

600V 22.1mohm Super-Junction Power MOSFET

AK3S60N221WMF

Description:

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

Features:

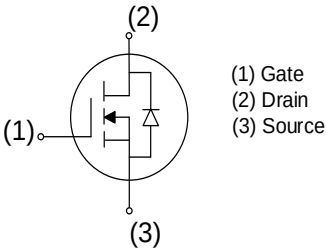
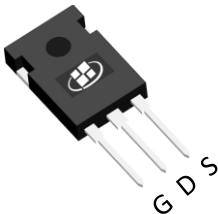
- Low FOM $R_{DS(ON)} \times Q_G$
- EMI-Friendly
- RoHS compliant
- Halogen-free

Applications:

- High Frequency Switching
- High Efficiency SMPS
- EV Charger

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	600	V
$R_{DS(ON), max} @V_{GS} = 10\text{ V}$	22.1	mΩ
I_D	100	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK3S60N221WMF	TO-247	3S60N221WMF	Tube	300 per box

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

Symbol	Parameter	Value	Units
V _{DS}	Drain-Source Voltage	600	V
I _D	Drain Current - Continuous (T _C = 25°C) ^(Note 1)	100	A
	Drain Current - Continuous (T _C = 100°C)	63	A
I _{DM}	Drain Current - Pulsed ^(Note 2)	300	A
V _{GS}	Gate-Source Voltage	± 30	V
E _{AS}	Single Pulsed Avalanche Energy ^(Note 3)	1470	mJ
P _D	Power Dissipation (T _C = 25°C)	500	W
dV/dT	MOSFET dv/dt ruggedness, V _{DS} = 0...400 V	110	V/ns
	Reverse diode dv/dt, V _{DS} = 0...400 V	55	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	0.25	°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} = 16.5 A, R_G = 50 Ω, Starting T_J = 25 °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	600			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V,			10	μA
I _{GSS}	Gate Leakage Current	V _{GS} = ± 30 V, V _{DS} = 0 V			±1	μA
V _{GS(th)}	Gate Threshold voltage	V _{DS} = V _{GS} , I _D = 2 mA	3	4.3	5	V
R _{DS(ON)}	Drain-Source on-state resistance	V _{GS} = 10 V, I _D = 55 A		18.5	22.1	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		9820		pF
C _{oss}	Output Capacitance			160		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		318		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		2675		pF
R _g	Gate Resistance	f = 1 MHz		1		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V , I _D = 50 A, V _{GS} = 10 V, R _G = 2 Ω		90		ns
t _r	Rise Time			70		ns
t _{d(off)}	Turn Off Delay Time			115		ns
t _f	Fall Time			4		ns
Q _g	Total Gate Charge	V _{DD} = 400 V , I _D = 50 A, V _{GS} = 10 V		245		nC
Q _{gs}	Gate-Source Charge			60		nC
Q _{gd}	Gate-Drain Charge			118		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body-Diode Forward Current				100	A
I _{SM}	Maximum Pulsed Body-Diode Forward Current				300	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 55 A		1		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 50 A, di/dt = 100 A/μs		180		ns
Q _{rr}	Reverse recovery charge			1.3		μC
I _{rrm}	Peak Reverse Recovery Current			13.3		A

Electrical Characteristics Diagrams

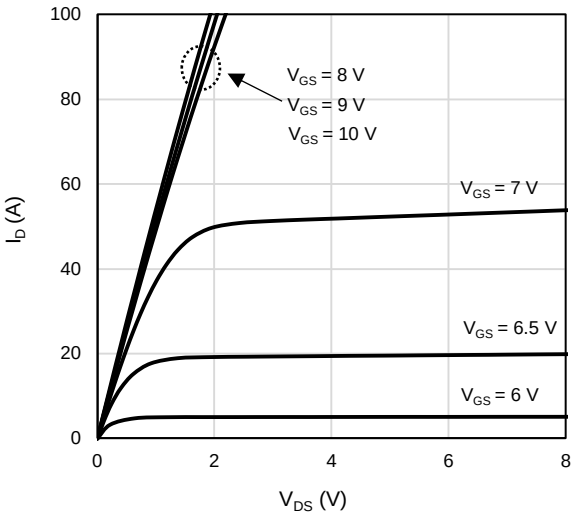


Figure 1: On-Region Characteristics

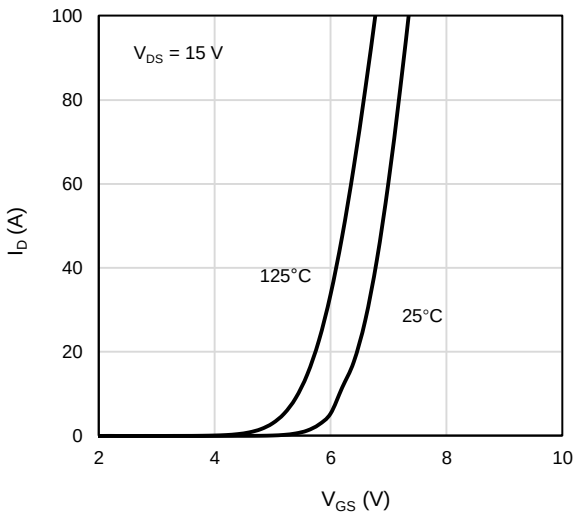


Figure 2: Transfer Characteristics

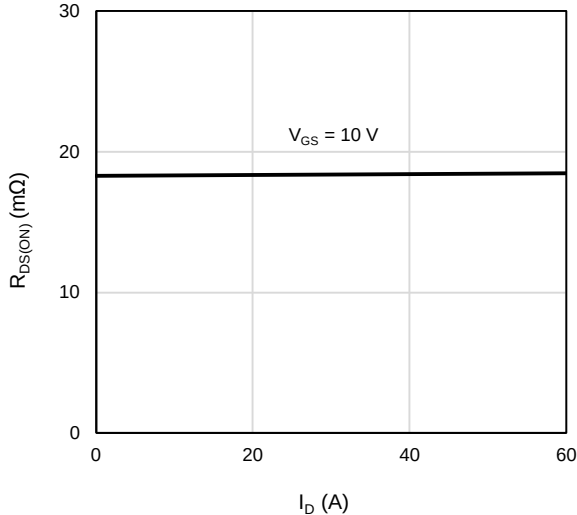


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

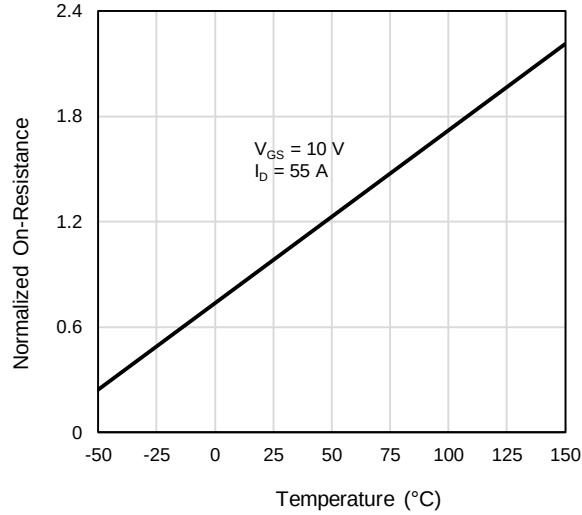


Figure 4: On-Resistance vs. Junction Temperature

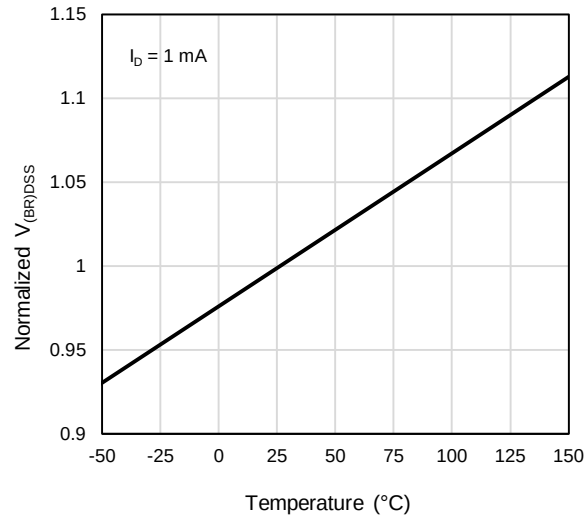


Figure 5: Breakdown Voltage vs. Junction Temperature

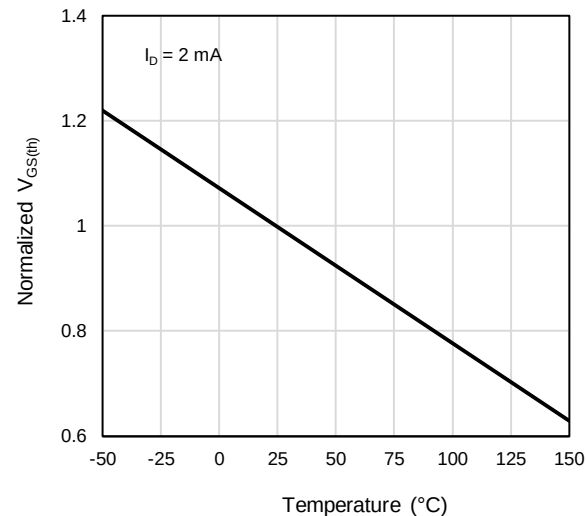


Figure 6: Threshold Voltage vs. Junction Temperature

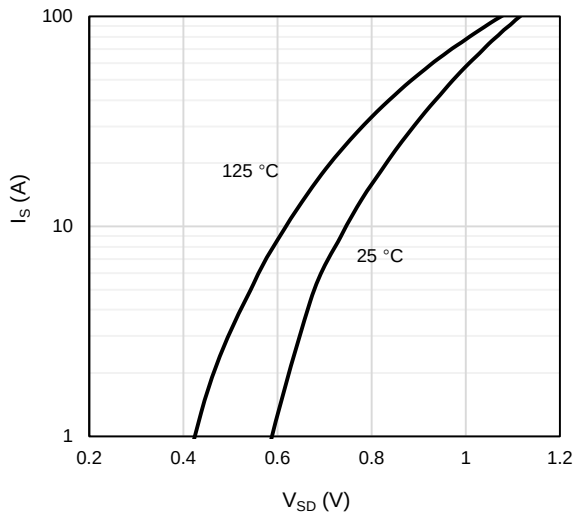


Figure 7: Body-Diode Characteristics

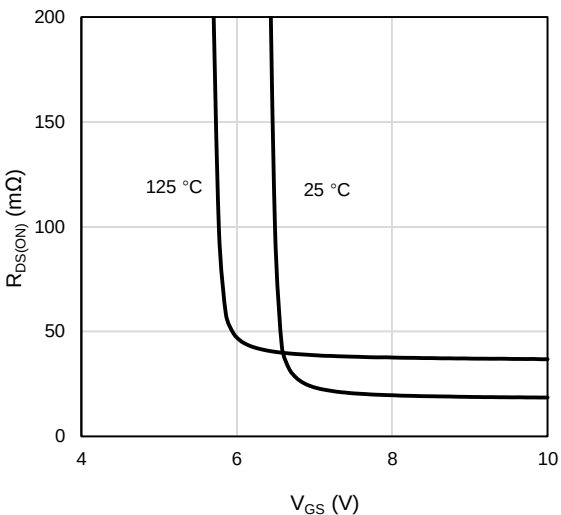


Figure 8: On-Resistance vs. Gate-Source Voltage

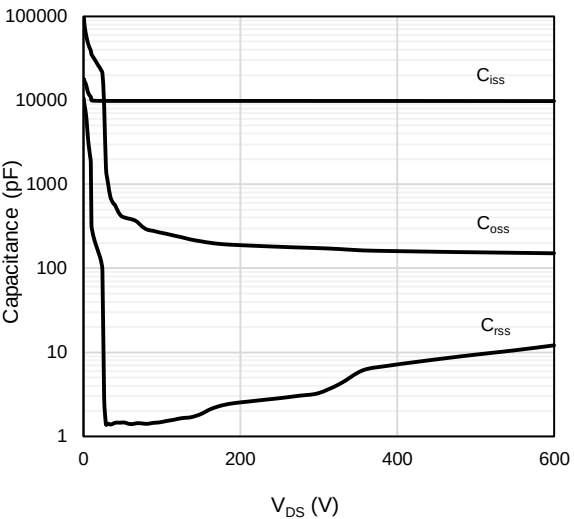


Figure 9: Capacitance Characteristics

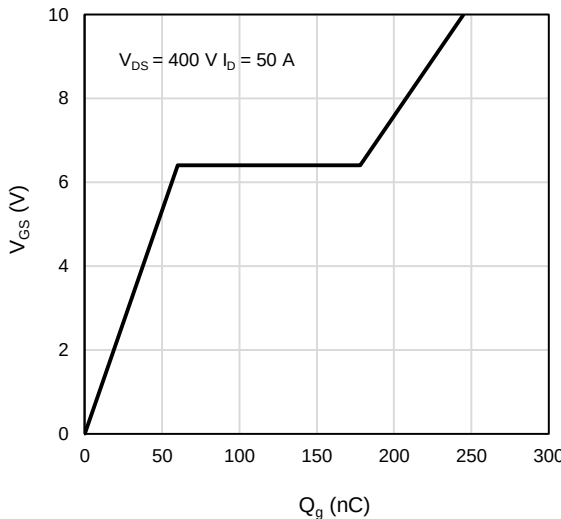


Figure 10: Gate-Charge Characteristics

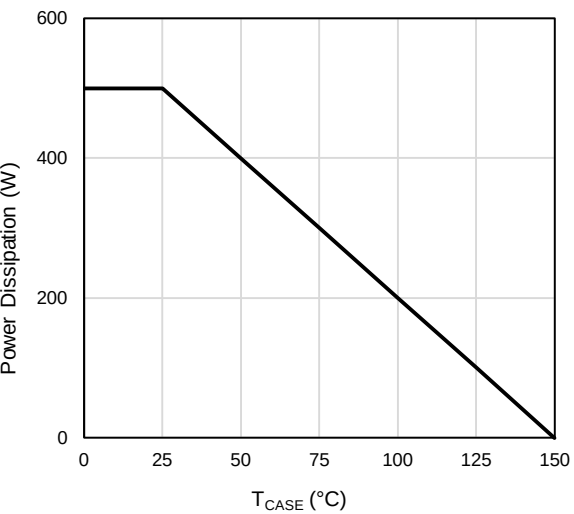


Figure 11: Power De-rating

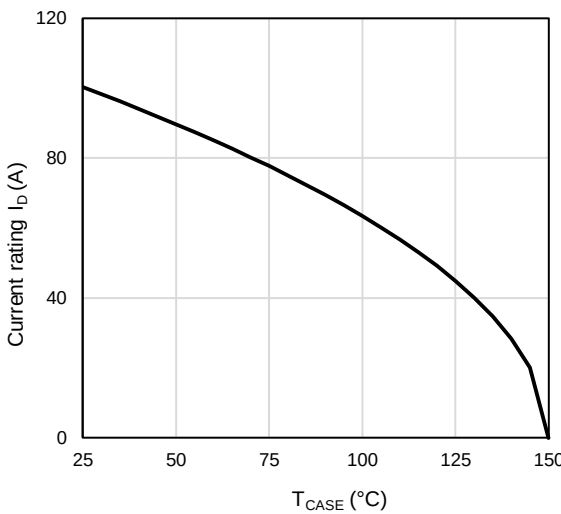


Figure 12: Current De-rating

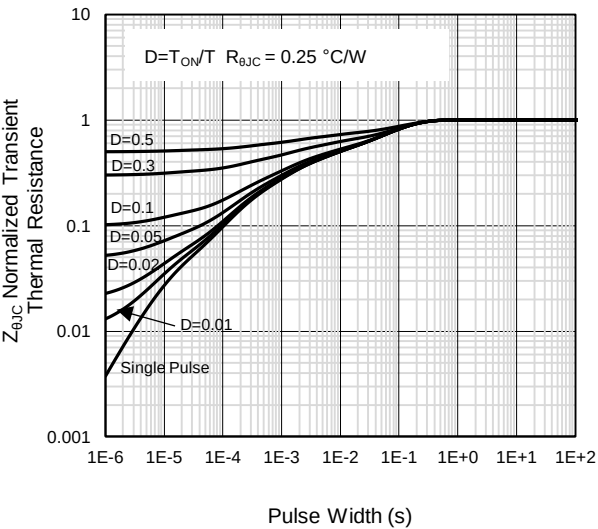


Figure 13: Normalized Maximum Transient Thermal Impedance

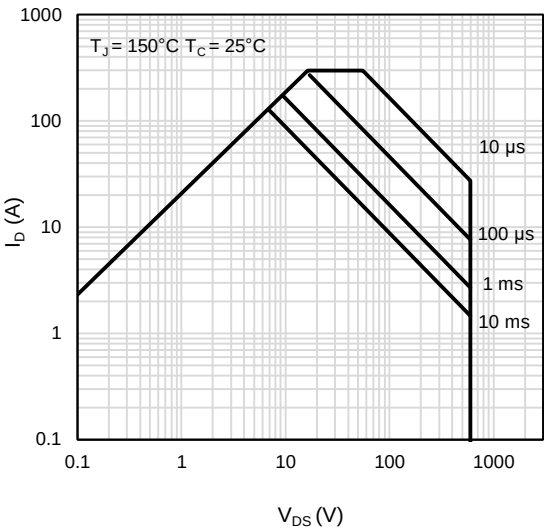
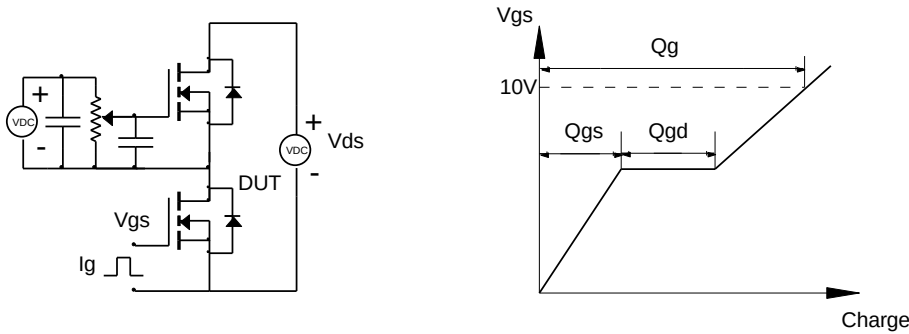


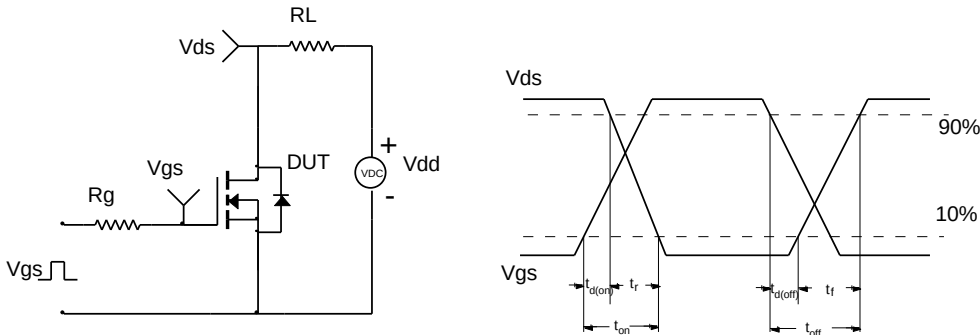
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

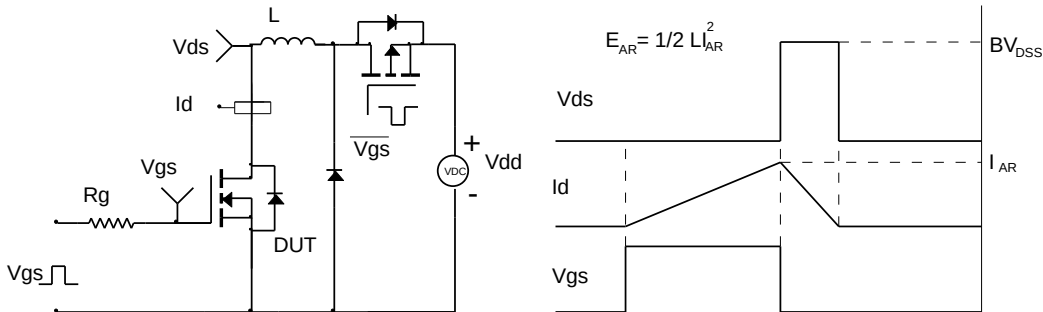
Gate Charge Test Circuit & Waveform



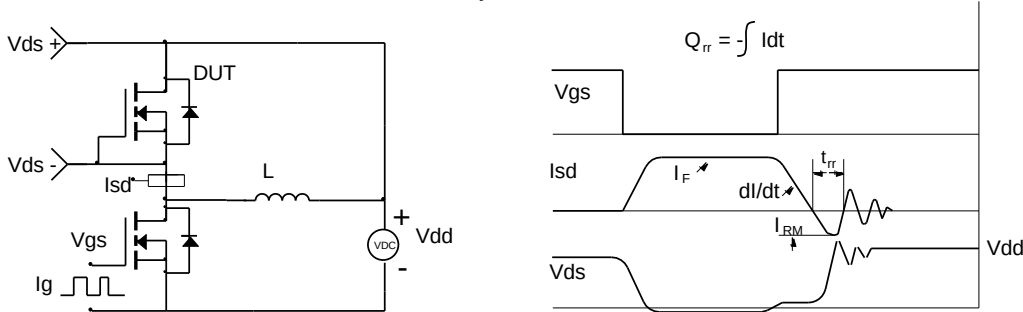
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

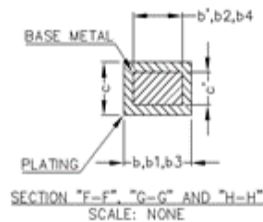
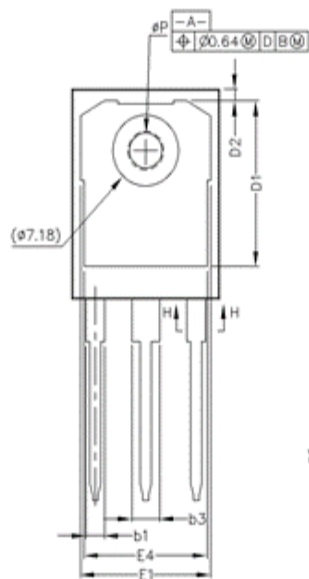
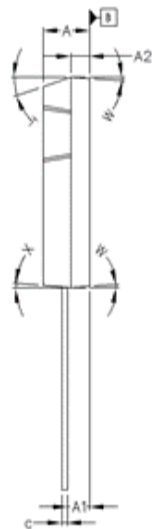
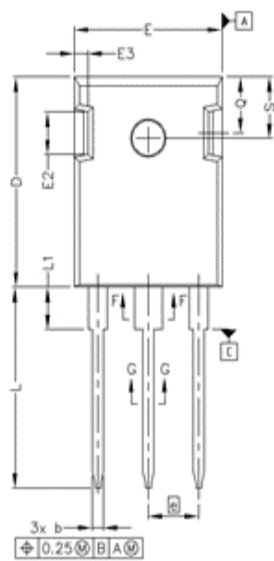


Diode Recovery Test Circuit & Waveforms



Package Outlines

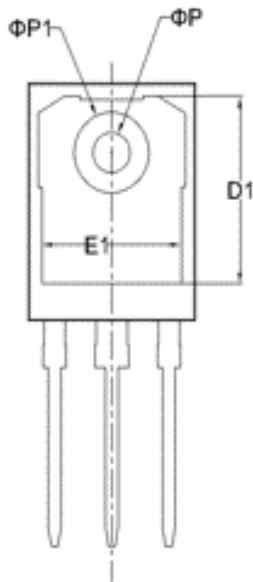
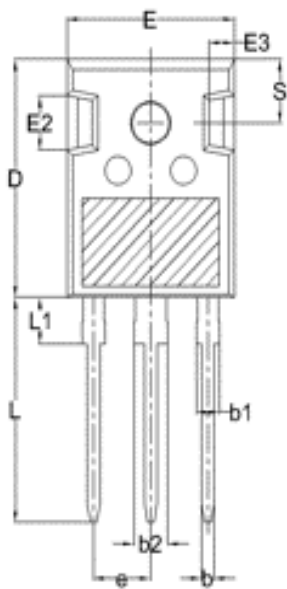
POD1



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	

Package Outlines

POD2



SYMBOL	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b1	1.91	2.01	2.21
b2	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44 BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15 BSC		

Marking Information



3S60N221WMF

KYWWZZZ

Note:

3S60N221WMF = Product Name Code

KYWWZZZ = 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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