

650V 600mohm Super-Junction Power MOSFET
AK3S65N6K0KMF

Description:

This SJ device provides good FOM performance, better EMI for customer application.

Features:

- EMI-Friendly
- RoHS compliant
- Halogen-free
- Ultra-fast body diode
- Improved MOSFET reverse diode dv/dt and di_f/dt ruggedness

Applications:

- High Frequency Switching
- Quick Charging and Adapter
- BLDC

Key Performance Parameters:

Parameter	Value	Unit
V _{DS}	650	V
R _{DS(on)} , max @V _{GS} = 10 V	600	mΩ
I _D	8	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK3S65N6K0KMF	TO-252	3S65N6K0KMF	Tape Reel	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	650	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) ^(Note 1)	8	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	5	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	24	A
V_{GS}	Gate - Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	30	mJ
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	54	W
dV/dT	MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 480 \text{ V}$	50	V/ns
	Reverse diode dv/dt, $V_{DS} = 0 \dots 480 \text{ V}$	50	V/ns
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction - to - Case, Steady State	2.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	60	$^\circ\text{C/W}$

Notes:

1. The max drain current rating limited by maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $L = 75 \text{ mH}$, $V_{DD} = 100 \text{ V}$, $I_{AS} = 0.9 \text{ A}$, $R_G = 50 \Omega$, Starting $T_J = 25^\circ\text{C}$
4. Mount on minimum PCB layout

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	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	650			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$			10	μA
I_{GSS}	Gate Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.5	3.5	4.5	V
$R_{DS(ON)}$	Drain - Source on - state resistance	$V_{GS} = 10\text{ V}, I_D = 4\text{ A}$		510	600	m Ω

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		338		pF
C_{oss}	Output Capacitance			13		pF
C_{rss}	Reverse Transfer Capacitance			5.5		pF
$C_{o(er)}$	Effective output capacitance, energy related	$V_{DS} = 0\ldots 400\text{ V}, V_{GS} = 0\text{ V}$		20		pF
$C_{o(tr)}$	Effective output capacitance, time related	$V_{DS} = 0\ldots 400\text{ V}, V_{GS} = 0\text{ V},$ $I_D = \text{constant}$		126		pF
R_g	Gate Resistance	$f = 1\text{ MHz}$		28		Ω

Switching Characteristics

$t_{d(on)}$	Turn On Delay Time	$V_{DD} = 400\text{ V}, I_D = 4\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 5\text{ }\Omega$		52		ns
t_r	Rise Time			8		ns
$t_{d(off)}$	Turn Off Delay Time			29		ns
t_f	Fall Time			9		ns
Q_g	Total Gate Charge	$V_{DD} = 400\text{ V}, I_D = 4\text{ A},$ $V_{GS} = 10\text{ V}$		14		nC
Q_{gs}	Gate - Source Charge			2		nC
Q_{gd}	Gate - Drain Charge			9		nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Body - Diode Forward Current			8		A
I_{SM}	Maximum Pulsed Body - Diode Forward Current			24		A
V_{SD}	Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 8\text{ A}$		1.3		V
t_{rr}	Reverse recovery time	$V_{DD} = 400\text{ V}, I_D = 4\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}$		62		ns
Q_{rr}	Reverse recovery charge			0.33		μC
I_{rrm}	Peak Reverse Recovery Current			10		A

Electrical Characteristics Diagrams

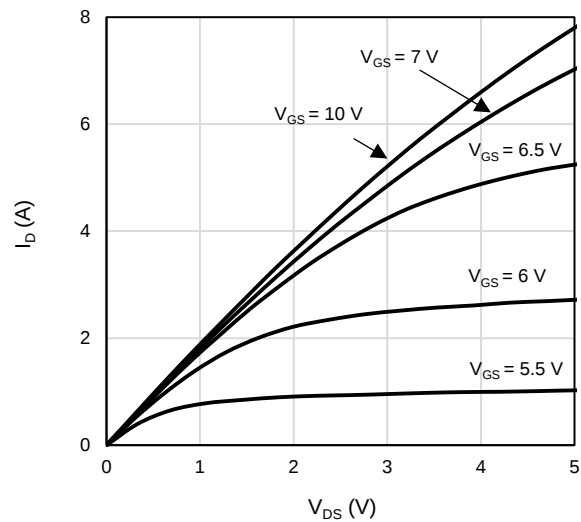


Figure 1: On-Region Characteristics

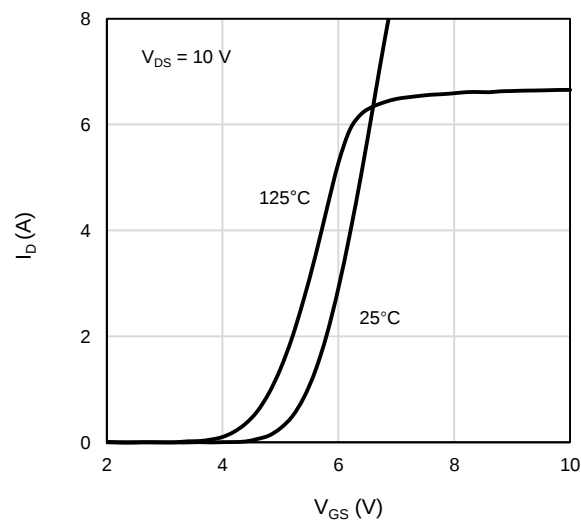


Figure 2: Transfer Characteristics

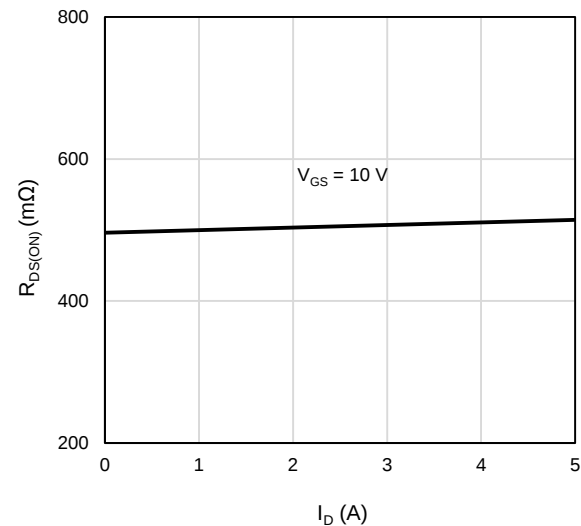


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

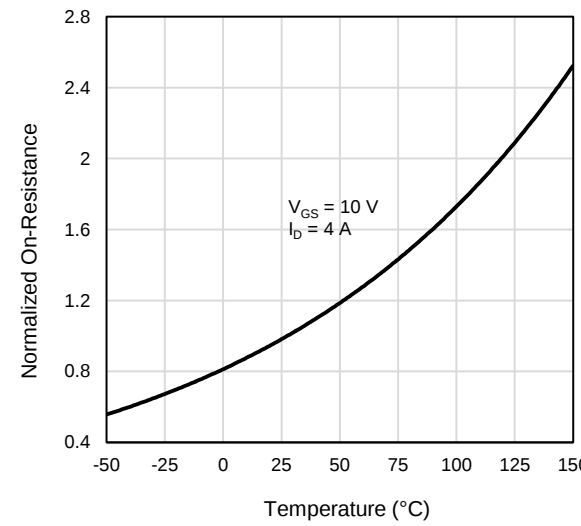


Figure 4: On-Resistance vs. Junction Temperature

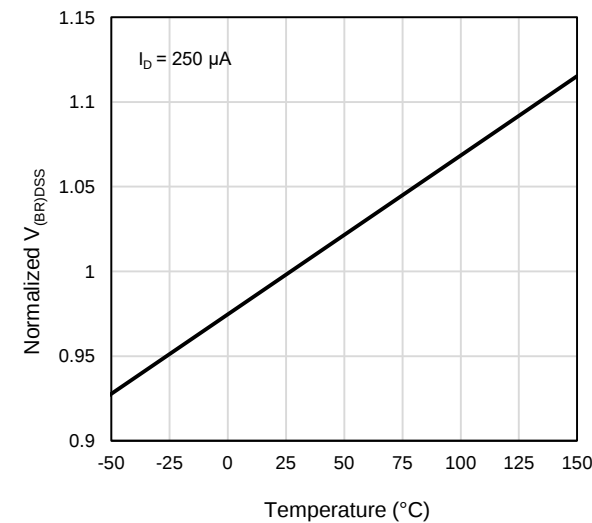


Figure 5: Breakdown Voltage vs. Junction Temperature

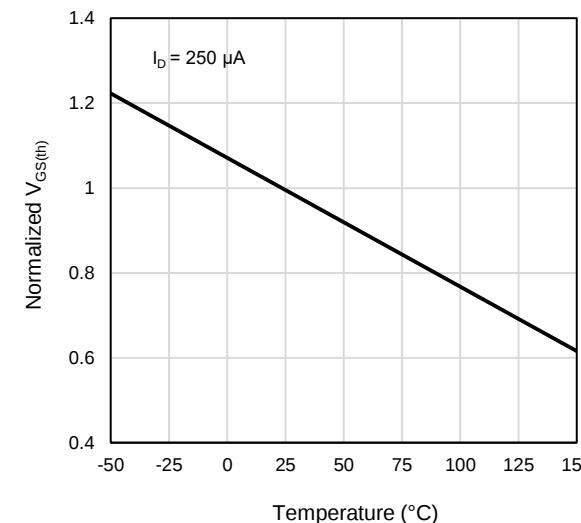


Figure 6: Threshold Voltage vs. Junction Temperature

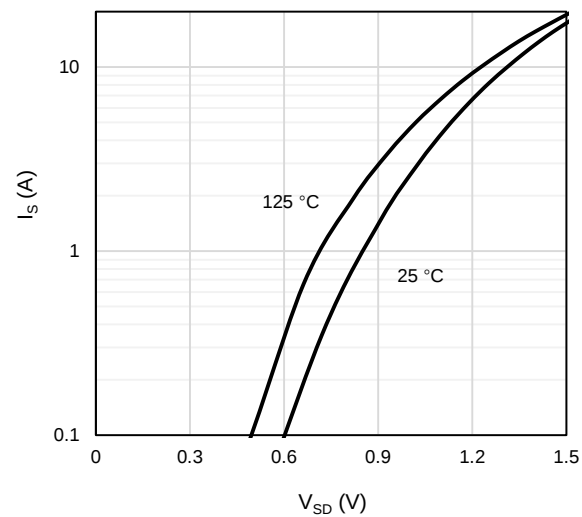


Figure 7: Body-Diode Characteristics

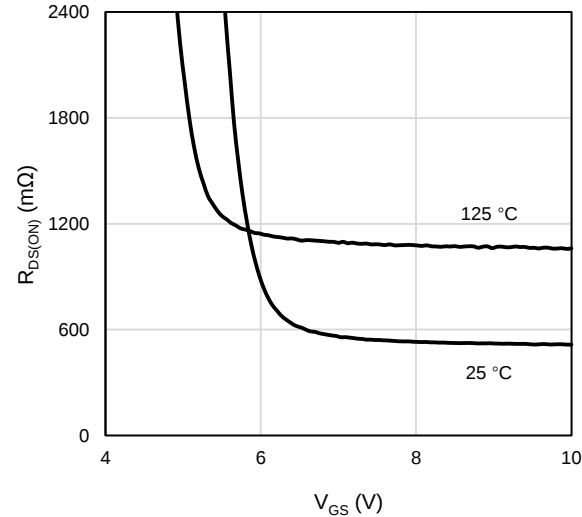


Figure 8: On-Resistance vs. Gate-Source Voltage

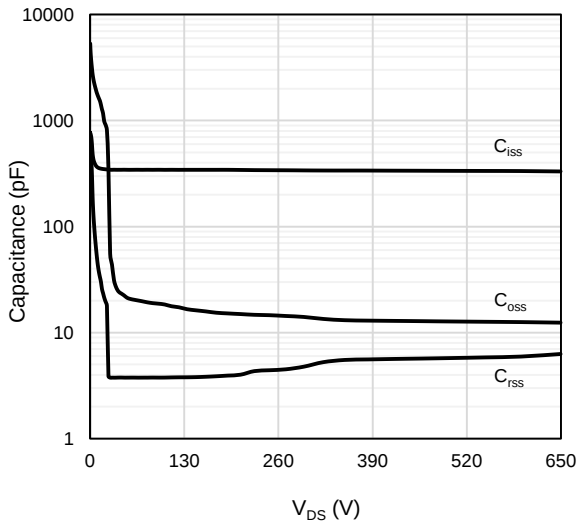


Figure 9: Capacitance Characteristics

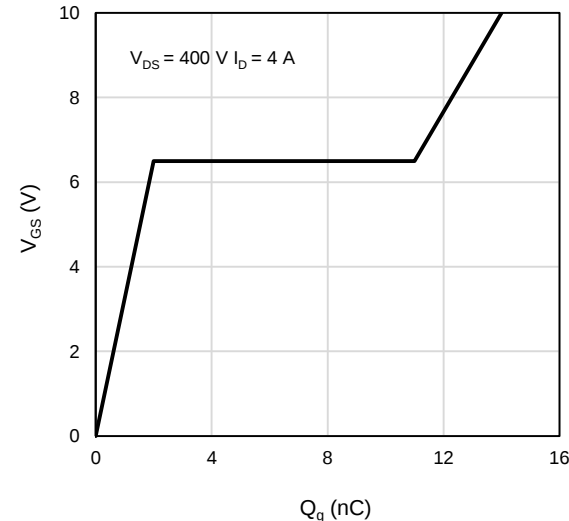


Figure 10: Gate-Charge Characteristics

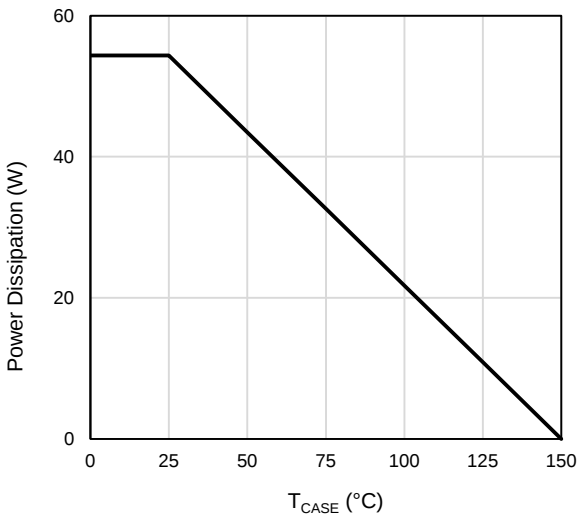


Figure 11: Power De-rating

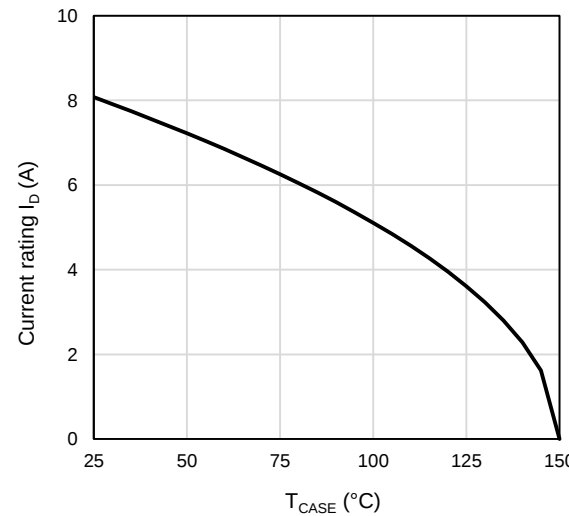


Figure 12: Current De-rating

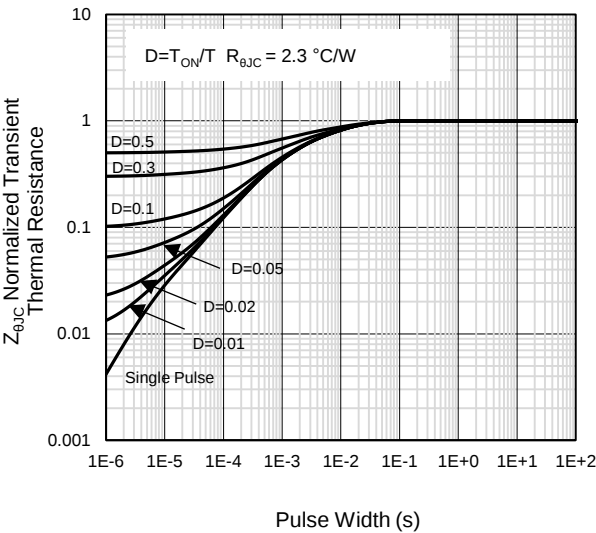


Figure 13: Normalized Maximum Transient Thermal Impedance

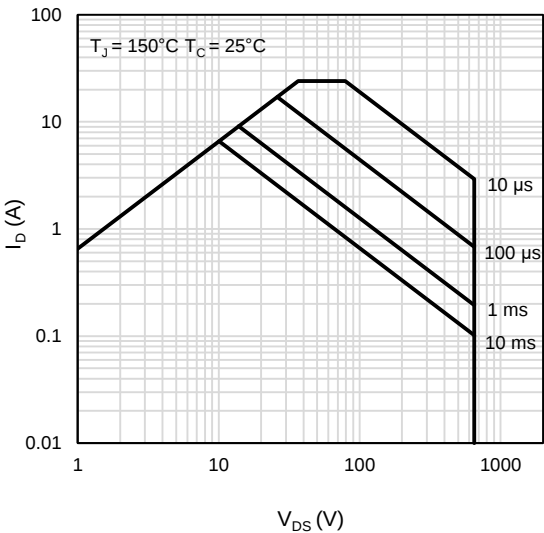
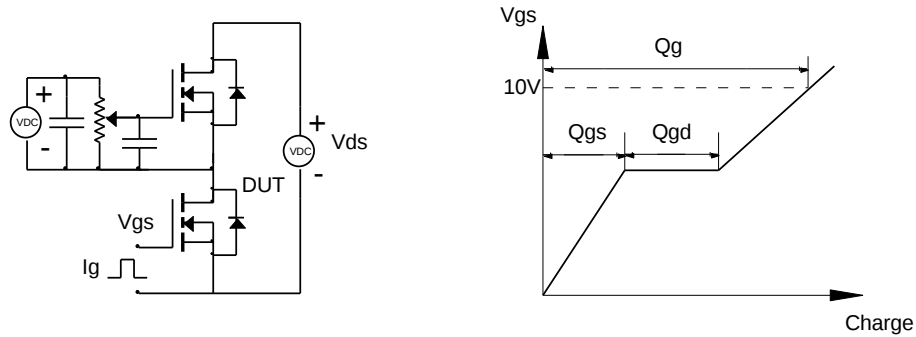


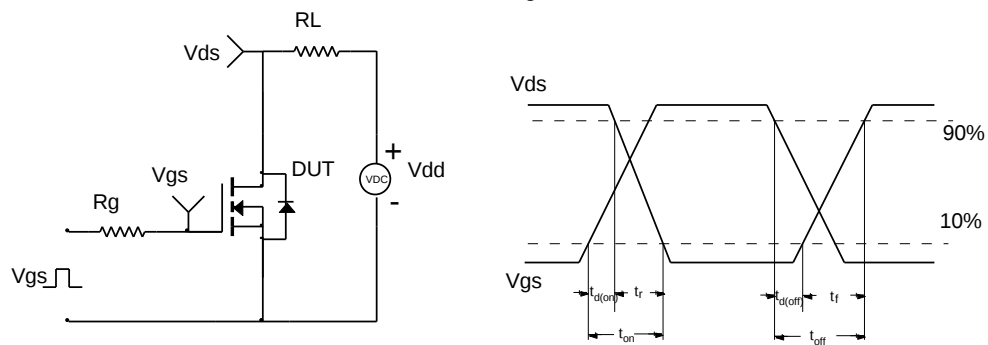
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

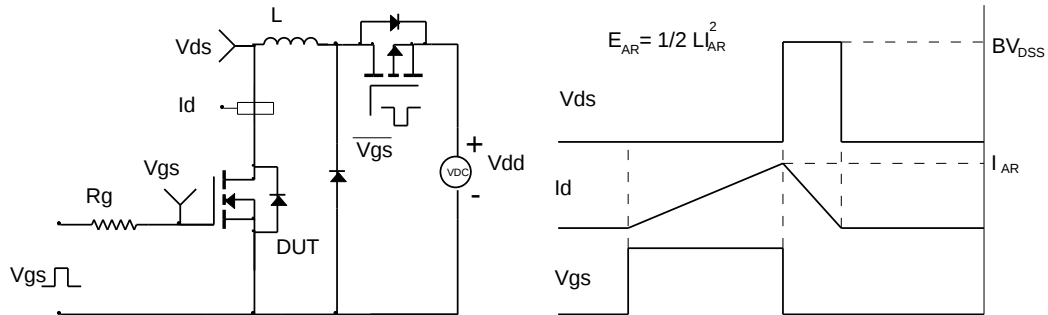
Gate Charge Test Circuit & Waveform



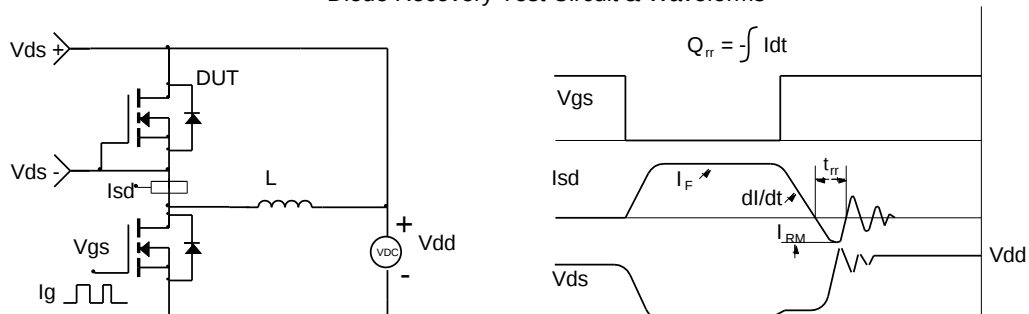
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) 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.

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