C2M0160120D

Silicon Carbide Power MOSFET
Z-FET™ MOSFET

N-Channel Enhancement Mode

V_{DS}	1200 V
$I_{D(MAX)}$ @ 25˚C	17.7 A
$R_{DS(on)}$	160 mΩ

Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to Parallel and Simple to Drive
- Resistant to Latch-Up
- Halogen Free, RoHS Compliant

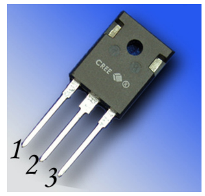
Benefits

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

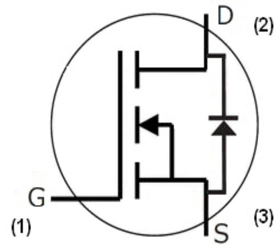
Applications

- Auxiliary Power Supplies
- Solar Inverters
- High Voltage DC/DC Converters
- High-frequency applications

Package



TO-247-3



Part Number	Package
C2M0160120D	TO-247-3

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
$I_{DS\ (DC)}$	Continuous Drain Current	17.7	A	V_{GS}@20 V, T_C = 25˚C	Fig. 19
		11		V_{GS}@20 V, T_C = 100˚C	
$I_{DS\ (pulse)}$	Pulsed Drain Current	45	A	Pulse width t_P = 50 μs duty limited by T_{jmax}, T_C = 25˚C	
V_{GS}	Gate Source Voltage	-10/+25	V		
P_{tot}	Power Dissipation	125	W	T_C=25˚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	

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_{DS} = 50 μA	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.5		V	V_{DS} = 10V, I_{DS} = 0.5 mA	Fig. 11
		1.5	1.9		V	V_{DS} = 10V, I_{DS} = 0.5 mA, T_J = 150ºC	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	μA	V_{DS} = 1200 V, V_{GS} = 0 V	
			10	250		V_{DS} = 1200 V, V_{GS} = 0 V T_J = 150ºC	
I_{GSS}	Gate-Source Leakage Current			0.25	μA	V_{GS} = 20 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		160	196	mΩ	V_{GS} = 20 V, I_D = 10 A	Fig. 4, 5, 6
			290	400		V_{GS} = 20 V, I_D = 10A, T_J = 150ºC	
g_{fs}	Transconductance		4.3		S	V_{DS}= 20 V, I_{DS}= 10 A	Fig. 7
			4.1			V_{DS}= 20 V, I_{DS}= 10 A, T_J = 150ºC	
C_{iss}	Input Capacitance		527		pF	V_{GS} = 0 V V_{DS} = 800 V f = 1 MHz V_{AC} = 25 mV	Fig. 16, 17
C_{oss}	Output Capacitance		47				
C_{rss}	Reverse Transfer Capacitance		4				
E_{oss}	C_{oss} Stored Energy		15		μJ		Fig. 18
$t_{d(on)v}$	Turn-On Delay Time		7		ns	V_{DD} = 800 V, V_{GS} = -5/20 V I_D = 10 A $R_{G(ext)}$ = 0 Ω, R_L = 40 Ω Timing relative to V_{DS}	Fig. 27
t_{fv}	Fall Time		7				
$t_{d(off)v}$	Turn-Off Delay Time		13				
t_{rv}	Rise Time		12				
R_G	Internal Gate Resistance		6.5		Ω	f = 1 MHz, V_{AC} = 25 mV	

Built-in SiC Body Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.1		V	V_{GS} = -5 V, I_F=5 A, T_J = 25 ºC	Fig 9, 10
		2.9			V_{GS} = -2 V, I_F=5 A, T_J = 150 ºC	

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.9	1.0	K/W		Fig. 21
$R_{\theta CS}$	Case to Sink, w/ Thermal Compound	0.25				
$R_{\theta JA}$	Thermal Resistance From Junction to Ambient		40			

Gate Charge Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
Q_{gs}	Gate to Source Charge	6.9		nC	V_{DS} = 800 V, V_{GS} = -5/20 V I_D =10 A Per JEDEC24 pg 27	Fig. 12
Q_{gd}	Gate to Drain Charge	13.6				
Q_g	Gate Charge Total	32.6				

Typical Performance

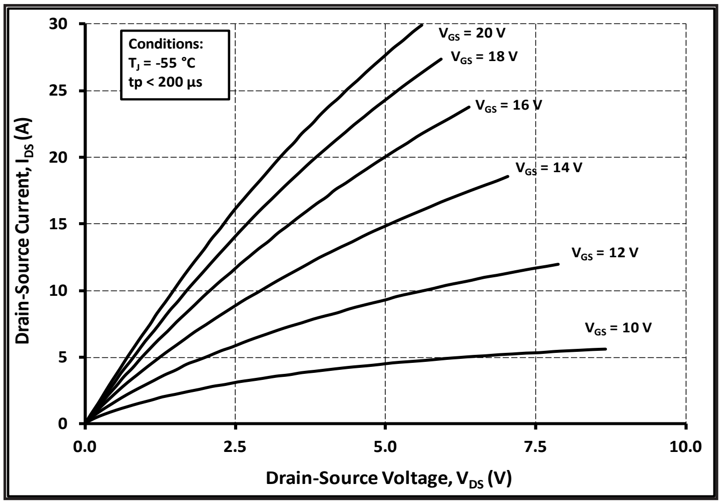


Figure 1. Typical Output Characteristics T_J = -55 ºC

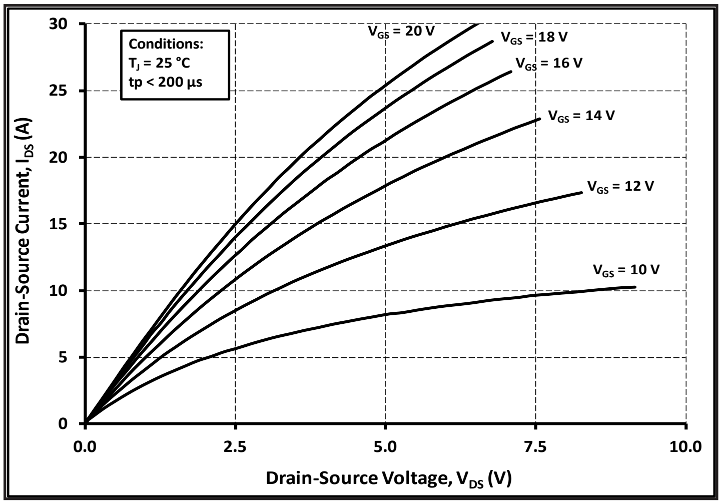


Figure 2. Typical Output Characteristics T_J = 25 ºC

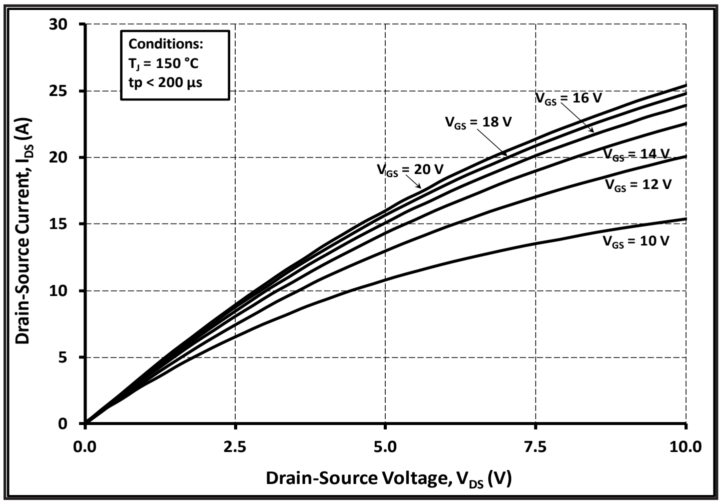


Figure 3. Typical Output Characteristics T_J = 150 ºC

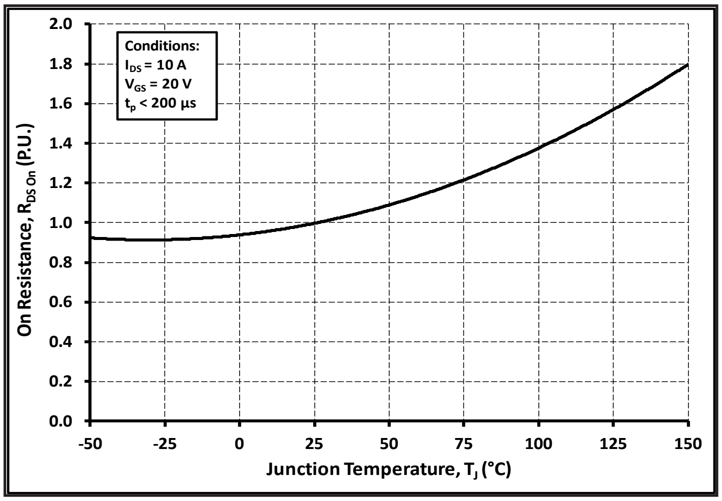


Figure 4. Normalized On-Resistance vs. Temperature

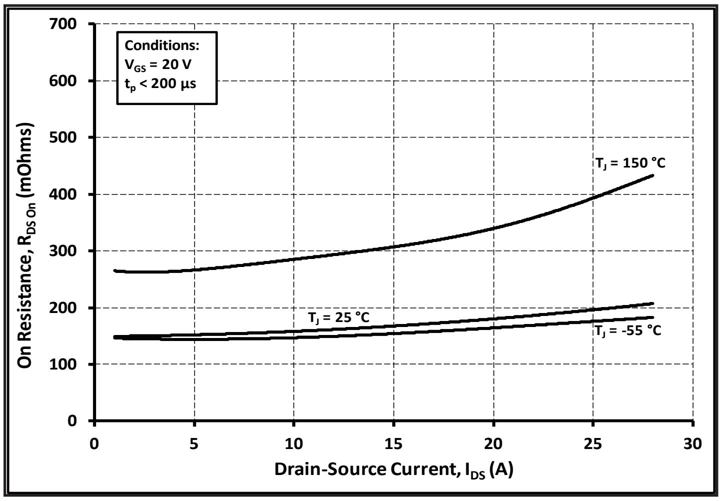


Figure 5. Typical On-Resistance vs. Drain Current For Various Temperatures

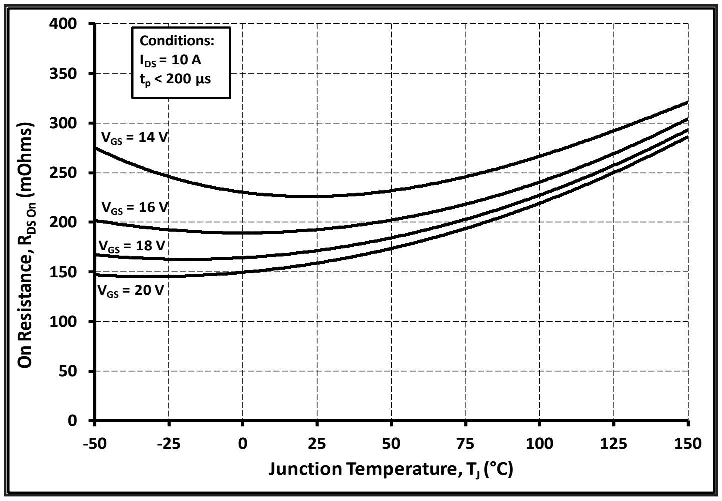


Figure 6. Typical On-Resistance vs. Temperature For Various Gate Voltage

Typical Performance

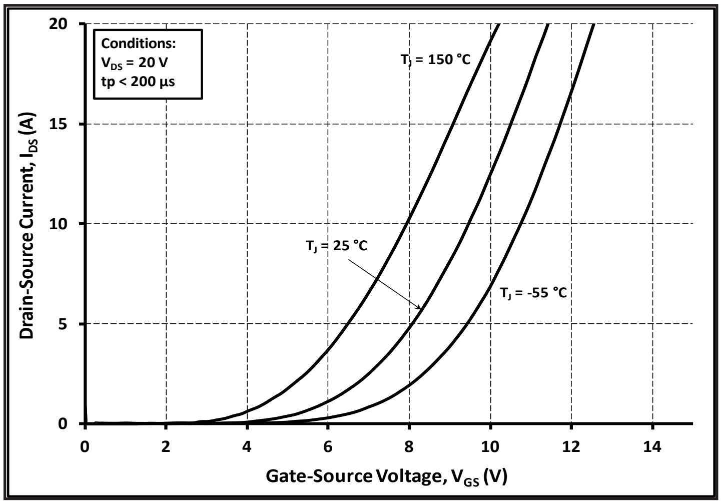


Figure 7. Typical Transfer Characteristic For Various Temperatures

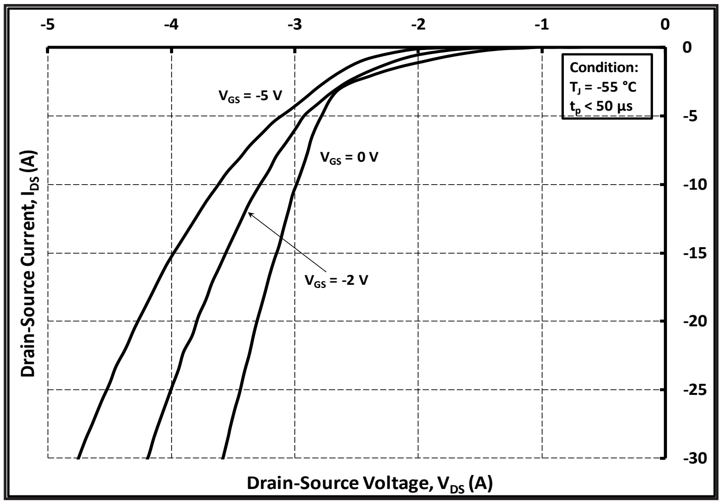


Figure 8. Typical Body Diode Characteristic T_J = -55 ºC

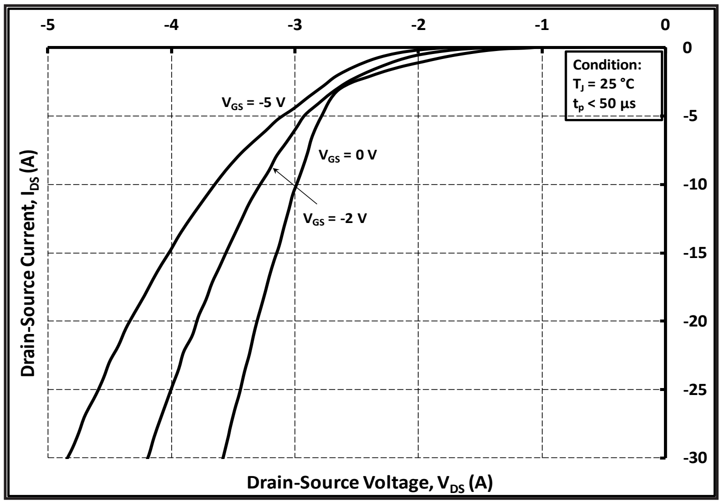


Figure 9. Typical Body Diode Characteristic T_J = 25 ºC

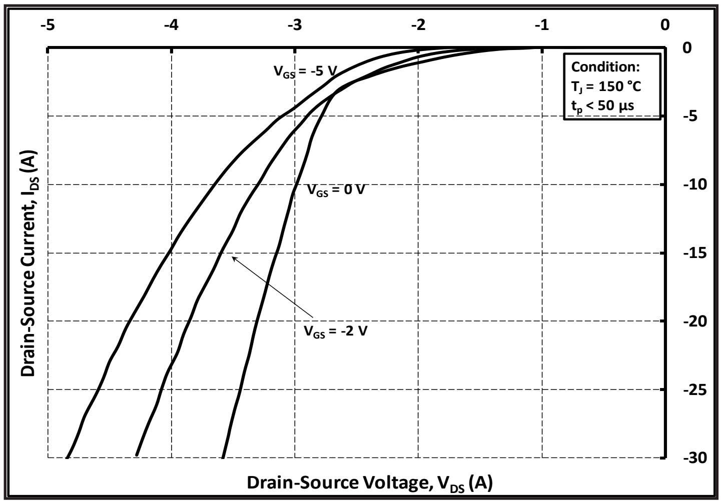


Figure 10. Typical Body Diode Characteristic T_J = 150 ºC

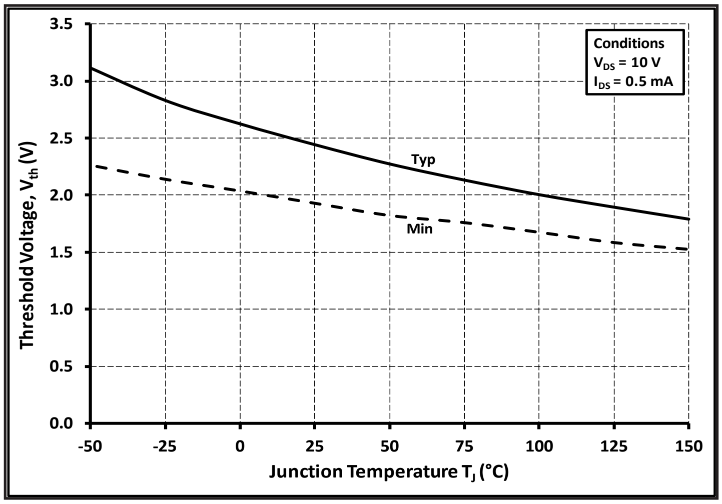


Figure 11. Typical and Minimum Threshold Voltage vs. Temperature

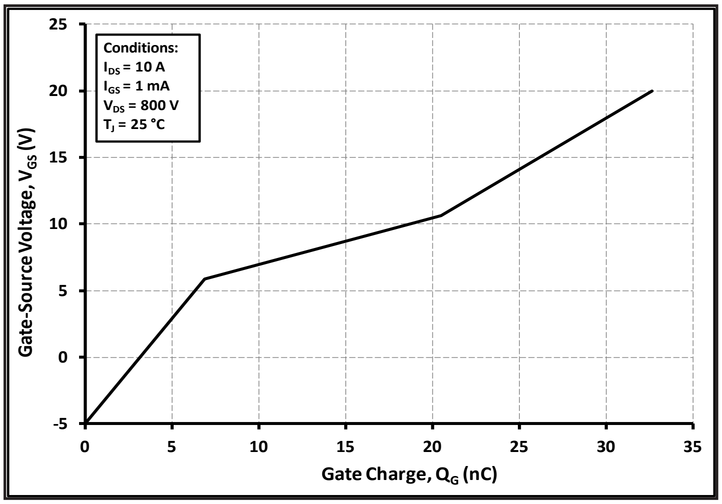


Figure 12. Typical Gate Charge Characteristic 25 ºC

Typical Performance

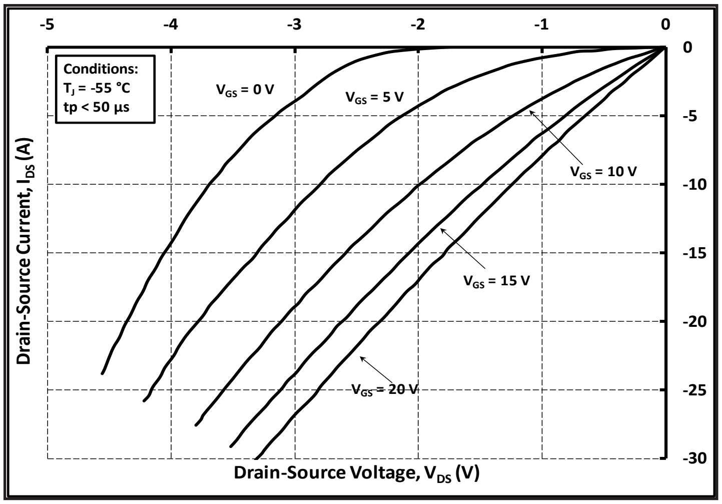


Figure 13. Typical 3rd Quadrant Characteristic
T_J = -55 ºC

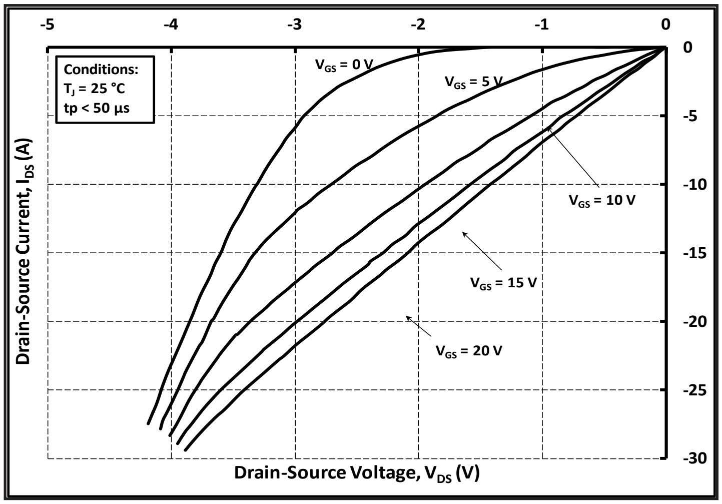


Figure 14. Typical 3rd Quadrant Characteristic
T_J = 25 ºC

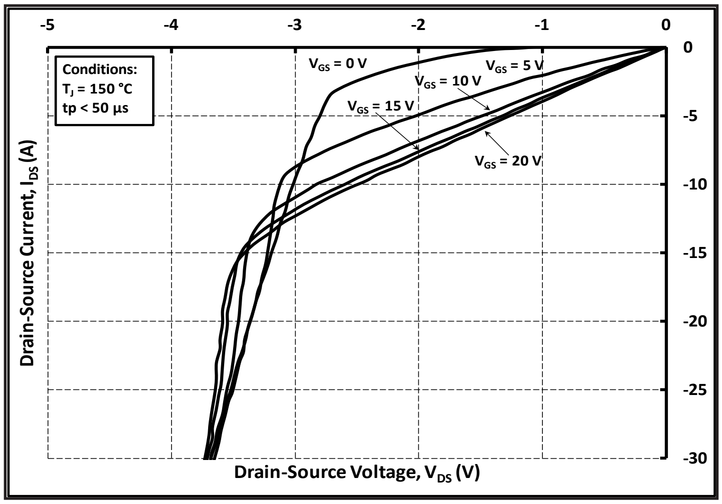


Figure 15. Typical 3rd Quadrant Characteristic
T_J = 150 ºC

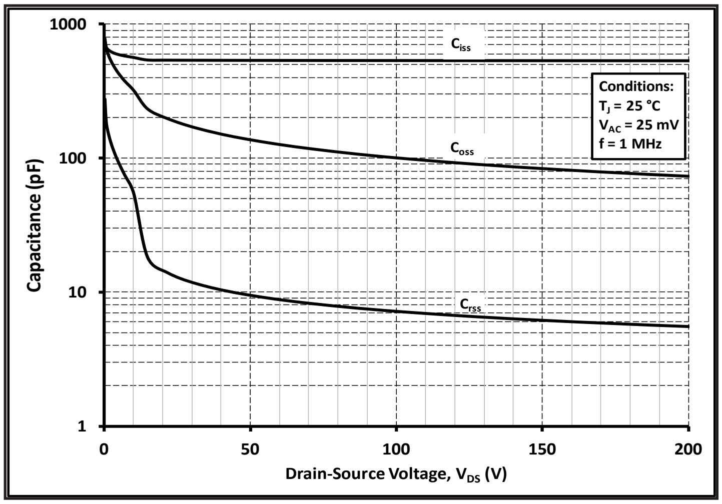


Figure 16. Typical Typical Capacitances vs. Drain-Source Voltage (0 - 200V)

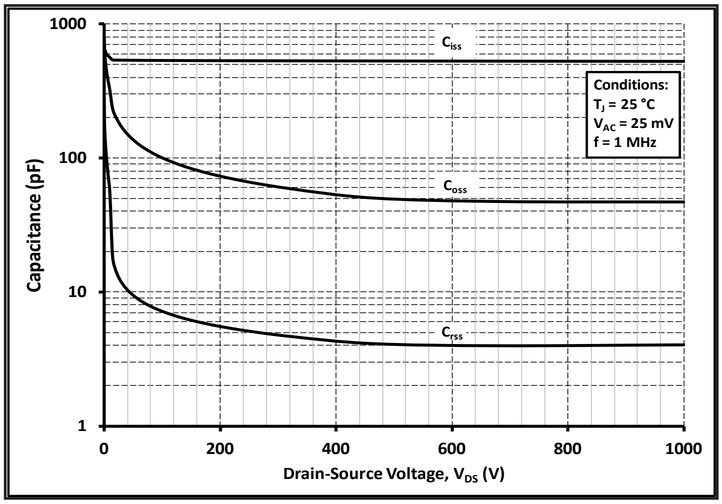


Figure 17. Typical Typical Capacitances vs. Drain-Source Voltage (0 - 1000V)

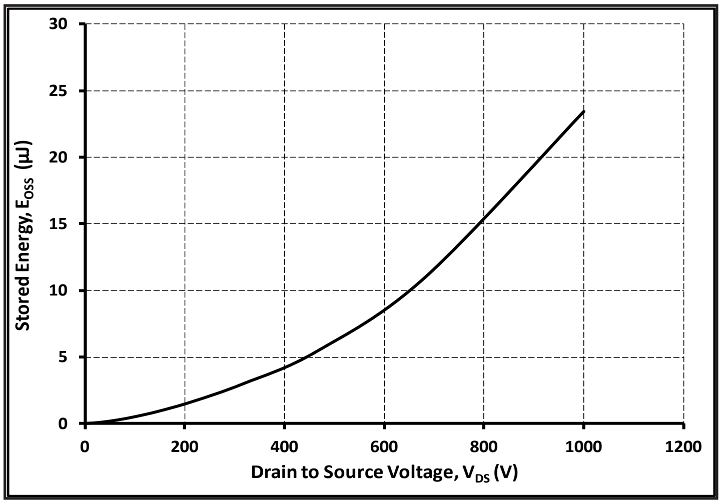


Figure 18. Stored Energy C_{OSS}

Typical Performance

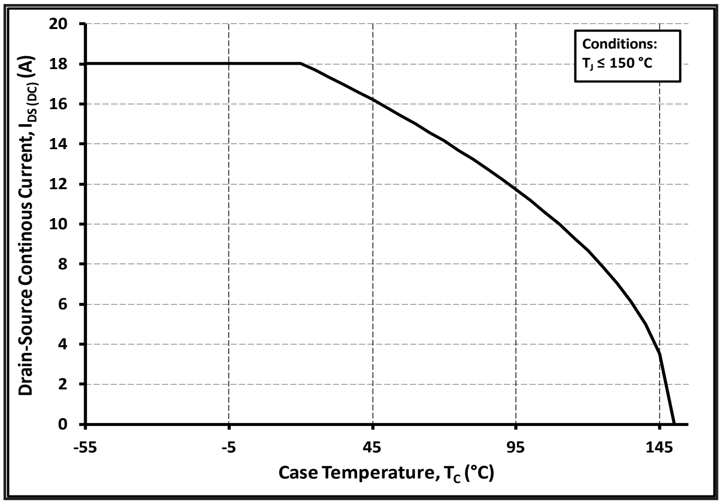


Figure 19. Continuous Current Derating Curve

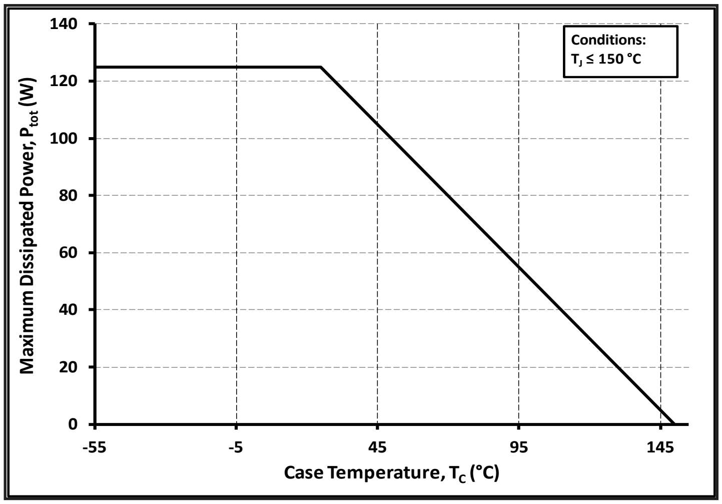


Figure 20. Continuous Power Derating

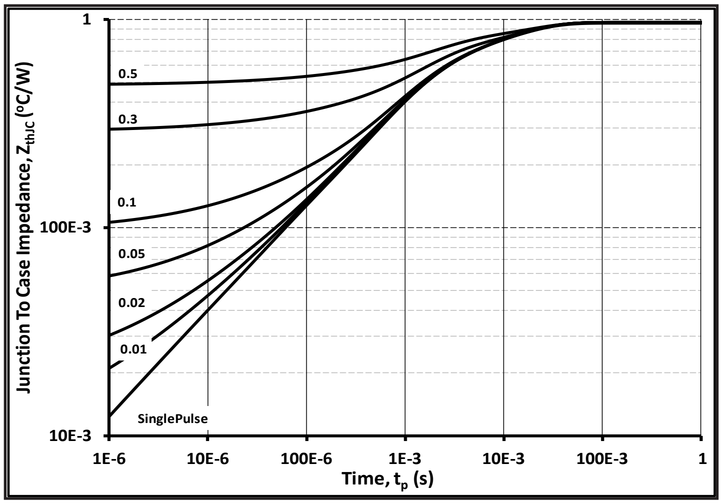


Figure 21. Typical Transient Thermal Impedance (Junction - Case)

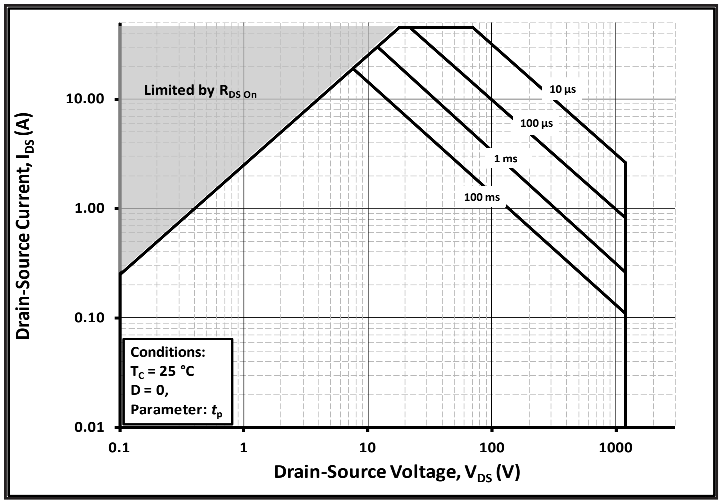


Figure 22. Safe Operating Area

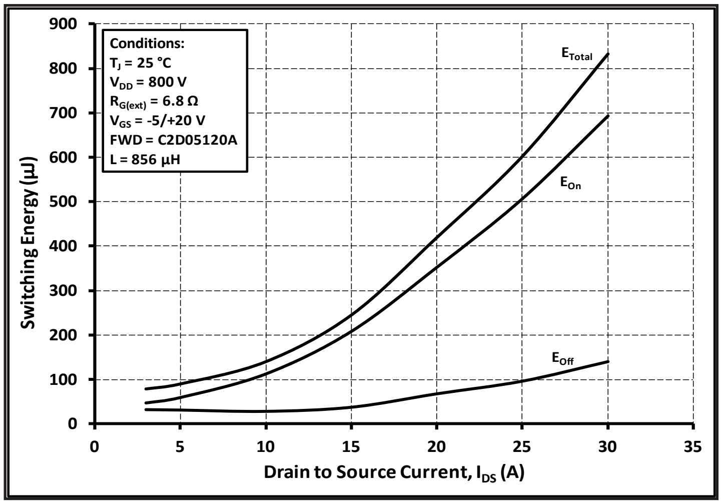


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DS} = 800 V)

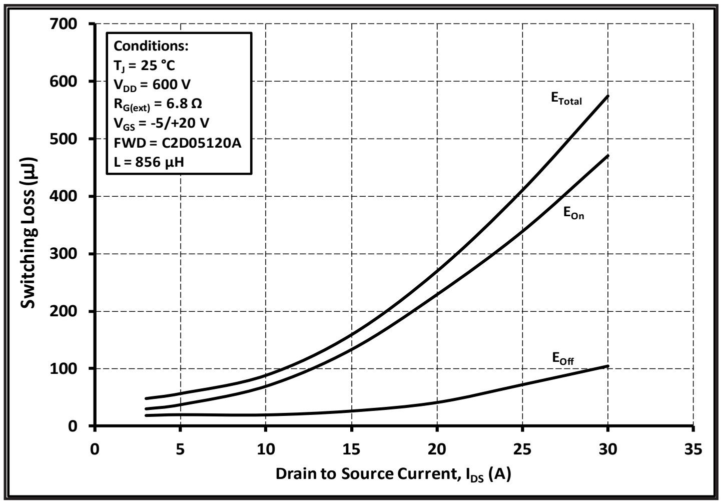


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DS} = 600 V)

Typical Performance

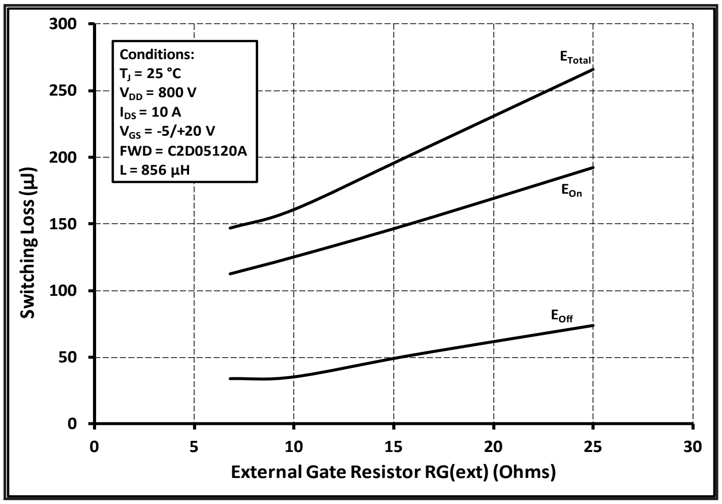


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

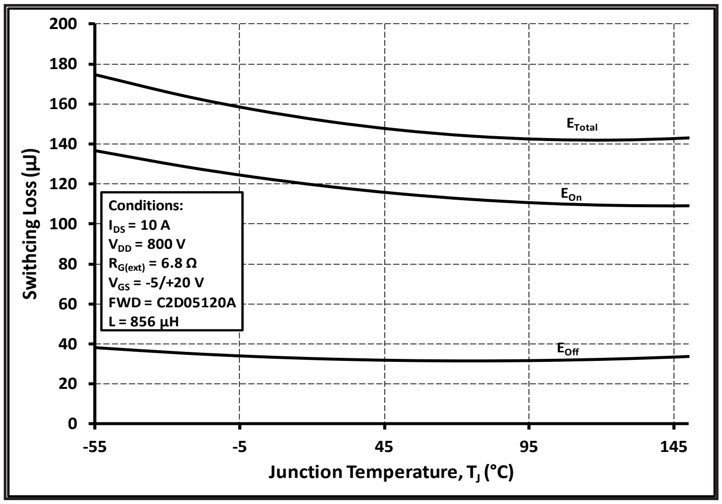


Figure 26. Clamped Inductive Switching Energy vs. Junction Temperature

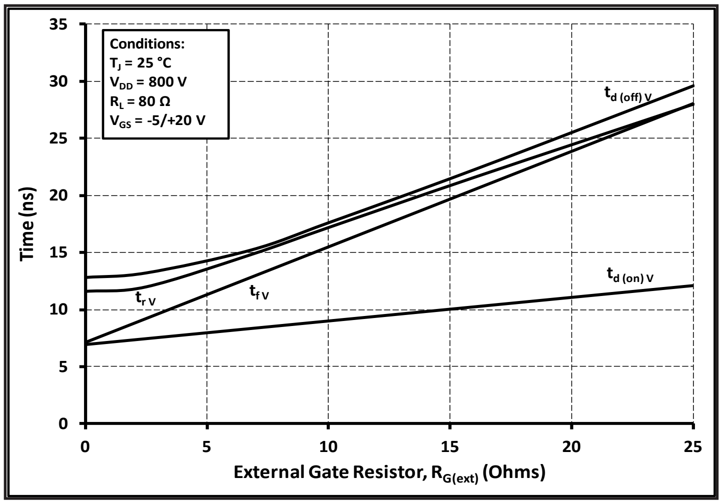


Figure 27. Resistive Switching Times vs. External Gate Resistor (V_{DD} = 800V, I_D = 10A)

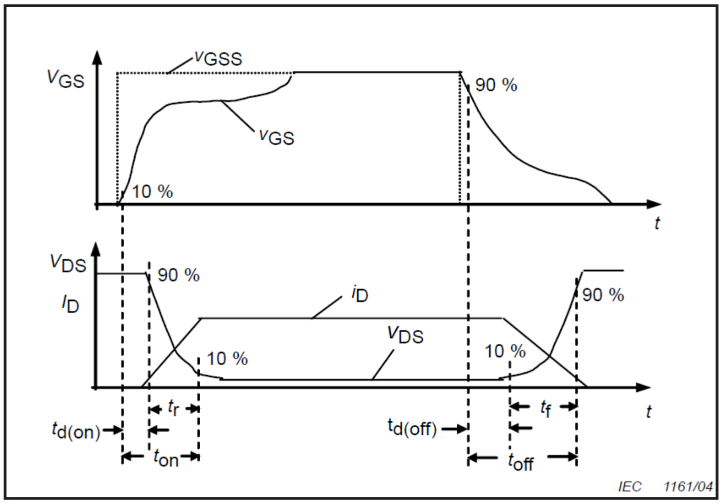


Figure 28. Resistive Switching Time Description

Clamped Inductive Switch Testing Fixture and Waveforms

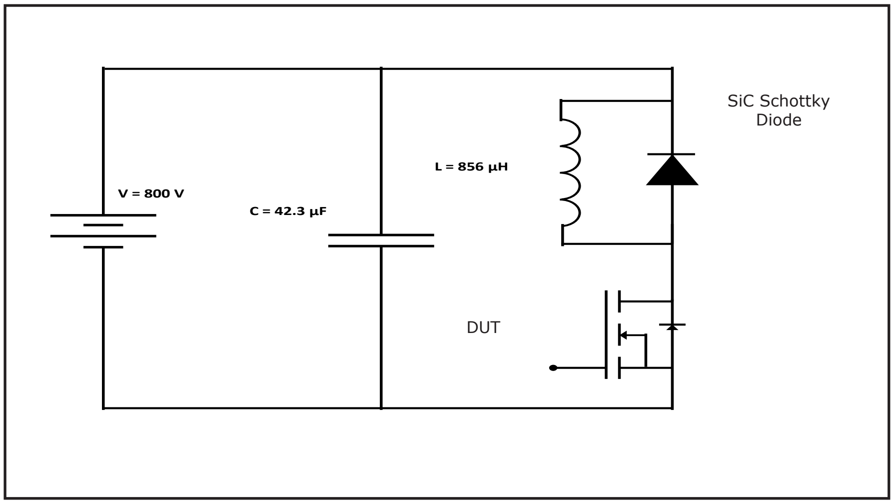


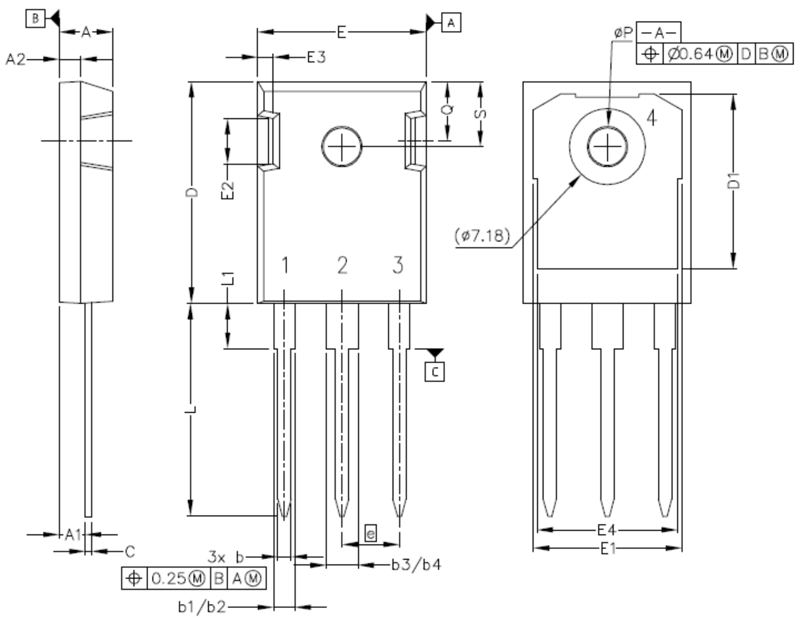
Figure 29. Clamped Inductive Switching Waveform Test Circuit

ESD Ratings

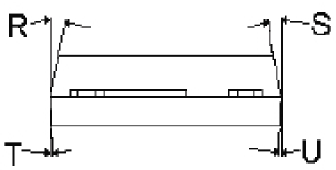
ESD Test	Total Devices Sampled	Resulting Classification
ESD-HBM	All Devices Passed 1000V	2 (>2000V)
ESD-MM	All Devices Passed 400V	C (>400V)
ESD-CDM	All Devices Passed 1000V	IV (>1000V)

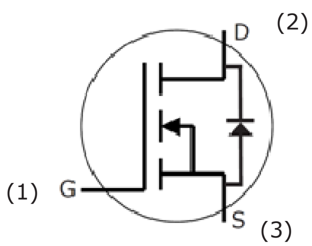
Package Dimensions

Package TO-247-3

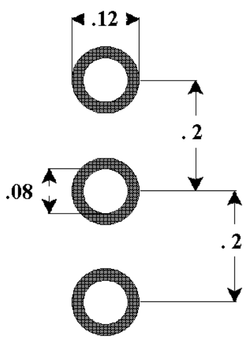


POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037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





Recommended Solder Pad Layout



TO-247-3

Part Number	Package	Marking
C2M0160120D	TO-247-3	C2M0160120

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