# 1700V 1000mohm Silicon Carbide Power MOSFET
# AKCK7M1K0DBMH

## Features:

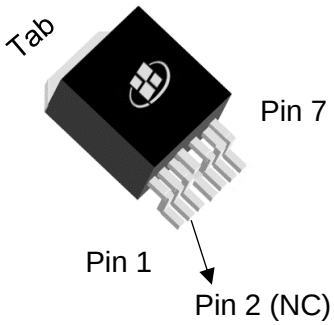
- Low on-resistance
- Fast switching speed with low capacitances
- Fast intrinsic diode with low reverse recovery ($Q_{RR}$)
- Halogen-free，RoHS compliant

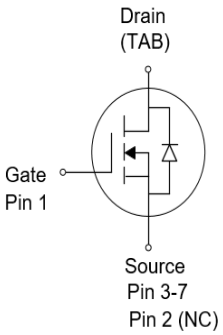
## Applications:

- Auxiliary power supplies
- Switch mode power supplies
- Solar inverters
- Smart meters

## Key Performance Parameters:

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ | 1700 | V |
| $R_{DSON,\ TYP}$ @$V_{GS}$ = 18 V | 1000 | mΩ |
| $I_D$ | 5.5 | A |
| $P_D$ | 100 | W |




## Ordering Information:

| Ordering Code | Package Type | Marking Code | Form | Packing |
|---|---|---|---|---|
| AKCK7M1K0DBMH | TO-263-7L | CK7M1K0DBMH | Tape Reel | See the detail package information |

## Maximum Ratings ($T_A$ = 25°C unless otherwise noted)

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 1700 | V |
| $I_D$ | Drain Current - Continuous ($T_C$ = 25°C) (Note 1) | 5.5 | A |
| | Drain Current - Continuous ($T_C$ = 100°C) (Note 1) | 4 | A |
| $I_{DM}$ | Drain Current - Pulsed (Note 2) | 11 | 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°C) | 100 | W |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | -55 to +175 | °C |

## Thermal Characteristics

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case, Steady-State | 1.5 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient, Steady-State | 40 | °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°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 | 1700 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 1700 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 | $V_{DS}$ = $V_{GS}$, $I_D$ = 0.7 mA | 1.8 | 3.2 | 4 | V |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = 0.7 mA, $T_J$ = 175 °C | | 2 | | V |
| $R_{DS(ON)}$ | Drain-Source on-state resistance | $V_{GS}$ = 18 V, $I_D$ = 2 A | | 1000 | 1500 | mΩ |
| | | $V_{GS}$ = 18 V, $I_D$ = 2 A, $T_J$ = 175 °C | | 2100 | | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 20 V, $I_D$ = 2 A | | 2.2 | | S |
| | | $V_{DS}$ = 20 V, $I_D$ = 2 A, $T_J$ = 175 °C | | 0.75 | | S |
| | | | | | | |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 1000 V, $V_{GS}$ = 0 V, F = 100 kHz, $V_{AC}$ = 25 mV | | 184 | | pF |
| $C_{oss}$ | Output Capacitance | | | 12 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 3 | | pF |
| $E_{oss}$ | $C_{OSS}$ Stored Energy | | | 7 | | μJ |
| $R_g$ | Gate Resistance | F = 1 MHz, $V_{AC}$ = 25 mV | | 8.7 | | Ω |
| $Q_{gs}$ | Gate-Source Charge | $V_{DS}$ = 1200 V , $I_D$ = 1 A, $V_{GS}$ = -6/+18 V | | 2.5 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 12 | | nC |
| $Q_g$ | Total Gate Charge | | | 16.5 | | nC |

| Switching Characteristics | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Test Conditions** | **Min** | **Typ** | **Max** | **Units** |
| $t_{d(on)}$ | Turn On Delay Time | $V_{DD}$ = 1200 V , $I_D$ = 2 A, $V_{GS}$ = -6/+18 V, $R_{G,EXT}$ = 2.5 Ω L = 1000 μH<br>Diode：<br>Body Diode at $V_{GS}$ = -4V<br>$T_J$ = 25 °C | | 5 | | ns |
| $t_r$ | Rise Time | | | 8 | | ns |
| $t_{d(off)}$ | Turn Off Delay Time | | | 6 | | ns |
| $t_f$ | Fall Time | | | 41 | | ns |
| $E_{on}$ | Turn On Energy | | | 45 | | μJ |
| $E_{off}$ | Turn Off Energy | | | 21 | | μJ |
| $t_{d(on)}$ | Turn On Delay Time | $V_{DD}$ = 1200 V , $I_D$ = 2 A, $V_{GS}$ = -6/+18 V, $R_{G,EXT}$ = 2.5 Ω L = 1000 μH<br>Diode：<br>Body Diode at $V_{GS}$ = -4V<br>$T_J$ = 175 °C | | 6 | | ns |
| $t_r$ | Rise Time | | | 10 | | ns |
| $t_{d(off)}$ | Turn Off Delay Time | | | 7 | | ns |
| $t_f$ | Fall Time | | | 48 | | ns |
| $E_{on}$ | Turn On Energy | | | 58 | | μJ |
| $E_{off}$ | Turn Off Energy | | | 7 | | μJ |
| | | | | | | |
| **Drain-Source Diode Characteristics** ($T_J$ = 25 °C unless otherwise noted) | | | | | | |
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | | | | 5.5 | A |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | | | | 11 | A |
| $V_{SD}$ | Diode Forward Voltage | $V_{GS}$ = -4 V , $I_{SD}$ = 1 A | | 4.5 | | V |
| | | $V_{GS}$ = -4 V , $I_{SD}$ = 1 A, $T_J$ = 175 °C | | 3.8 | | V |
| $I_{rrm}$ | Peak Reverse Recovery Current | $V_{GS}$ = -4 V , $I_{SD}$ = 2 A, $V_R$ = 1200 V, di/dt = 2350 A/μs $T_J$ = 175 °C | | 5 | | A |
| $t_{rr}$ | Reverse Recovery Time | | | 15 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 68 | | nC |

## Electrical Characteristics Diagrams

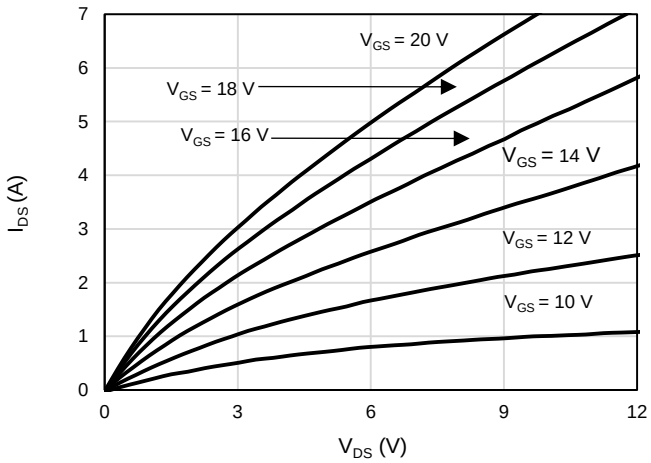



Figure 1: Output Characteristics $T_J$ = -40℃

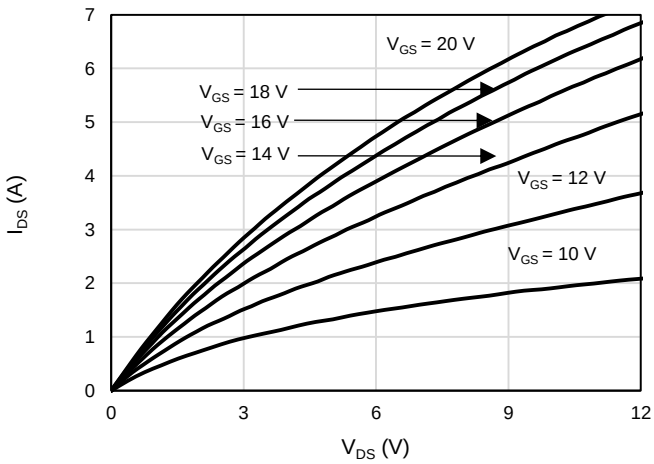



Figure 2: Output Characteristics $T_J$ = 25℃

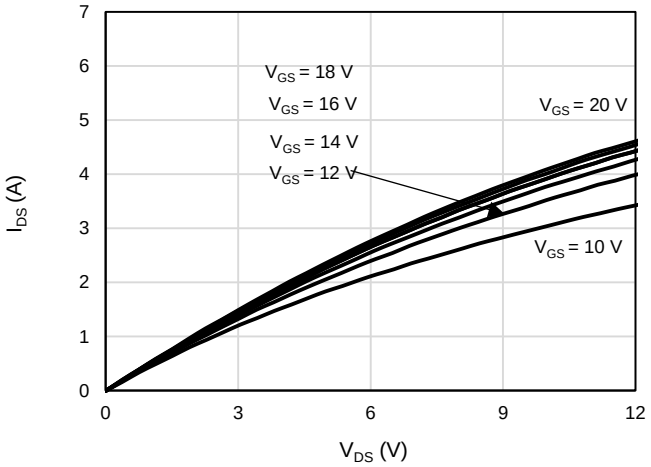



Figure 3: Output Characteristics $T_J$ = 175℃

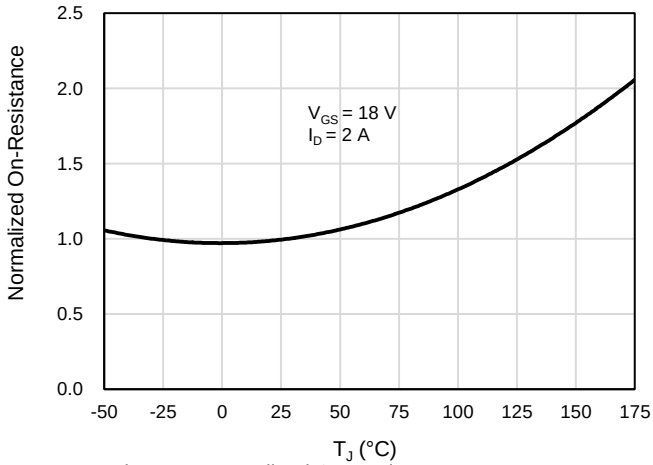



Figure 4: Normalized On-Resistance vs. Temperature

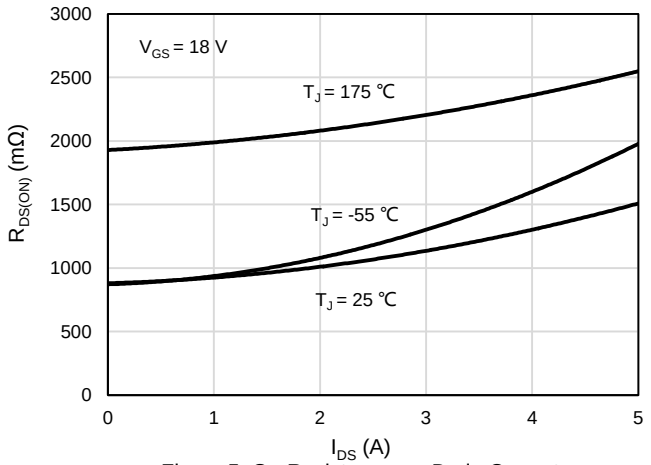



Figure 5: On-Resistance vs. Drain Current
For Various Temperatures

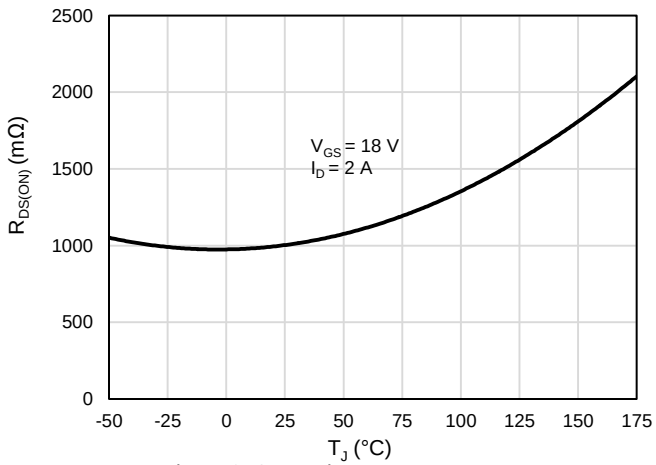



Figure 6: On-Resistance vs. Temperature
For Various Gate Voltage

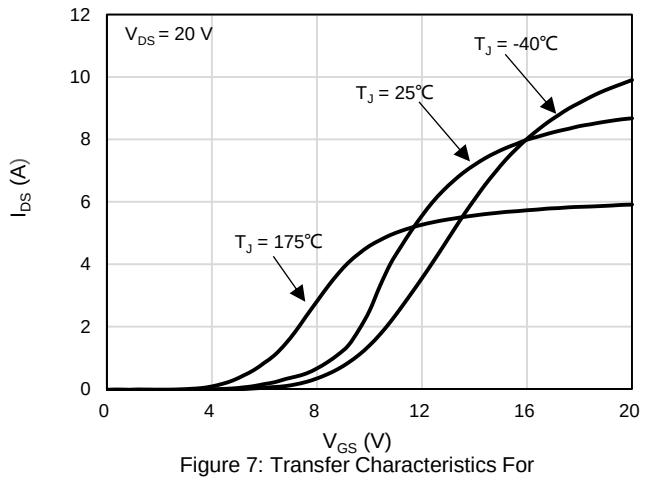



Figure 7: Transfer Characteristics For Various Junction Temparature

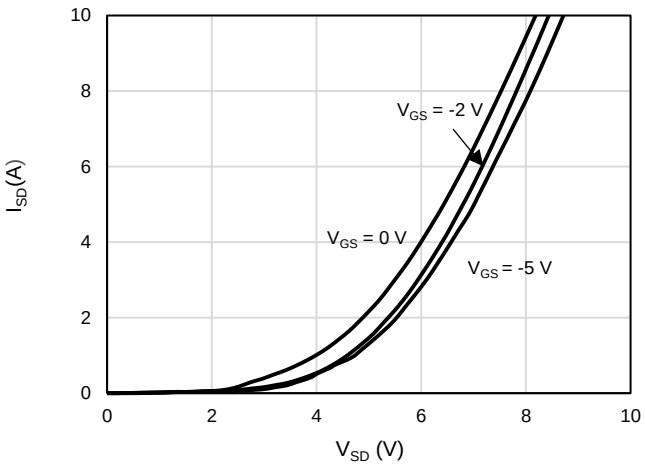



Figure 8: Body Diode Characteristics at -55℃

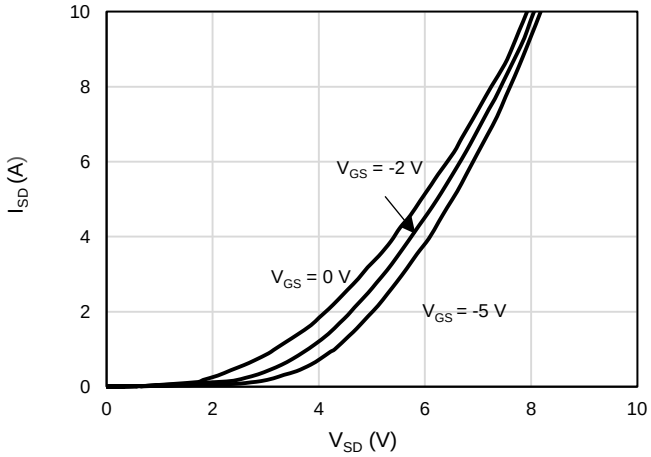



Figure 9: Body Diode Characteristics at 25℃

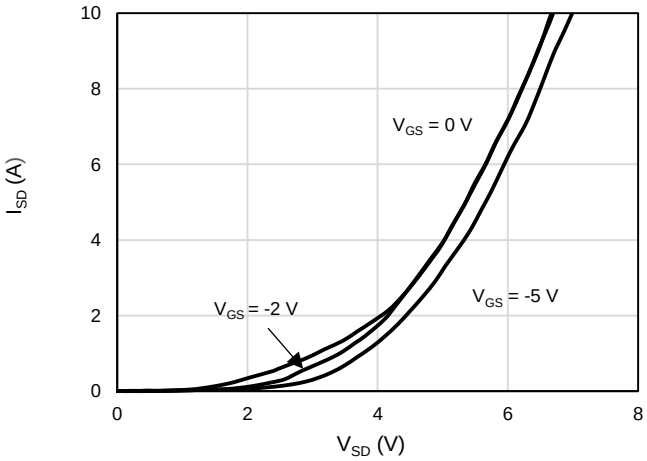



Figure 10: Body Diode Characteristics at 175℃

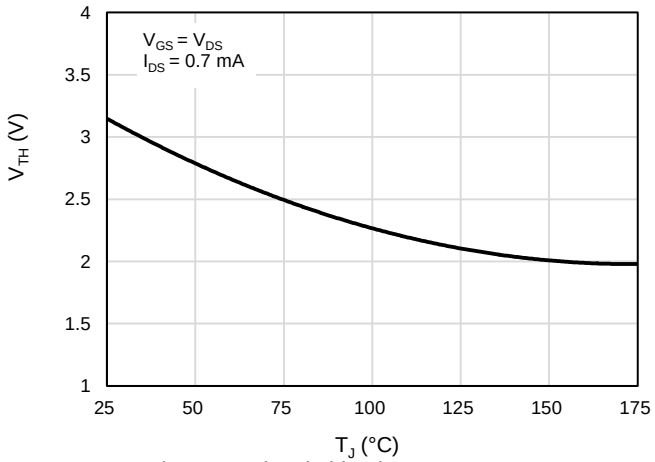



Figure 11: Threshold Voltage vs. Temperature

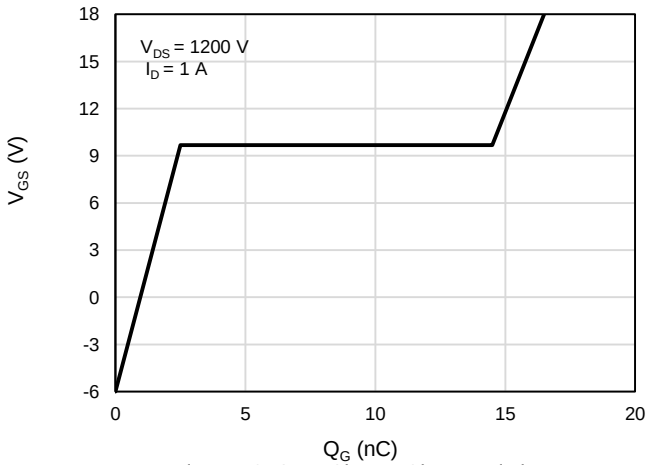



Figure 12: Gate-Charge Characteristics

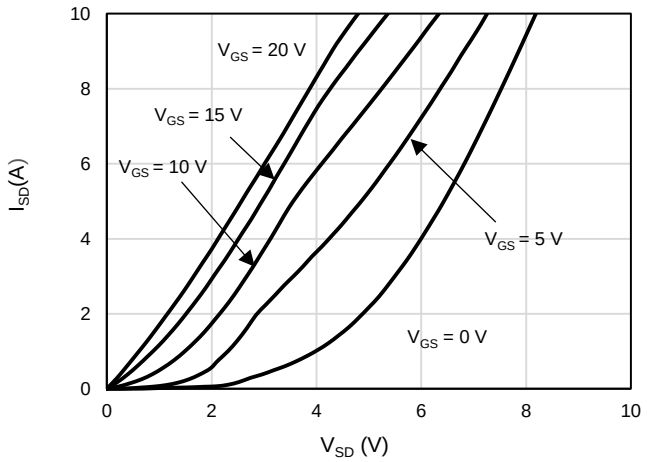



Figure 13: 3rd Quadrant Characteristics at -55℃

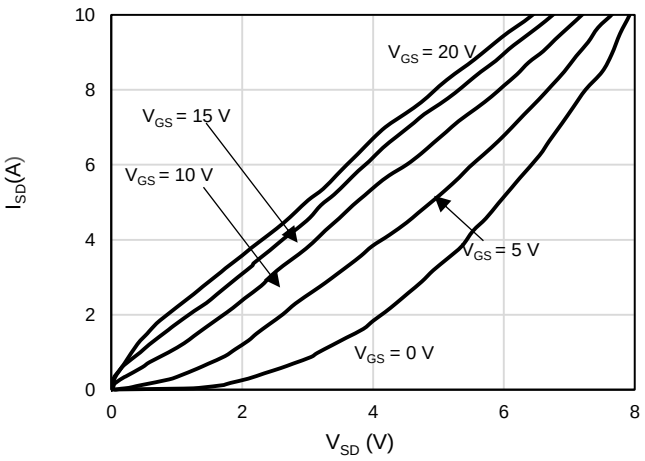



Figure 14: 3rd Quadrant Characteristics at 25℃

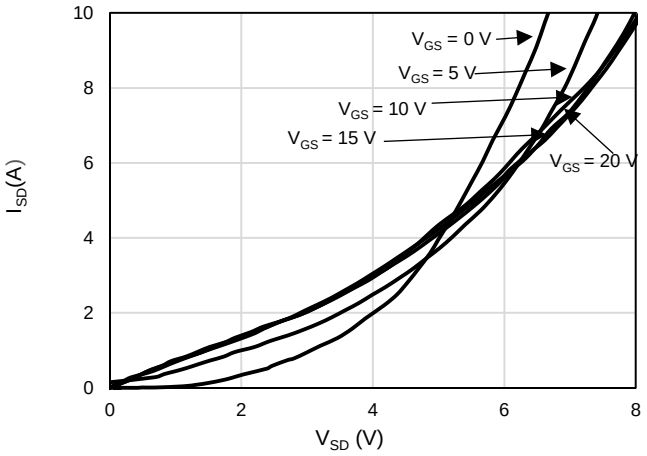



Figure 15: 3rd Quadrant Characteristics at 175℃

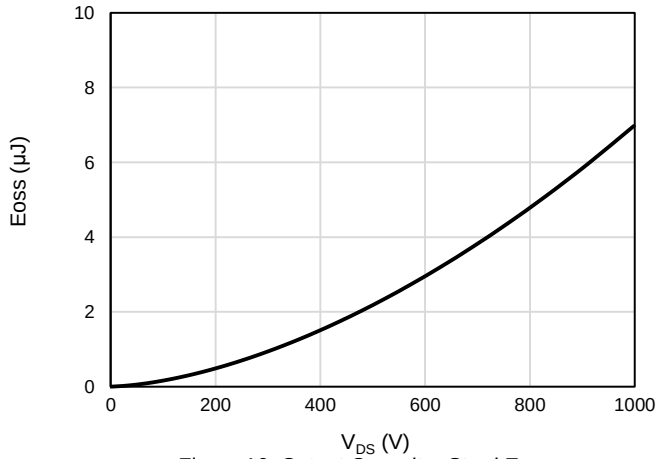



Figure 16: Output Capacitor Stord Energy

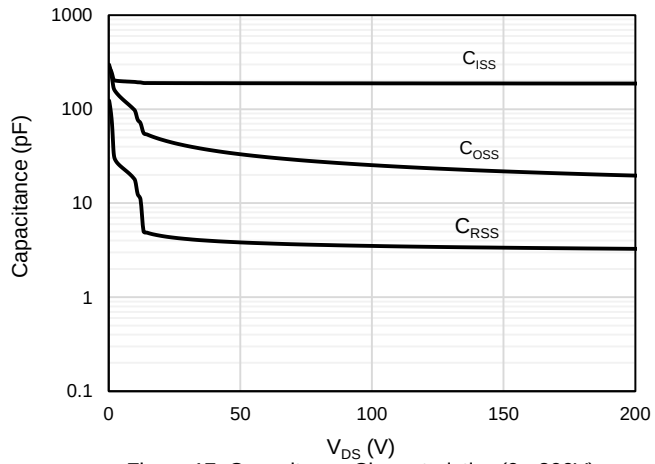



Figure 17: Capacitance Characteristics (0 - 200V)

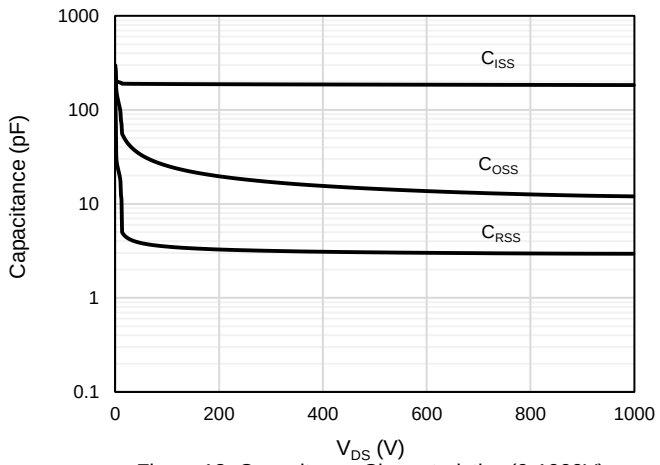



Figure 18: Capacitance Characteristics (0-1000V)

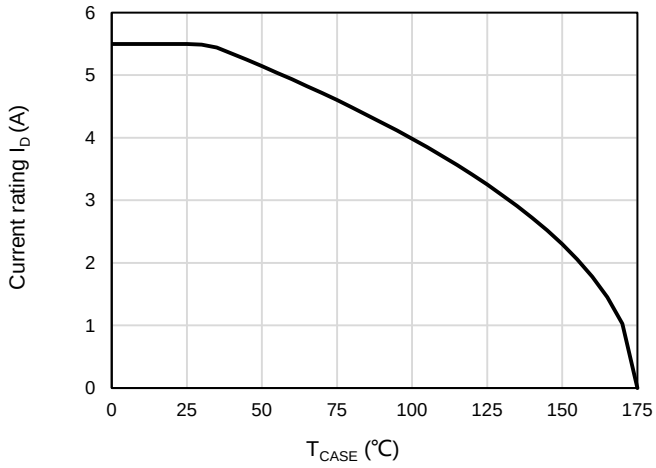



Figure 19: Current De-rating

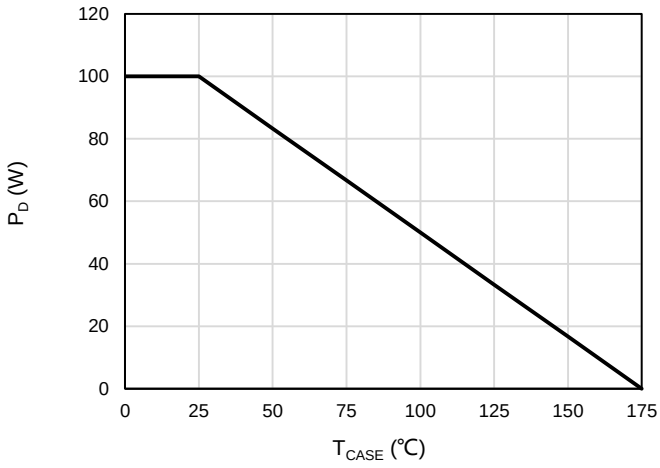



Figure 20: Maximum Power Disspation Derating vs CaseTemperature

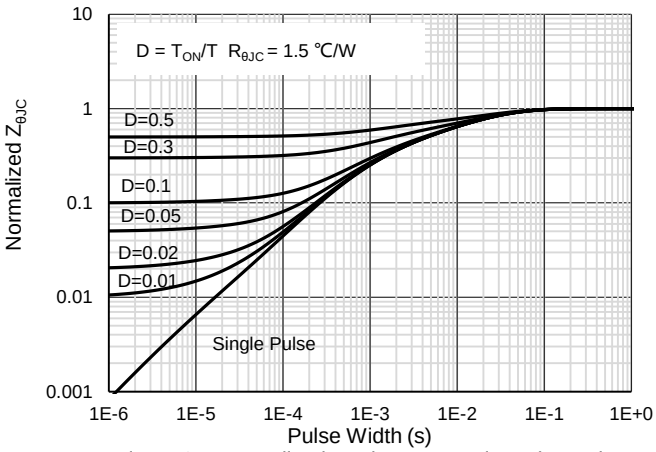



Figure 21: Normalized Maximum Transient Thermal Impedance

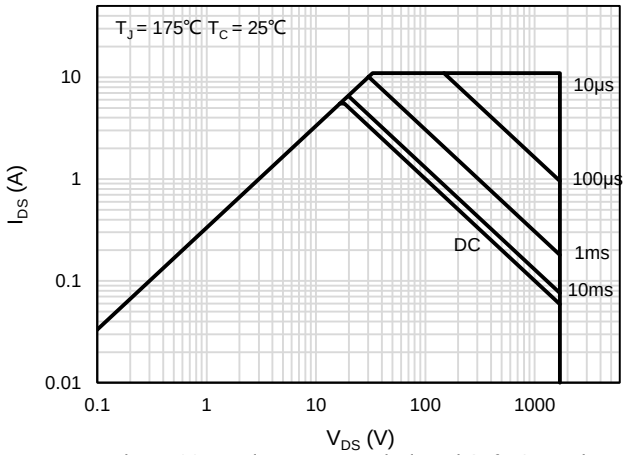



Figure 22: Maximum Forward Biased Safe Operating Area

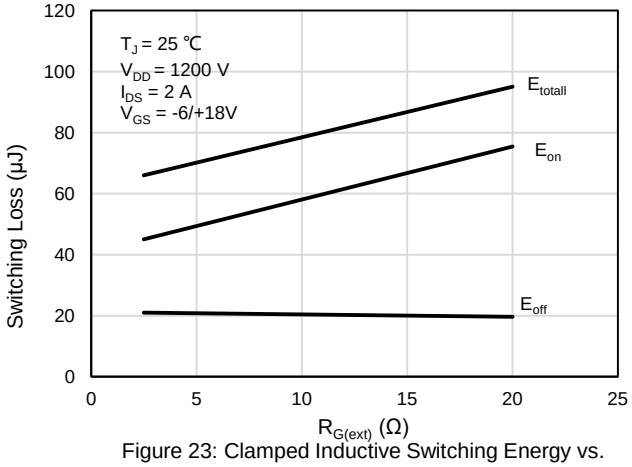



Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

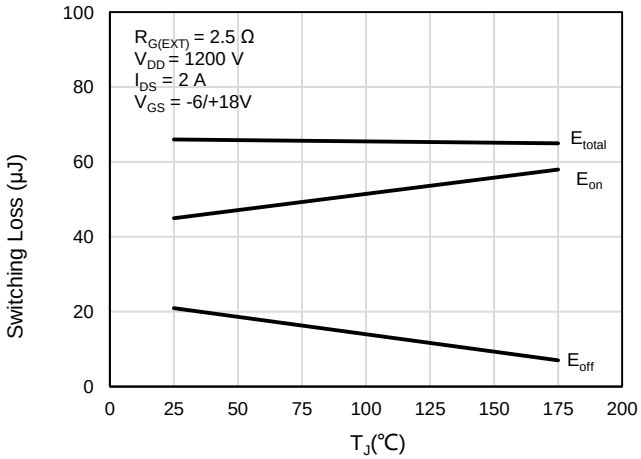



Figure 24: Clamped Inductive Switching Energy vs. $T_J$

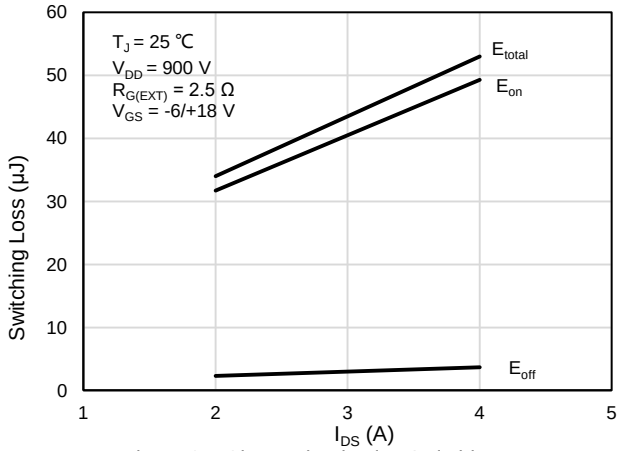



Figure 25: Clamped Inductive Switching Energy vs. Drain Current ($V_{DD}$ = 600 V)

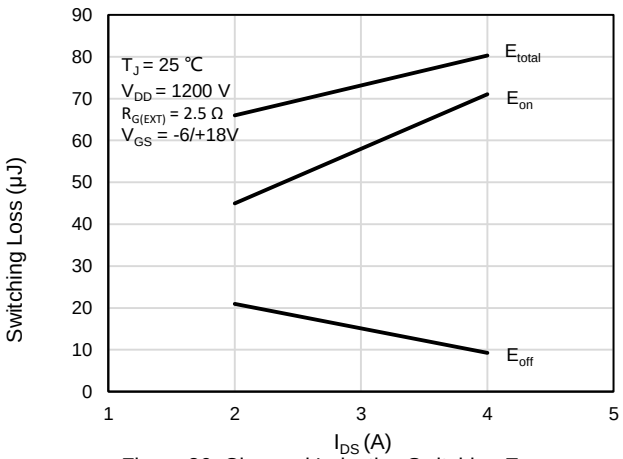



Figure 26: Clamped Inductive Switching Energy vs. Drain Current ($V_{DD}$ = 1200 V)

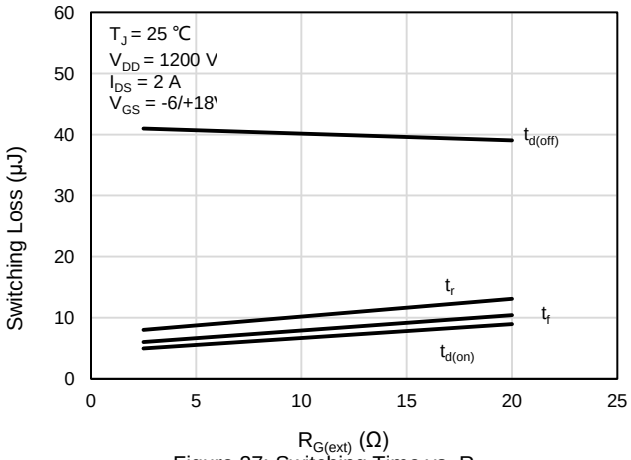
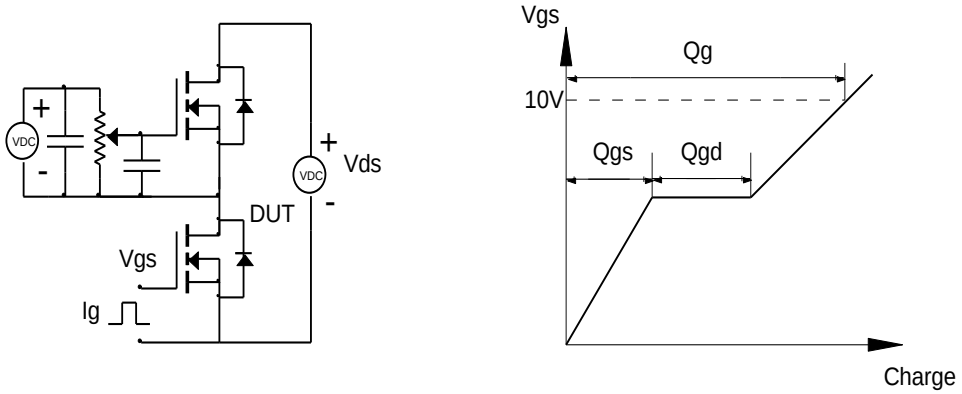


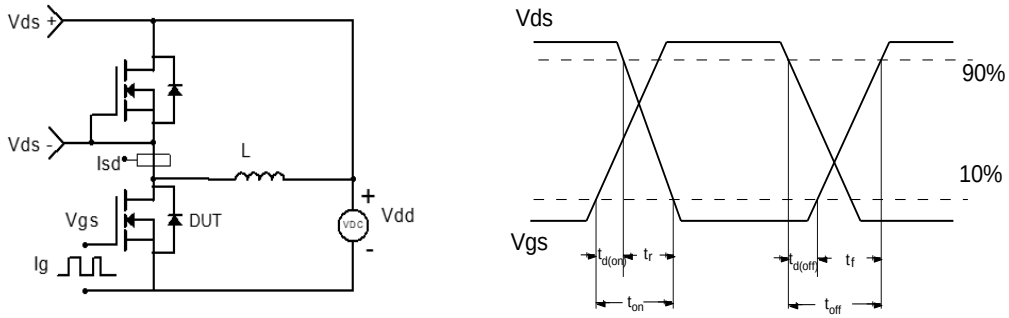

Figure 27: Switching Time vs. $R_{G(ext)}$

# Test Circuit and Waveform

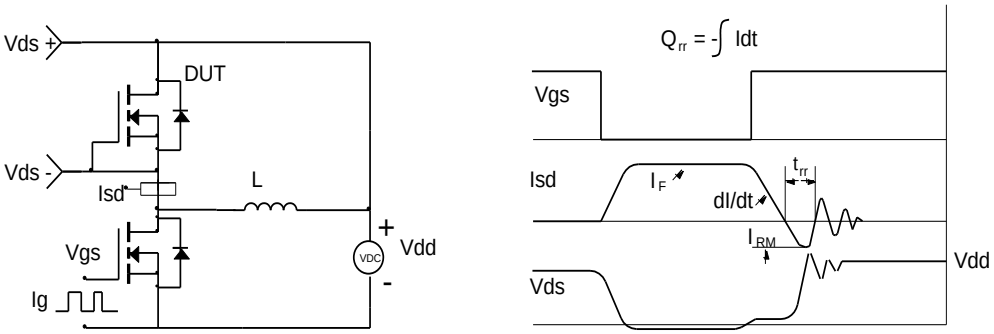
Gate Charge Test Circuit & Waveform




Clamped Inductive Switching Test Circuit & Waveforms




Diode Recovery Test Circuit & Waveforms



## Revision History

| Revision | Released | Remark |
|---|---|---|
| Rev.1.1 | 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.