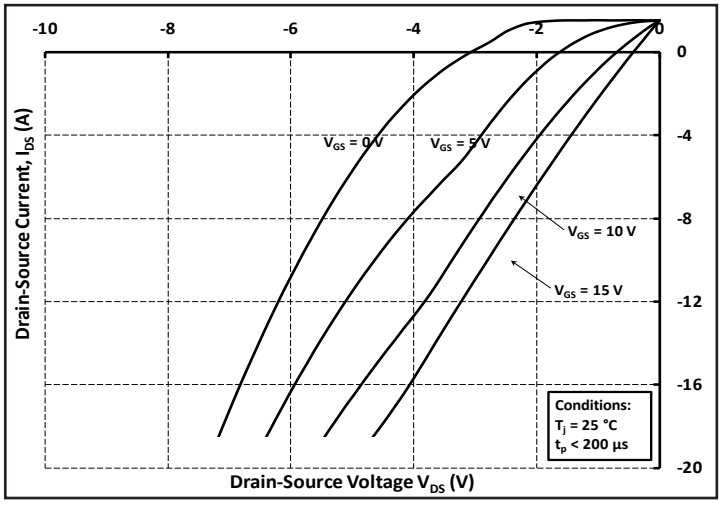


Figure 14. 3rd Quadrant Characteristic at 25 ºC

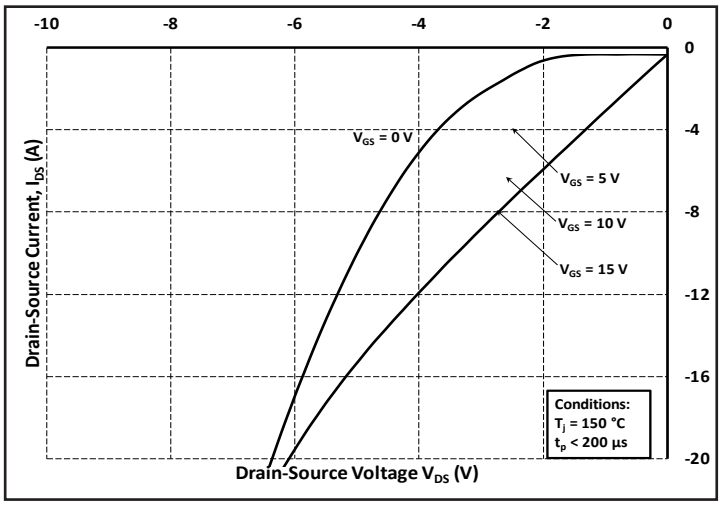


Figure 15. 3rd Quadrant Characteristic at 150 ºC

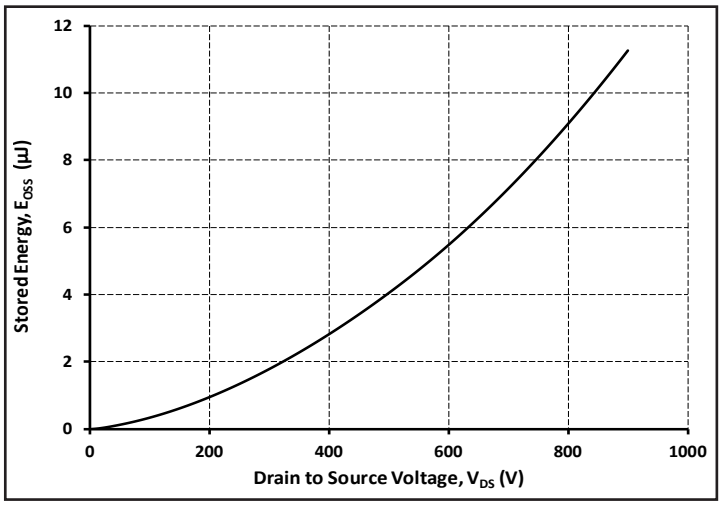


Figure 16. Output Capacitor Stored Energy

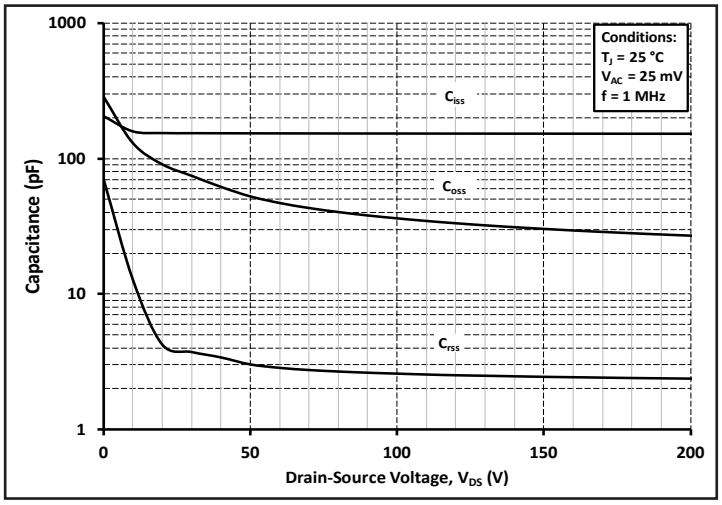


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

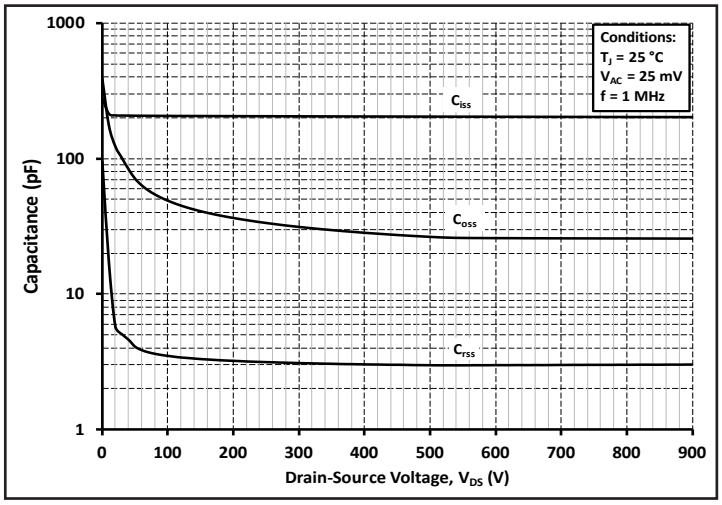


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 900V)

Typical Performance

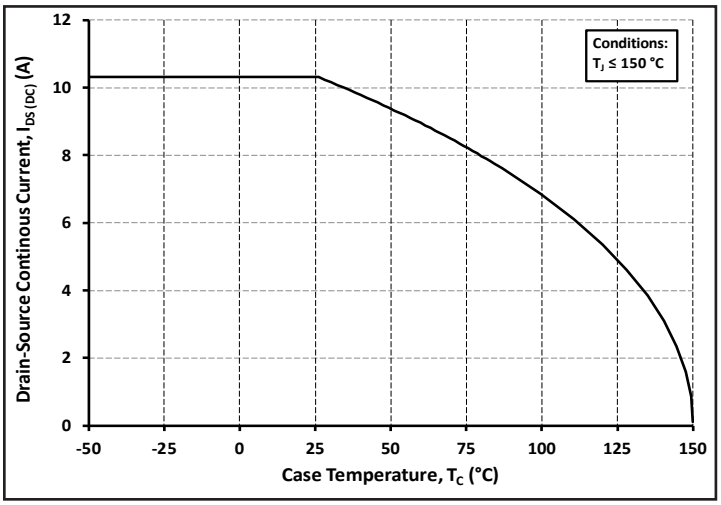


Figure 19. Continuous Drain Current Derating vs. Case Temperature

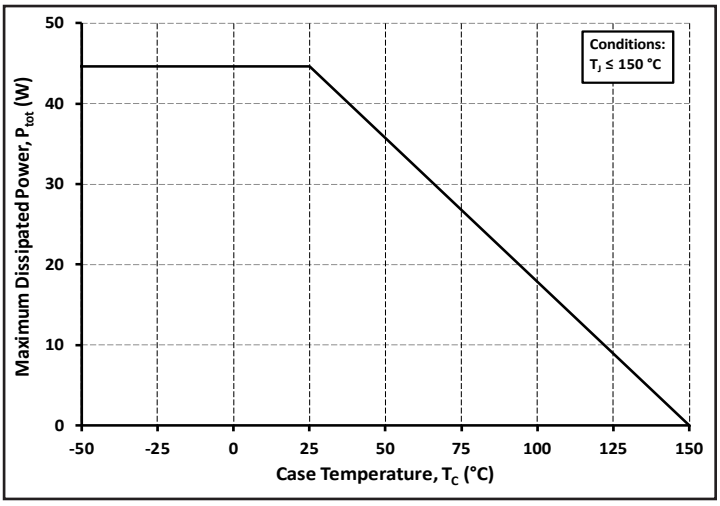


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

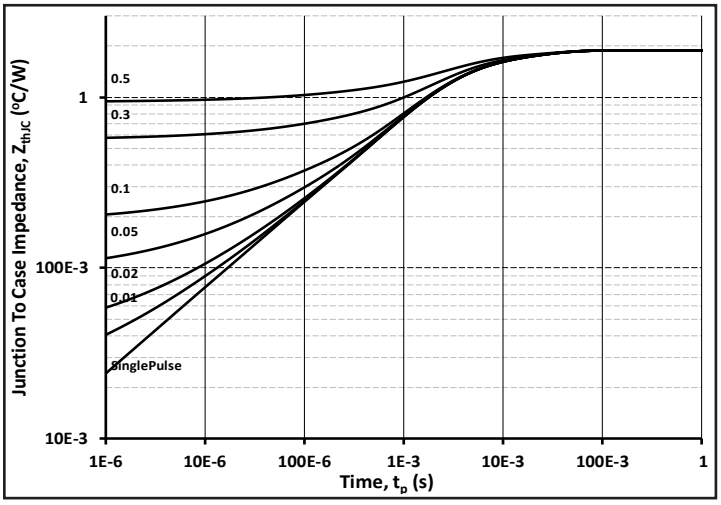


Figure 21. Transient Thermal Impedance (Junction - Case)

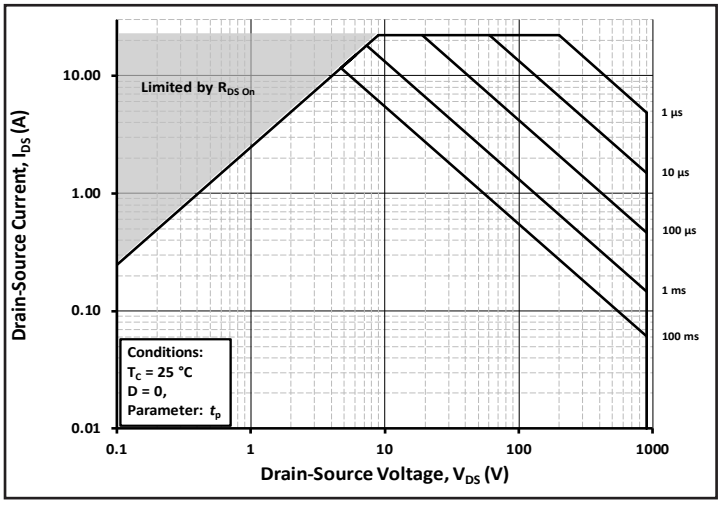


Figure 22. Safe Operating Area

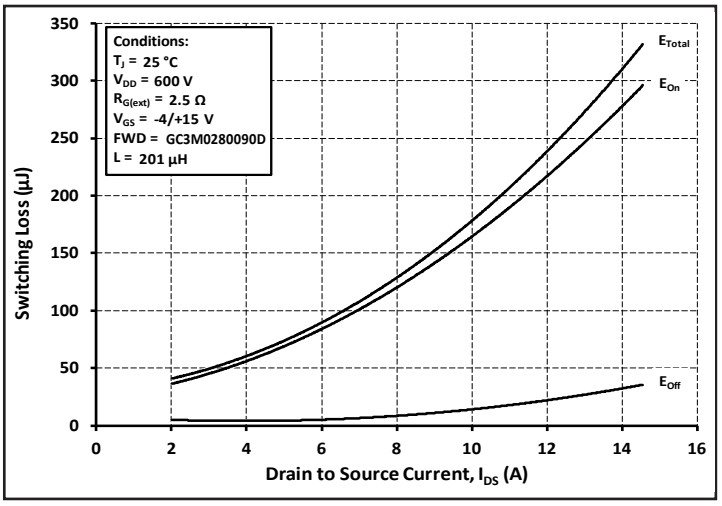


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 600V)

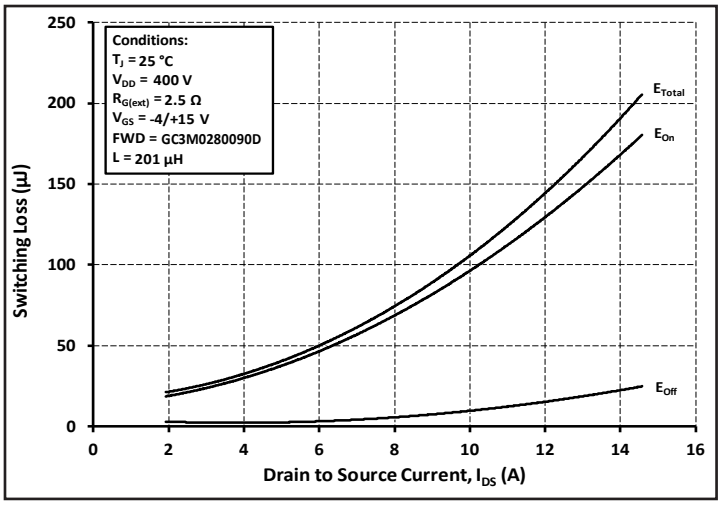


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 400V)

Typical Performance

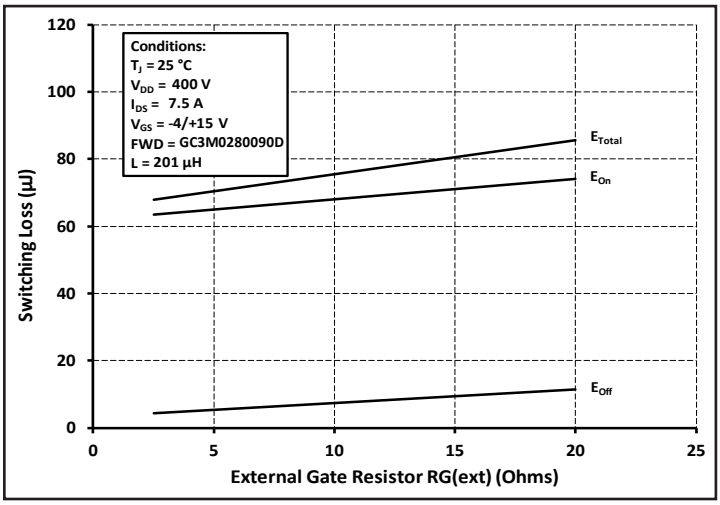


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

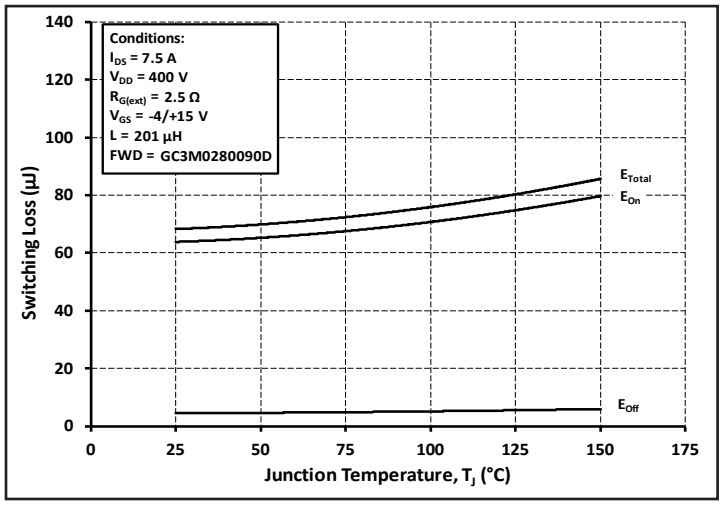


Figure 26. Clamped Inductive Switching Energy vs. Temperature

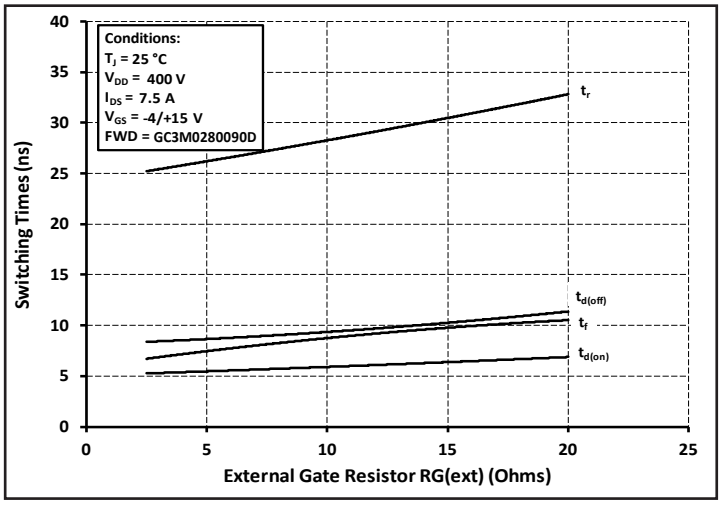


Figure 27. Switching Times vs. $R_{G(ext)}$

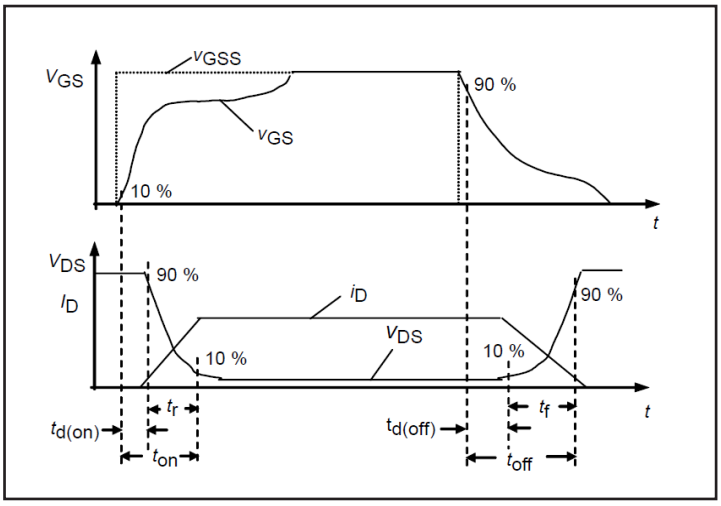


Figure 28. Switching Times Definition

Test Circuit Schematic

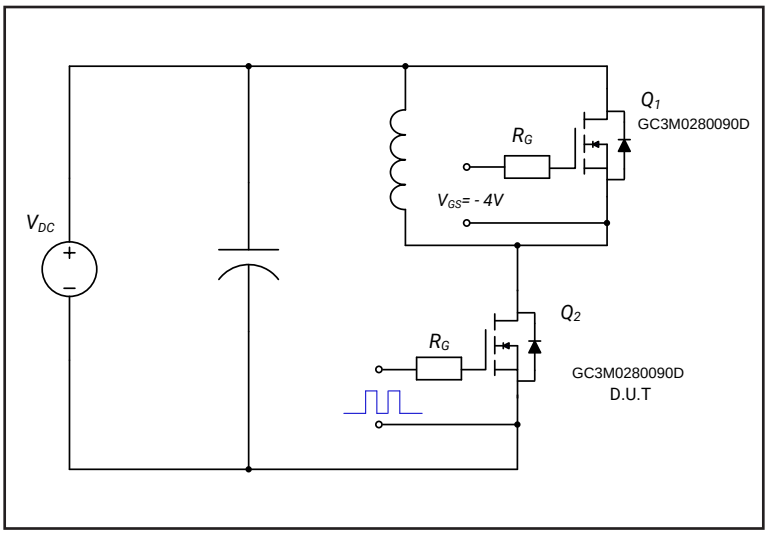
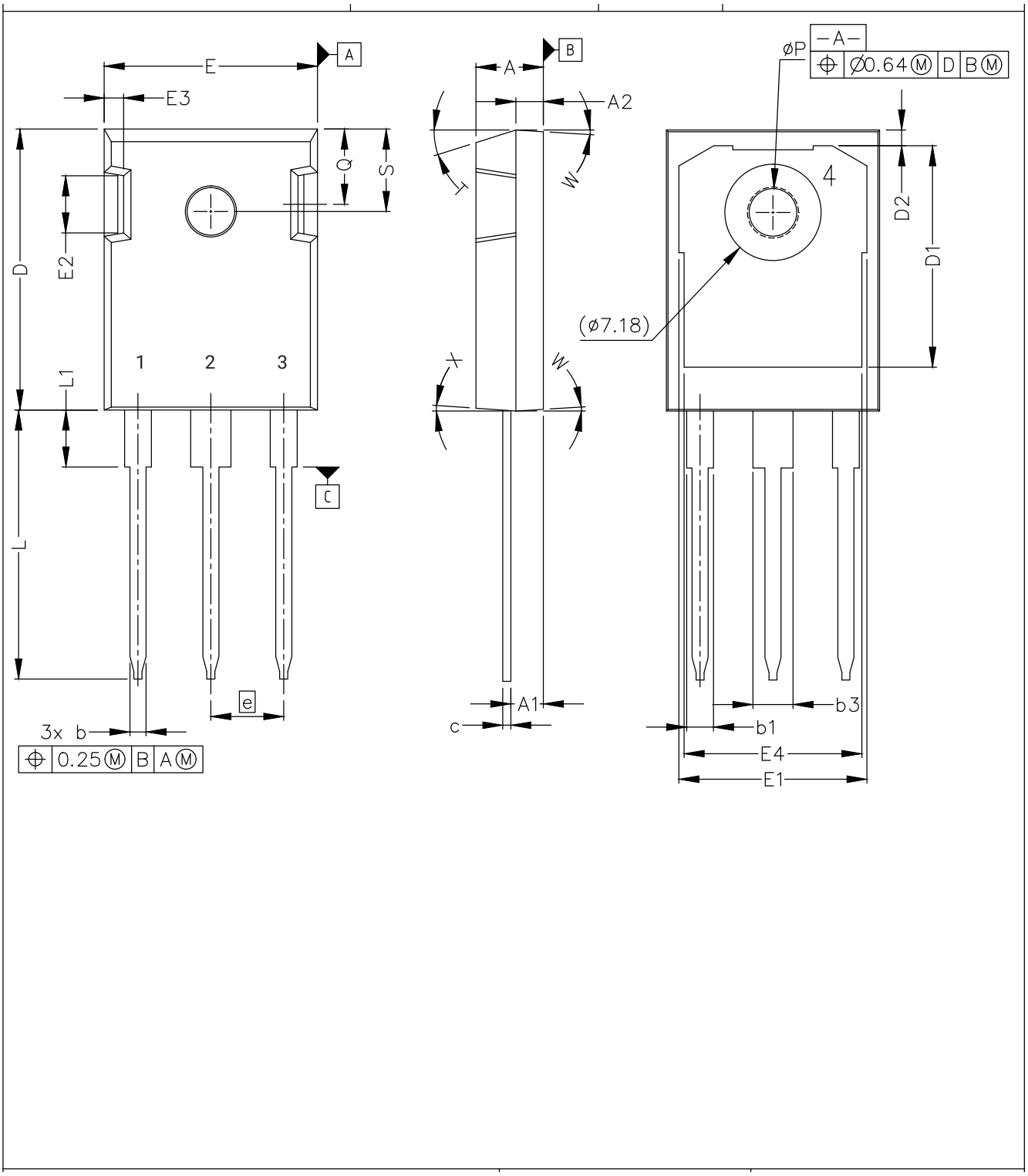


Figure 29. Clamped Inductive Switching Test Circuit

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

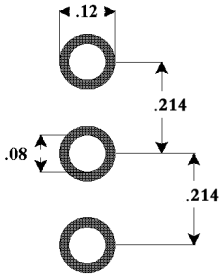


Package Dimensions

Package TO-247-3

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



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