

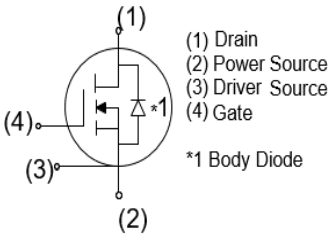
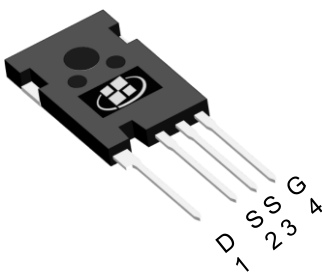
1200V 70mohm Silicon Carbide Power MOSFET

AK1CK2M070WAMH

- Features:
- Low on-resistance
 - Fast switching speed with low capacitances
 - Fast intrinsic diode with low reverse recovery (Q_{rr})
 - Halogen-free, RoHS compliant
- Applications:
- Motor drives
 - Switched mode power supplies

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	1200	V
$R_{DS(on),\text{ TYP}} @V_{GS} = 18\text{ V}$	60	m Ω
I_D	35	A
P_D	176	W



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK1CK2M070WAMH	TO-247-4L	1CK2M070WAMH	Tube	See the detail package information

Maximum Ratings ($T_A = 25^{\circ}\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Units
V_{DS}	Drain-Source Voltage	1200	V
I_D	Drain Current - Continuous ($T_C = 25^{\circ}\text{C}$) ^(Note 1)	35	A
	Drain Current - Continuous ($T_C = 100^{\circ}\text{C}$) ^(Note 1)	25	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	87.5	A
V_{GS}	Gate - Source Voltage (dynamic)	-10/+22	V
V_{GS}	Gate - Source Voltage (static)	-6/+18	V
P_D	Power Dissipation ($T_C = 25^{\circ}\text{C}$)	176	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^{\circ}\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction - to - Case, Steady - State	0.85	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady - State	40	$^{\circ}\text{C/W}$

Notes:

1. The max drain current limited by maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Static Characteristics						
V _{(BR)DSS}	Drain - Source Breakdown Voltage	V _{GS} = 0 V, I _D = 100 μA	1200			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 1200 V, V _{GS} = 0 V		5	50	μA
I _{GSS}	Gate Leakage Current	V _{GS} = + 22 V, V _{DS} = 0 V			100	nA
		V _{GS} = - 10 V, V _{DS} = 0 V			-100	nA
V _{GS(th)}	Gate Threshold voltage	V _{DS} = V _{GS} , I _D = 6 mA	1.8	2.8	4	V
		V _{DS} = V _{GS} , I _D = 6 mA, T _J = 175 °C		2.1		V
R _{DS(ON)}	Drain-Source on-state resistance	V _{GS} = 18 V, I _D = 20 A		60	78	mΩ
		V _{GS} = 18 V, I _D = 20 A, T _J = 175 °C		105		mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 20 A		13		S
		V _{DS} = 20 V, I _D = 20 A, T _J = 175 °C		14		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 800 V, V _{GS} = 0 V, F = 100 kHz, V _{AC} = 25 mV		1447		pF
C _{oss}	Output Capacitance			59		pF
C _{rss}	Reverse Transfer Capacitance			5		pF
E _{oss}	C _{oss} Stored Energy			24		μJ
R _g	Gate Resistance	F = 1 MHz, V _{AC} = 25 mV		2.5		Ω
Q _{gs}	Gate-Source Charge	V _{DS} = 800 V , I _D = 20 A, V _{GS} = -5/+18 V		18		nC
Q _{gd}	Gate-Drain Charge			30		nC
Q _g	Total Gate Charge			78		nC

Switching Characteristics						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t _{d(on)}	Turn On Delay Time	V _{DD} = 800 V , I _D = 20 A, V _{GS} = -4/+18 V, R _{G,EXT} = 2.5 Ω L = 100 μH Diode: Body Diode at V _{GS} = -4V		8		ns
t _r	Rise Time			12		ns
t _{d(off)}	Turn Off Delay Time			22		ns
t _f	Fall Time			8		ns
E _{on}	Turn On Energy			176		μJ
E _{off}	Turn Off Energy			48		μJ
t _{d(on)}	Turn On Delay Time	V _{DD} = 800 V , I _D = 20 A, V _{GS} = -4/+18 V, R _{G,EXT} = 2.5 Ω L = 100 μH Diode: Body Diode at V _{GS} = -4V T _J = 175 °C		8		ns
t _r	Rise Time			13		ns
t _{d(off)}	Turn Off Delay Time			26		ns
t _f	Fall Time			9		ns
E _{on}	Turn On Energy			177		μJ
E _{off}	Turn Off Energy			95		μJ
Drain-Source Diode Characteristics (T _J = 25 °C unless otherwise noted)						
I _S	Maximum Continuous Drain-Source Diode Forward Current				35	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				87.5	A
V _{SD}	Diode Forward Voltage	V _{GS} = -4 V , I _{SD} = 20 A		5.6		V
		V _{GS} = -4 V , I _{SD} = 20 A, T _J = 175 °C		5		V
I _{rrm}	Peak Reverse Recovery Current	V _{GS} = -4 V , I _{SD} = 20 A, V _R = 800 V, di/dt = 470 A/μs		6.5		A
t _{rr}	Reverse Recovery Time			31.5		ns
Q _{rr}	Reverse Recovery Charge			92		nC

Electrical Characteristics Diagrams

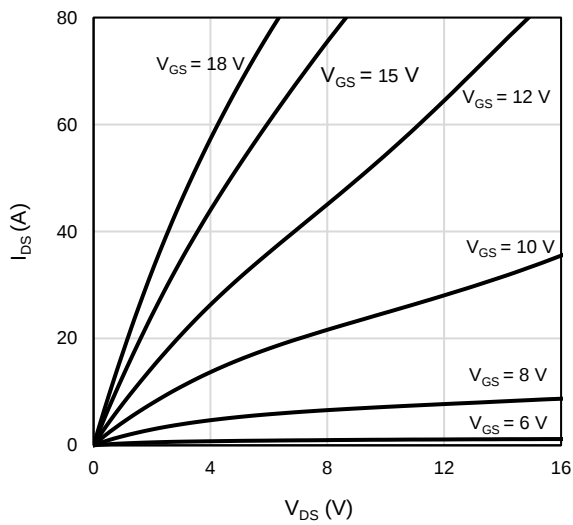
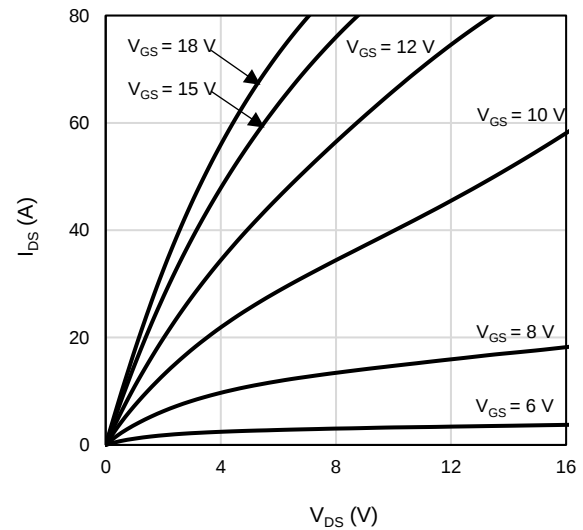
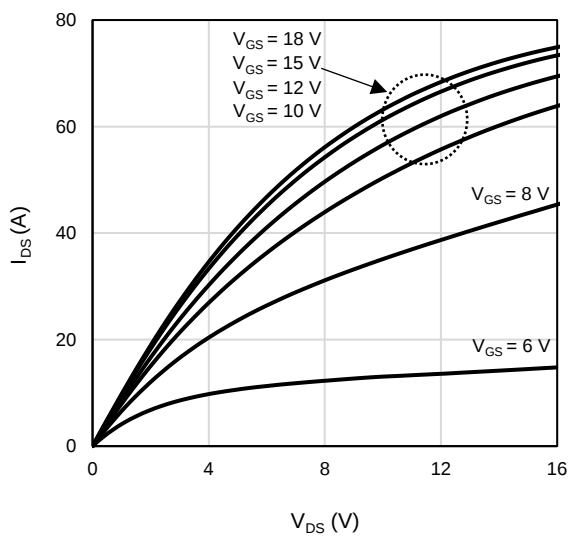
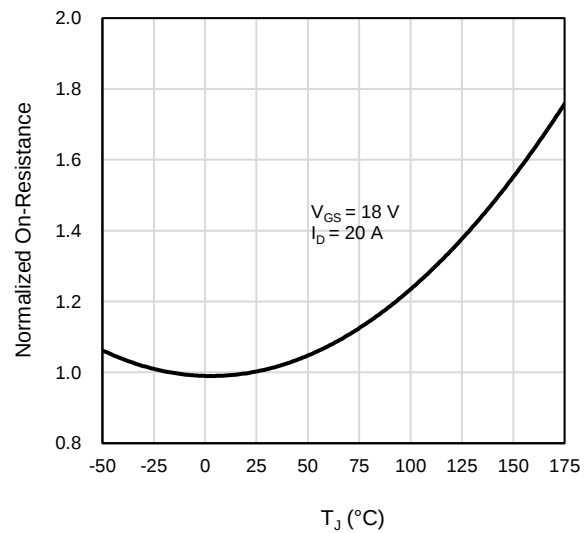
Figure 1: Output Characteristics $T_j = -40^\circ\text{C}$ Figure 2: Output Characteristics $T_j = 25^\circ\text{C}$ Figure 3: Output Characteristics $T_j = 175^\circ\text{C}$ 

Figure 4: Normalized On-Resistance vs. Temperature

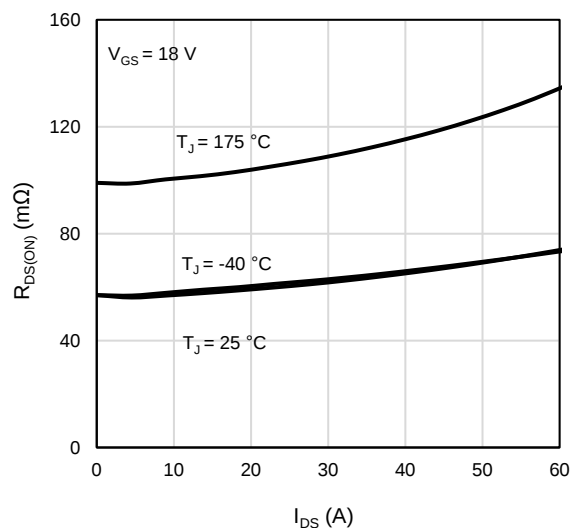
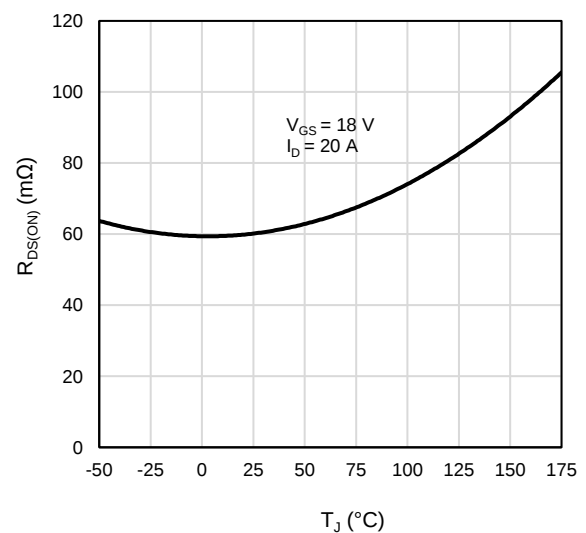
Figure 5: On-Resistance vs. Drain Current
For Various Temperatures

Figure 6: On-Resistance vs. Temperature

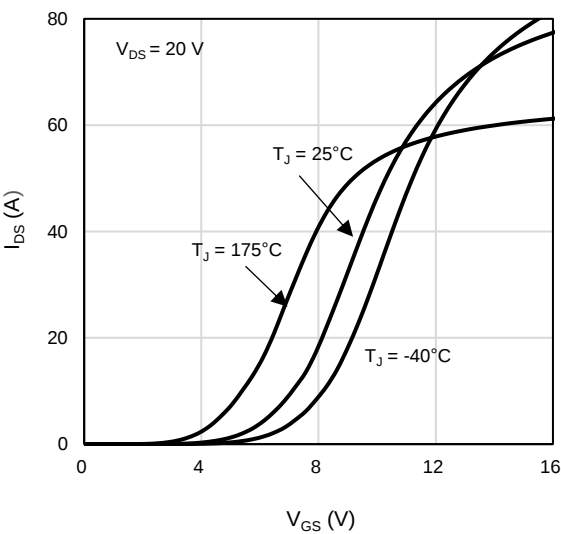


Figure 7: Transfer Characteristics For Various Junction Temperature

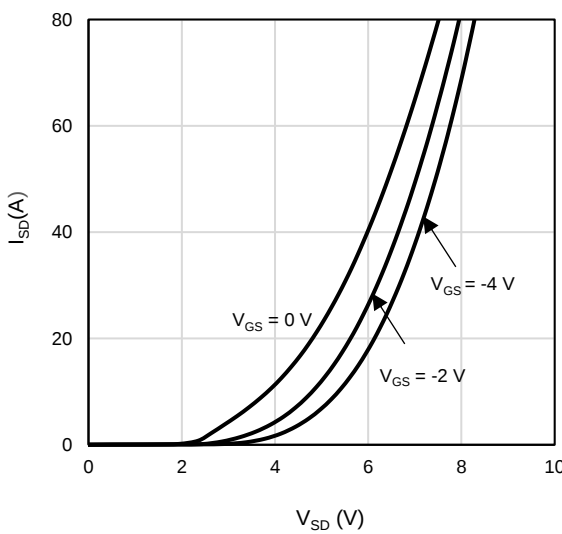


Figure 8: Body Diode Characteristics at -40°C

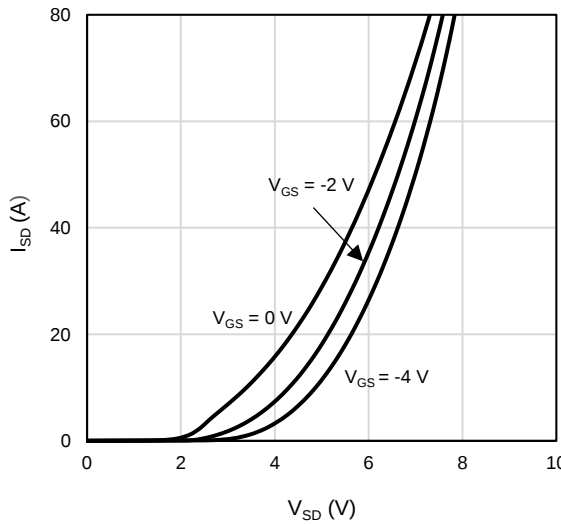


Figure 9: Body Diode Characteristics at 25°C

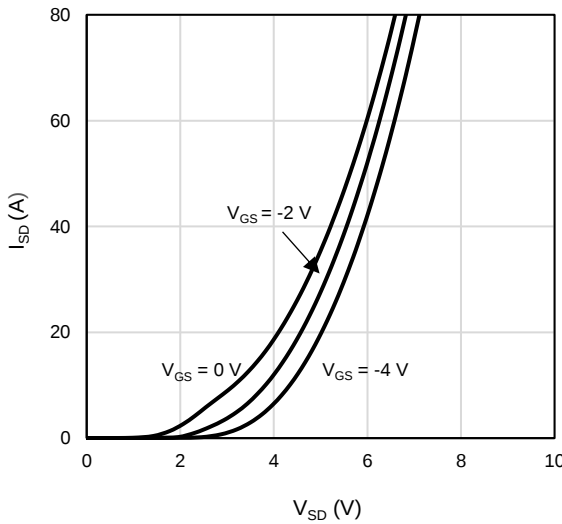


Figure 10: Body Diode Characteristics at 175°C

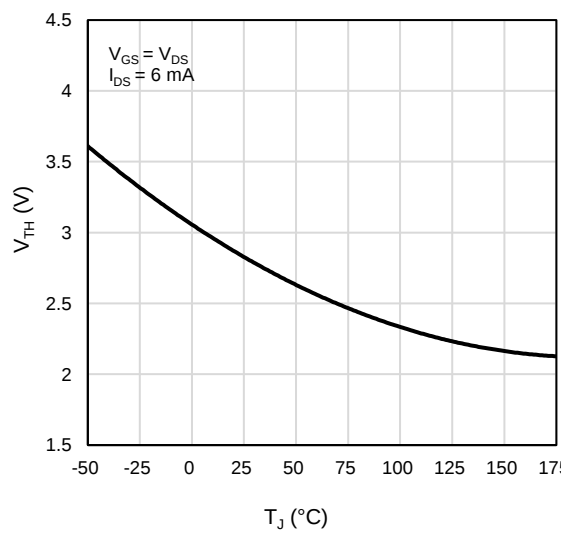


Figure 11: Threshold Voltage vs. Temperature

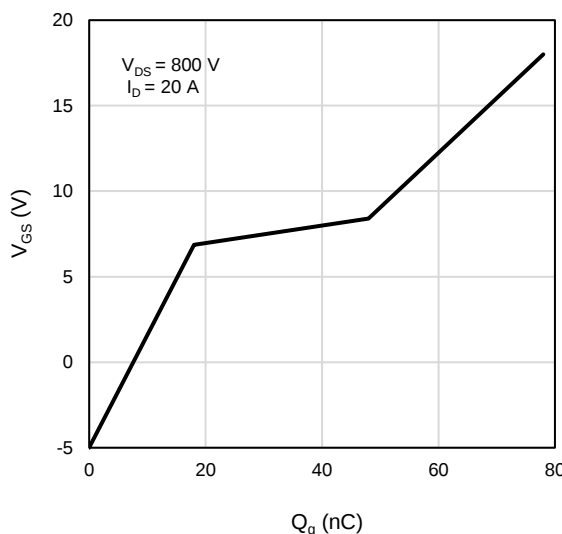


Figure 12: Gate-Charge Characteristics

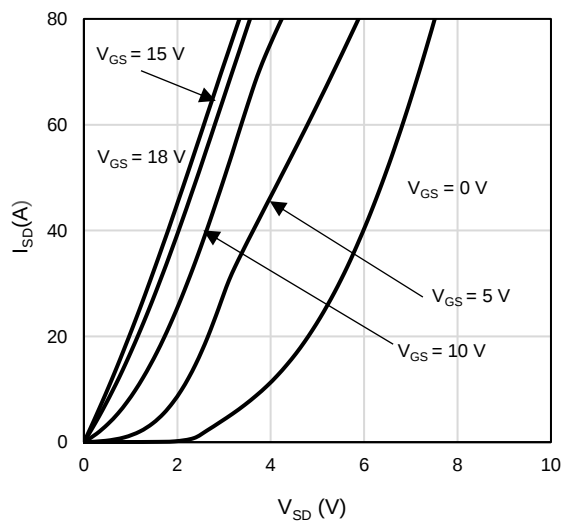


Figure 13: 3rd Quadrant Characteristics at -40°C

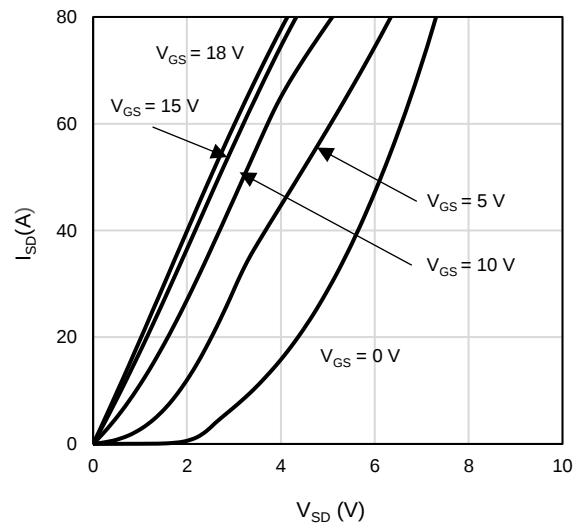


Figure 14: 3rd Quadrant Characteristics at 25°C

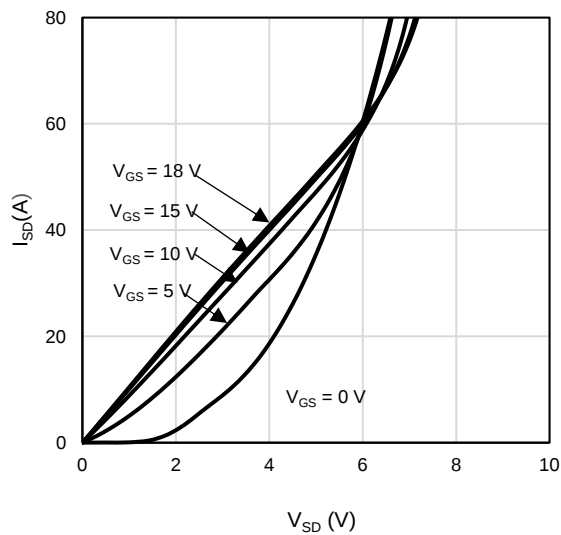


Figure 15: 3rd Quadrant Characteristics at 175°C

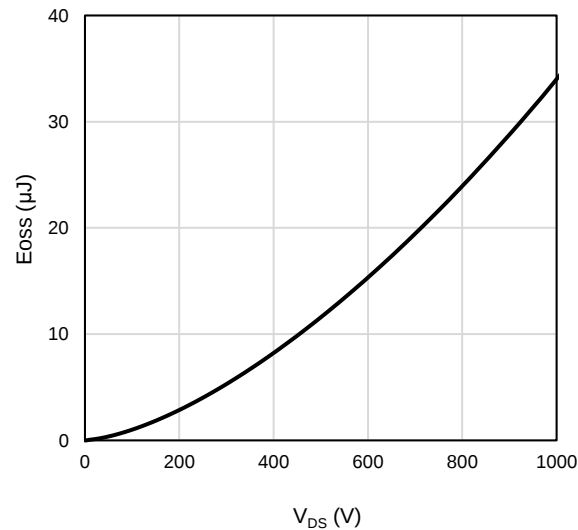


Figure 16: Output Capacitor Stord Energy

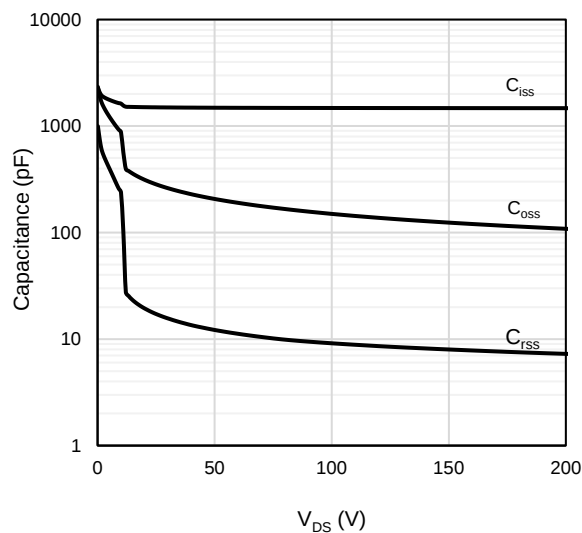


Figure 17: Capacitance Characteristics (0 - 200 V)

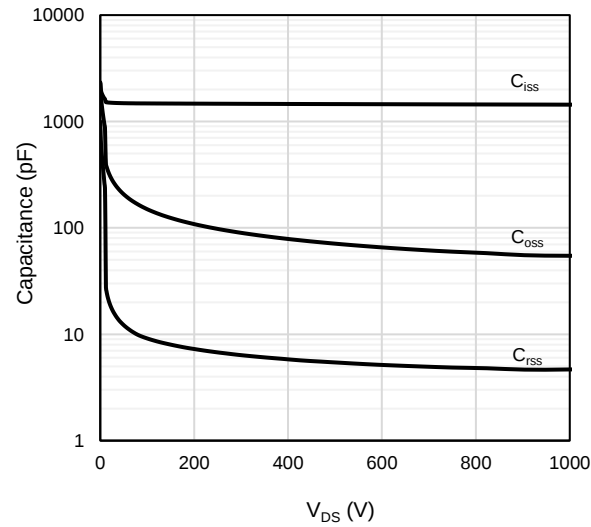


Figure 18: Capacitance Characteristics (0 - 1000 V)

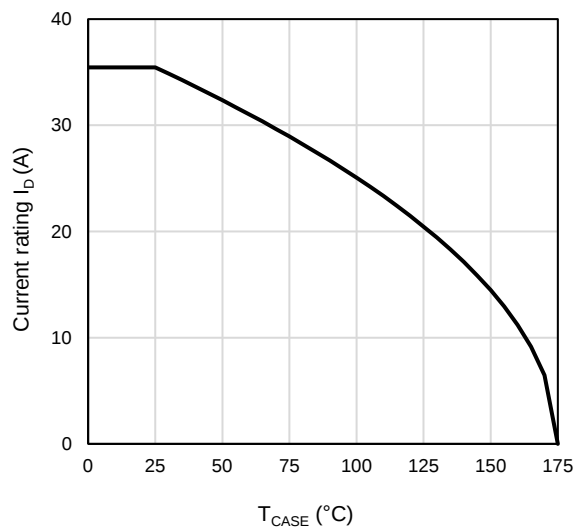


Figure 19: Current De-rating

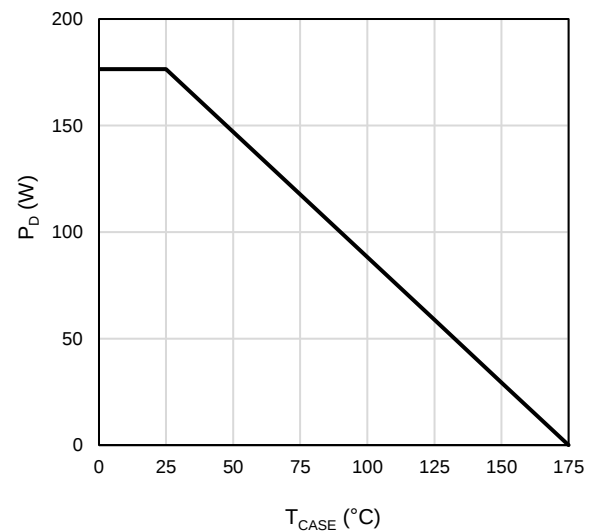


Figure 20: Maximum Power Dissipation Derating vs. Case Temperature

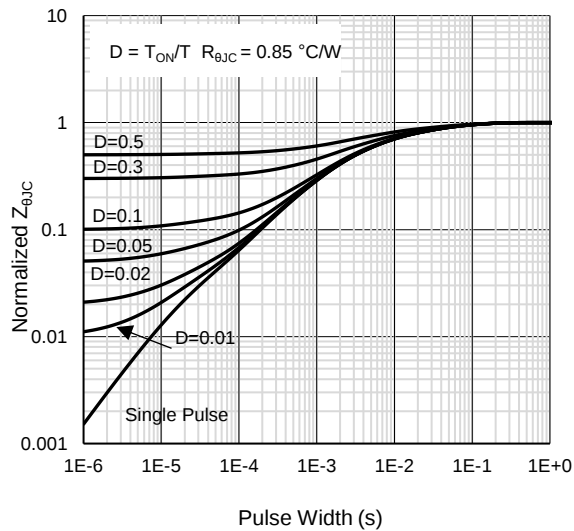


Figure 21: Normalized Maximum Transient Thermal Impedance

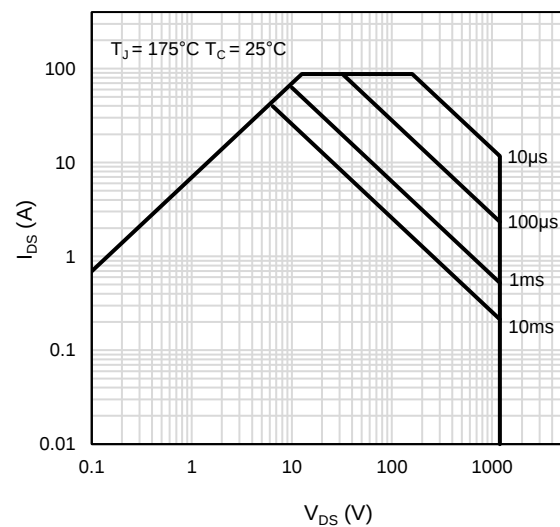
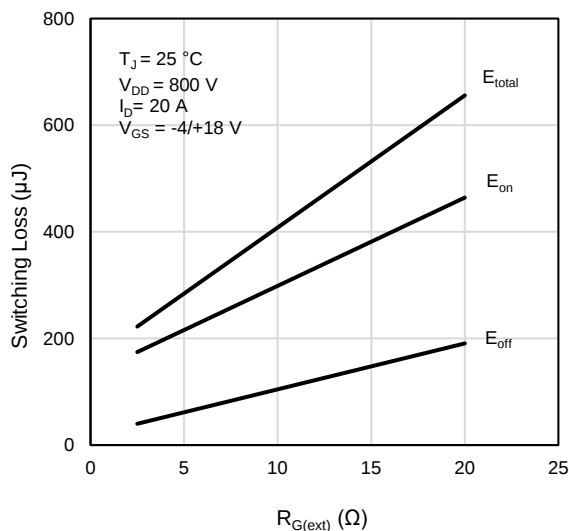
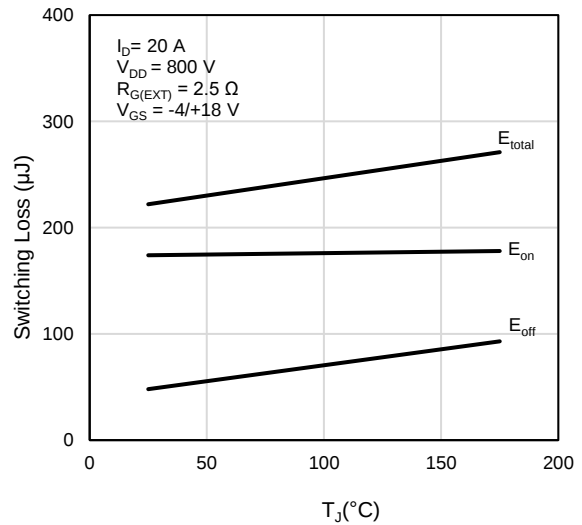


Figure 22: Maximum Forward Biased Safe Operating Area

Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$ Figure 24: Clamped Inductive Switching Energy vs. T_J

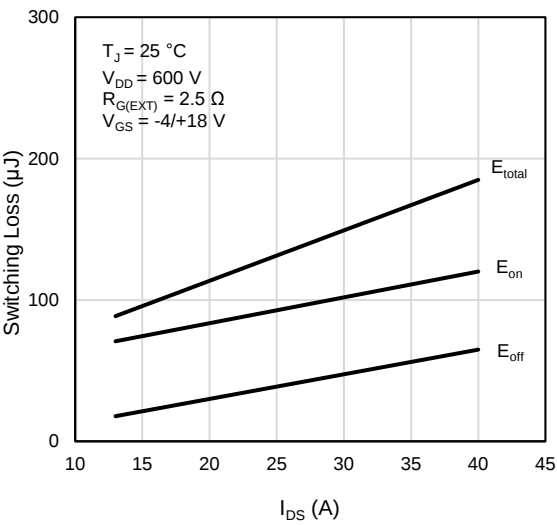


Figure 25: Clamped Inductive Switching Energy vs. Drain Current ($V_{\text{DD}} = 600\text{ V}$)

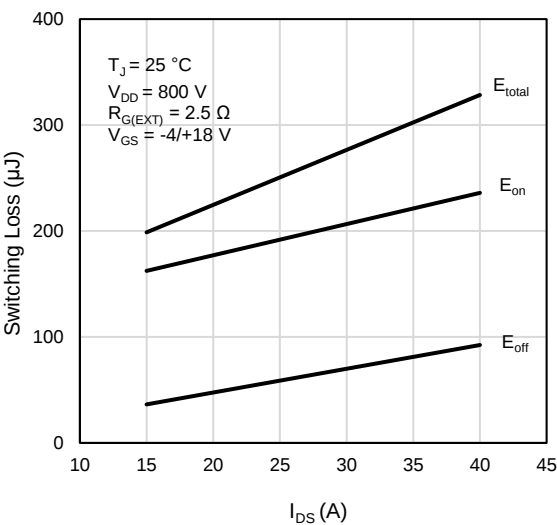
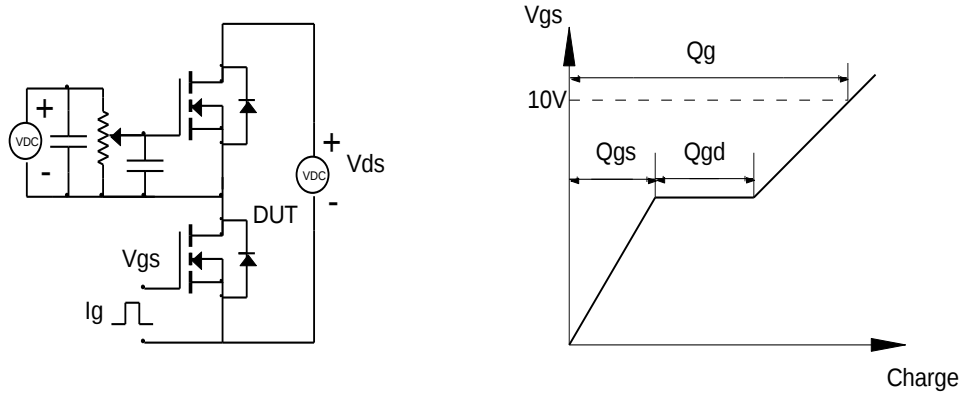


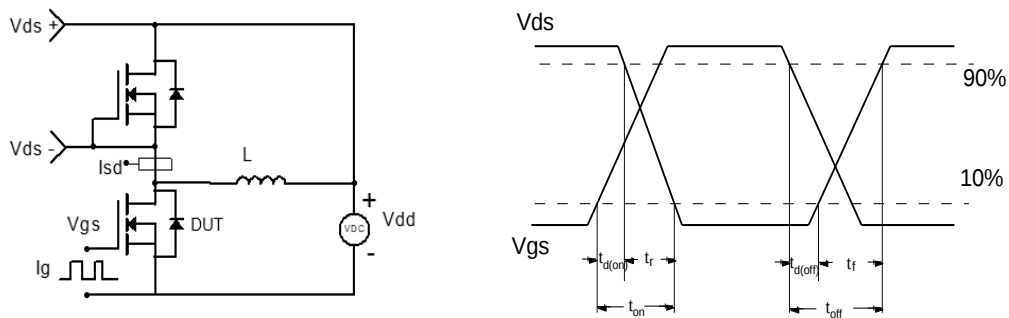
Figure 26: Clamped Inductive Switching Energy vs. Drain Current ($V_{\text{DD}} = 800\text{ V}$)

Test Circuit and Waveform

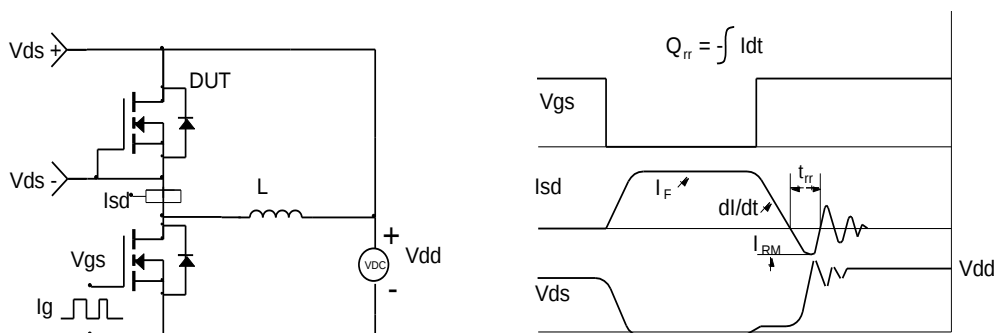
Gate Charge Test Circuit & Waveform



Clamped Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History		
Revision	Released	Remark
Rev.1.0	2024	Initial Release

Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Alkaidsemi assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which requires high reliability. Customers using or selling these products for use in medical, life-saving, or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.