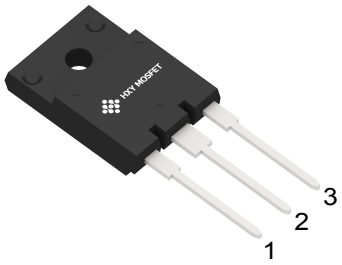
WNSC2M1K0170JQ

SiC Power MOSFET N-Channel Enhancement Mode

Features

- Effectively lower down Tj and Rth,high anti-EMI ability
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to Parallel and Simple to Drive
- Ultra-low Drain-Gate capacitance
- Halogen Free, RoHS Compliant



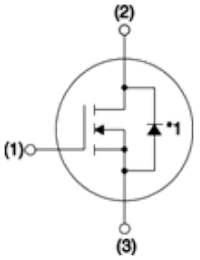
TO-3PF

Benefits

- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

- Auxiliary Power Supplies Switch
- Mode Power Supplies
- High-Voltage Capacitive Loads



(1) Gate
(2) Drain
(3) Source

Ordering Part Number	Package	Brand
WNSC2M1K0170JQ	TO-3PF	HXY MOSFET

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Voltage	1700	V	V_{GS}=0V, I_D=100μA	
V_{GSmax}	Gate-Source Voltage	-8/+22	V	Absolute maximum values	
V_{GSop}	Gate-Source Voltage	-4/+18	V	Recommended operational values	
I_D	Continuous Drain Current	5.0	A	V_{GS}=20V, T_c=25˚C	Fig. 19
		3.5		V_{GS}=20V, T_c=100˚C	
$I_{D(pulse)}$	Pulsed Drain Current	15	A	Pulse width t_p limited by T_{Jmax}	Fig. 22
P_D	Power Dissipation	69	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, 1.6mm from case for 10s	260	˚C		
M_d	Mounting Torque, (M3 or 6-32 screw)	1 8.8	Nm lbf-in		

Electrical Characteristics (T_C = 25˚C unless other

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700			V	V_{GS} = 0 V, I_D = 100 µA	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.8	4.3	V	V_{DS} = V_{GS}, I_D = 0.5 mA	Fig. 11
			2.4		V	V_{DS} = V_{GS}, I_D = 0.5 mA, T_J = 150 °C	
I_{DSS}	Zero Gate Voltage Drain Current		0.01	10	µA	V_{DS} = 1.7 kV, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage Current			100	nA	V_{GS} = 18 V, V_{DS} = 0 V	
$R_{DS(on)}$	Drain-Source On-State Resistance		0.80	1.4	Ω	V_{GS} = 18 V, I_D = 2 A	Fig. 4,5,6
			1.4			V_{GS} = 18 V, I_D = 2 A, T_J = 150 °C	
g_{fs}	Transconductance		1.04		S	V_{DS}= 18 V, I_{DS}= 2 A	Fig. 7
			1.09			V_{DS}= 18 V, I_{DS}= 2 A, T_J = 150 °C	
C_{iss}	Input Capacitance		215		pF	V_{GS} = 0 V V_{DS} = 1000 V f = 1 MHz V_{AC} = 25 mV	Fig. 17,18
C_{oss}	Output Capacitance		19				
C_{rss}	Reverse Transfer Capacitance		2.2				
E_{oss}	C_{oss} Stored Energy		10.2		µJ		Fig 16
E_{ON}	Turn-On Switching Energy		89		µJ	V_{DS} = 1.2 kV, V_{GS} = -5/20 V I_D = 2 A, $R_{G(ext)}$ = 2.5 Ω, L= 1478 µH, T_J = 150 °C	Fig. 26
E_{OFF}	Turn Off Switching Energy		14				
$t_{d(on)}$	Turn-On Delay Time		5		ns	V_{DD} = 1.2 kV, V_{GS} = -5/20 V I_D = 2 A, $R_{G(ext)}$ = 2.5 Ω, R_L = 600 Ω Timing relative to V_{DS} Per IEC60747-8-4 pg 83	Fig. 27
t_r	Rise Time		19				
$t_{d(off)}$	Turn-Off Delay Time		14				
t_f	Fall Time		63				
$R_{G(int)}$	Internal Gate Resistance		24.8		Ω	f = 1 MHz, V_{AC} = 25 mV	
Q_{gs}	Gate to Source Charge		4		nC	V_{DS} = 1.2 kV, V_{GS} = -5/20 V I_D = 2 A Per IEC60747-8-4 pg 21	Fig. 12
Q_{gd}	Gate to Drain Charge		12				
Q_g	Total Gate Charge		22				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.8		V	V_{GS} = - 5 V, I_{SD} = 1 A, T_J = 25 °C	Fig. 8, 9, 10
		3.3		V	V_{GS} = - 5 V, I_{SD} = 1 A, T_J = 150 °C	
I_S	Continuous Diode Forward Current		4	A	T_C= 25 °C	Note 1
t_{rr}	Reverse Recovery Time	30		ns	V_{GS} = - 5 V, I_{SD} = 2 A T_J = 150 ° C V_R = 1.2 kV dif/dt = 1135 A/µs	Note 1
Q_{rr}	Reverse Recovery Charge	31		nC		
I_{rrm}	Peak Reverse Recovery Current	3		A		

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

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	2.0	2.3	°C/W		Fig. 21
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient		50			

Typical Performance

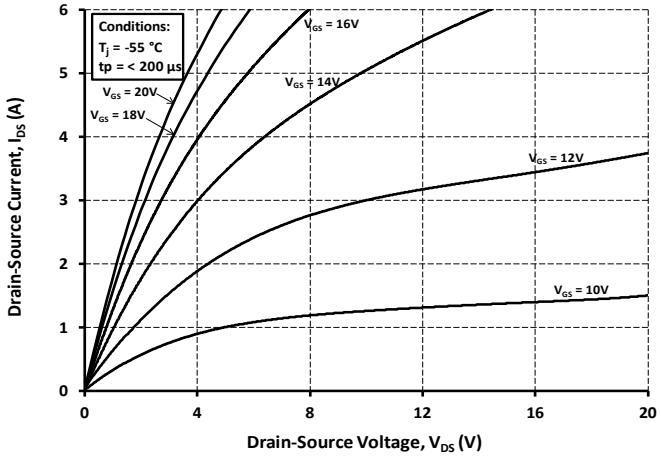


Figure 1. Output Characteristics T_J = -55 °C

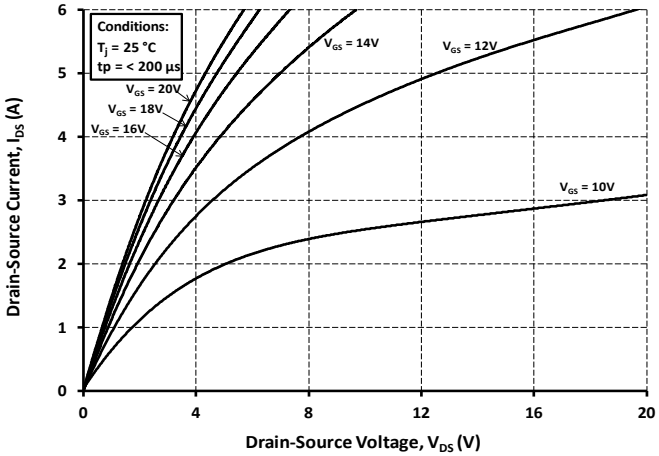


Figure 2. Output Characteristics T_J = 25 °C

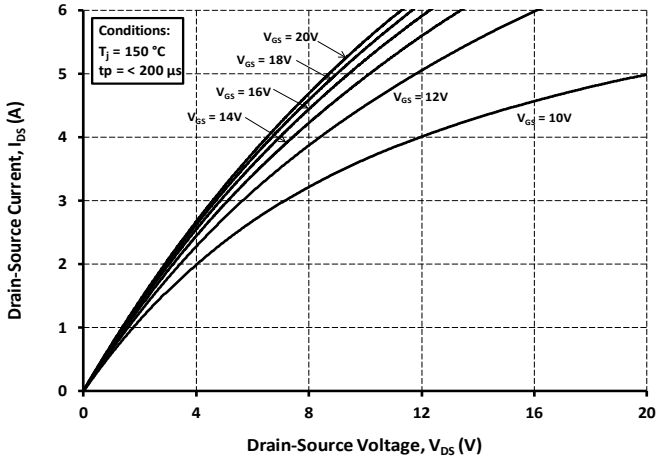


Figure 3. Output Characteristics T_J = 150 °C

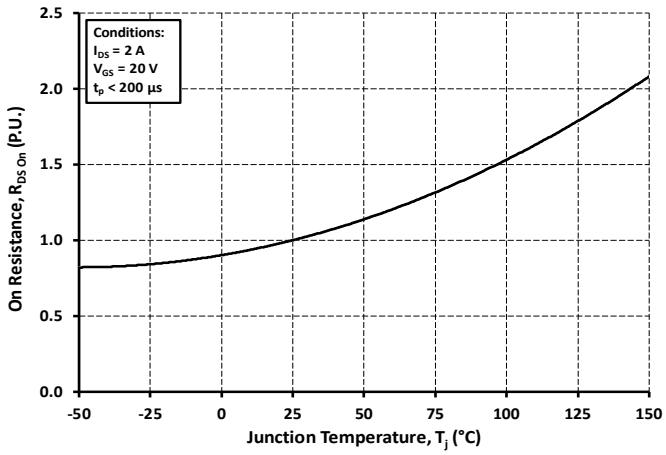


Figure 4. Normalized On-Resistance vs. Temperature

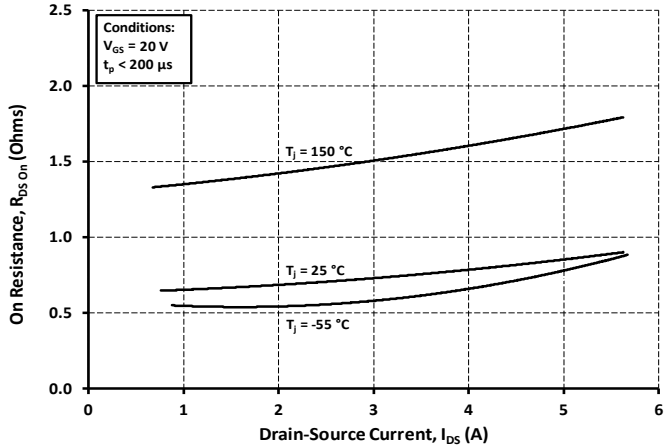


Figure 5. On-Resistance vs. Drain Current
For Various Temperatures

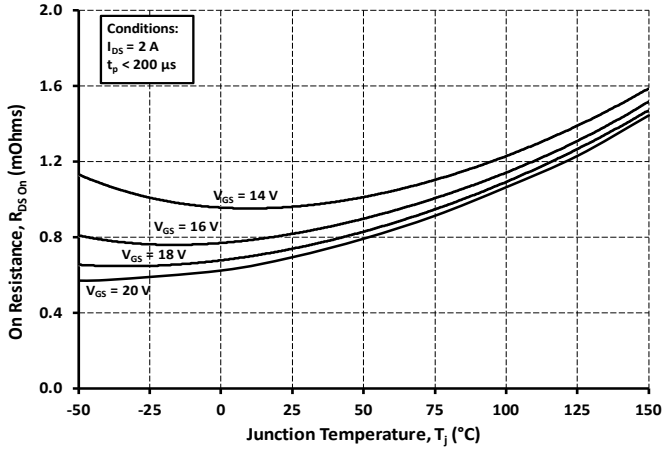


Figure 6. On-Resistance vs. Temperature
For Various Gate Voltage

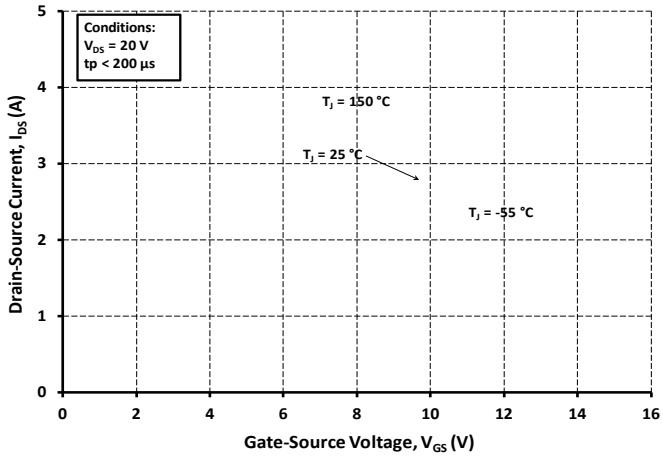


Figure 7. Transfer Characteristic for Various Junction Temperatures

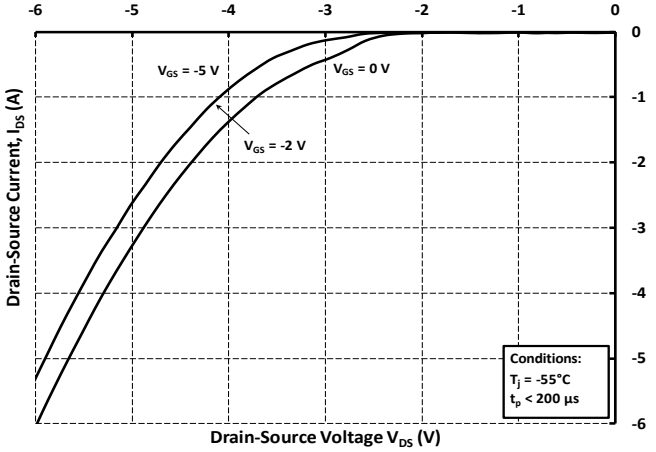


Figure 8. Body Diode Characteristic at -55 ºC

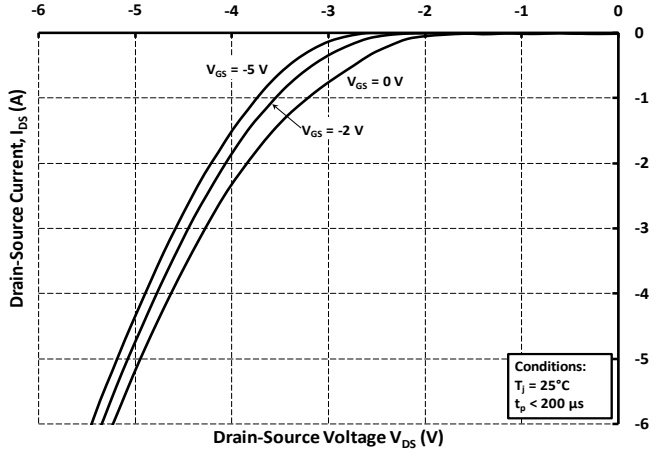


Figure 9. Body Diode Characteristic at 25 ºC

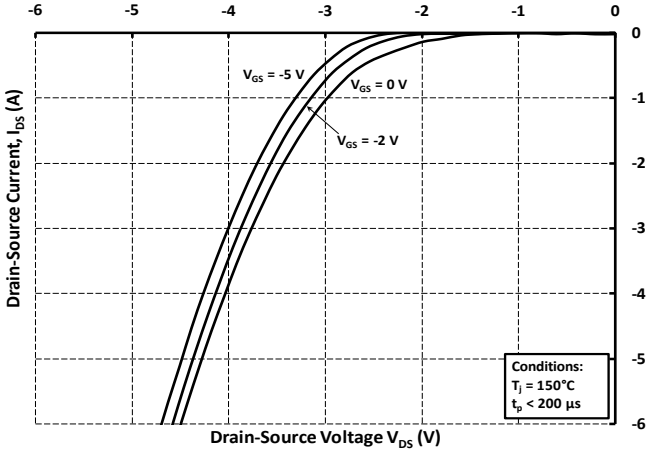


Figure 10. Body Diode Characteristic at 150 ºC

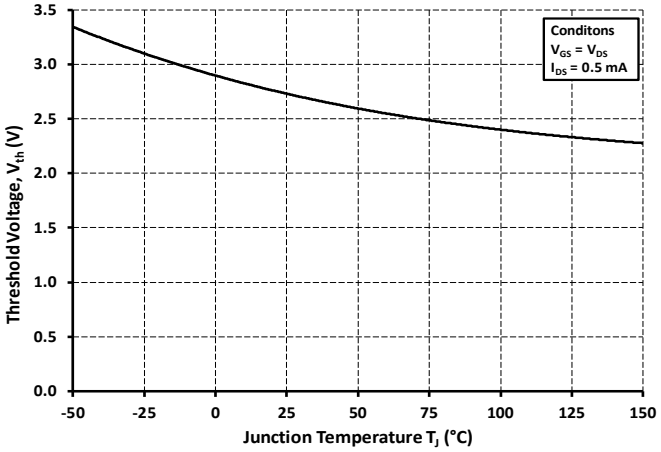


Figure 11. Threshold Voltage vs. Temperature

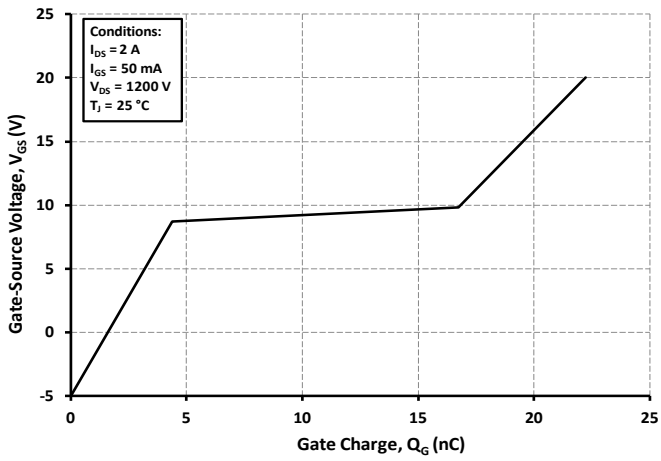


Figure 12. Gate Charge Characteristics

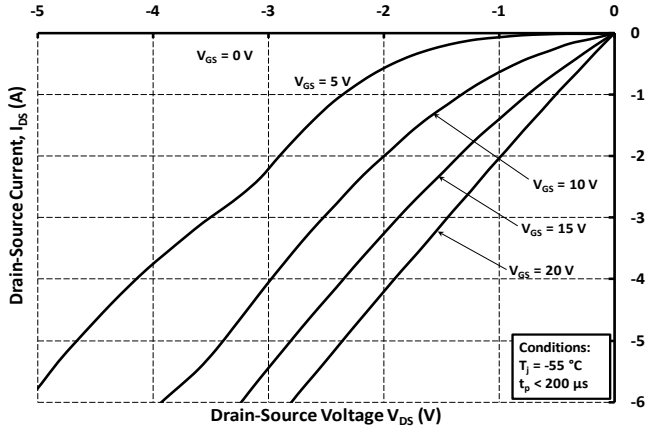


Figure 13. 3rd Quadrant Characteristic at -55 °C

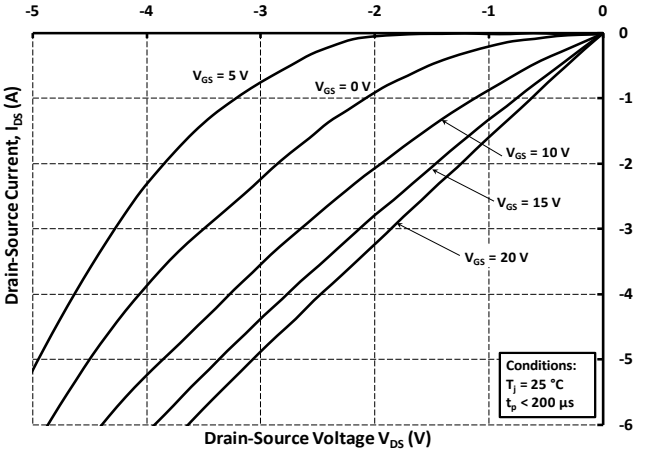


Figure 14. 3rd Quadrant Characteristic at 25 °C

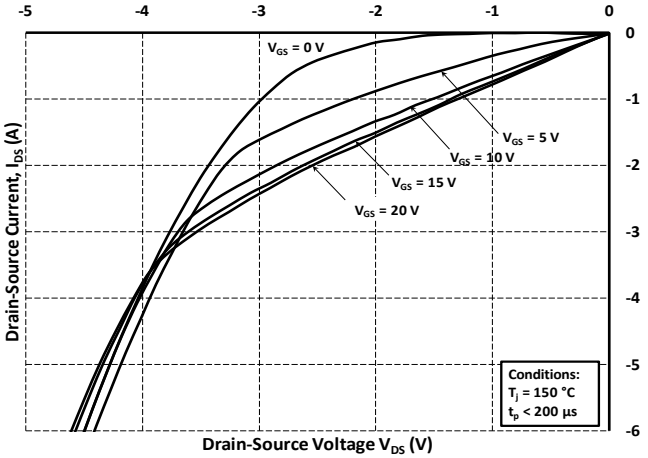


Figure 15. 3rd Quadrant Characteristic at 150 °C

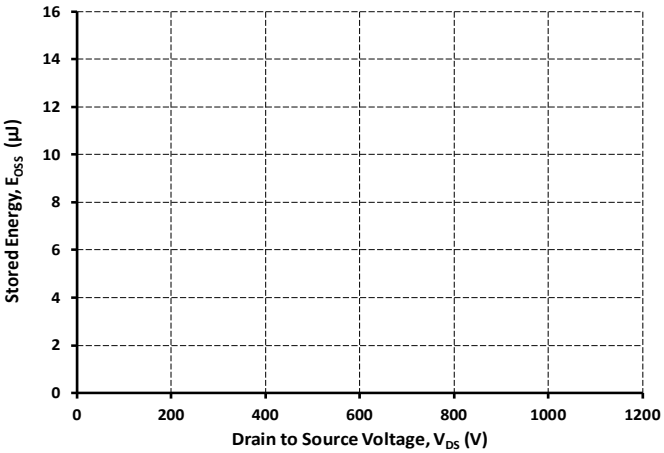


Figure 16 Output Capacitor Stored Energy

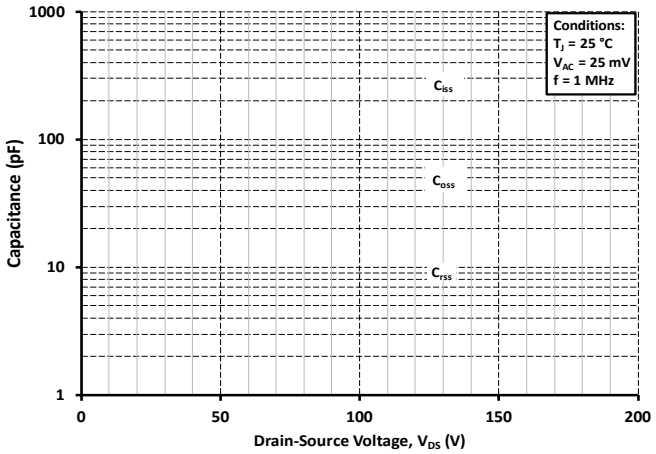


Figure 17. Capacitances vs. Drain-Source Voltage (0-200 V)

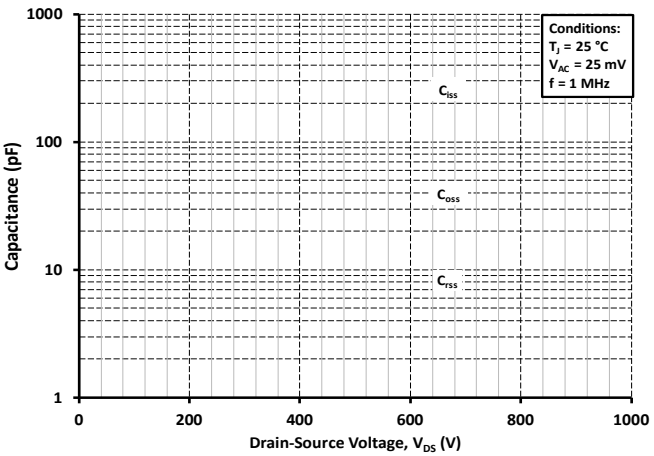


Figure 18. Capacitances vs. Drain-Source Voltage (0-1000 V)

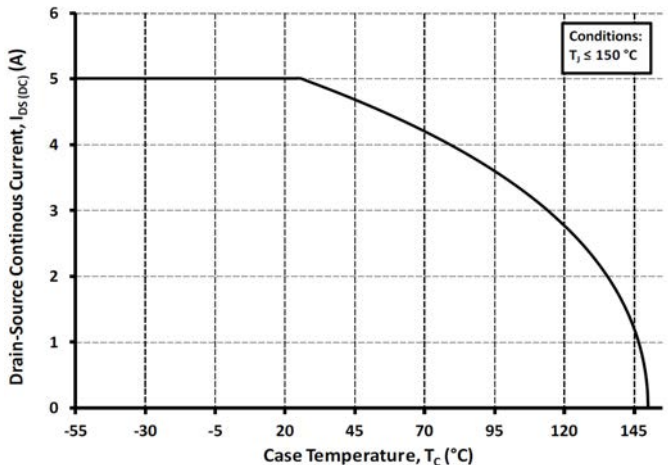


Figure 19. Continuous Drain Current Derating vs. Case Temperature

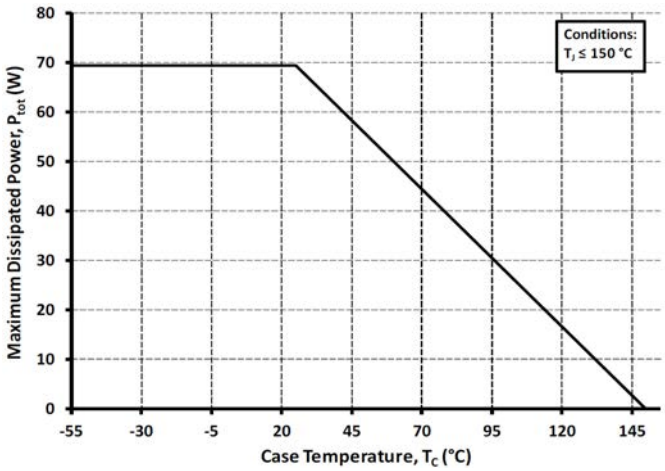


Figure 20. Maximum Power Dissipation Derating Vs Case Temperature

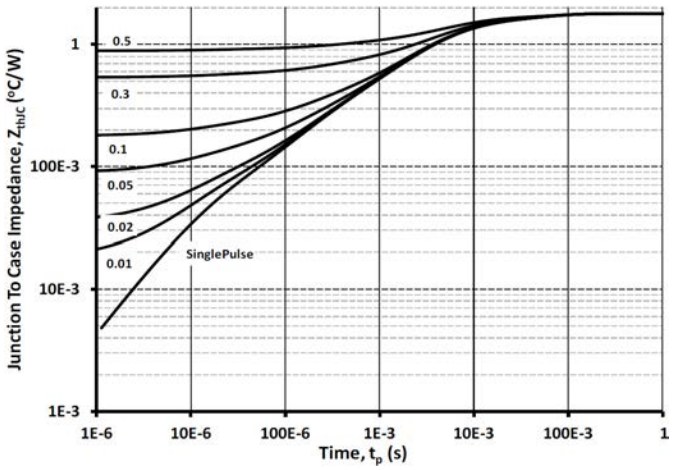


Figure 21. Transient Thermal Impedance (Junction - Case)

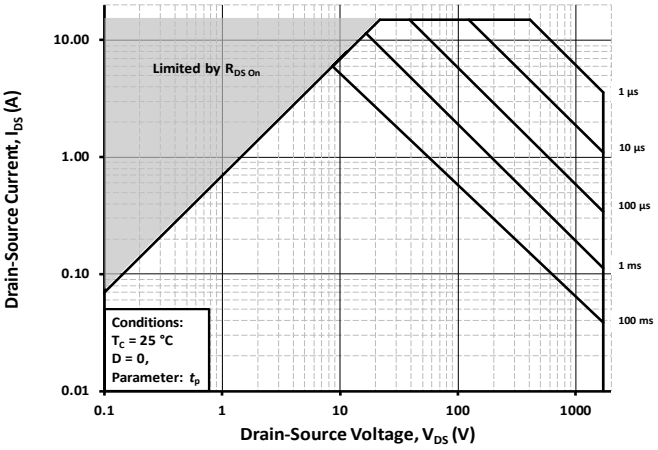


Figure 22. Safe Operating Area

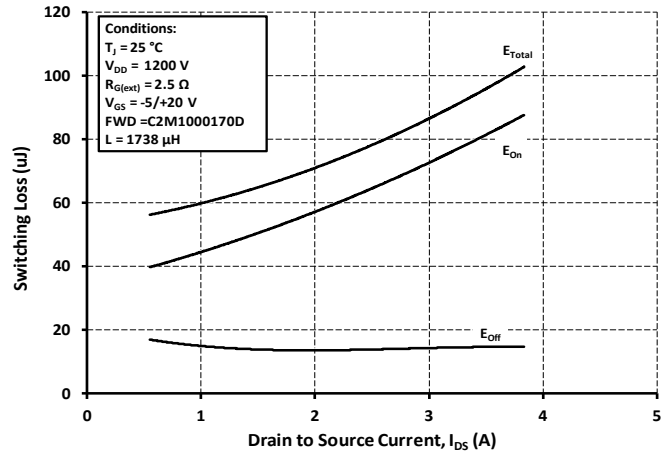


Figure 23. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 1200V)

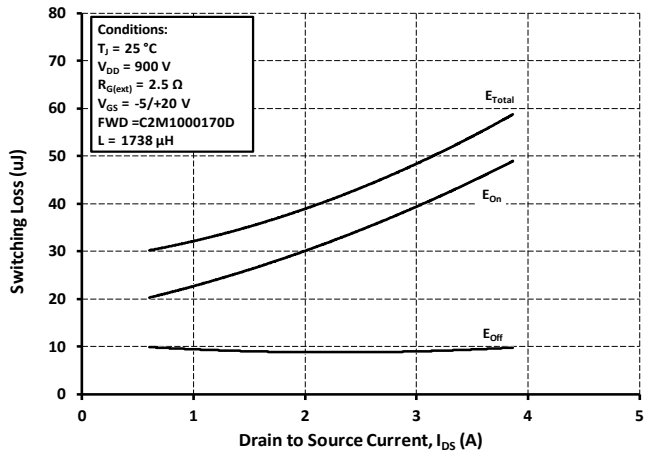


Figure 24. Clamped Inductive Switching Energy vs. Drain Current (V_{DD} = 900 V)

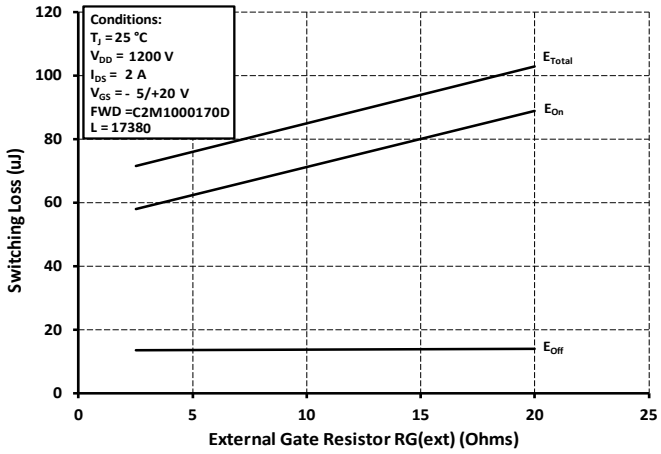


Figure 25. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

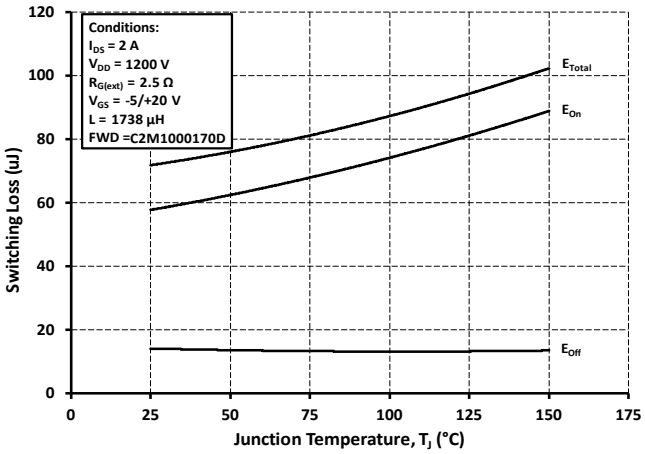


Figure 26. Clamped Inductive Switching Energy vs. Temperature

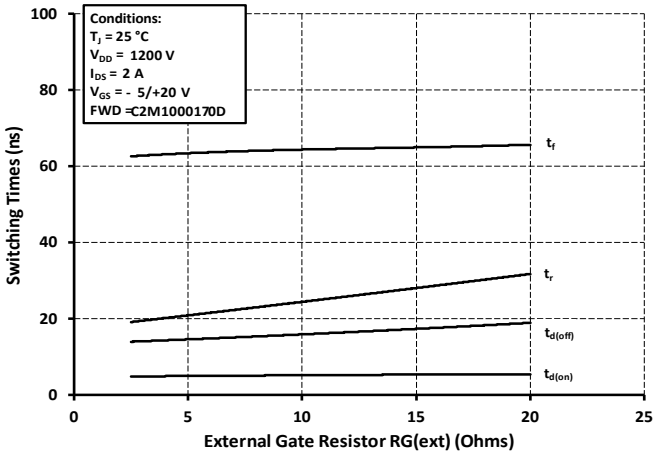


Figure 27. Switching Times vs. $R_{G(ext)}$

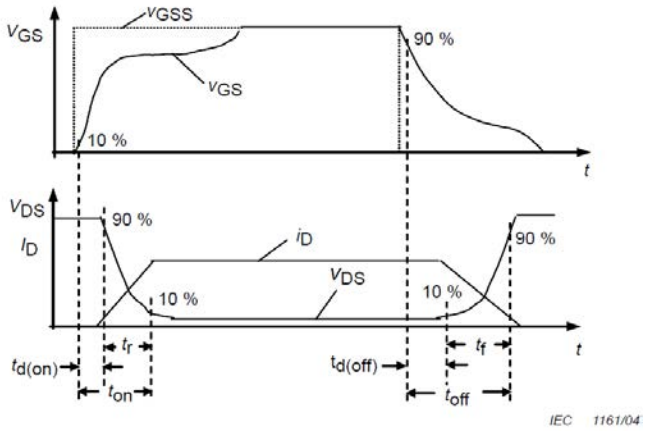


Figure 28. Switching Times Definition

Test Circuit Schematic

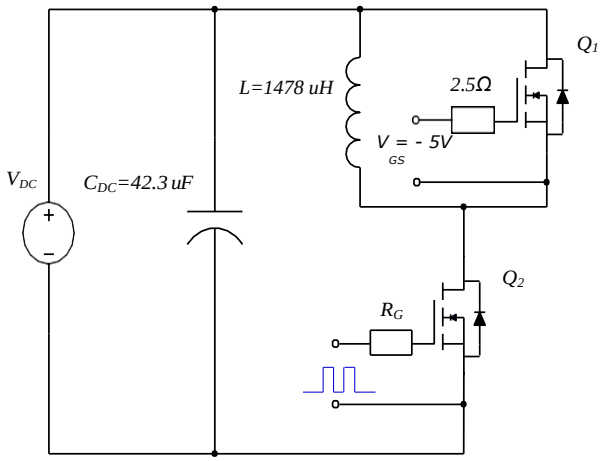


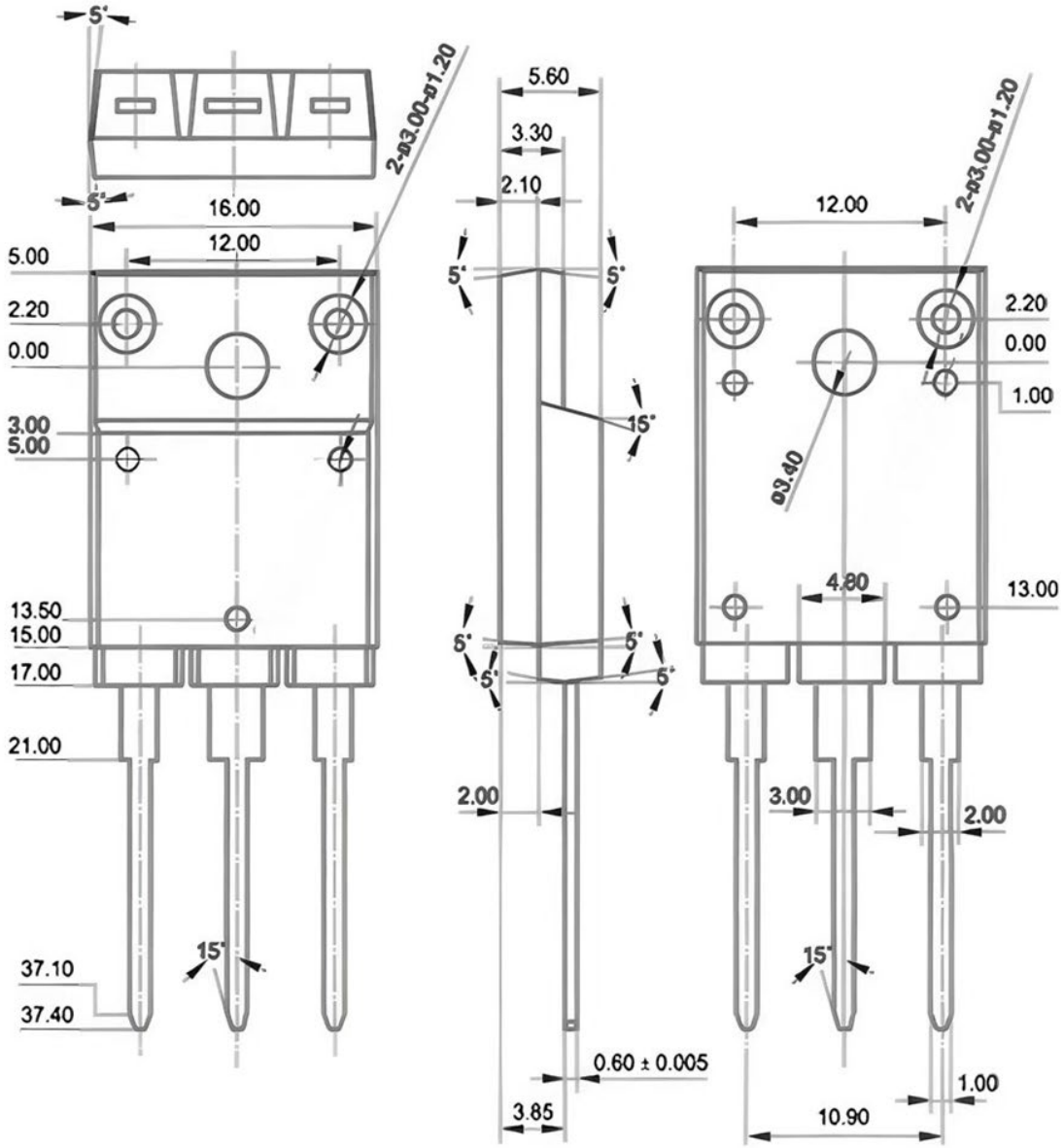
Figure 29. Clamped Inductive Switching
Waveform Test Circuit

ESD Ratings

ESD Test	Total Devices Sampled	Resulting Classification
ESD-HBM	All Devices Passed 4000V	3A (>4000V)
ESD-CDM	All Devices Passed 1000V	IV (>1000V)

Package Dimensions

Package TO-3PF



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