

650V 99mohm Super-Junction Power MOSFET

AK2S65N990WMF

Description:

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

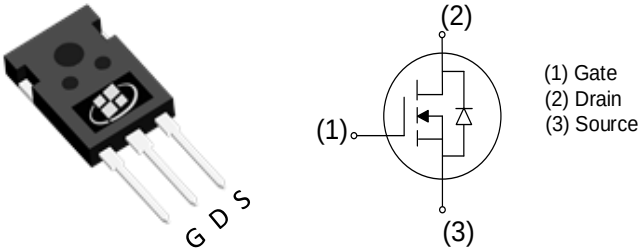
- Features:**

 - 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
$R_{DS(on), max} @V_{GS} = 10\text{ V}$	99	mΩ
I_D	38	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK2S65N990WMF	TO-247	2S65N990WMF	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)	38	A
	Drain Current - Continuous (T _C = 100°C)	24	A
I _{DM}	Drain Current - Pulsed ^(Note 2)	114	A
V _{GS}	Gate - Source Voltage	± 30	V
E _{AS}	Single Pulsed Avalanche Energy ^(Note 3)	612	mJ
P _D	Power Dissipation (T _C = 25°C)	266	W
dV/dT	MOSFET dv/dt ruggedness, V _{DS} = 0...400 V	150	V/ns
	Reverse diode dv/dt, V _{DS} = 0...400 V	60	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	0.47	°C/W
R _{θJA}	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	35	°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 = 23 mH, V_{DD} = 100 V, I_{AS} = 7.3 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 = 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 = 1 mA	3	4.1	5	V
R _{DS(ON)}	Drain - Source on - state resistance	V _{GS} = 10 V, I _D = 20 A		75	99	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		2380		pF
C _{oss}	Output Capacitance			66		pF
C _{rss}	Reverse Transfer Capacitance			7		pF
C _{o(er)}	Effective output capacitance, energy related	V _{DS} = 0...400 V, V _{GS} = 0 V		106		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		590		pF
R _g	Gate Resistance	f = 1 MHz		2.5		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V , I _D = 10 A, V _{GS} = 10 V, R _G = 2 Ω		113		ns
t _r	Rise Time			5		ns
t _{d(off)}	Turn Off Delay Time			90		ns
t _f	Fall Time			13		ns
Q _g	Total Gate Charge	V _{DD} = 400 V , I _D = 10 A, V _{GS} = 10 V		68		nC
Q _{gs}	Gate - Source Charge			14		nC
Q _{gd}	Gate - Drain Charge			34		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body - Diode Forward Current				38	A
I _{SM}	Maximum Pulsed Body - Diode Forward Current				114	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 20 A		0.88		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 10 A, di/dt = 100 A/μs		119		ns
Q _{rr}	Reverse recovery charge			0.9		μC
I _{rrm}	Peak Reverse Recovery Current			12.5		A

Electrical Characteristics Diagrams

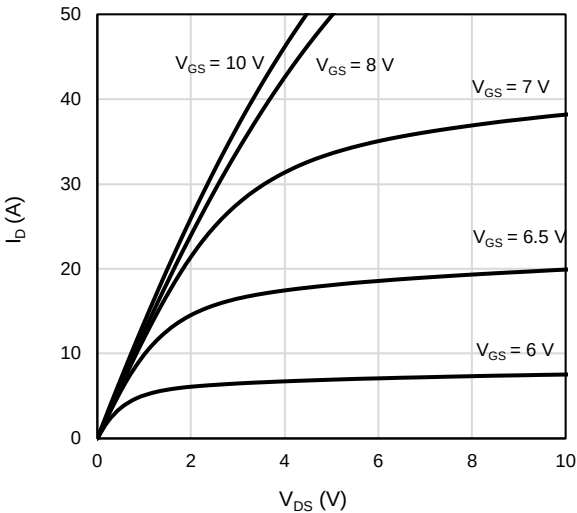


Figure 1: On-Region Characteristics

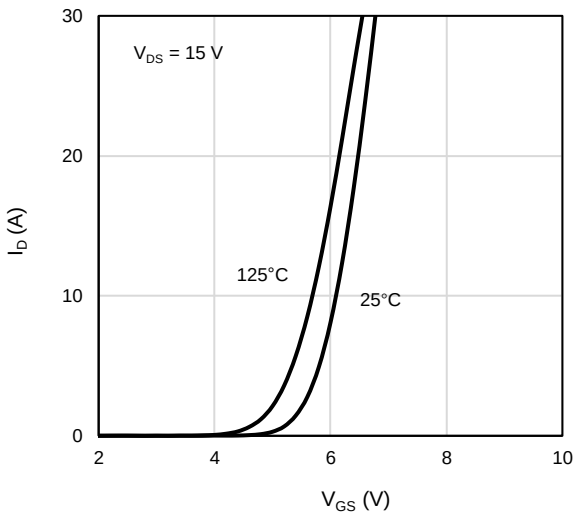


Figure 2: Transfer Characteristics

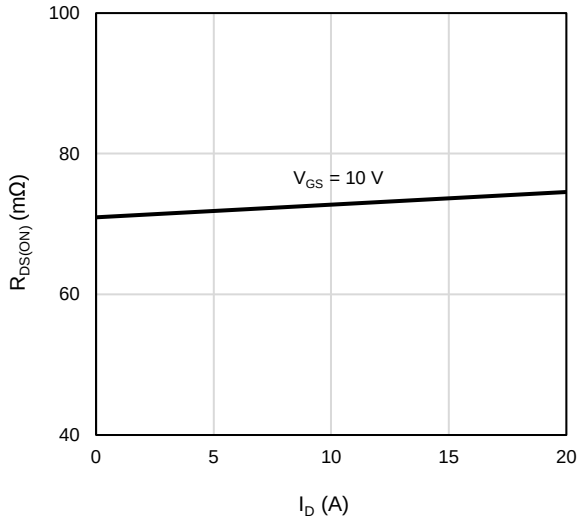


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

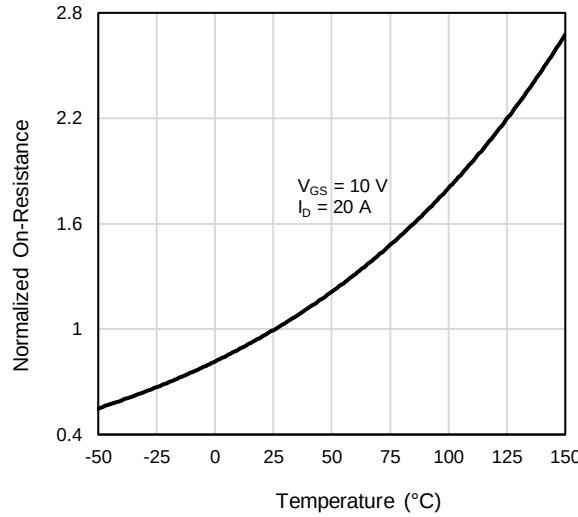


Figure 4: On-Resistance vs. Junction Temperature

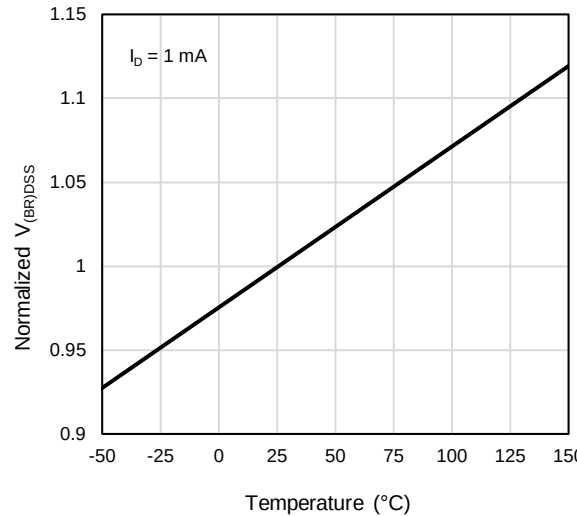


Figure 5: Breakdown Voltage vs. Junction Temperature

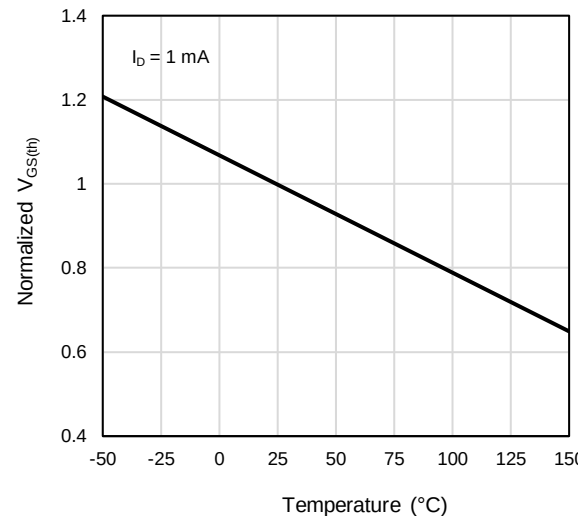


Figure 6: Threshold Voltage vs. Junction Temperature

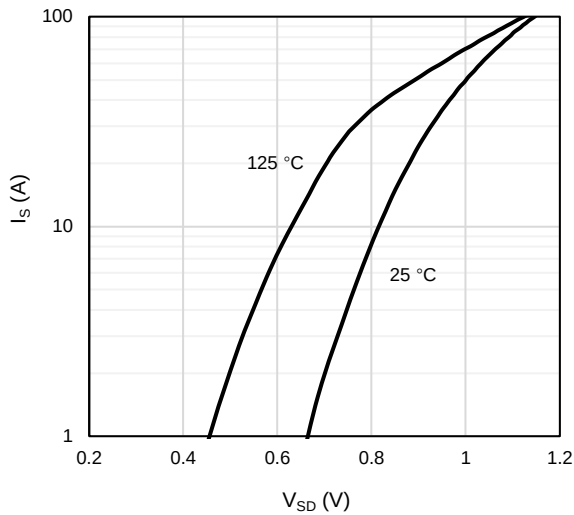


Figure 7: Body-Diode Characteristics

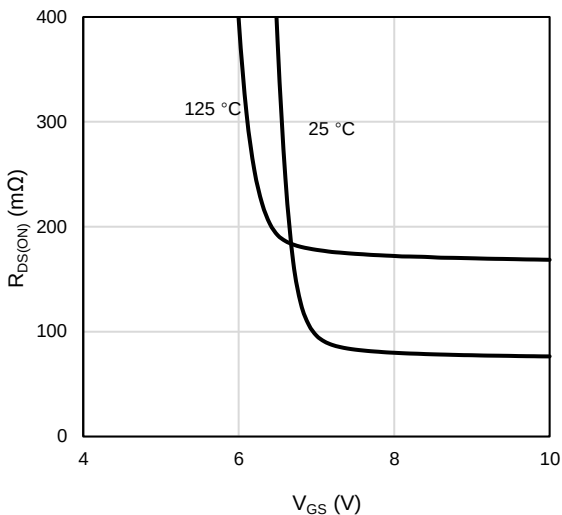


Figure 8: On-Resistance vs. Gate-Source Voltage

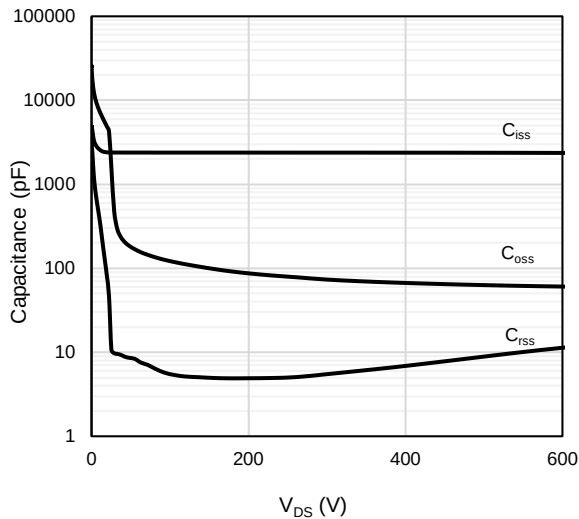


Figure 9: Capacitance Characteristics

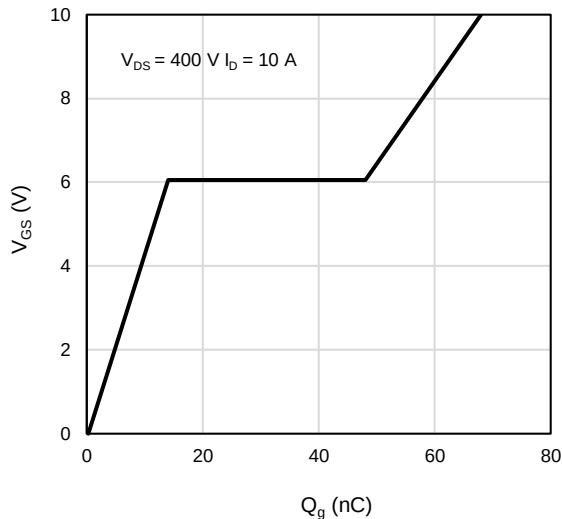


Figure 10: Gate-Charge Characteristics

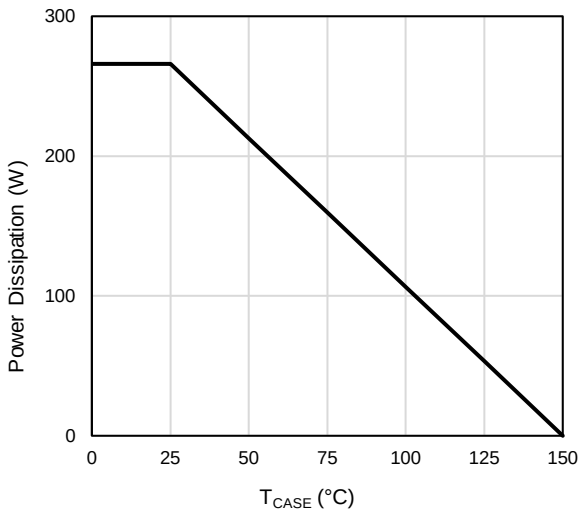


Figure 11: Power De-rating

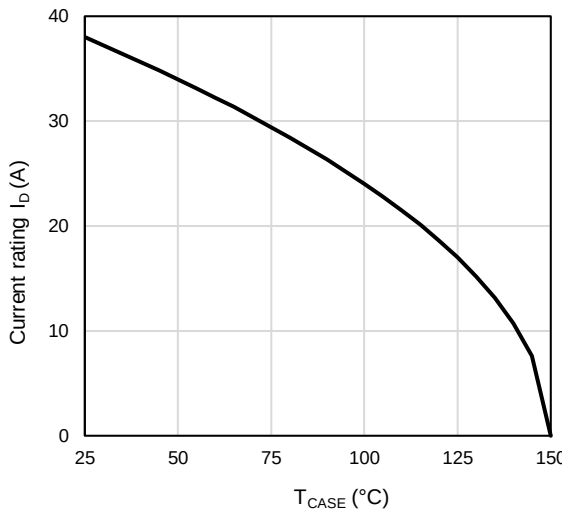


Figure 12: Current De-rating

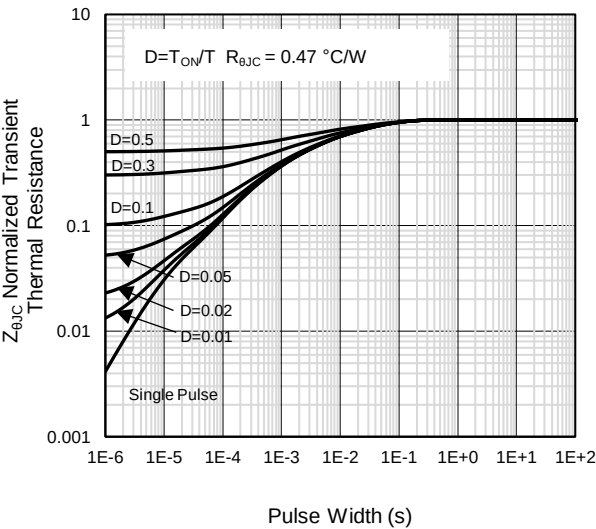


Figure 13: Normalized Maximum Transient Thermal Impedance

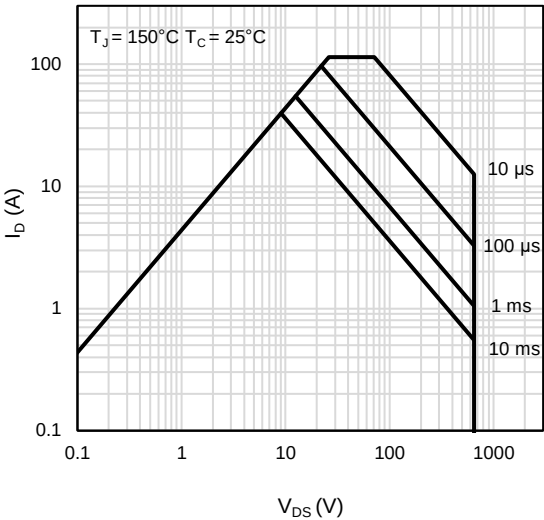
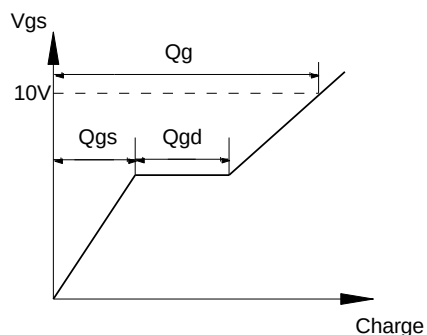
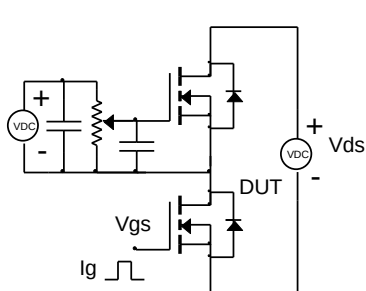


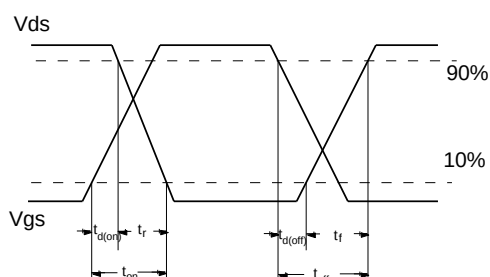
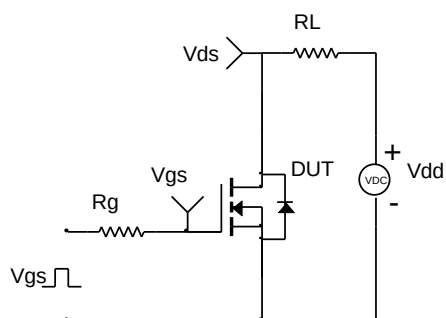
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

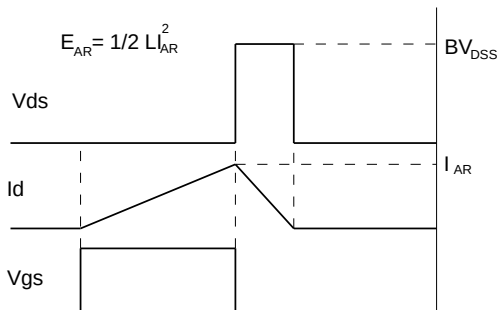
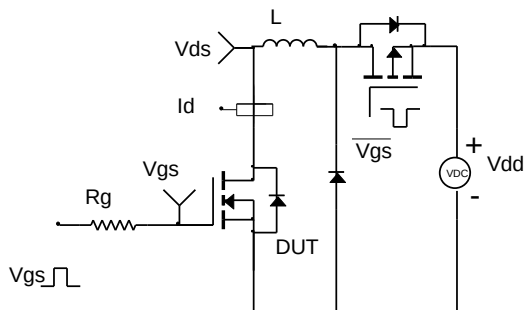
Gate Charge Test Circuit & Waveform



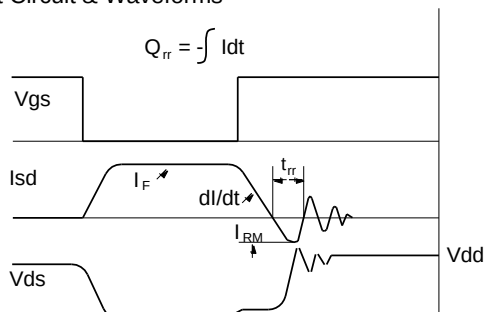
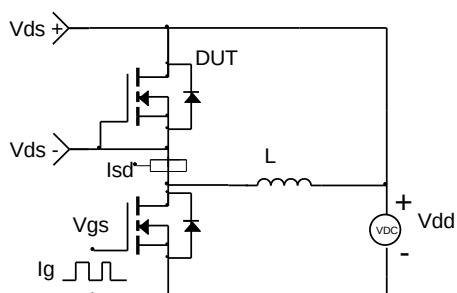
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History

Revision	Released	Remark
Rev.1.1	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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