

1200V 40mohm Silicon Carbide Power MOSFET
AK2CK2M040WDMH

Features:

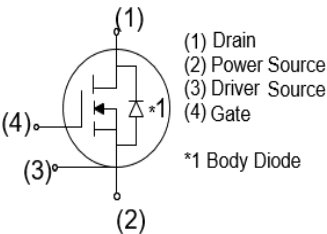
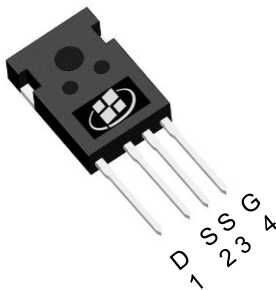
- $V_{DSS} = 1200\text{ V}$ at $T_{vj}= 25^{\circ}\text{C}$
- Low on-resistance
- Fast switching speed with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen-free, RoHS compliant

Applications:

- High Power SMPS
- EV-Charging
- Online UPS/HVDC
- String inverters
- Solar power optimizer

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	1200	V
$R_{DS(on),\text{ TYP}} @V_{GS} = 18\text{ V}$	34	mΩ
I_D	60	A
P_D	306	W



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK2CK2M040WDMH	TO-247LP-4L	2CK2M040WDMH	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)	60	A
	Drain Current - Continuous ($T_C = 100^{\circ}\text{C}$) ^(Note 1)	42	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	180	A
V_{GS}	Gate - Source Voltage (dynamic)	-12/+24	V
V_{GS}	Gate - Source Voltage (static)	-6/+18	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	441	mJ
P_D	Power Dissipation ($T_C = 25^{\circ}\text{C}$)	306	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	0.49	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady - State	40	$^{\circ}\text{C/W}$

Recommended values

Symbol	Parameter	Value	Units
$V_{GS(on)}$	Recommended turn-on gate voltage	18	V
$V_{GS(off)}$	Recommended turn-off gate voltage	-5...-2	V

Notes:

- 1. The max drain current limited by maximum junction temperature
- 2. Repetitive Rating: Pulse width limited by maximum junction temperature
- 3. $L = 0.5\text{ mH}$, $V_{DD} = 50\text{ V}$, $I_{AS} = 42\text{ A}$, $R_G = 50\text{ }\Omega$, Starting $T_J = 25\text{ }^{\circ}\text{C}$

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} = + 24 V, V _{DS} = 0 V			100	nA
		V _{GS} = - 12 V, V _{DS} = 0 V			-100	nA
V _{GS(th)}	Gate Threshold voltage	V _{DS} = V _{GS} , I _D = 11 mA	1.8	2.8	4	V
		V _{DS} = V _{GS} , I _D = 11 mA, T _J = 175 °C		2.1		V
R _{DS(ON)}	Drain-Source on-state resistance	V _{GS} = 15 V, I _D = 33 A		40	55	mΩ
		V _{GS} = 15 V, I _D = 33 A, T _J = 175 °C		67		mΩ
		V _{GS} = 18 V, I _D = 33 A		34	45	mΩ
		V _{GS} = 18 V, I _D = 33 A, T _J = 175 °C		64		mΩ
g _{FS}	Forward Transconductance	V _{DS} = 20 V, I _D = 33 A		20		S
		V _{DS} = 20 V, I _D = 33 A, T _J = 175 °C		20		S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 800 V, V _{GS} = 0 V, F = 100 kHz, V _{AC} = 25 mV		2313		pF
C _{oss}	Output Capacitance			86		pF
C _{rss}	Reverse Transfer Capacitance			5		pF
E _{oss}	C _{oss} Stored Energy			35		μJ
R _g	Gate Resistance	F = 1 MHz, V _{AC} = 25 mV		1.7		Ω
Q _{gs}	Gate-Source Charge	V _{DS} = 800 V , I _D = 33 A, V _{GS} = -4/+18 V		28		nC
Q _{gd}	Gate-Drain Charge			23		nC
Q _g	Total Gate Charge			95		nC

Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn On Delay Time	$V_{DD} = 800\text{ V}$, $I_D = 33\text{ A}$, $V_{GS} = -4/+18\text{ V}$, $R_{G,EXT} = 2.5\ \Omega$ $L = 100\ \mu\text{H}$ Diode: Body Diode at $V_{GS} = -4\text{V}$		11		ns
t_r	Rise Time			13		ns
$t_{d(off)}$	Turn Off Delay Time			27		ns
t_f	Fall Time			6		ns
E_{on}	Turn On Energy			285		μJ
E_{off}	Turn Off Energy			30		μJ
$t_{d(on)}$	Turn On Delay Time	$V_{DD} = 800\text{ V}$, $I_D = 33\text{ A}$, $V_{GS} = -4/+18\text{ V}$, $R_{G,EXT} = 5\ \Omega$ $L = 100\ \mu\text{H}$ Diode: Body Diode at $V_{GS} = -4\text{V}$ $T_J = 175^\circ\text{C}$		10		ns
t_r	Rise Time			14		ns
$t_{d(off)}$	Turn Off Delay Time			31		ns
t_f	Fall Time			7		ns
E_{on}	Turn On Energy			270		μJ
E_{off}	Turn Off Energy			67		μJ

Drain-Source Diode Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

I_S	Maximum Continuous Drain-Source Diode Forward Current			60	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current			180	A
V_{SD}	Diode Forward Voltage	$V_{GS} = -4\text{ V}$, $I_{SD} = 20\text{ A}$		4.4	V
		$V_{GS} = -4\text{ V}$, $I_{SD} = 20\text{ A}$, $T_J = 175^\circ\text{C}$		3.9	V
I_{rrm}	Peak Reverse Recovery Current	$V_{GS} = -4\text{ V}$, $I_{SD} = 33\text{ A}$, $V_R = 800\text{ V}$, $di/dt = 1500\text{ A}/\mu\text{s}$		19	A
t_{rr}	Reverse Recovery Time			18	ns
Q_{rr}	Reverse Recovery Charge			196	nC

Electrical Characteristics Diagrams

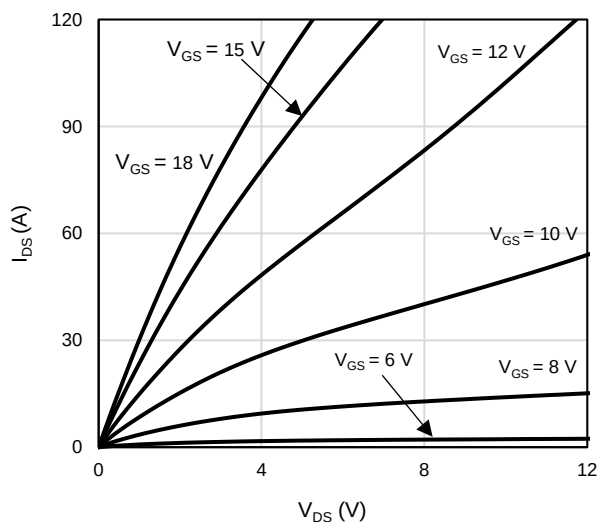
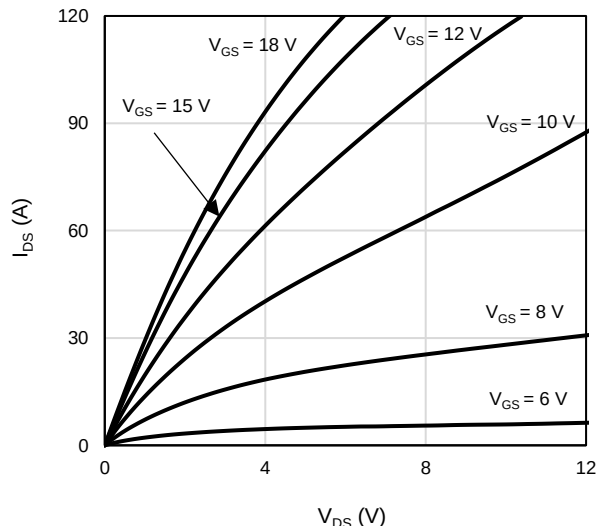
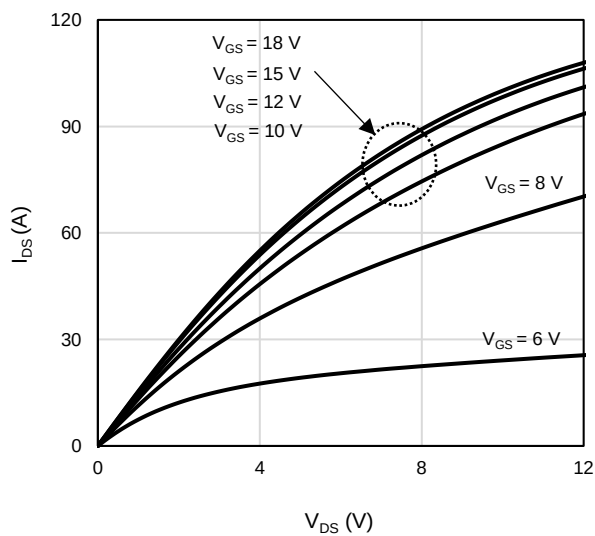
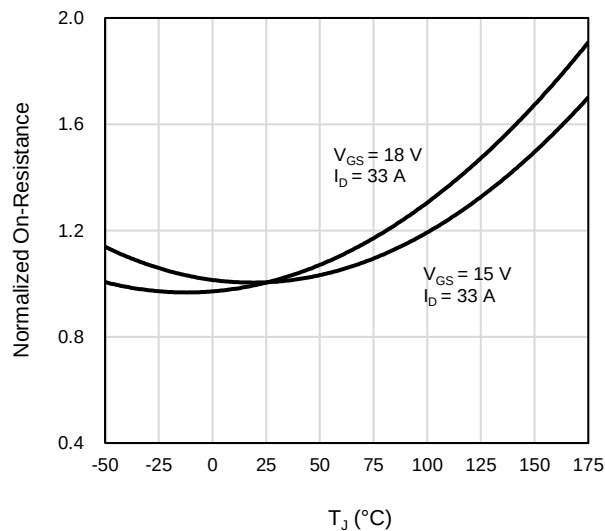
Figure 1: Output Characteristics $T_J = -40^{\circ}\text{C}$ Figure 2: Output Characteristics $T_J = 25^{\circ}\text{C}$ Figure 3: Output Characteristics $T_J = 175^{\circ}\text{C}$ 

Figure 4: Normalized On-Resistance vs. Temperature

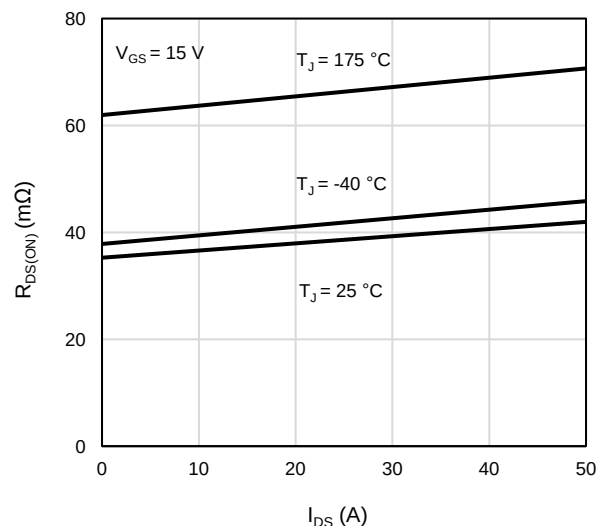


Figure 5: On-Resistance vs. Drain Current For Various Temperatures

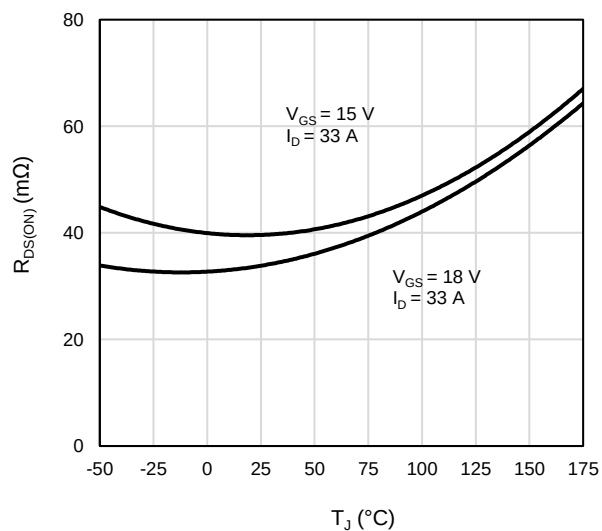


Figure 6: On-Resistance vs. Temperature

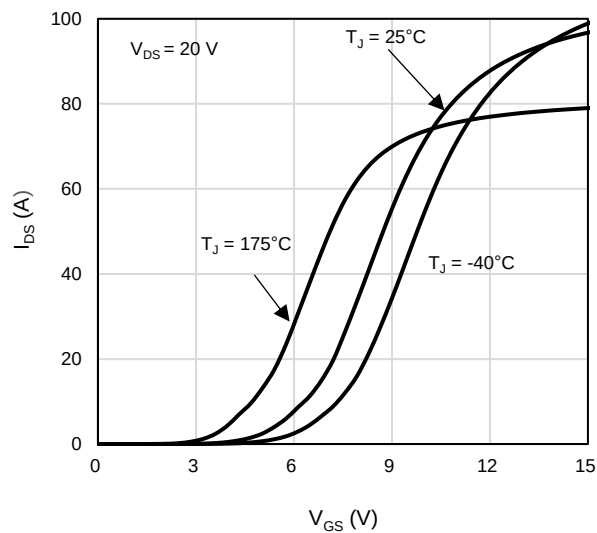


Figure 7: Transfer Characteristics For Various Junction Temperatures

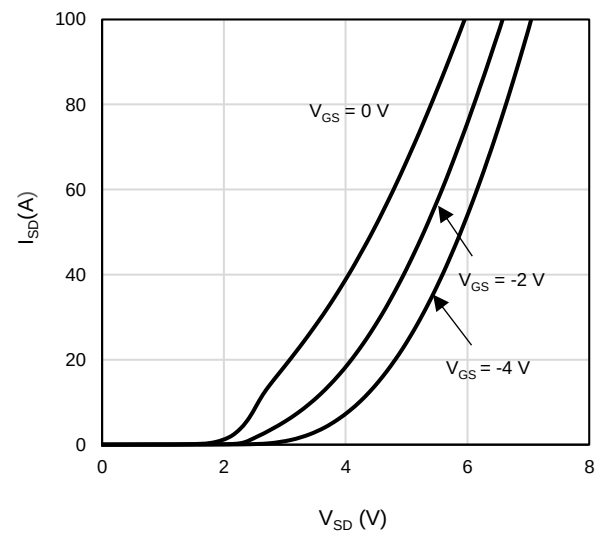


Figure 8: Body Diode Characteristics at -40°C

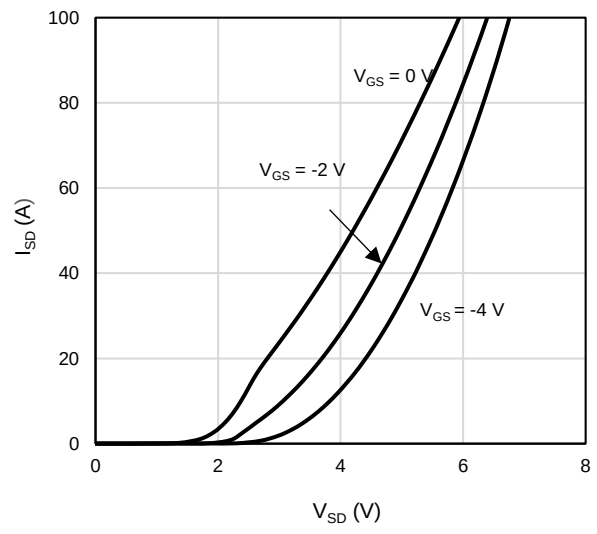


Figure 9: Body Diode Characteristics at 25°C

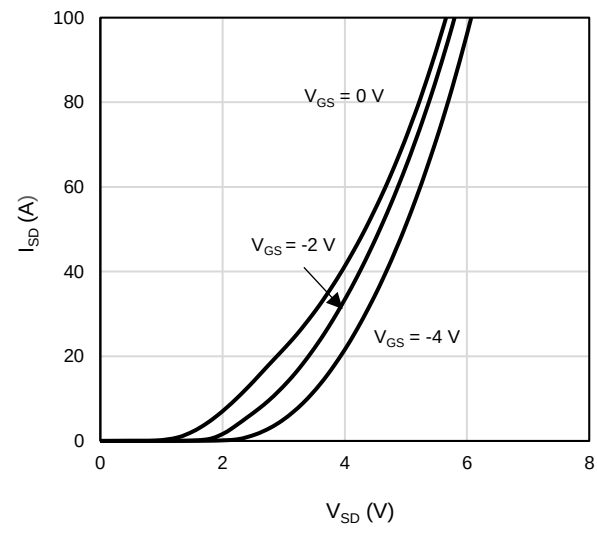


Figure 10: Body Diode Characteristics at 175°C

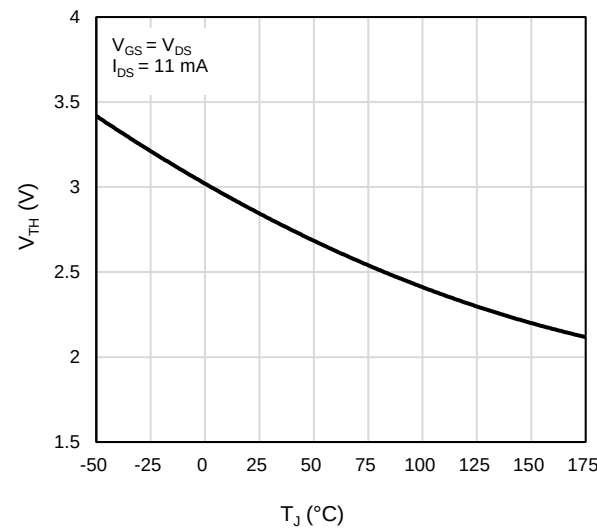


Figure 11: Threshold Voltage vs. Temperature

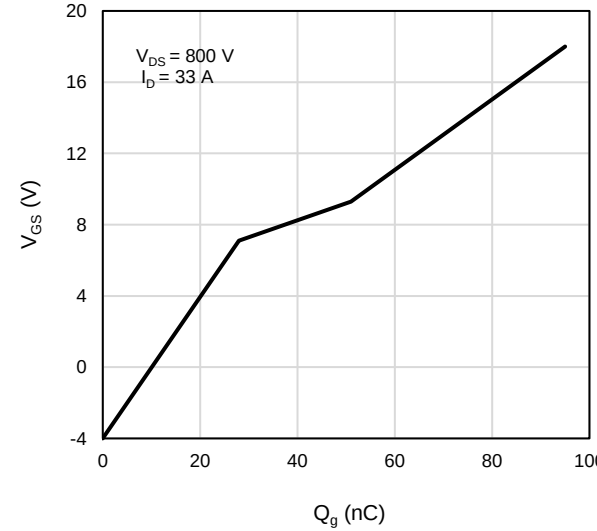


Figure 12: Gate-Charge Characteristics

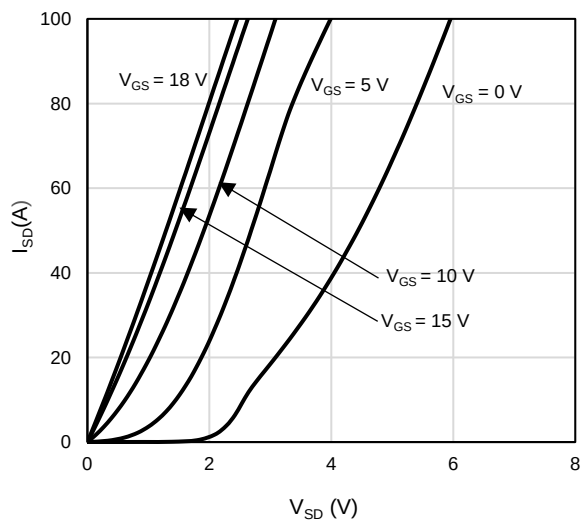


Figure 13: 3rd Quadrant Characteristics at -40°C

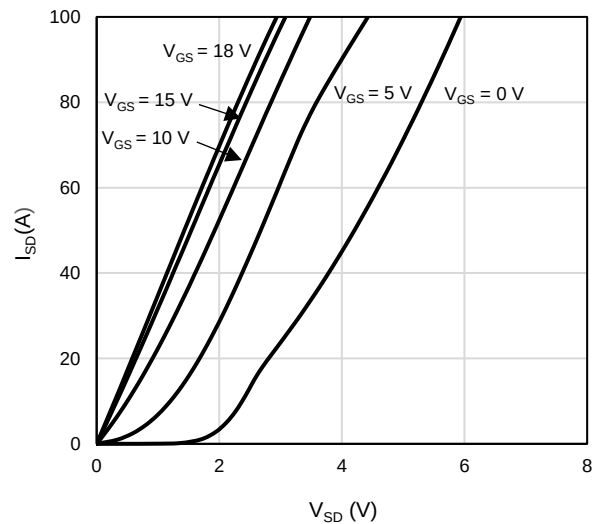


Figure 14: 3rd Quadrant Characteristics at 25°C

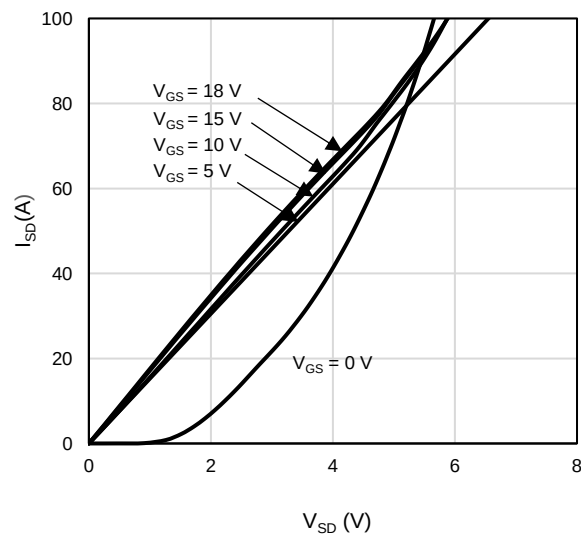


Figure 15: 3rd Quadrant Characteristics at 175°C

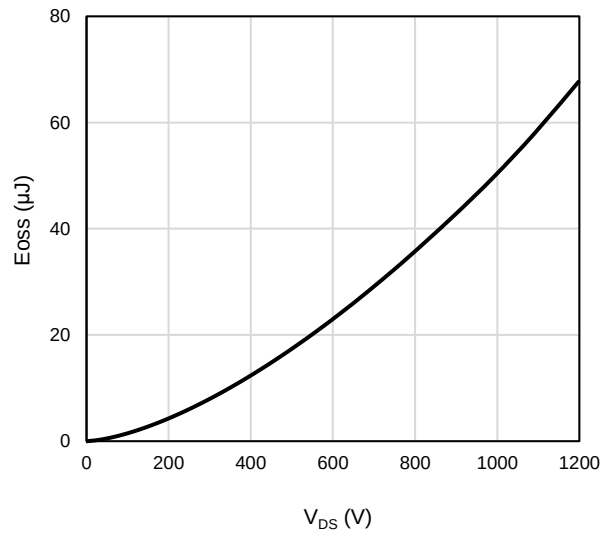


Figure 16: Output Capacitor Stord Energy

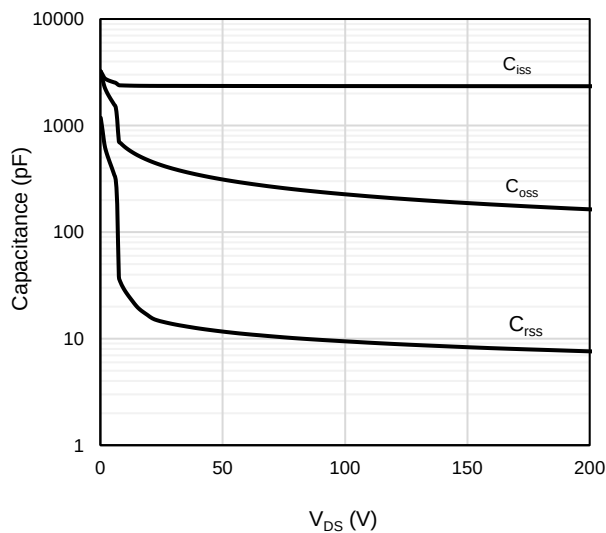


Figure 17: Capacitance Characteristics (0 - 200 V)

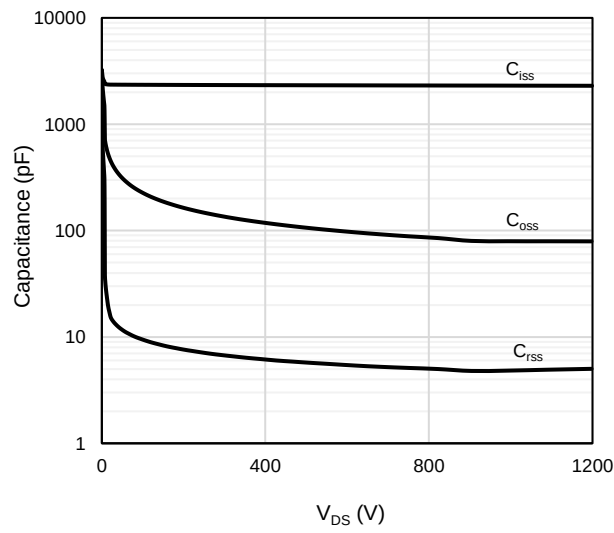


Figure 18: Capacitance Characteristics (0 - 1200 V)

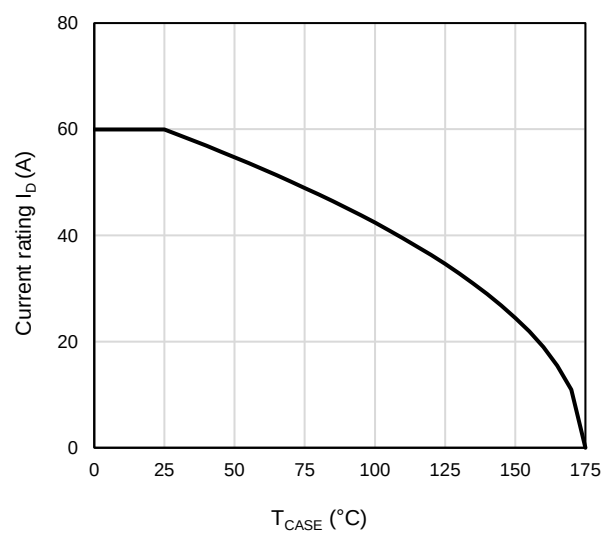


Figure 19: Current De-rating

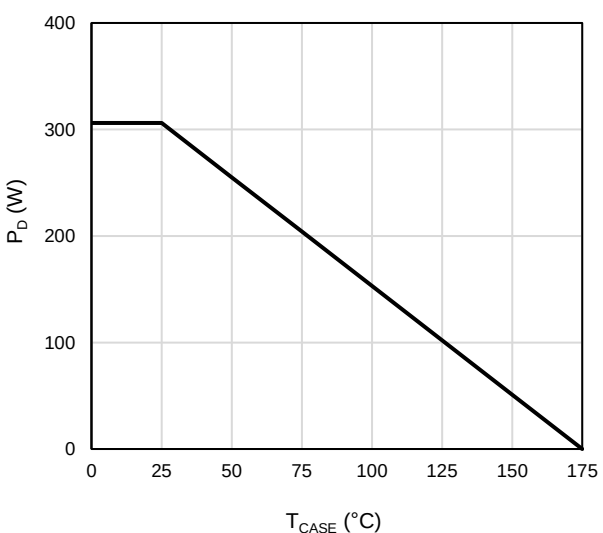


Figure 20: Maximum Power Dissipation Derating vs. Case Temperature

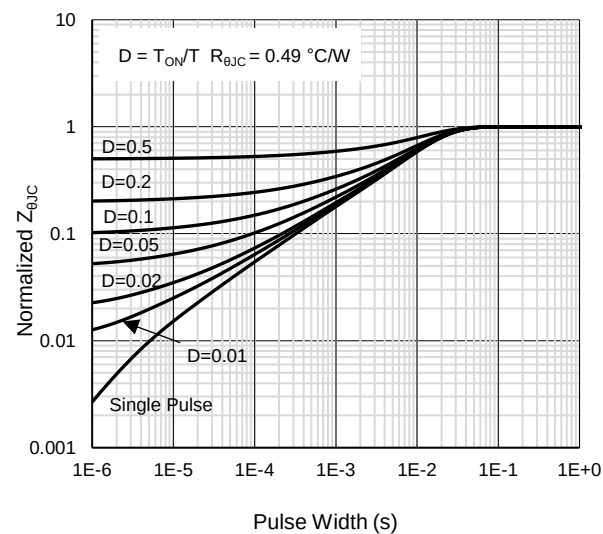


Figure 21: Normalized Maximum Transient Thermal Impedance

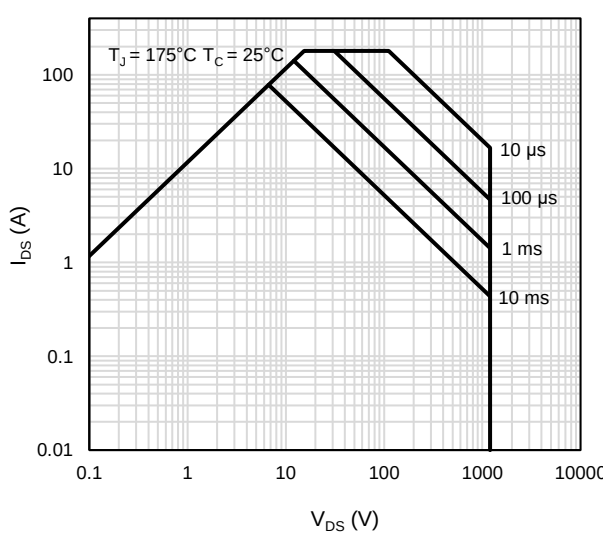


Figure 22: Maximum Forward Biased Safe Operating Area

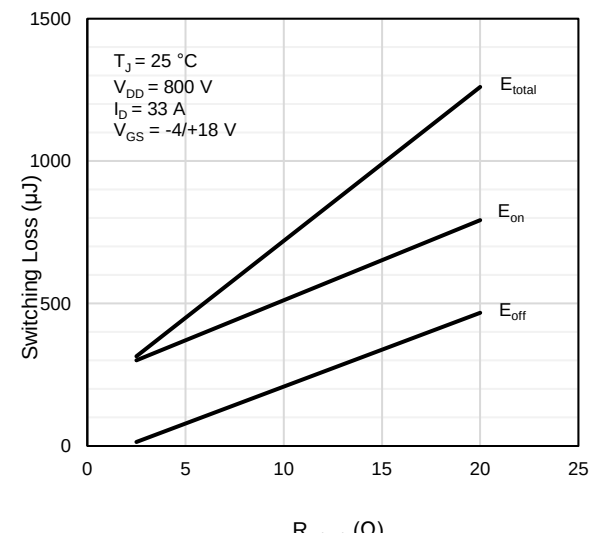


Figure 23: Clamped Inductive Switching Energy vs. R_G(ext)

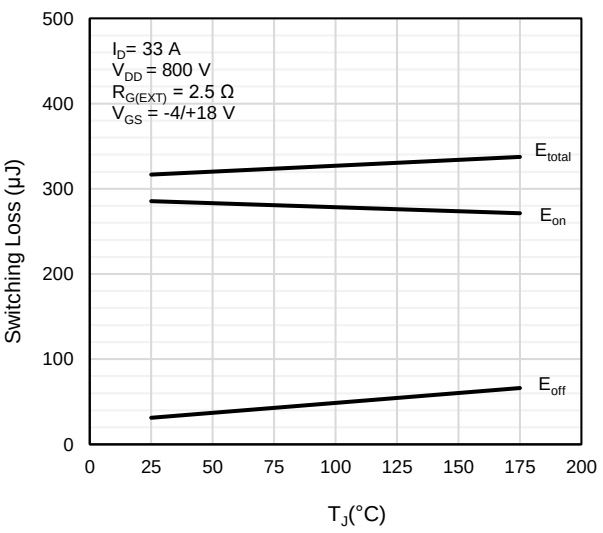


Figure 24: Clamped Inductive Switching Energy vs. T_J

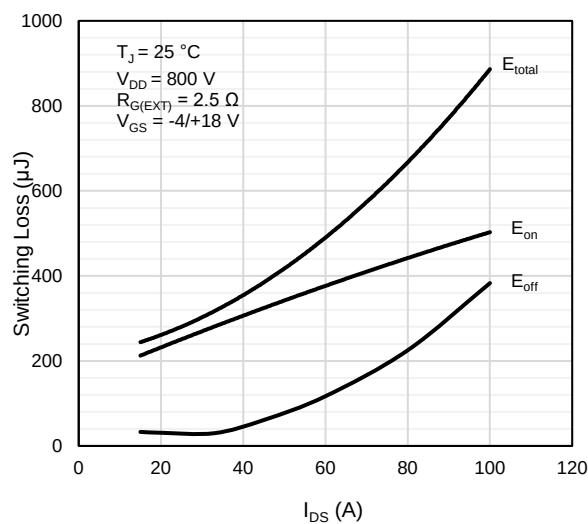


Figure 25: Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800\text{ V}$)

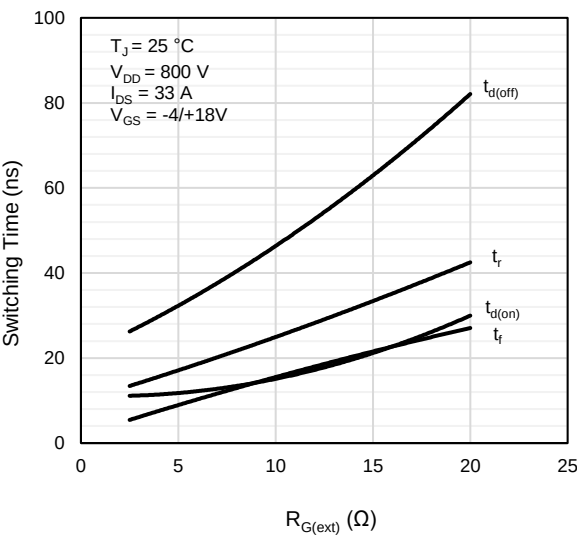
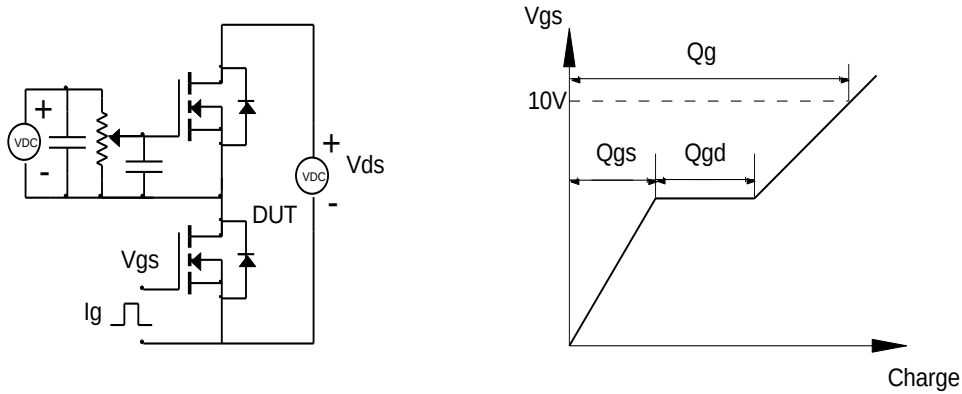


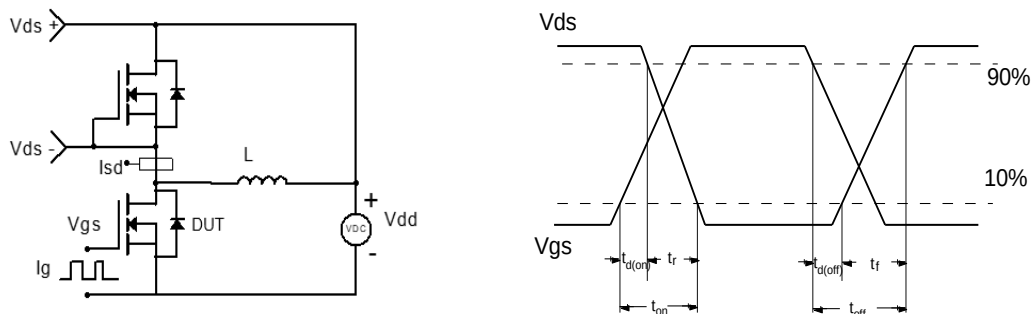
Figure 26: Switching Times vs. $R_{G(EXT)}$

Test Circuit and Waveform

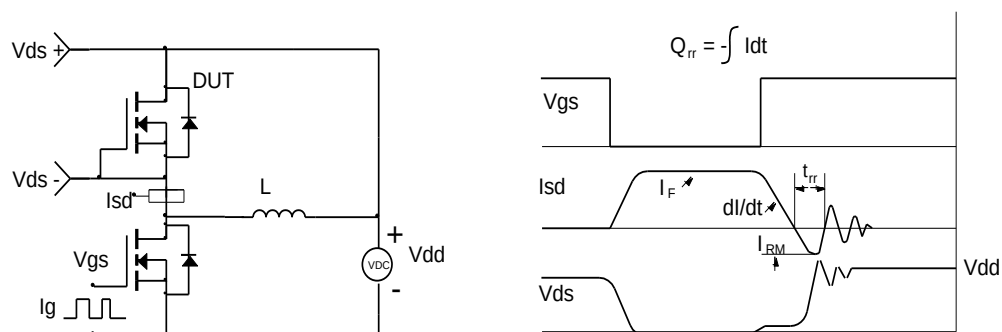
Gate Charge Test Circuit & Waveform



Clamped Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History

Revision	Released	Remark
Rev.1.2	2025	

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.