

650V 190mohm Super-Junction Power MOSFET
AKS65N1K9FMF

Description:

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

Features:

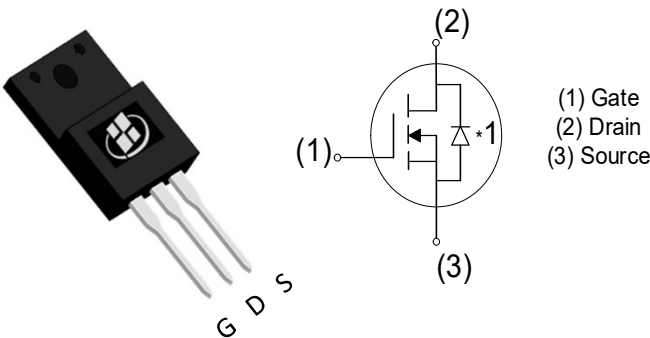
- Low FOM $R_{DS(ON)}$
- EMI-Friendly
- 100% UIS tested
- RoHS compliant (Note 1)
- Halogen-free (Note 1)

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
$R_{DS(ON), max} @V_{GS} = 10V$	190	mΩ
I_D	20	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AKS65N1K9FMF	TO-220F	S65N1K9FMF	Tube	1000 per box

Notes:

1. Contact ALKAIDSEMI sales for detail 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)	20	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$) ^(Note 1)	13	A
I_{DM}	Drain Current - Pulsed ^(Note 1, 2)	60	A
V_{GS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	390	mJ
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	22.7	W
dV/dT	MOSFET dv/dt ruggedness	50	V/ns
	Reverse diode dv/dt	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	5.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Steady State ^(Note 4)	45.5	$^\circ\text{C/W}$

Notes:

1. The max drain current rating limited by TO-220 package and maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $L = 10.8 \text{ mH}$, $V_{DD} = 150\text{V}$, $I_{AS} = 8.5 \text{ A}$, $R_G = 25 \Omega$, 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						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	650			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V			1	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		136	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
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		26		nS
T _R	Rise Time			25		nS
T _{D(OFF)}	Turn Off Delay Time			130		nS
T _F	Fall Time			15		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	A
I _{SM}	Maximum Pulsed Body-Diode Forward Current ^(NOTE 1)				60	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		84		nS
Q _{RR}	Reverse recovery charge			465		nC
I _{RRM}	Peak Reverse Recovery Current			11		A

Electrical Characteristics Diagrams

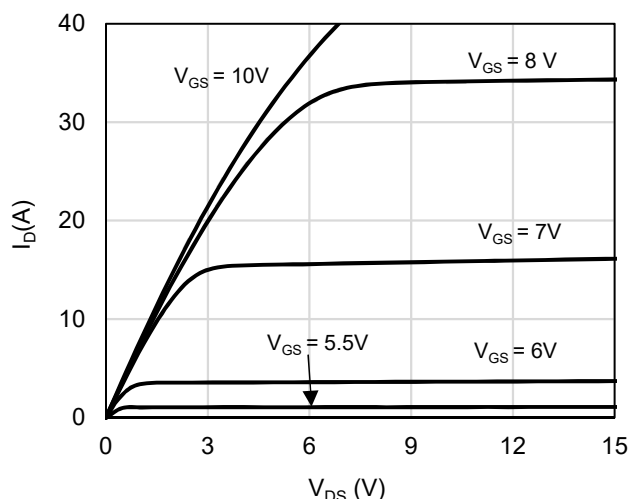


Figure 1: On-Region Characteristics

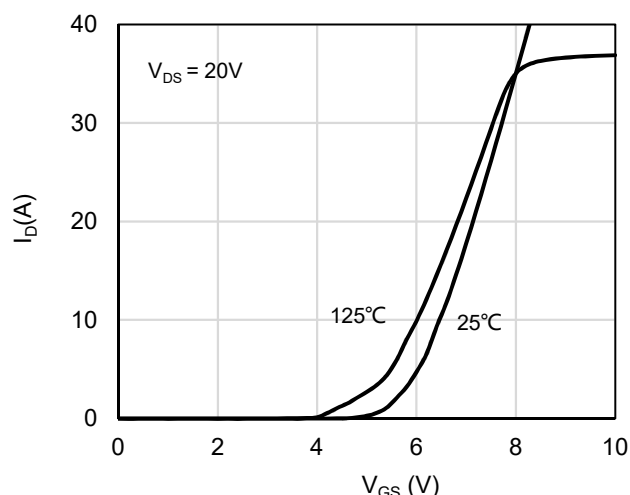


Figure 2: Transfer Characteristics

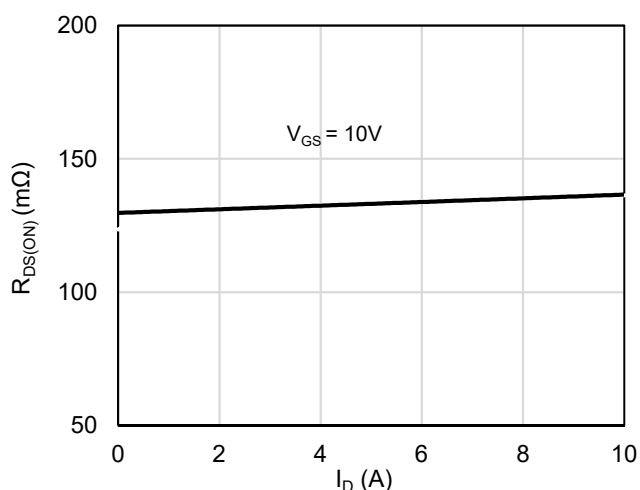


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

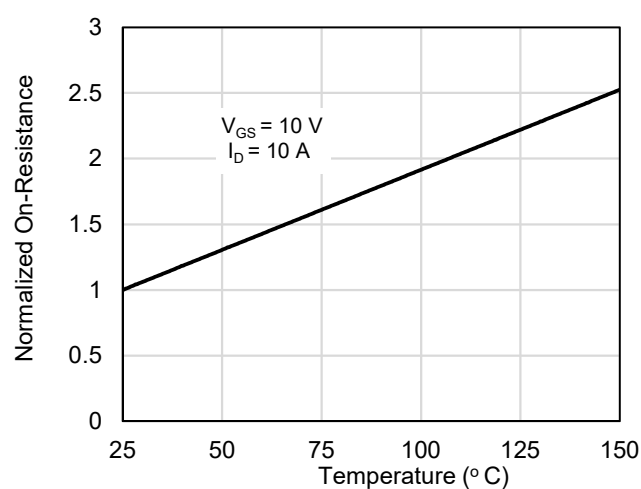


Figure 4: On-Resistance vs. Junction Temperature

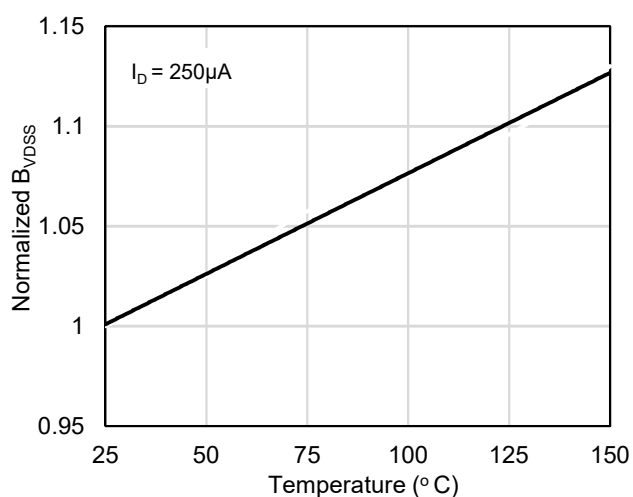


Figure 5: Breakdown Voltage vs. Junction Temperature

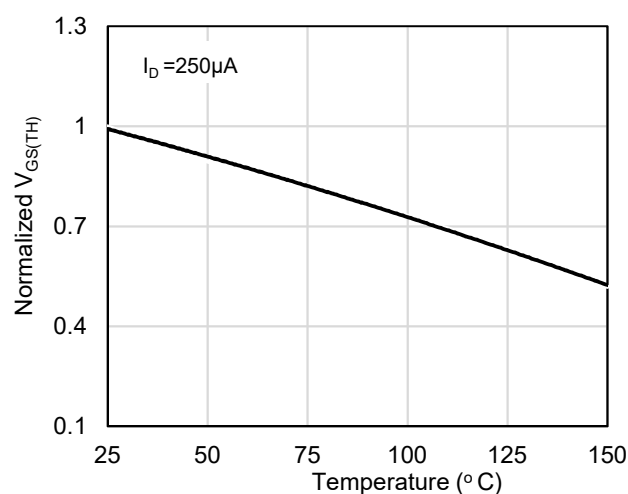


Figure 6: Threshold Voltage vs. Junction Temperature

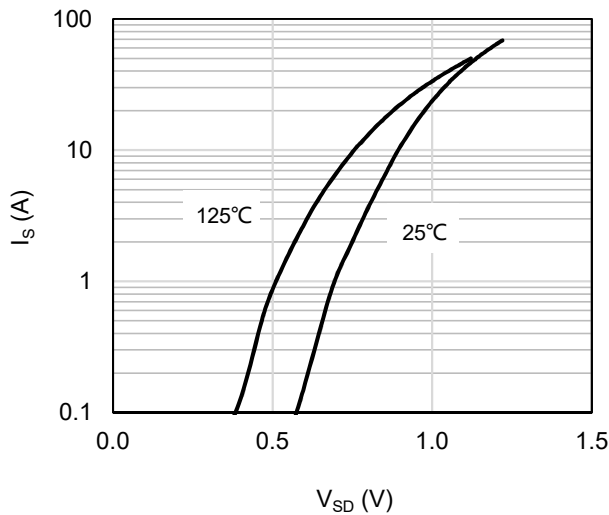


Figure 7: Body-Diode Characteristics

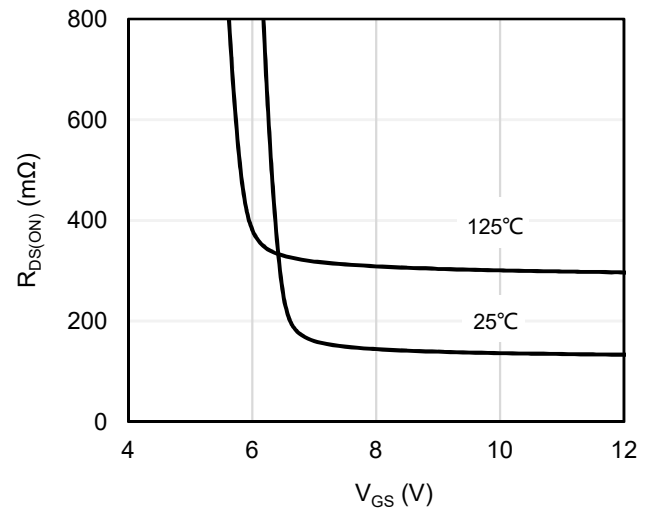


Figure 8: On-Resistance vs. Gate-Source Voltage

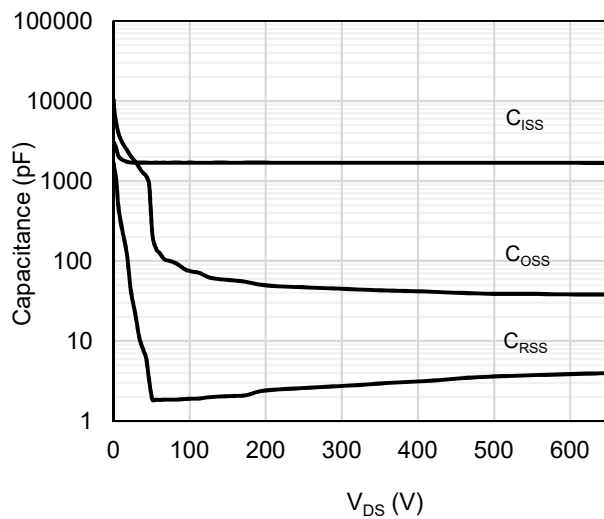


Figure 9: Capacitance Characteristics

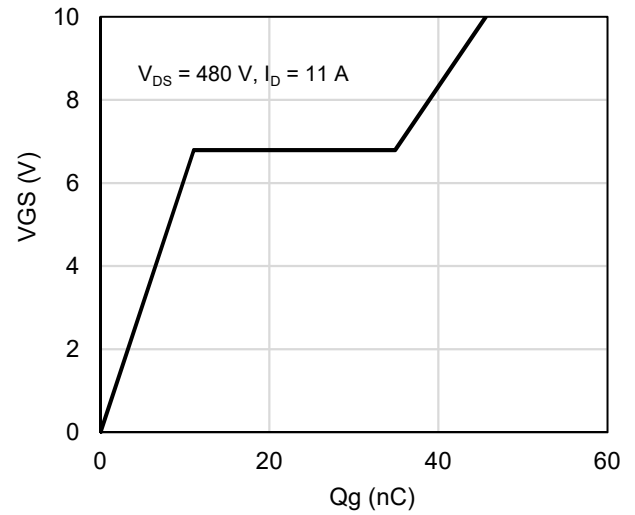


Figure 10: Gate-Charge Characteristics

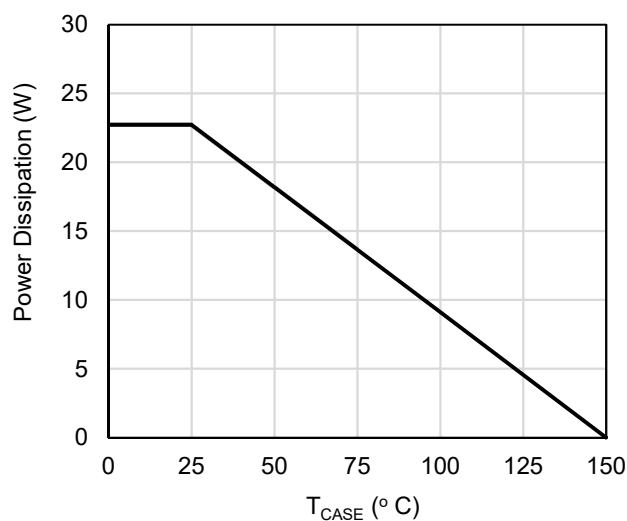


Figure 11: Power De-rating

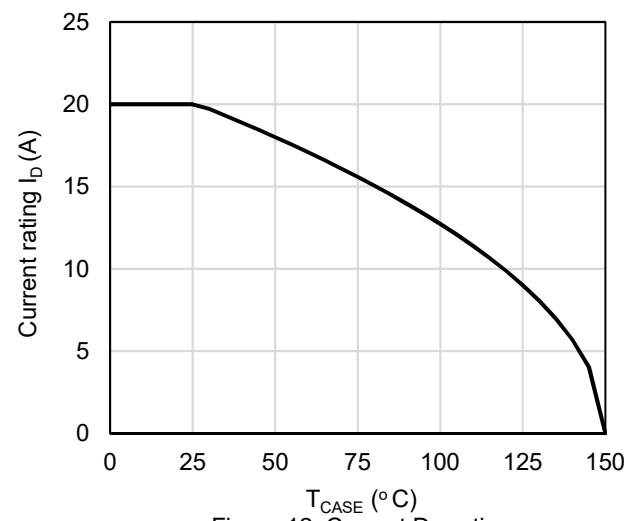
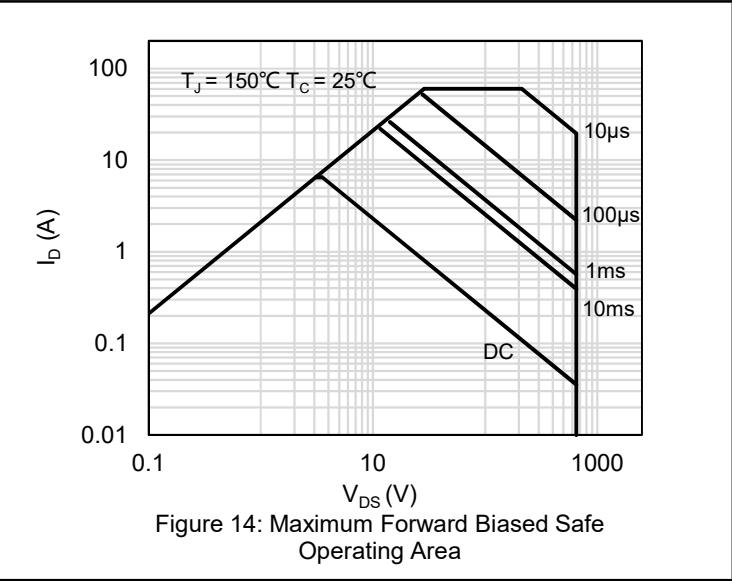
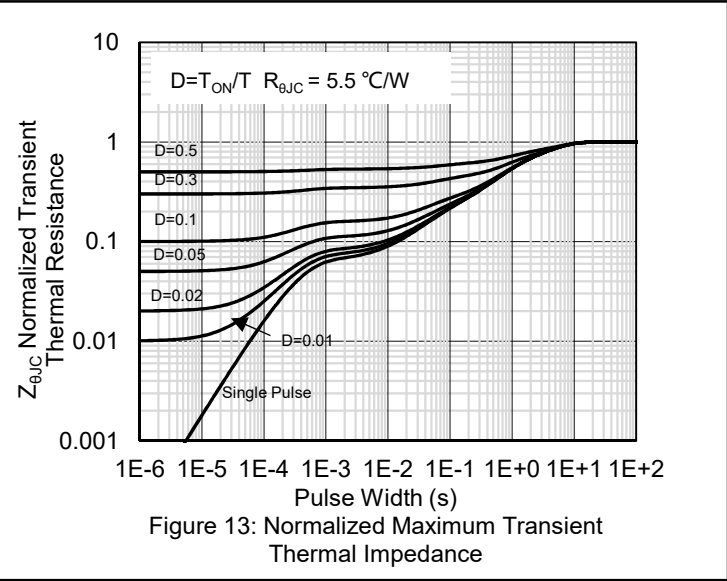
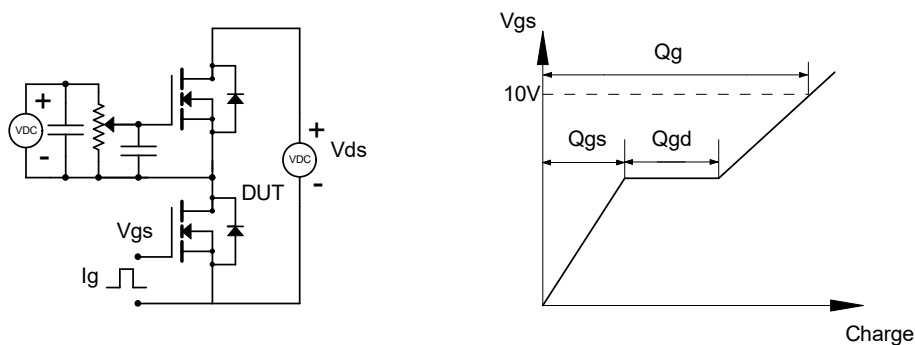


Figure 12: Current De-rating

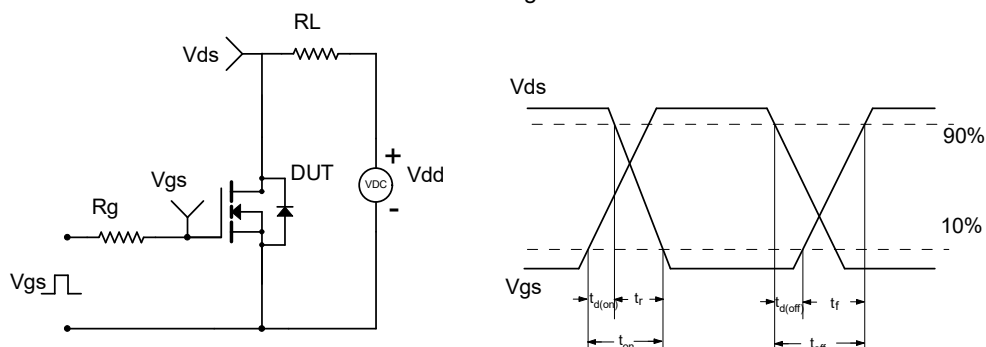


Test Circuit and Waveform

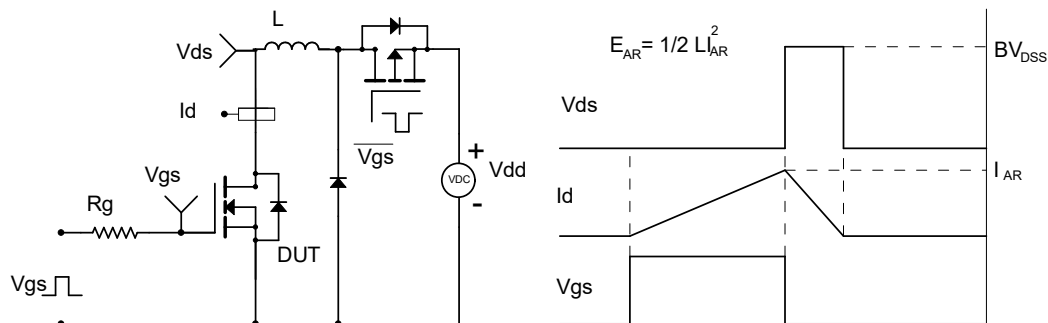
Gate Charge Test Circuit & Waveform



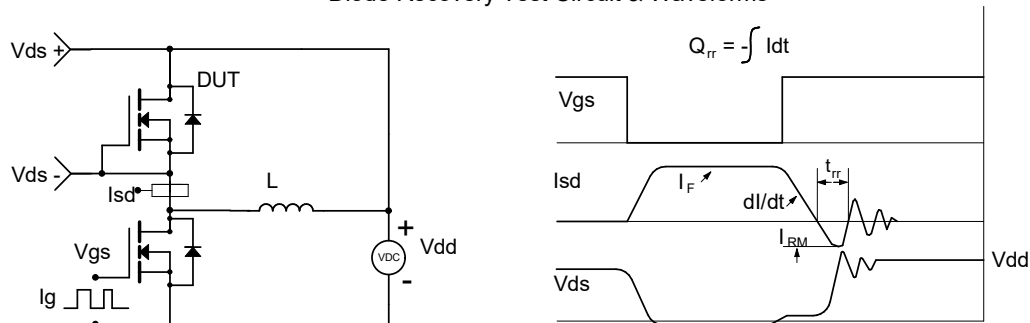
Resistive Switching Test Circuit & Waveforms



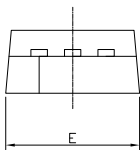
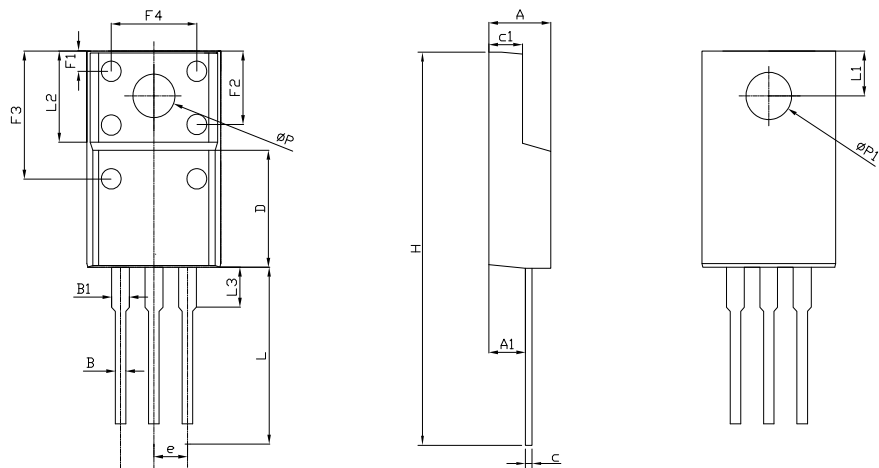
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



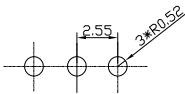
Diode Recovery Test Circuit & Waveforms



Package Outlines



RECOMMENDED LAND PATTERN



UNIT:mm

	MIN	NOM	MAX
A	4.40	4.60	4.80
A1	2.63	2.76	2.89
B	0.75	0.80	0.90
B1	1.12	1.27	1.42
c	0.40	0.50	0.60
c1	2.60	2.70	2.80
D	7.50	7.80	8.10
e	-	2.55REF	-
E	9.86	10.00	10.10
F1	1.90	2.12	2.40
F2	5.00	5.30	5.65
F3	8.70	9.00	9.30
F4	6.20	6.50	6.80
H	27.80	28.30	28.80
L	13.10	13.30	13.50
L1	2.85	3.00	3.15
L2	-	6.70REF	-
L3	2.80	3.10	3.40
ΦP	3.00	3.30	3.60
ΦP1	2.80	3.10	3.40

Marking Information



S65N1K9FMF
XXXXXXX

Note:

S65N1K9FMF = Product Name Code

XXXXXXX = Date code

Contact ALKAIDSEMI sales for detail information

Revision History

Revision	Release Date	Remark
Rev.1.0	2023/2/10	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.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.