

650V 99mohm Super-Junction Power MOSFET

AK3S65N990WMF

Description:

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

Features:

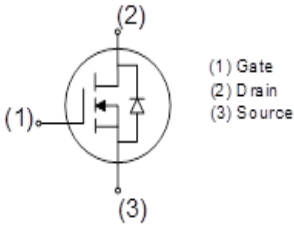
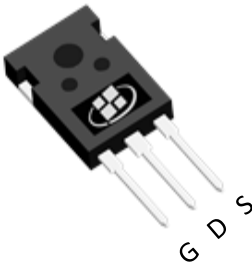
- EMI-Friendly
- RoHS compliant
- Halogen-free

Applications:

- High Frequency Switching
- High Efficiency SMPS

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on)}$, max @ $V_{GS} = 10\text{ V}$	99	m Ω
I_D	30	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK3S65N990WMF	TO-247	3S65N990WMF	Tube	See the detail package information

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

Symbol	Parameter	Value	Units
V _{DS}	Drain - Source Voltage	650	V
I _D	Drain Current - Continuous (T _C = 25°C) ^(Note 1)	30	A
	Drain Current - Continuous (T _C = 100°C)	19	A
I _{DM}	Drain Current - Pulsed ^(Note 2)	75	A
V _{GS}	Gate - Source Voltage	± 30	V
E _{AS}	Single Pulsed Avalanche Energy ^(Note 3)	214	mJ
P _D	Power Dissipation (T _C = 25°C)	215.5	W
dV/dT	MOSFET dv/dt ruggedness, V _{DS} = 0...400 V	100	V/ns
	Reverse diode dv/dt, V _{DS} = 0...400 V	20	V/ns
T _J , T _{STG}	Operating and Storage Temperature Range	-55 to +150	°C

Thermal Characteristics

Symbol	Parameter	Value	Units
R _{θJC}	Thermal Resistance, Junction - to - Case, Steady State	0.58	°C/W
R _{θJA}	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	30	°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 mH, V_{DD} = 100 V, I_{AS} = 6.3 A, R_G = 25 Ω, Starting T_J = 25 °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 = 250 μA	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 = 1 mA	3	4	5	V
R _{DS(ON)}	Drain - Source on - state resistance	V _{GS} = 10 V, I _D = 15 A		85	99	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		1485		pF
C _{oss}	Output Capacitance			43		pF
C _{rss}	Reverse Transfer Capacitance			9		pF
C _{o(er)}	Effective output capacitance, energy related	V _{DS} = 0...400 V, V _{GS} = 0 V		80		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		600		pF
R _g	Gate Resistance	f = 1 MHz		6		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V , I _D = 15 A, V _{GS} = 10 V, R _G = 5 Ω		19		ns
t _r	Rise Time			35		ns
t _{d(off)}	Turn Off Delay Time			42		ns
t _f	Fall Time			10		ns
Q _g	Total Gate Charge	V _{DD} = 400 V , I _D = 15 A, V _{GS} = 10 V		48		nC
Q _{gs}	Gate - Source Charge			10		nC
Q _{gd}	Gate - Drain Charge			28		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body - Diode Forward Current				30	A
I _{SM}	Maximum Pulsed Body - Diode Forward Current				75	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 15 A		1.06		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 15 A, di/dt = 100 A/μs		114		ns
Q _{rr}	Reverse recovery charge			0.7		μC
I _{rrm}	Peak Reverse Recovery Current			11		A

Electrical Characteristics Diagrams

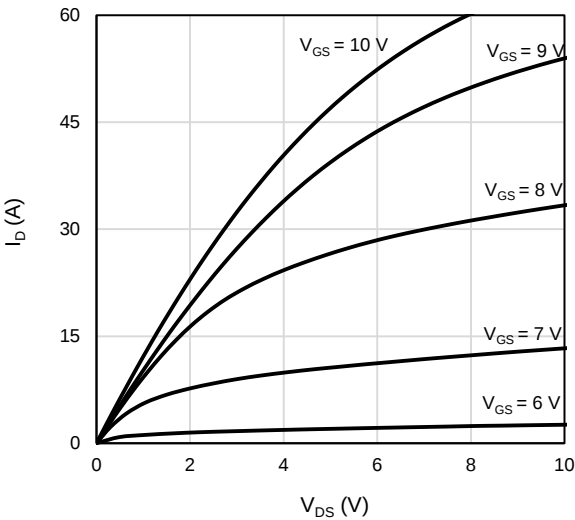


Figure 1: On-Region Characteristics

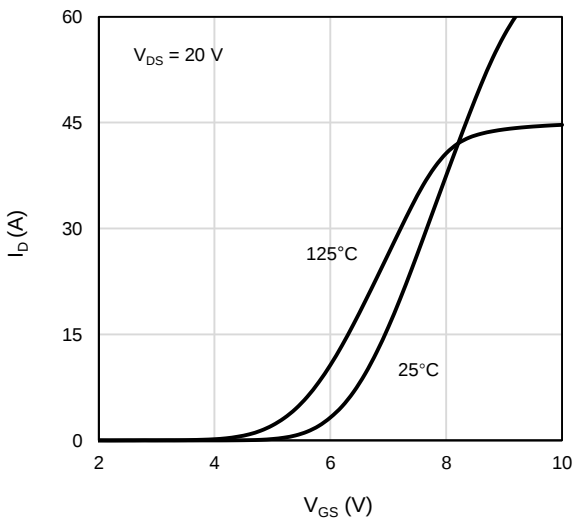


Figure 2: Transfer Characteristics

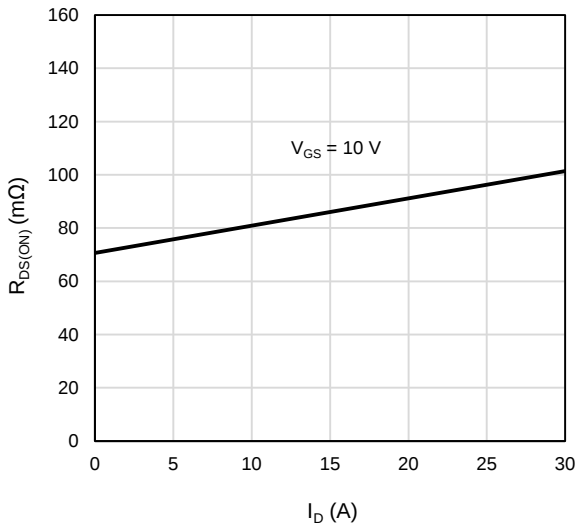


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

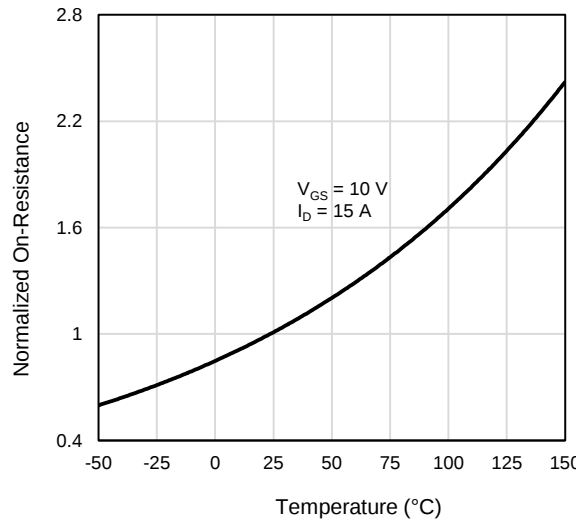


Figure 4: On-Resistance vs. Junction Temperature

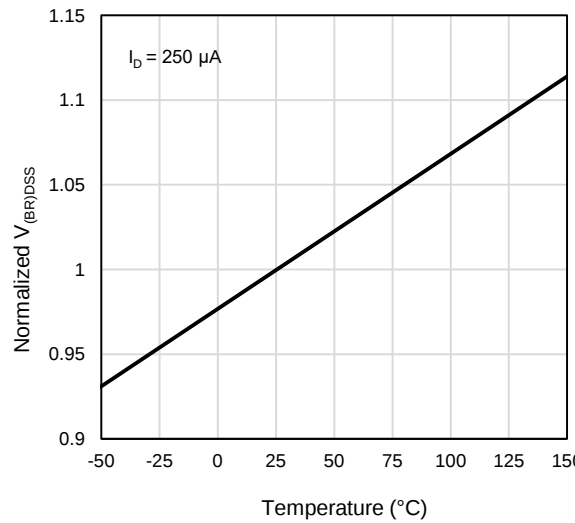


Figure 5: Breakdown Voltage vs. Junction Temperature

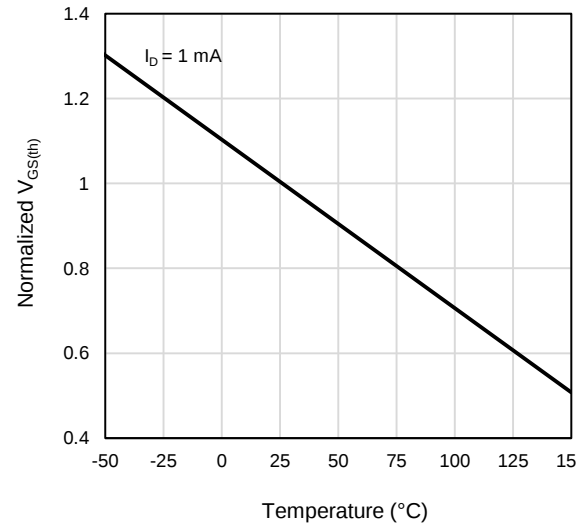


Figure 6: Threshold Voltage vs. Junction Temperature

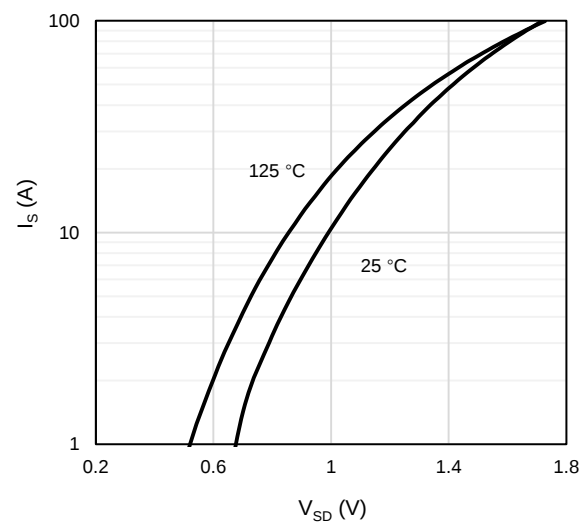


Figure 7: Body-Diode Characteristics

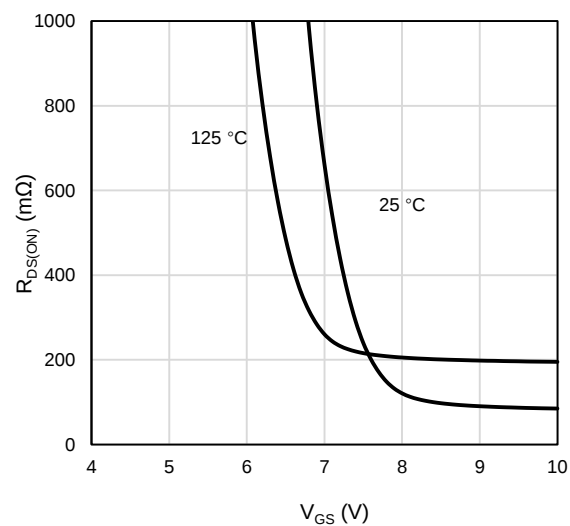


Figure 8: On-Resistance vs. Gate-Source Voltage

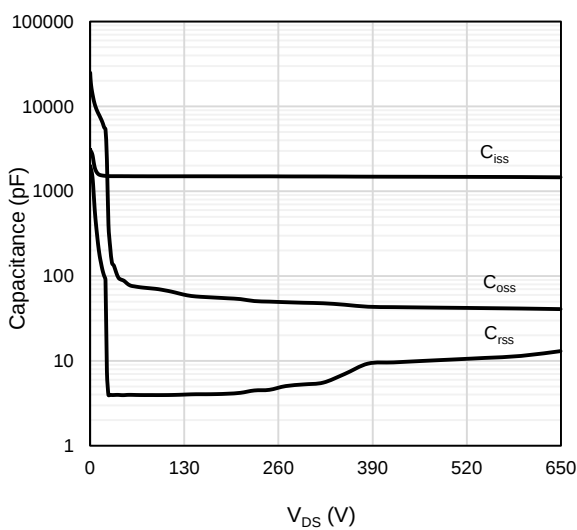


Figure 9: Capacitance Characteristics

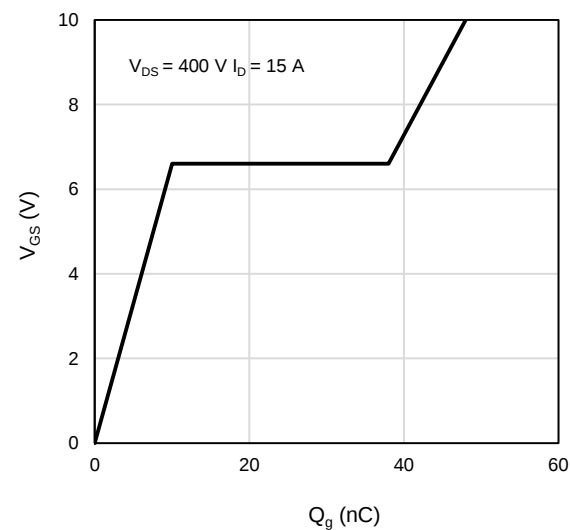


Figure 10: Gate-Charge Characteristics

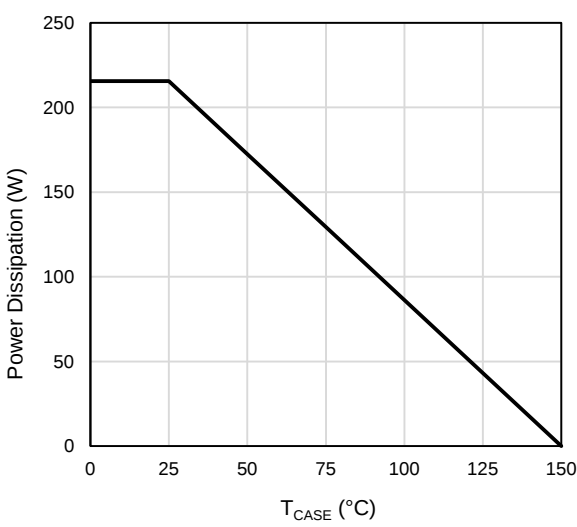


Figure 11: Power De-rating

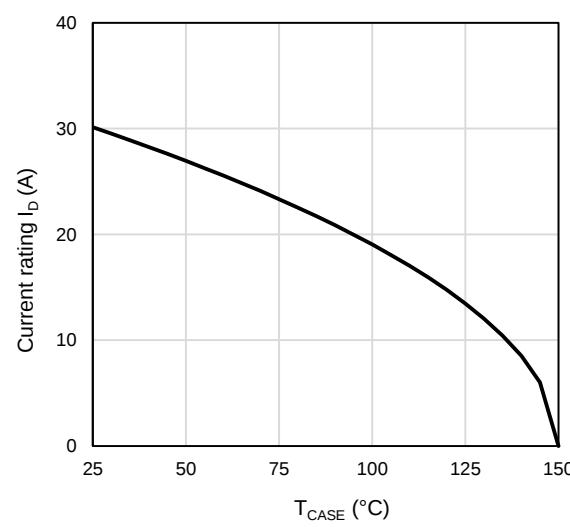


Figure 12: Current De-rating

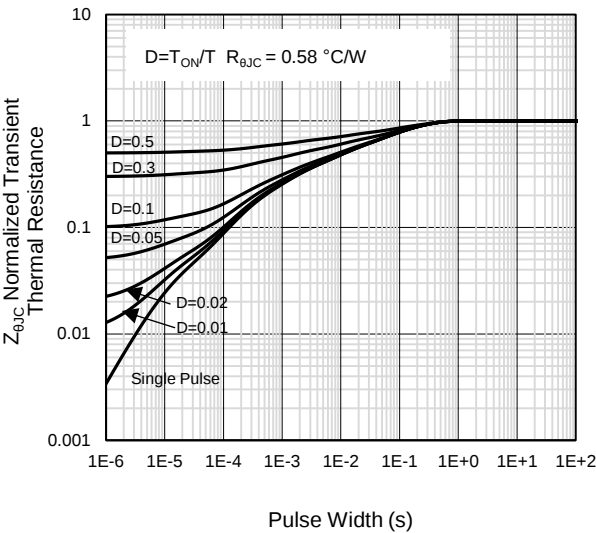


Figure 13: Normalized Maximum Transient Thermal Impedance

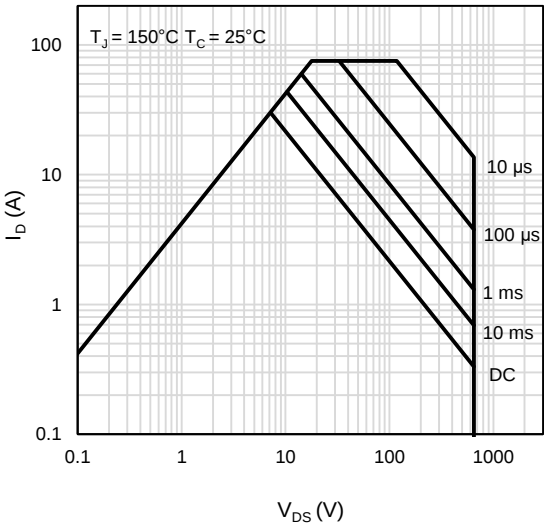
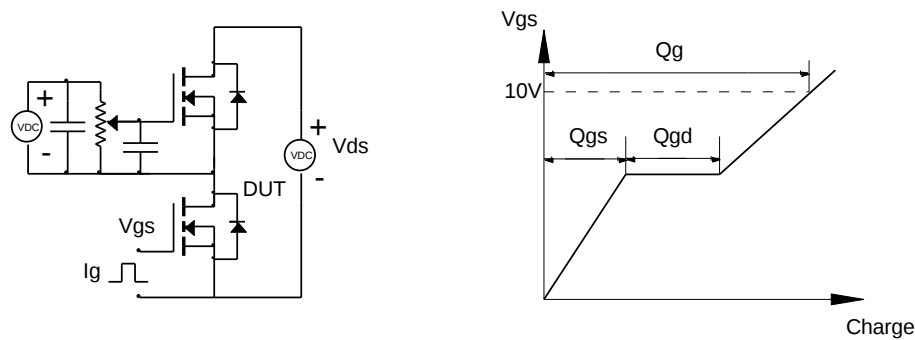


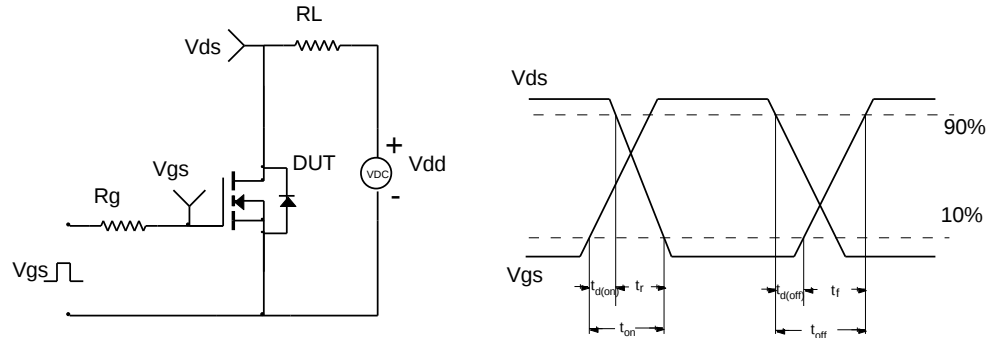
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

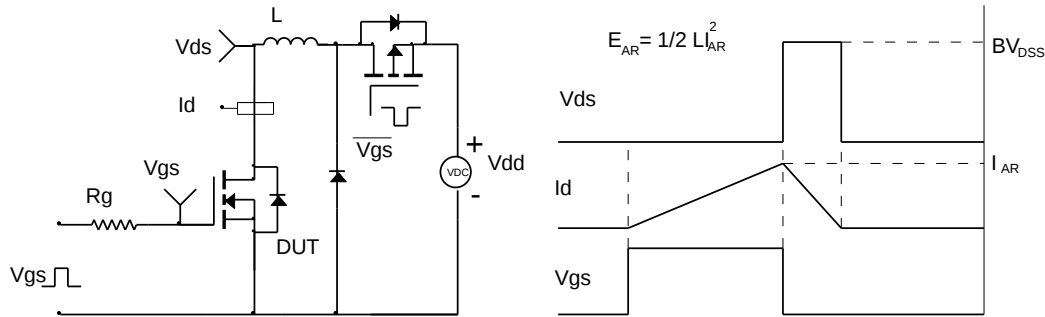
Gate Charge Test Circuit & Waveform



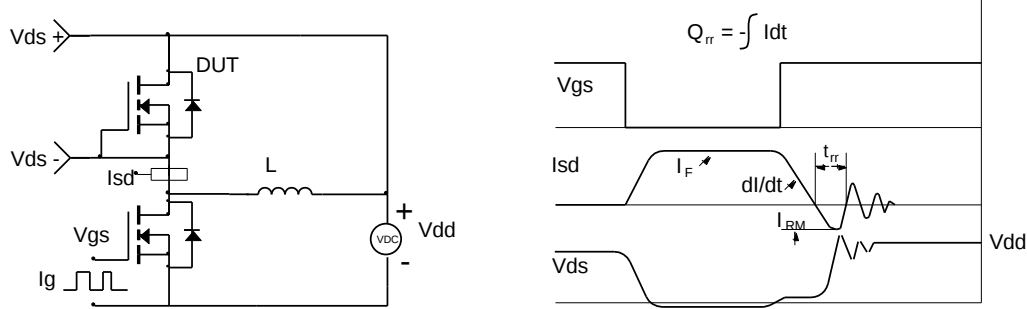
Resistive Switching Test Circuit & Waveforms



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.

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