

650V 190mohm Super-Junction Power MOSFET AKS65N1K9PMF

Description:

This SJ device integrated with fast-recovery diode provides good FOM factor, EMI friendly for customer application.

Features:

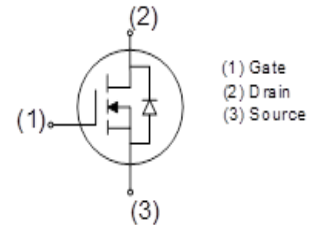
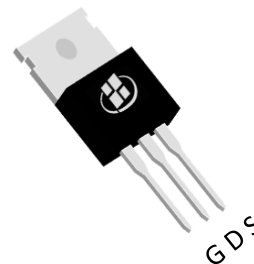
- EMI-Friendly
- RoHS compliant
- Halogen-free

Applications:

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on), max} @V_{GS} = 10 V$	190	m Ω
I_D	20.5	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AKS65N1K9PMF	TO-220	S65N1K9PMF	Tube	1000 per box

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)	20.5	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	13	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	61.5	A
V_{GS}	Gate - Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	390	mJ
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	208	W
dV/dT	MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 400$ V	50	V/ns
	Reverse diode dv/dt, $V_{DS} = 0 \dots 400$ 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	0.6	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	55	$^\circ\text{C}/\text{W}$

Notes:

1. The max drain current rating limited by maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $L = 10.8$ mH, $V_{DD} = 150$ V, $I_{AS} = 8.5$ A, $R_G = 25$ Ω , Starting $T_J = 25$ $^\circ\text{C}$
4. Mount on minimum PCB layout

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 = 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 = 250 μA	3	3.8	4.5	V
R _{DS(ON)}	Drain - Source on - state resistance	V _{GS} = 10 V, I _D = 10 A		144	190	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 100 V, V _{GS} = 0 V, f = 1 MHz		1695		pF
C _{oss}	Output Capacitance			74		pF
C _{rss}	Reverse Transfer Capacitance			2		pF
C _{o(er)}	Effective output capacitance, energy related	V _{DS} = 0...400 V, V _{GS} = 0 V		75		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		348		pF
R _g	Gate Resistance	f = 1 MHz		21		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V, I _D = 10 A, V _{GS} = 13 V, R _G = 3.3 Ω		73		ns
t _r	Rise Time			26		ns
t _{d(off)}	Turn Off Delay Time			120		ns
t _f	Fall Time			11		ns
Q _g	Total Gate Charge	V _{DD} = 480 V, I _D = 11 A, V _{GS} = 10 V		46		nC
Q _{gs}	Gate - Source Charge			11		nC
Q _{gd}	Gate - Drain Charge			24		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body - Diode Forward Current				20.5	A
I _{SM}	Maximum Pulsed Body - Diode Forward Current				61.5	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 1 A		0.7		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 11 A, di/dt = 100 A/μs		118		ns
Q _{rr}	Reverse recovery charge			0.7		μC
I _{rrm}	Peak Reverse Recovery Current			12		A

Electrical Characteristics Diagrams

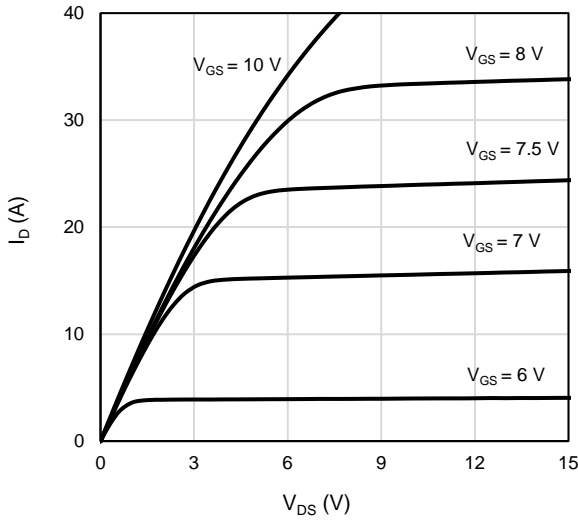


Figure 1: On-Region Characteristics

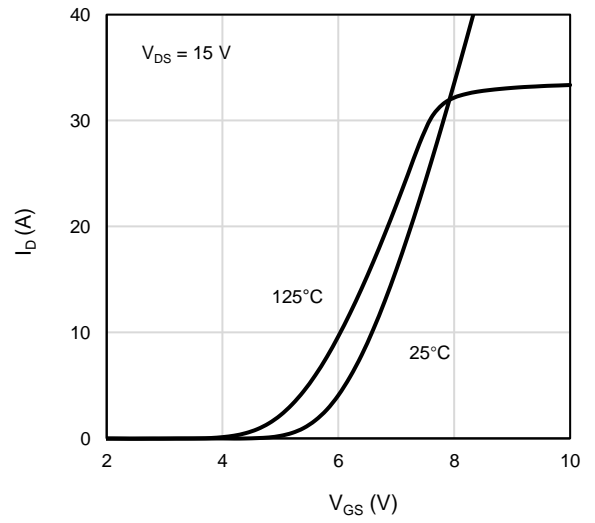


Figure 2: Transfer Characteristics

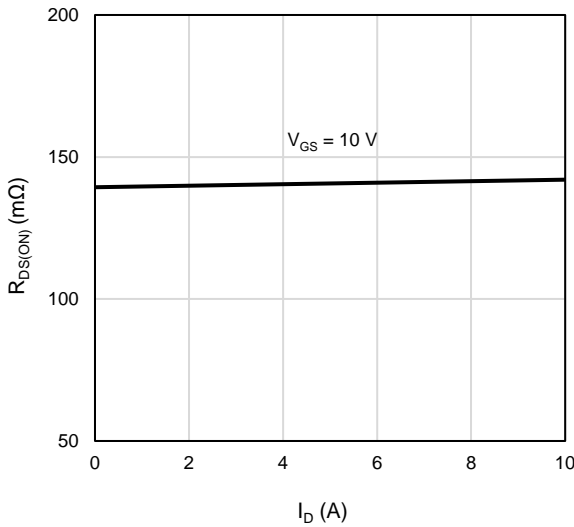


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

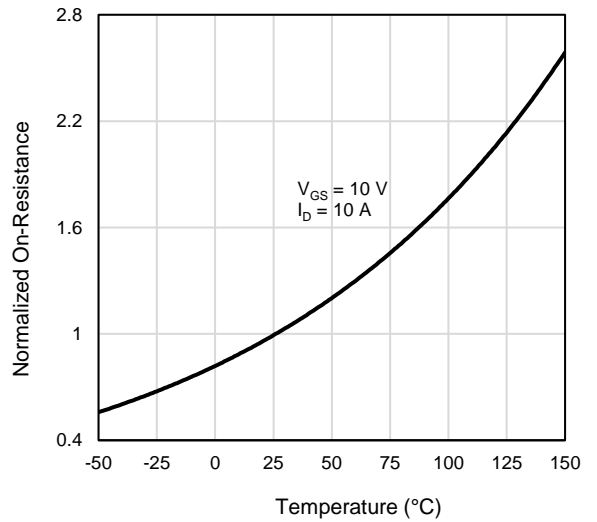


Figure 4: On-Resistance vs. Junction Temperature

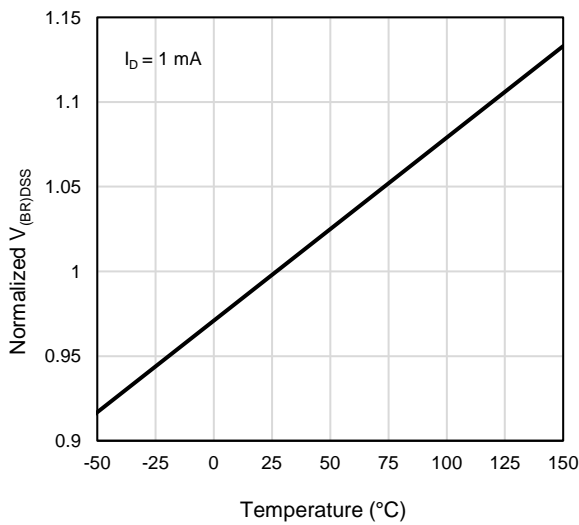


Figure 5: Breakdown Voltage vs. Junction Temperature

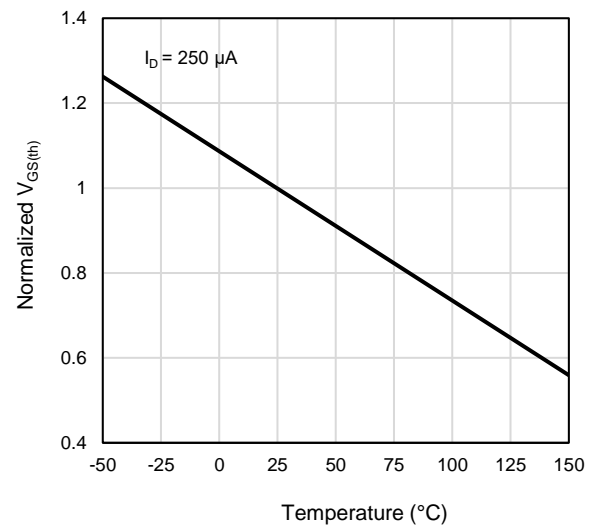


Figure 6: Threshold Voltage vs. Junction Temperature

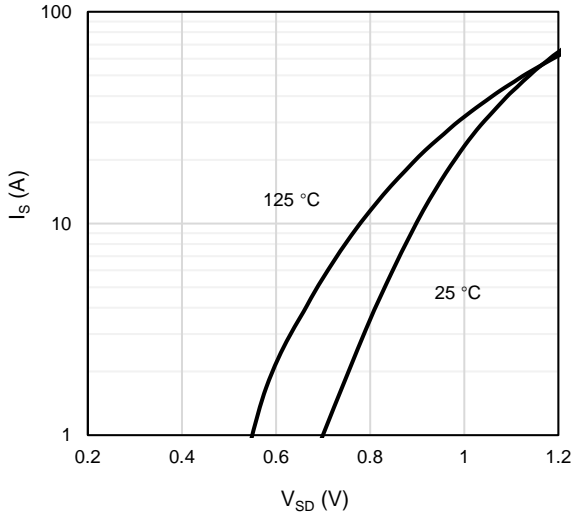


Figure 7: Body-Diode Characteristics

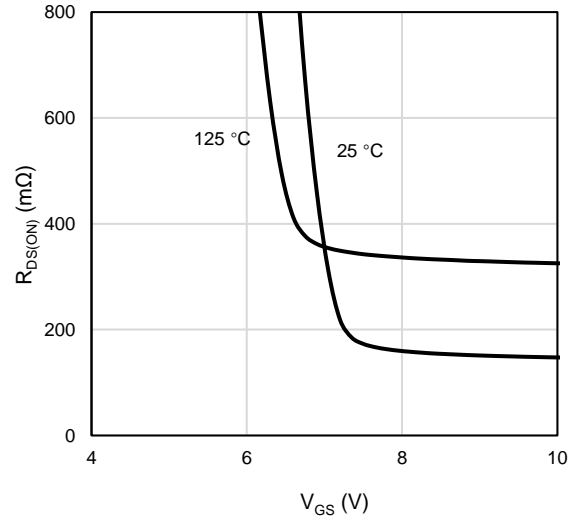


Figure 8: On-Resistance vs. Gate-Source Voltage

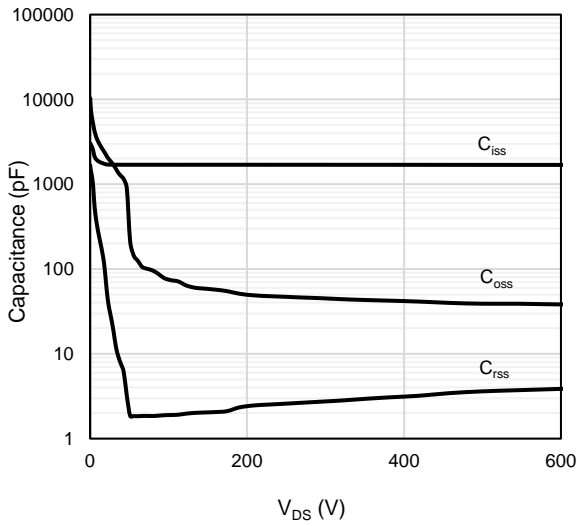


Figure 9: Capacitance Characteristics

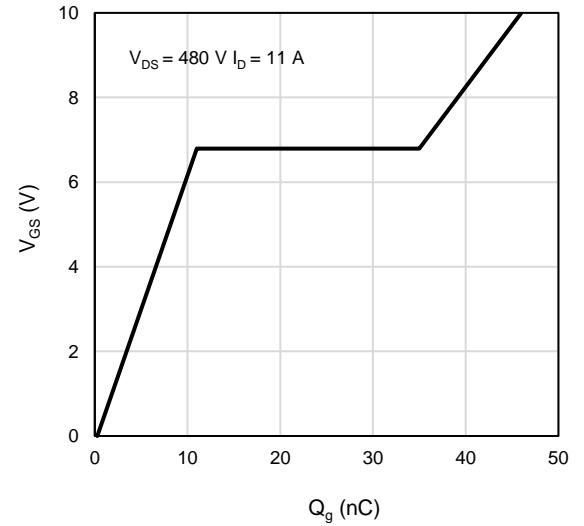


Figure 10: Gate-Charge Characteristics

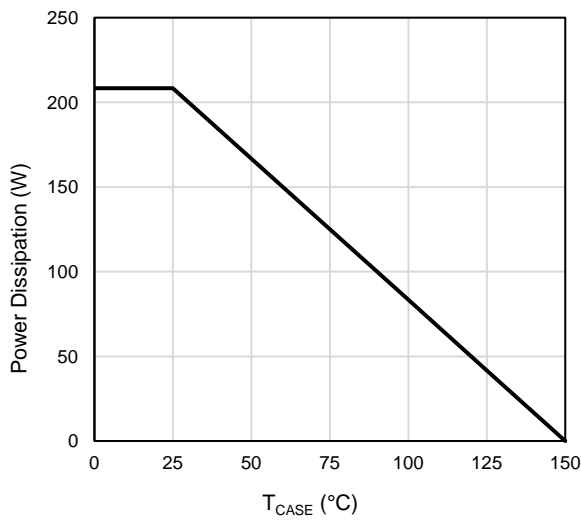


Figure 11: Power De-rating

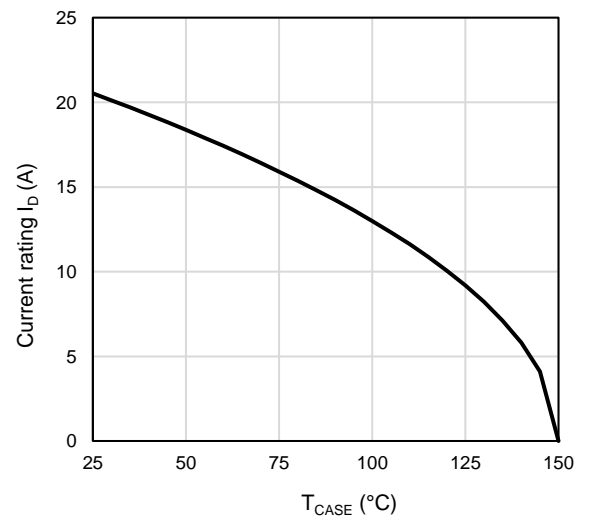


Figure 12: Current De-rating

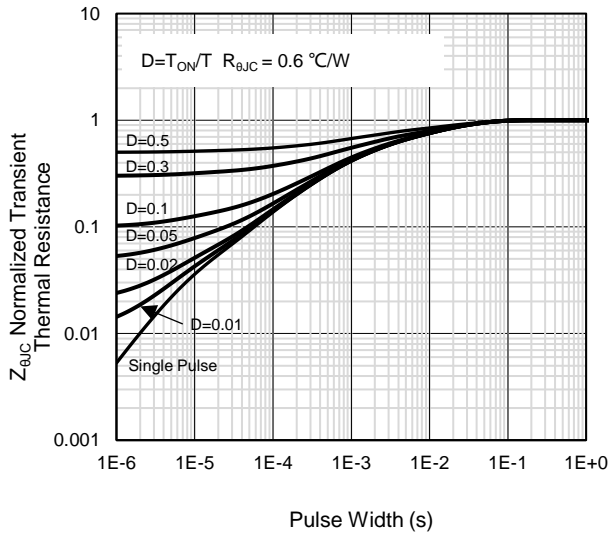


Figure 13: Normalized Maximum Transient Thermal Impedance

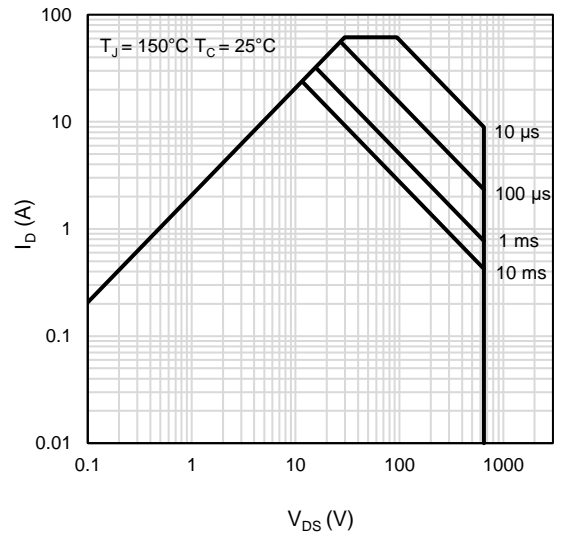
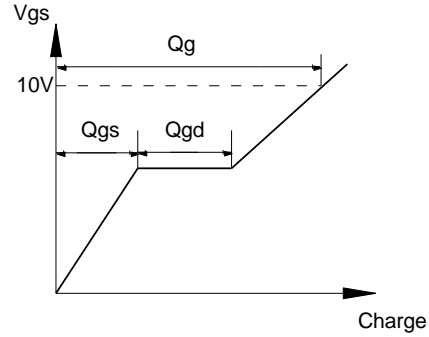
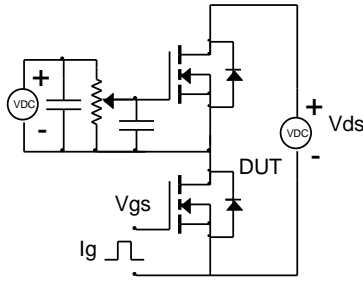


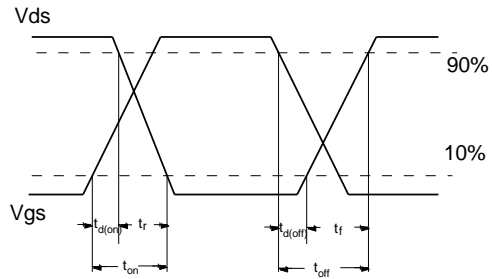
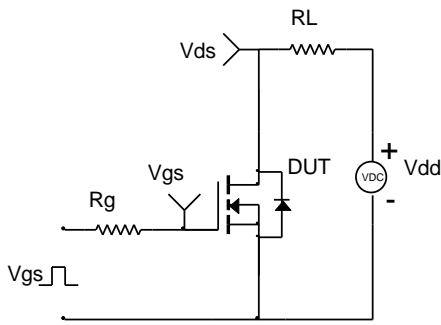
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

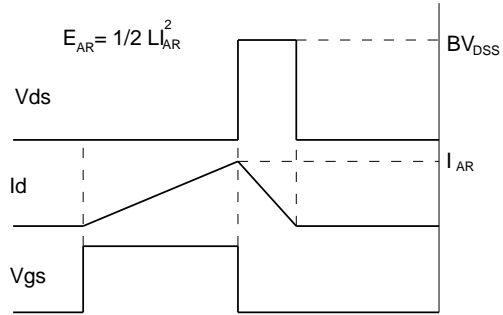
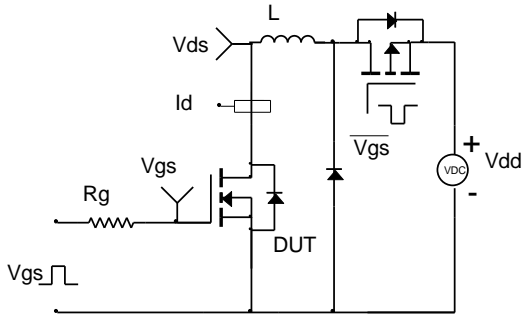
Gate Charge Test Circuit & Waveform



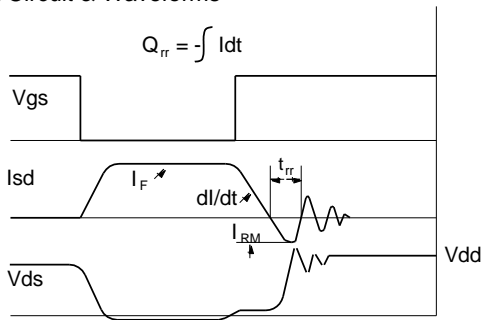
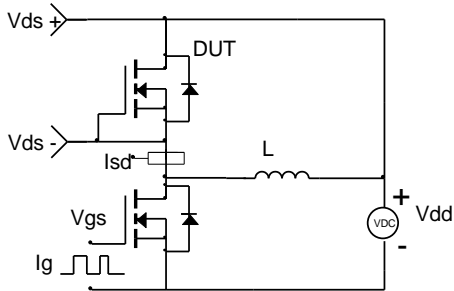
Resistive Switching Test Circuit & Waveforms



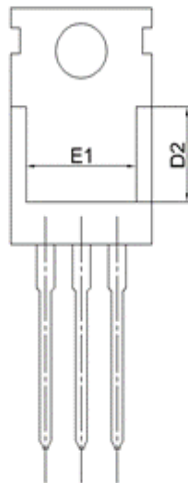
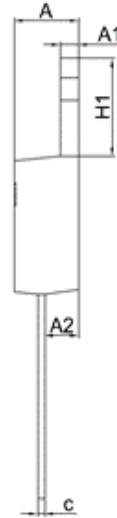
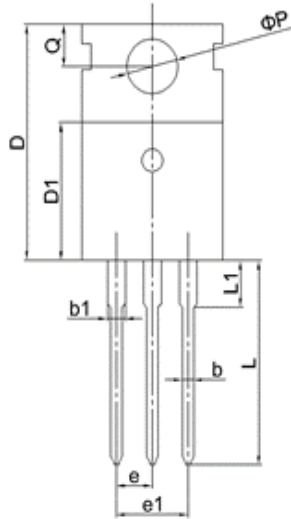
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Outlines



SYMBOL	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b1	1.17	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	6.30	7.10
E	9.70	10.00	10.30
E1	7.00	7.80	8.60
e	2.54 BSC		
e1	5.08 BSC		
H	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
ΦP	3.40	3.60	3.80
Q	2.60	2.80	3.00

Marking Information



Note:

S65N1K9PMF = Product Name Code

XXXXXXXX = Date code

Contact ALKAIDSEMI sales for detail information

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.

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