

650V 41mohm Super-Junction Power MOSFET

AK3S65N410WMF

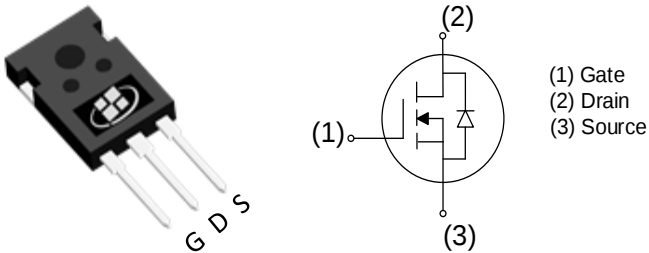
Description:

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

- Features:
- EMI-Friendly
 - RoHS compliant
 - Halogen-free
- Applications:
- Switch Mode Power Supply (SMPS)
 - Uninterruptible Power Supply (UPS)
 - Power Factor Correction (PFC)
 - LED Light

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on), max} @V_{GS} = 10\text{ V}$	41	m Ω
I_D	57	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK3S65N410WMF	TO-247	3S65N410WMF	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	650	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) ^(Note 1)	57	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	36	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	220	A
V_{GS}	Gate - Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	677	mJ
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	320	W
dV/dT	MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 400 \text{ V}$	120	V/ns
	Reverse diode dv/dt, $V_{DS} = 0 \dots 400 \text{ V}$	70	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	0.39	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	30	$^\circ\text{C/W}$

Notes:

1. The max drain current rating limited by maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $L = 10.8 \text{ mH}$, $V_{DD} = 100 \text{ V}$, $I_{AS} = 11.2 \text{ A}$, $R_G = 50 \Omega$, 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 V, I _D = 1 mA	650			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V			10	μA
I _{GSS}	Gate Leakage Current	V _{GS} = ± 30 V, V _{DS} = 0 V			±100	nA
V _{GS(th)}	Gate Threshold voltage	V _{DS} = V _{GS} , I _D = 2 mA	3	4	5	V
R _{DS(ON)}	Drain - Source on - state resistance	V _{GS} = 10 V, I _D = 25 A		38	41	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		3320		pF
C _{oss}	Output Capacitance			86		pF
C _{rss}	Reverse Transfer Capacitance			19		pF
C _{o(er)}	Effective output capacitance, energy related	V _{DS} = 0...400 V, V _{GS} = 0 V		167		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		1320		pF
R _g	Gate Resistance	f = 1 MHz		4.2		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V , I _D = 16 A, V _{GS} = 10 V, R _G = 3 Ω		163		ns
t _r	Rise Time			11		ns
t _{d(off)}	Turn Off Delay Time			68.5		ns
t _f	Fall Time			7		ns
Q _g	Total Gate Charge	V _{DD} = 400 V , I _D = 16 A, V _{GS} = 10 V		101		nC
Q _{gs}	Gate - Source Charge			21		nC
Q _{gd}	Gate - Drain Charge			55		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body - Diode Forward Current				57	A
I _{SM}	Maximum Pulsed Body - Diode Forward Current				220	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 25 A		0.96		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 16 A, di/dt = 100 A/μs		142		ns
Q _{rr}	Reverse recovery charge			0.9		μC
I _{rrm}	Peak Reverse Recovery Current			12.5		A

Electrical Characteristics Diagrams

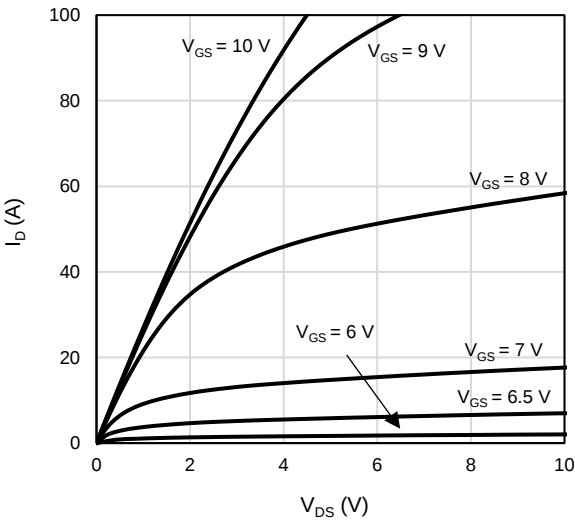


Figure 1: On-Region Characteristics

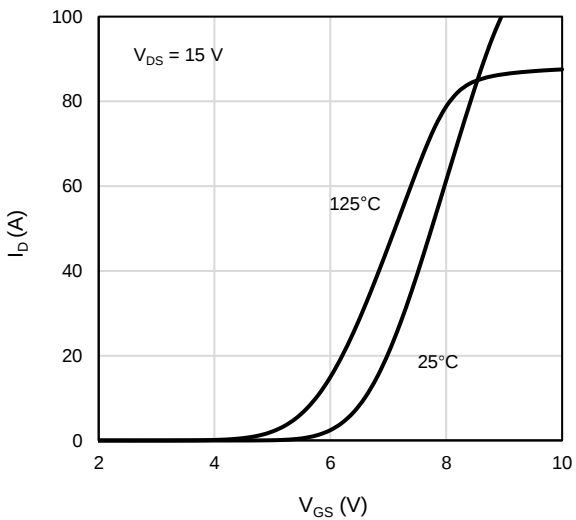


Figure 2: Transfer Characteristics

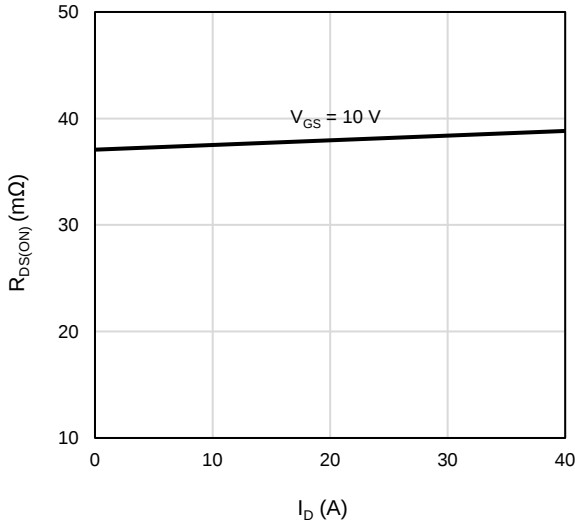


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

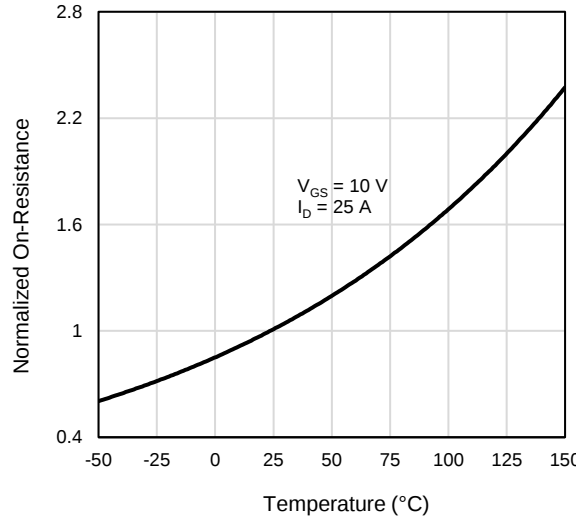


Figure 4: On-Resistance vs. Junction Temperature

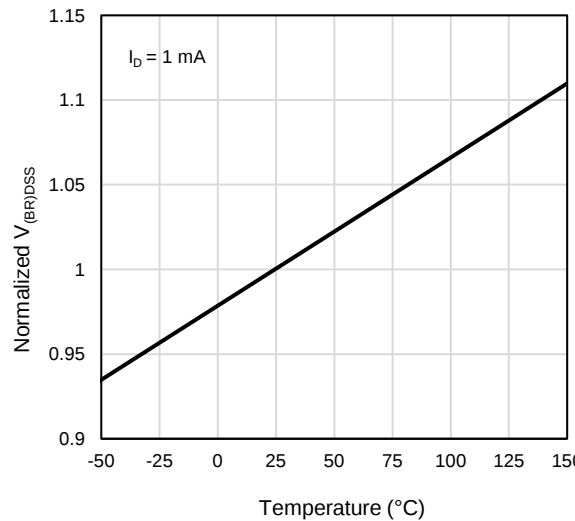


Figure 5: Breakdown Voltage vs. Junction Temperature

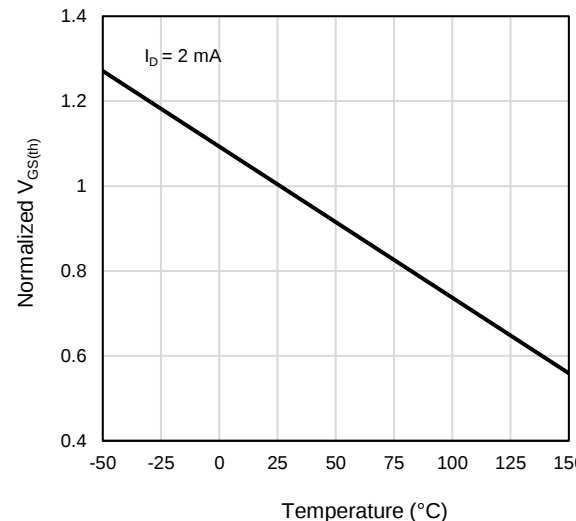


Figure 6: Threshold Voltage vs. Junction Temperature

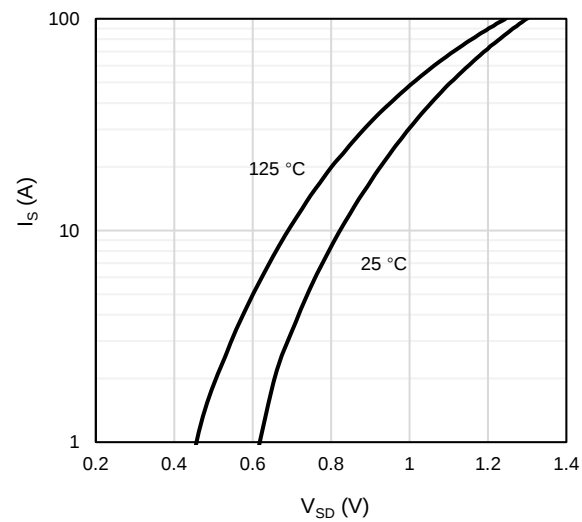


Figure 7: Body-Diode Characteristics

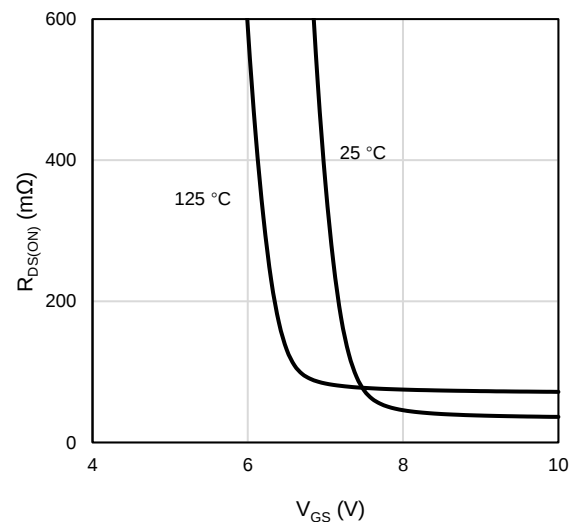


Figure 8: On-Resistance vs. Gate-Source Voltage

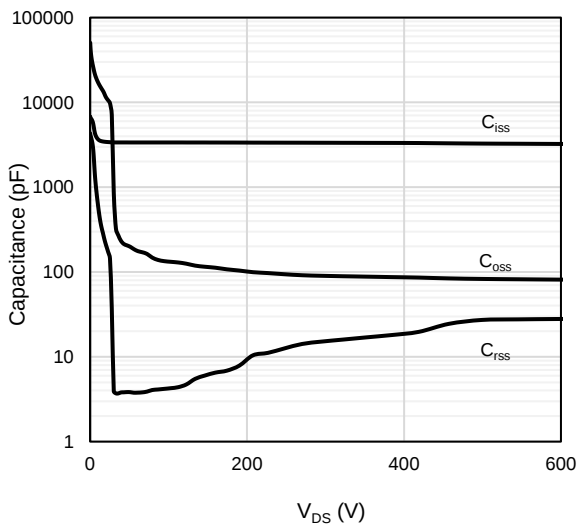


Figure 9: Capacitance Characteristics

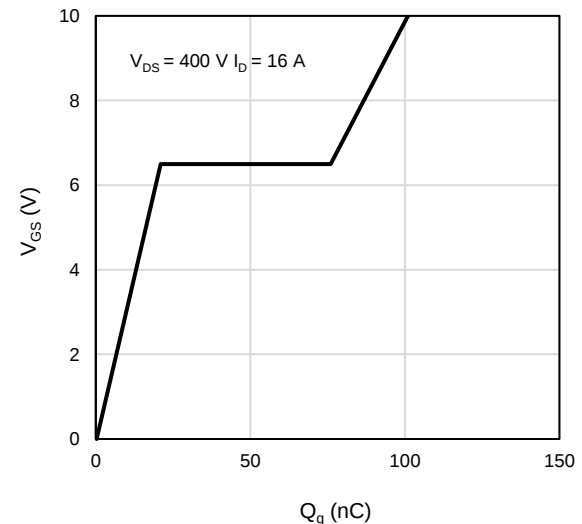


Figure 10: Gate-Charge Characteristics

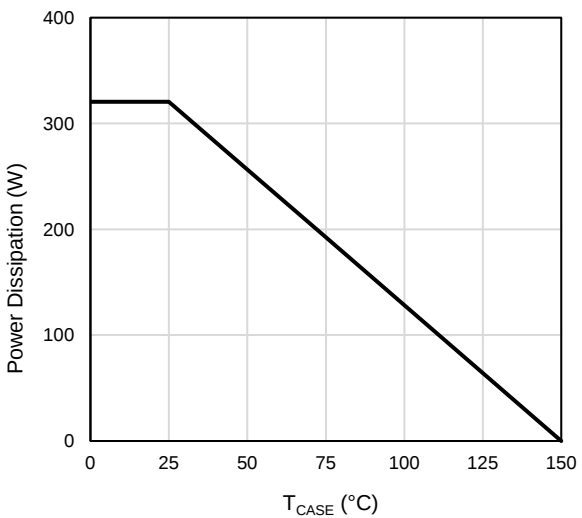


Figure 11: Power De-rating

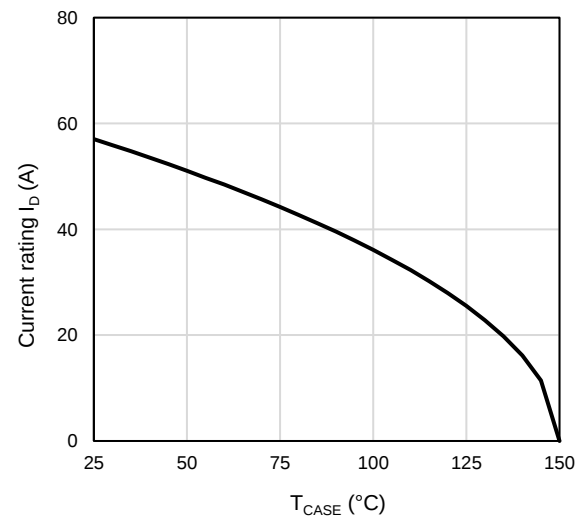


Figure 12: Current De-rating

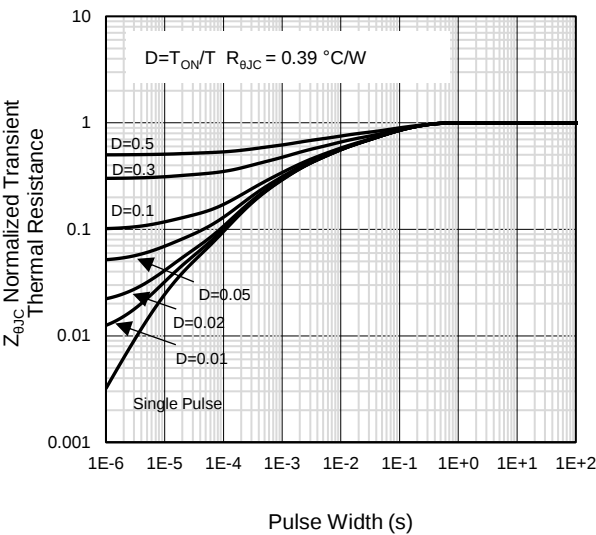


Figure 13: Normalized Maximum Transient Thermal Impedance

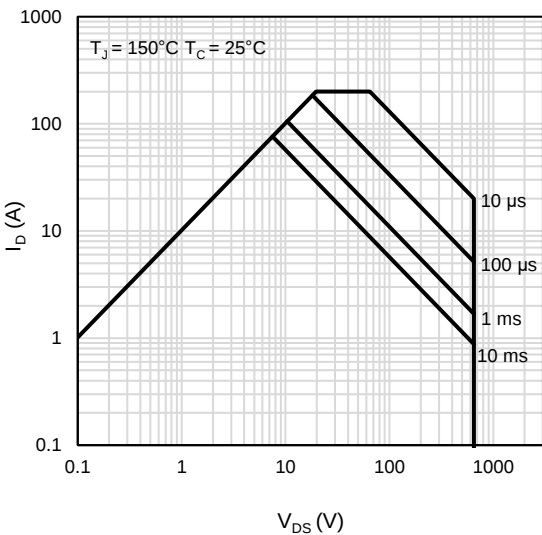
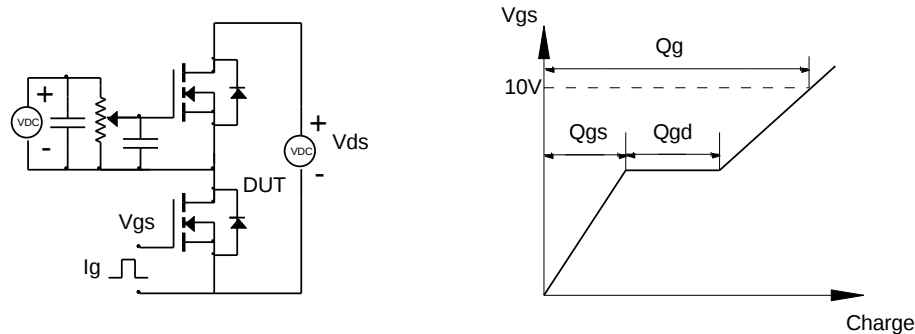


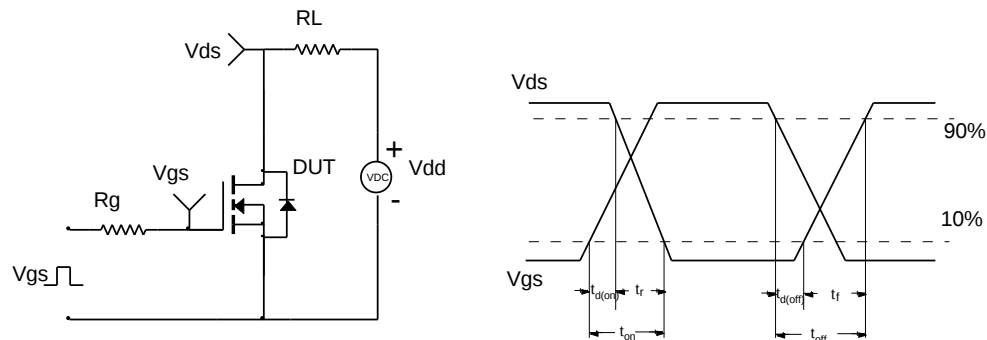
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

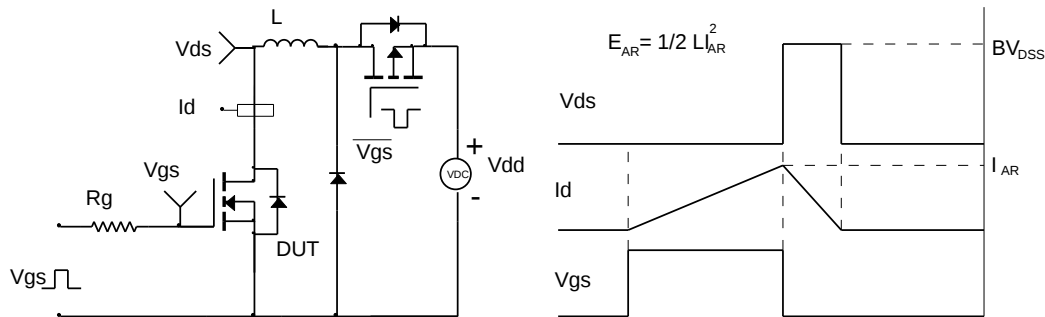
Gate Charge Test Circuit & Waveform



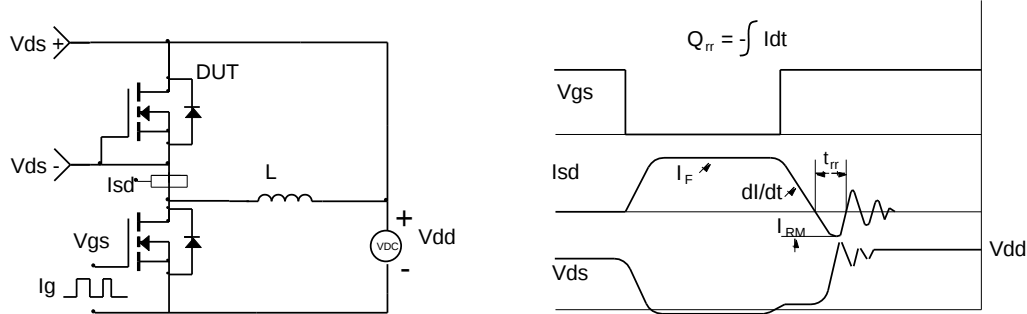
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History

Revision	Released	Remark
Rev.1.0	2025	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.

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