

650V 59mohm Super-Junction Power MOSFET

AK2S65N590WMF

Description:

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

Features:

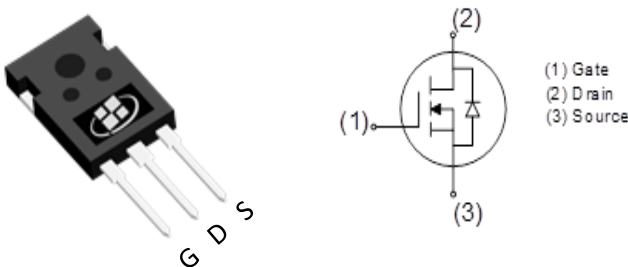
- RoHS compliant
- Halogen-free
- 100% UIS tested
- EMI-Friendly

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
$R_{DS(ON)}, max @V_{GS} = 10\text{ V}$	59	mΩ
I_D	50	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK2S65N590WMF	TO-247-3L	2S65N590WMF	Tube	300 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)	50	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	32	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	200	A
V_{GS}	Gate - Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	1390	mJ
dv/dt	MOSFET dv/dt ruggedness	100	V/ns
	Reverse diode dv/dt	35	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	403	W
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	0.31	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	35	$^\circ\text{C/W}$

Notes:

1. The max drain current rating limited by package and maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $L = 23 \text{ mH}$, $V_{DD} = 150 \text{ V}$, $I_{AS} = 11 \text{ A}$, $R_g = 50 \Omega$, Starting $T_J = 25^\circ\text{C}$, guarantee by design
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	3.5	5	V
R _{DS(ON)}	Drain - Source on - state resistance	V _{GS} = 10 V, I _D = 20 A		48	59	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		5270		pF
C _{oss}	Output Capacitance			122		pF
C _{rss}	Reverse Transfer Capacitance			8		pF
C _{o(er)}	Effective output capacitance, energy related	V _{DS} = 0...400 V, V _{GS} = 0 V		180		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		962		pF
R _g	Gate Resistance	f = 1 MHz		1.7		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V , I _D = 15 A V _{GS} = 10 V, R _G = 3 Ω		47		ns
t _r	Rise Time			23		ns
t _{d(off)}	Turn Off Delay Time			87		ns
t _f	Fall Time			2		ns
Q _g	Total Gate Charge	V _{DD} = 400 V , I _D = 15 A, V _{GS} = 10 V		133		nC
Q _{gs}	Gate - Source Charge			31		nC
Q _{gd}	Gate - Drain Charge			58		nC
Drain - Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body - Diode Forward Current				50	A
I _{SM}	Maximum Pulsed Body - Diode Forward Current				200	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 15 A		0.8		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 15 A, di/dt = 100 A/μs		192		ns
Q _{rr}	Reverse recovery charge			2		μC
I _{rrm}	Peak Reverse Recovery Current			20		A

Electrical Characteristics Diagrams

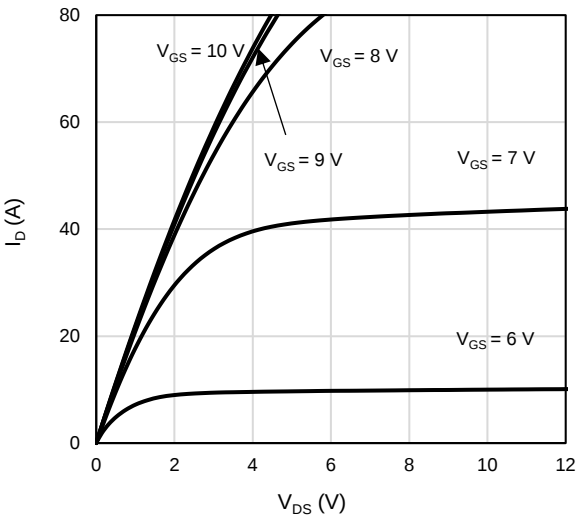


Figure 1: On-Region Characteristics

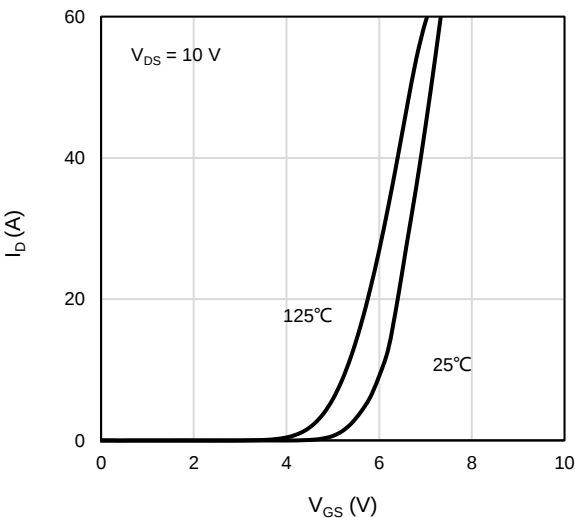


Figure 2: Transfer Characteristics

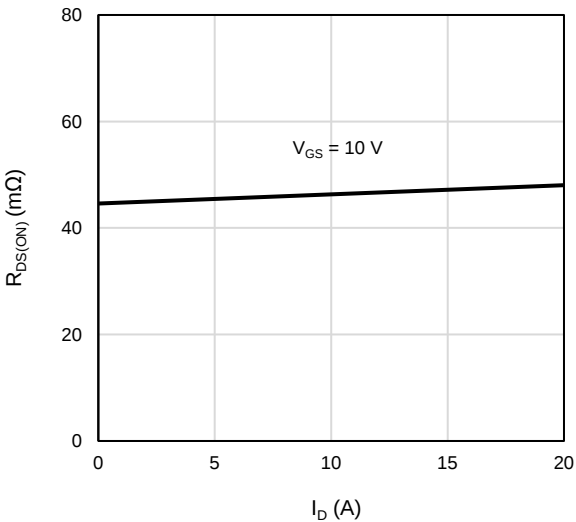


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

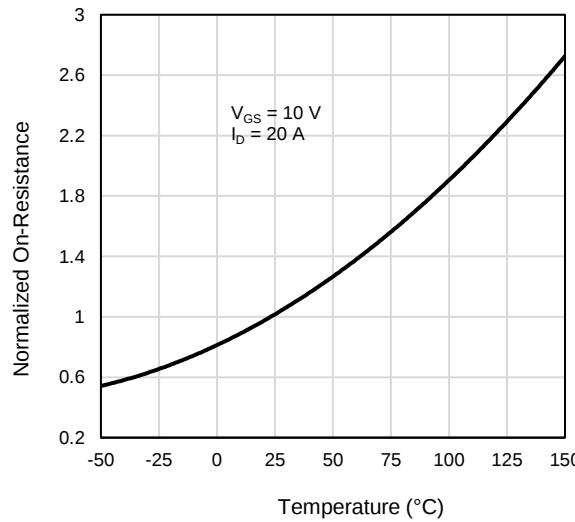


Figure 4: On-Resistance vs. Junction Temperature

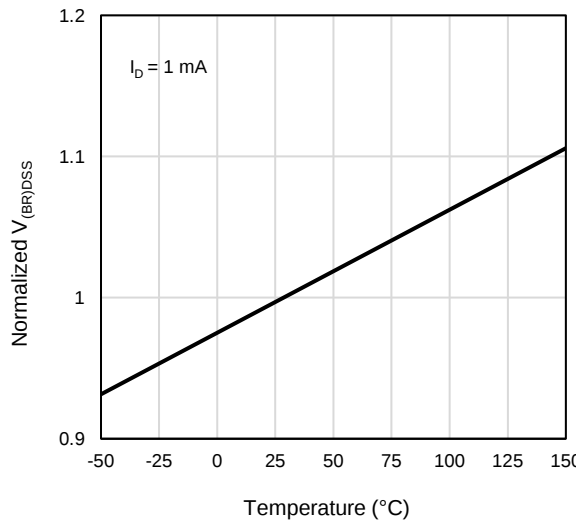


Figure 5: Breakdown Voltage vs. Junction Temperature

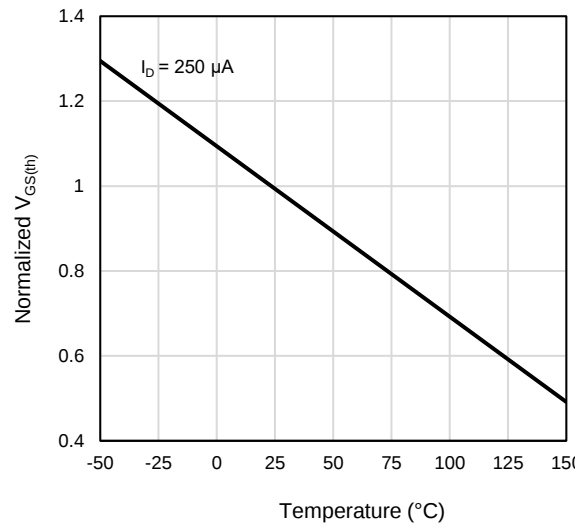


Figure 6: Threshold Voltage vs. Junction Temperature

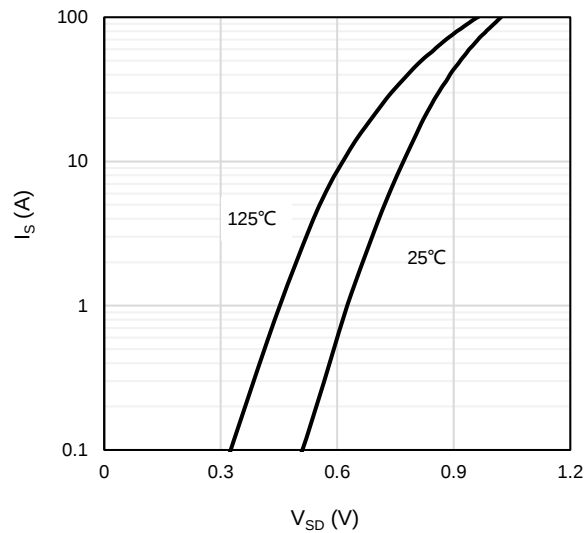


Figure 7: Body-Diode Characteristics

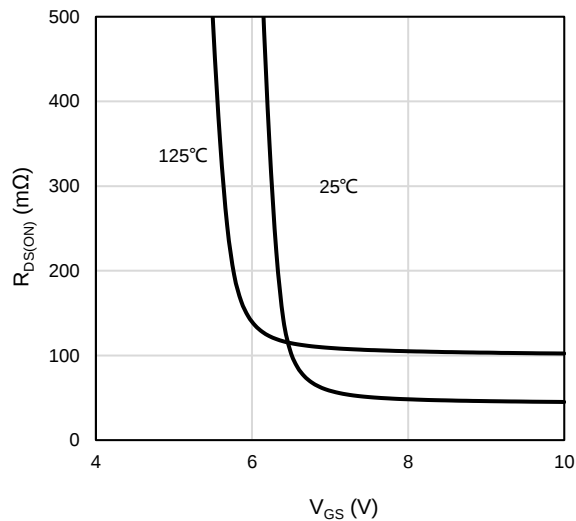


Figure 8: On-Resistance vs. Gate-Source Voltage

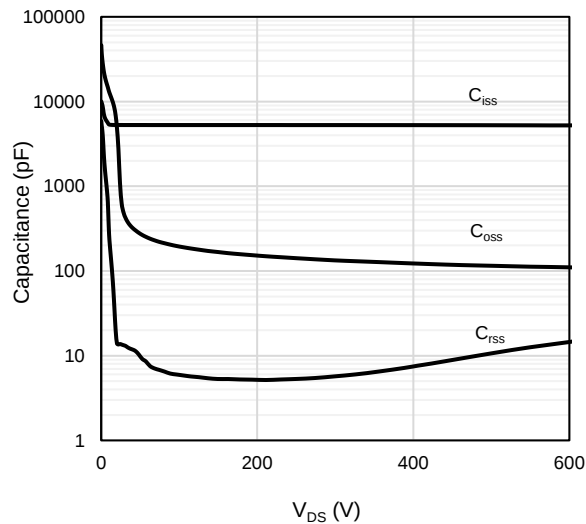


Figure 9: Capacitance Characteristics

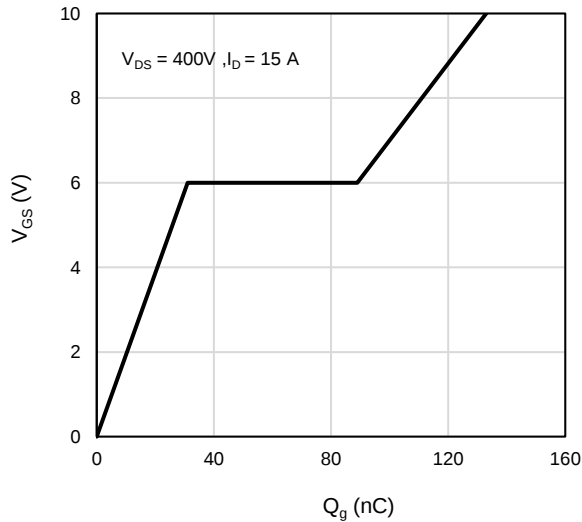


Figure 10: Gate-Charge Characteristics

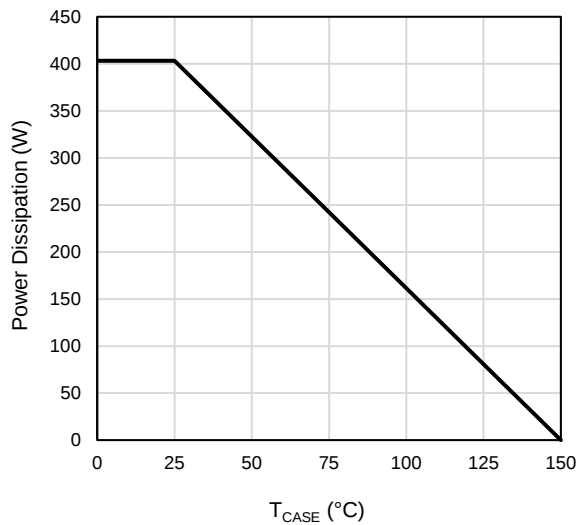


Figure 11: Power De-rating

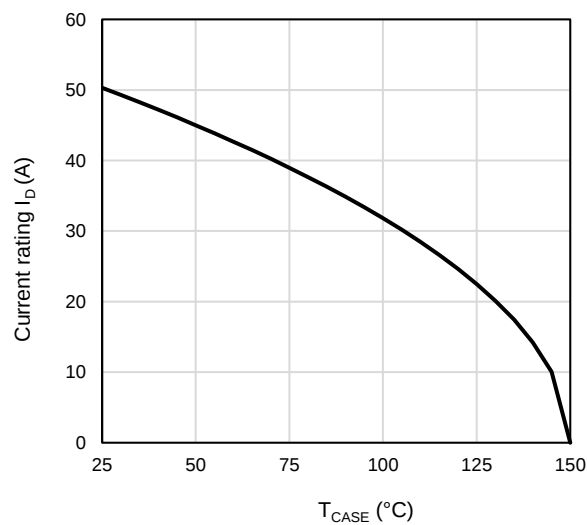


Figure 12: Current De-rating

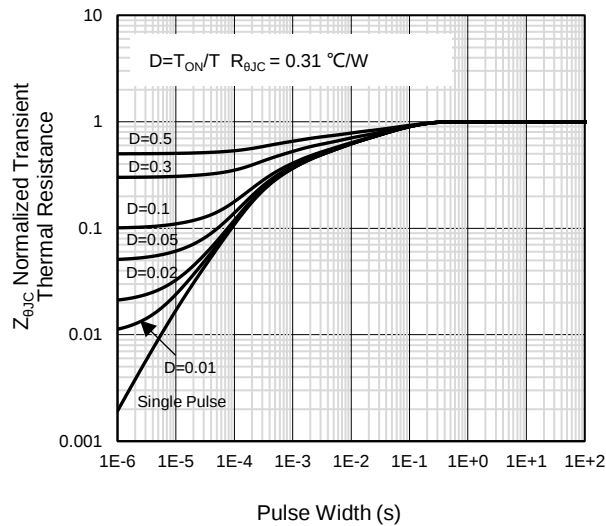


Figure 13: Normalized Maximum Transient Thermal Impedance

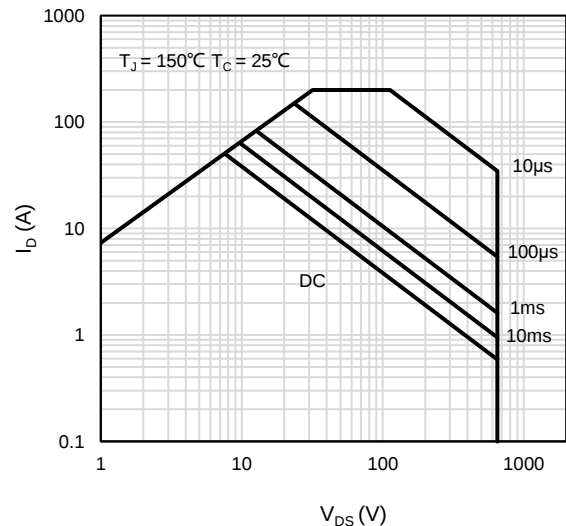
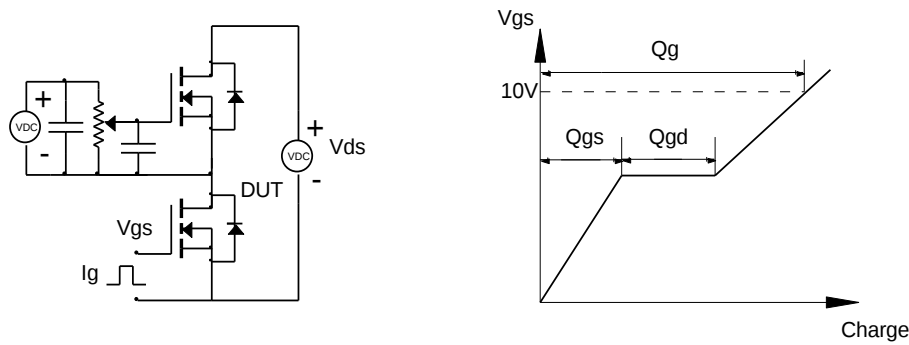


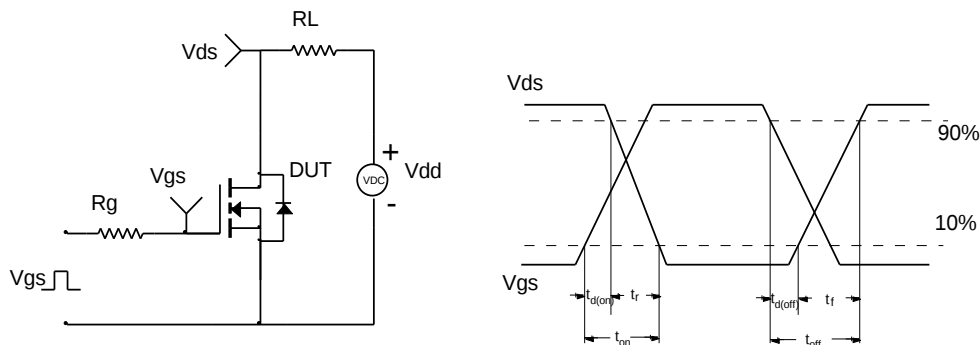
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

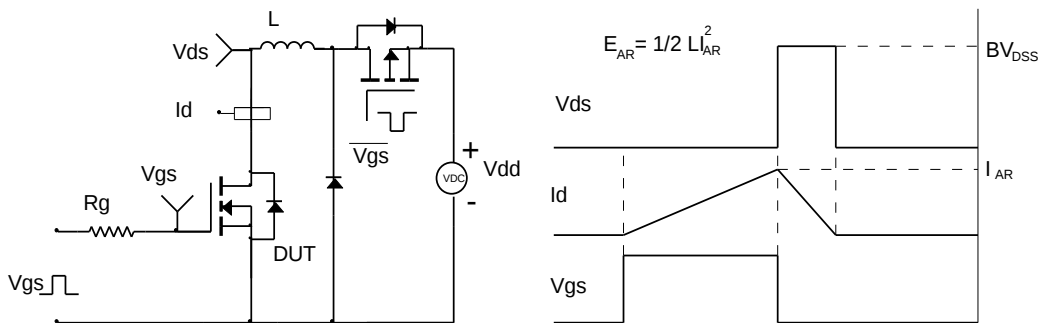
Gate Charge Test Circuit & Waveform



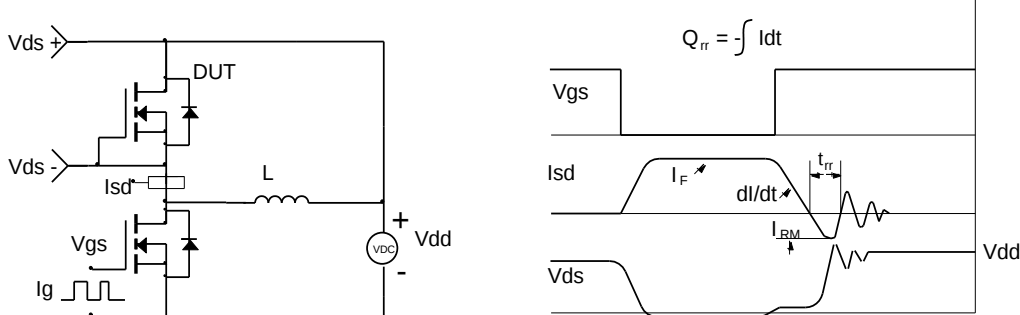
Resistive Switching Test Circuit & Waveforms



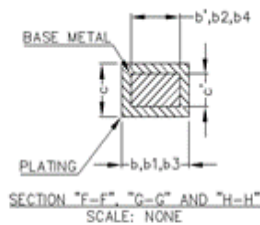
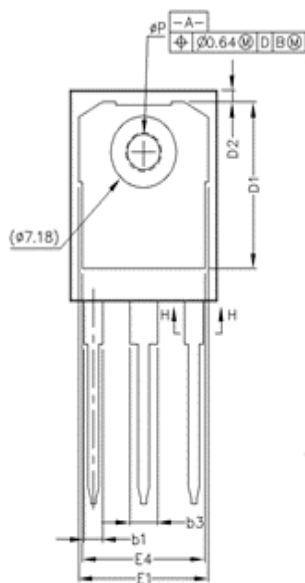
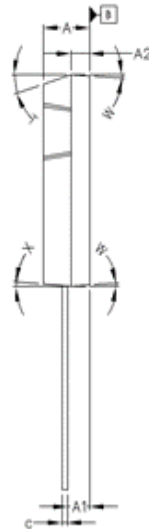
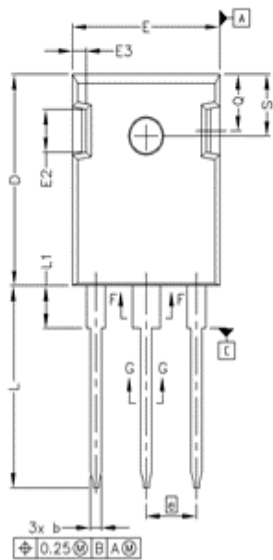
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Outlines



SYMBOL	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	1.91	2.41
b2	1.91	2.16
b3	2.87	3.38
b4	2.87	3.13
c'	0.55	0.65
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC	
N	3	
L	19.81	20.32
L1	4.10	4.40
P	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5 ° REF	
W	3.5 ° REF	
X	4 ° REF	

Marking Information



2S65N590WMF
KYWWZZZ

Note:

2S65N590WMF = Product Name Code

KYWWZZZ = Date code

Contact ALKAIDSEMI sales for detail information



Revision History

Revision	Released	Remark
Rev.1.1	2023	

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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