

600V 22mohm Super-Junction Power MOSFET
AK3S60N220WMF

Description:

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

Features:

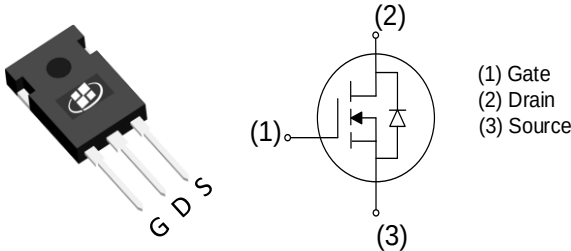
- Low FOM $R_{DS(ON)} \times Q_G$
- EMI-Friendly
- RoHS compliant (Note 1)
- Halogen-free (Note 1)

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	mΩ
I_D	130	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK3S60N220WMF	TO-247	3S60N220WMF	Tube	300 per box

Notes:

1. Contact ALKAIDSEMI sales for detail information

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)	130	A
	Drain Current - Continuous (T _C = 100°C)	82	A
I _{DM}	Drain Current - Pulsed ^(Note 2)	390	A
V _{GS}	Gate-Source Voltage	± 30	V
E _{AS}	Single Pulsed Avalanche Energy ^(Note 3)	1653	mJ
P _D	Power Dissipation (T _C = 25°C)	657	W
dV/dT	MOSFET dv/dt ruggedness, V _{DS} = 0...400 V	120	V/ns
	Reverse diode dv/dt, V _{DS} = 0...400 V	70	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	0.19	°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} = 17.5 A, R_G = 50 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

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	600			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$			10	μA
I_{GSS}	Gate Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$			± 1	μA
$V_{GS(TH)}$	Gate Threshold voltage	$V_{DS} = V_{GS}, I_D = 2\text{ mA}$	3	4.3	5	V
$R_{DS(ON)}$	Drain-Source on-state resistance	$V_{GS} = 10\text{ V}, I_D = 55\text{ A}$		15.5	22	m Ω

Dynamic Characteristics

C_{ISS}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V},$ $F = 1\text{ MHz}$		11165		pF
C_{OSS}	Output Capacitance			173		pF
C_{RSS}	Reverse Transfer Capacitance			20		pF
$C_{o(er)}$	Effective output capacitance, energy related	$V_{DS} = 0\ldots 400\text{ V}, V_{GS} = 0\text{ V}$		320		pF
$C_{o(tr)}$	Effective output capacitance, time related	$V_{DS} = 0\ldots 400\text{ V}, V_{GS} = 0\text{ V},$ $I_D = \text{constant}$		1488		pF
R_G	Gate Resistance	$F = 1\text{ MHz}$		1		Ω

Switching Characteristics

$T_{D(ON)}$	Turn On Delay Time	$V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $V_{GS} = 10\text{ V}, R_G = 2\text{ }\Omega$		85		nS
T_R	Rise Time			60		nS
$T_{D(OFF)}$	Turn Off Delay Time			180		nS
T_F	Fall Time			5		nS
Q_G	Total Gate Charge	$V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $V_{GS} = 10\text{ V}$		278		nC
Q_{GS}	Gate-Source Charge			67		nC
Q_{GD}	Gate-Drain Charge			130		nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Body-Diode Forward Current			130	A
I_{SM}	Maximum Pulsed Body-Diode Forward Current			390	A
V_{SD}	Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 55\text{ A}$		0.91	V
T_{RR}	Reverse recovery time	$V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $di/dt = 100\text{ A}/\mu\text{S}$		200	nS
Q_{RR}	Reverse recovery charge			1.4	μC
I_{RRM}	Peak Reverse Recovery Current			14.3	A

Electrical Characteristics Diagrams

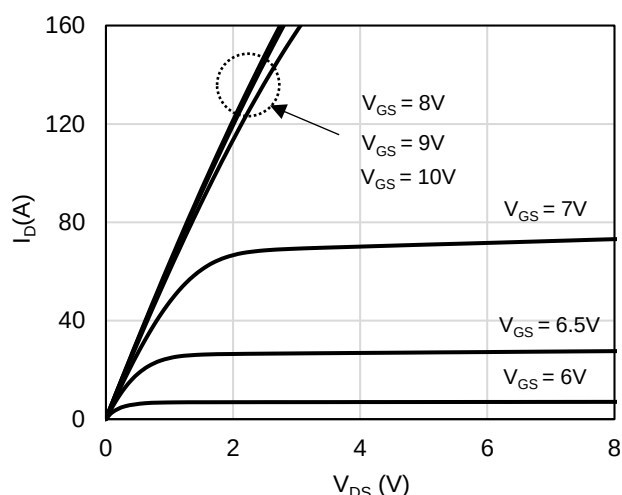


Figure 1: On-Region Characteristics

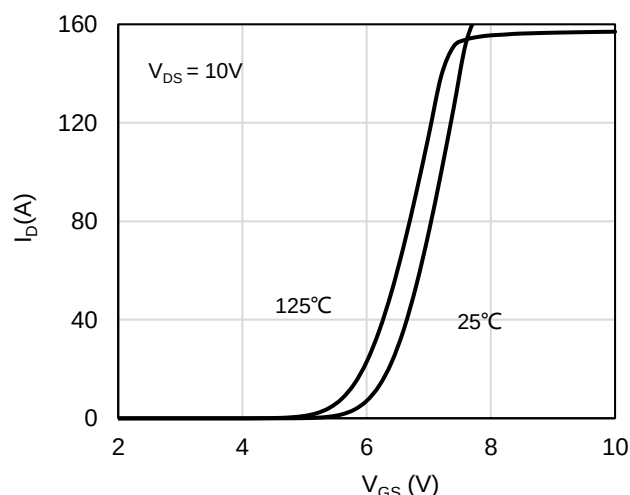


Figure 2: Transfer Characteristics

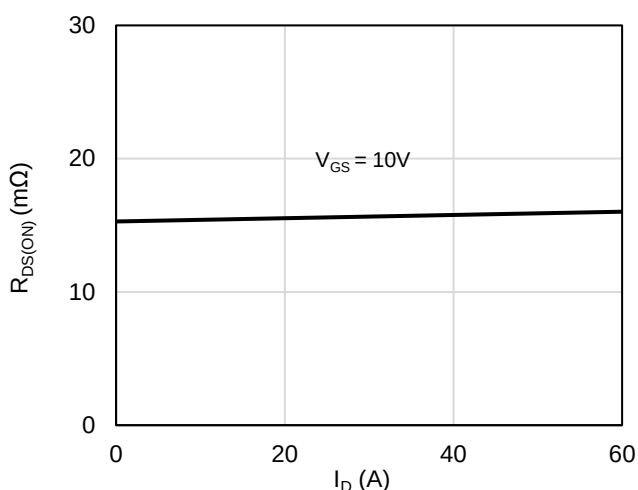


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

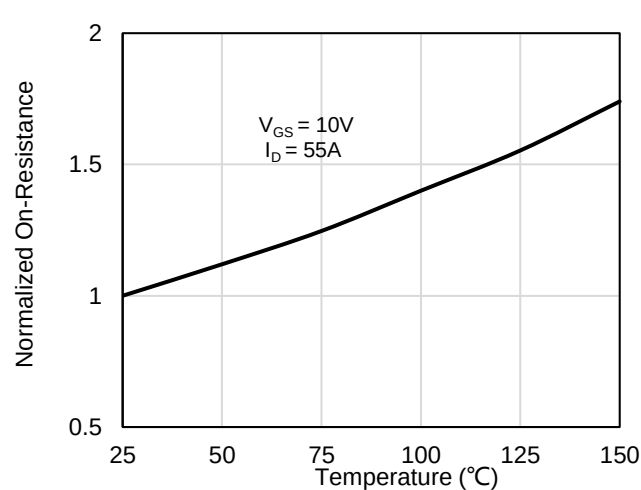


Figure 4: On-Resistance vs. Junction Temperature

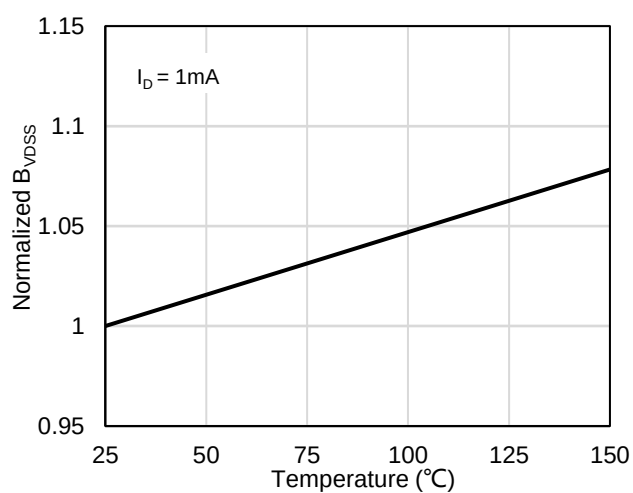


Figure 5: Breakdown Voltage vs. Junction Temperature

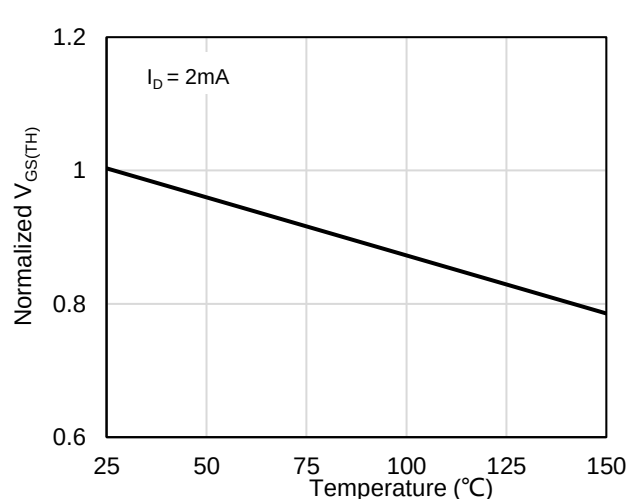


Figure 6: Threshold Voltage vs. Junction Temperature

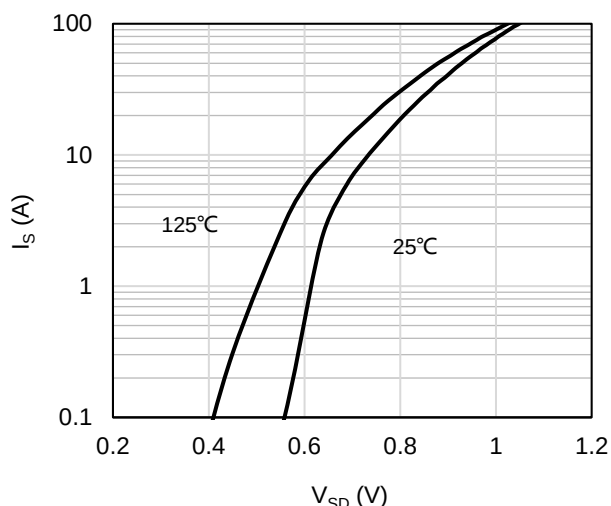


Figure 7: Body-Diode Characteristics

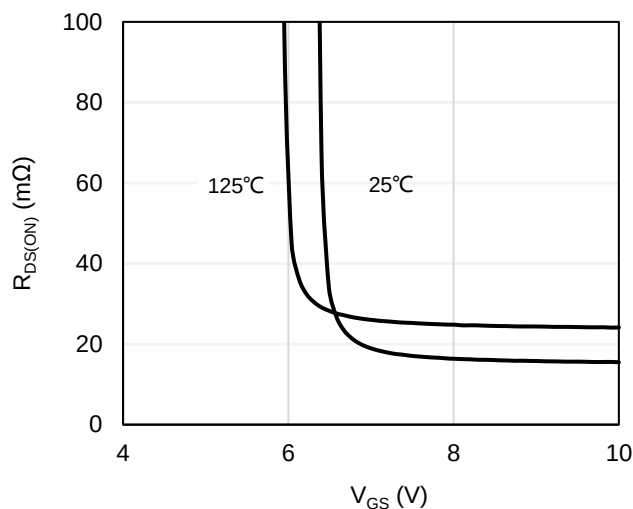


Figure 8: On-Resistance vs. Gate-Source Voltage

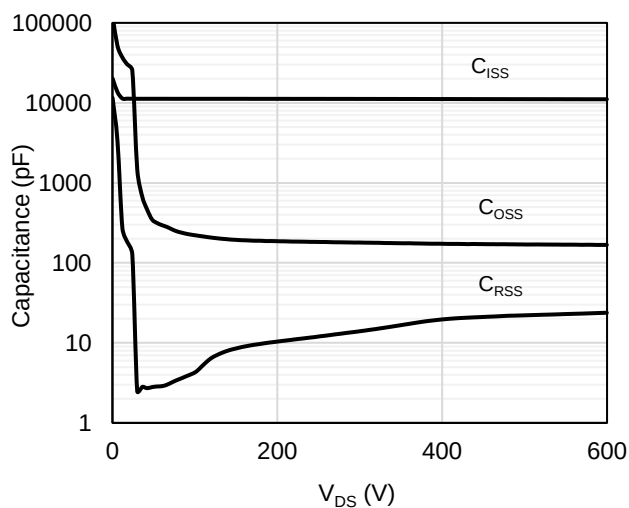


Figure 9: Capacitance Characteristics

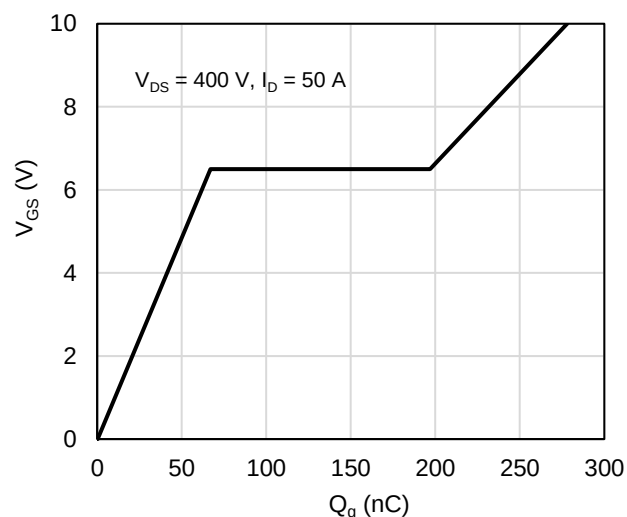


Figure 10: Gate-Charge Characteristics

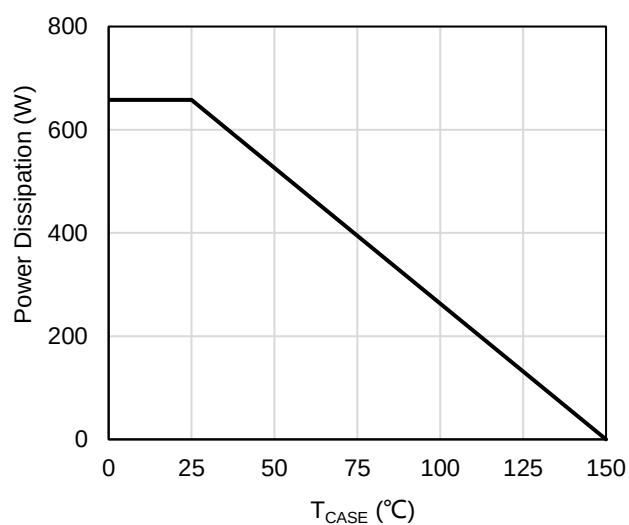


Figure 11: Power De-rating

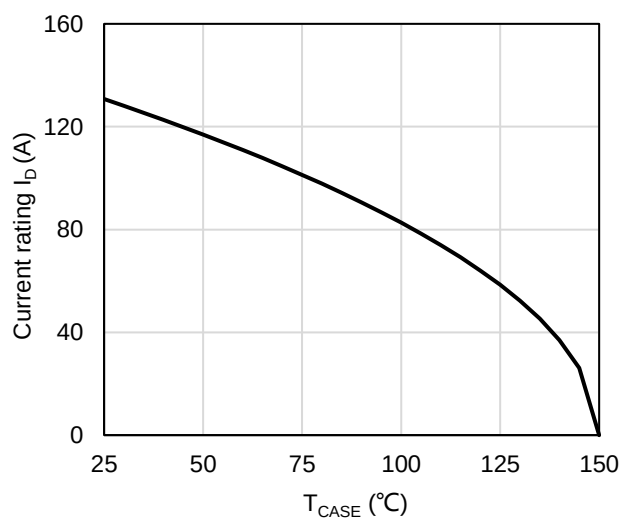
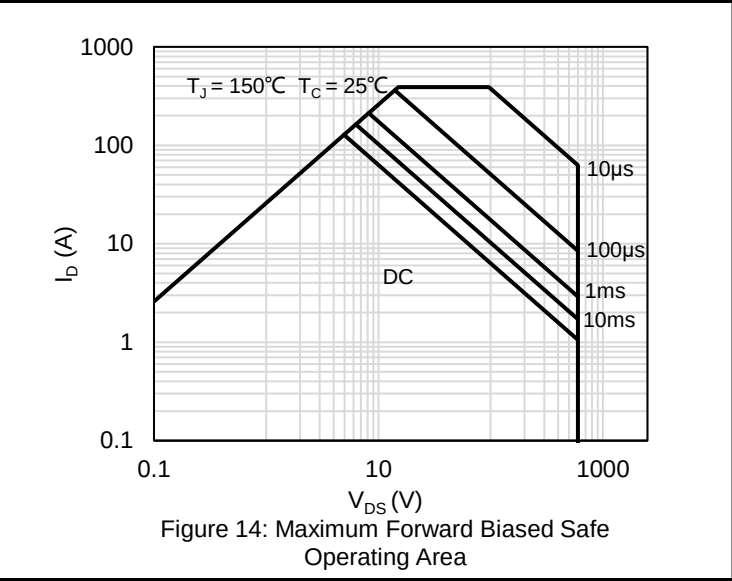
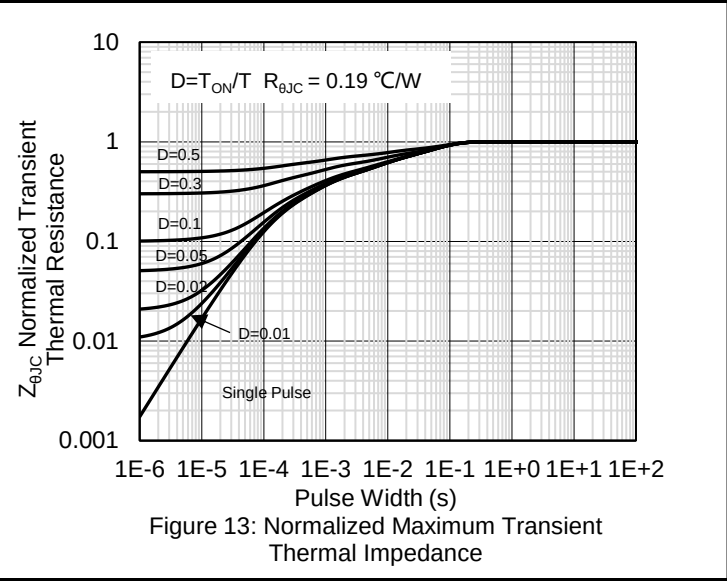
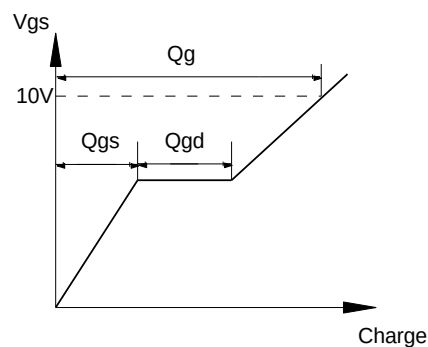
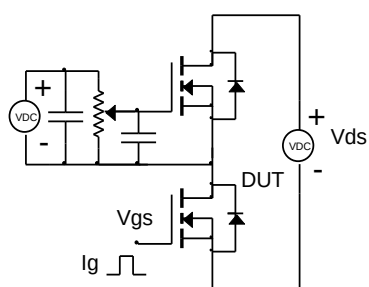


Figure 12: Current De-rating

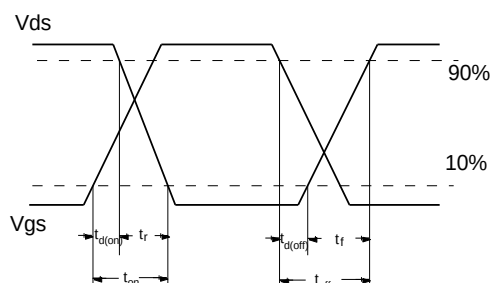
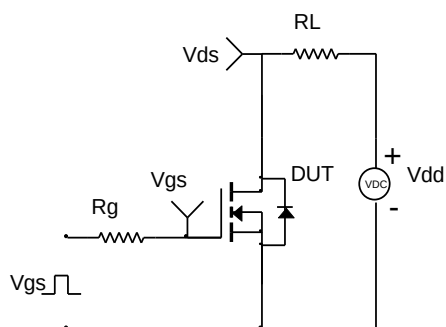


Test Circuit and Waveform

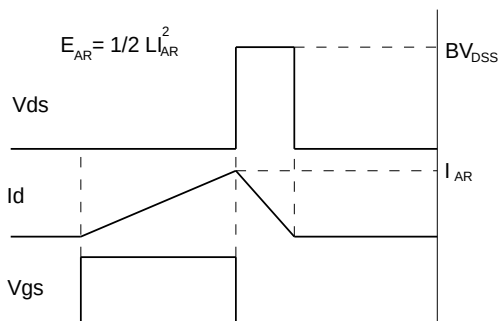
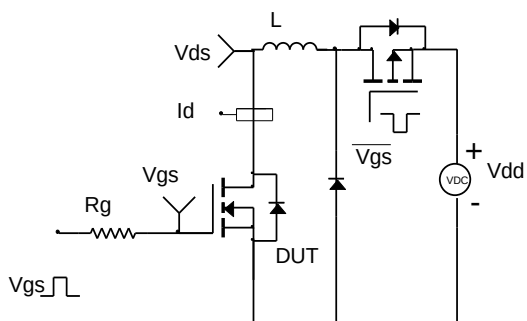
Gate Charge Test Circuit & Waveform



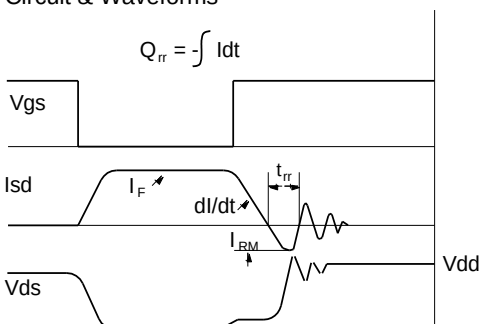
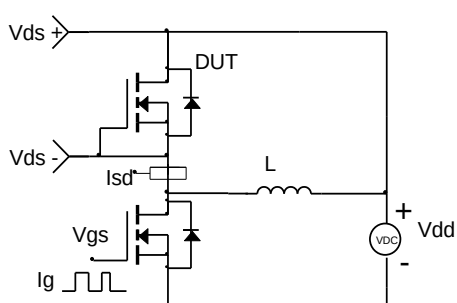
Resistive Switching Test Circuit & Waveforms



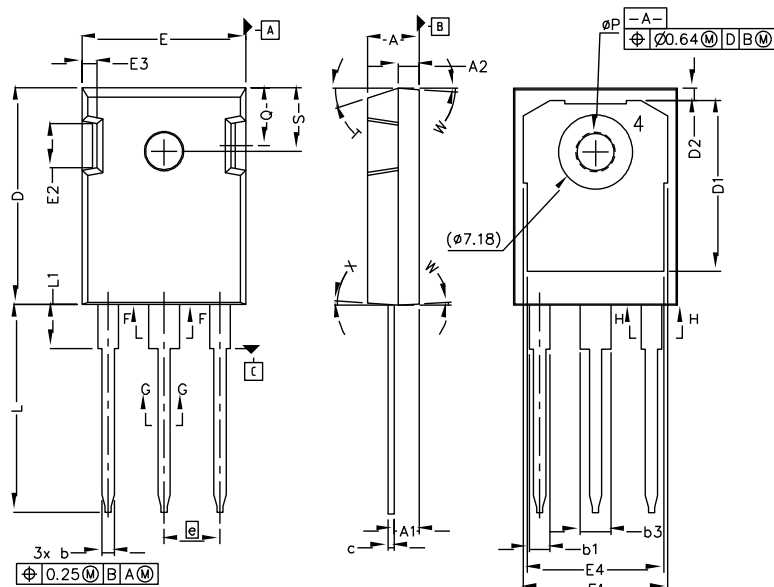
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



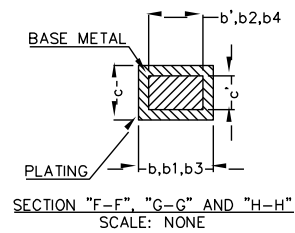
Diode Recovery Test Circuit & Waveforms



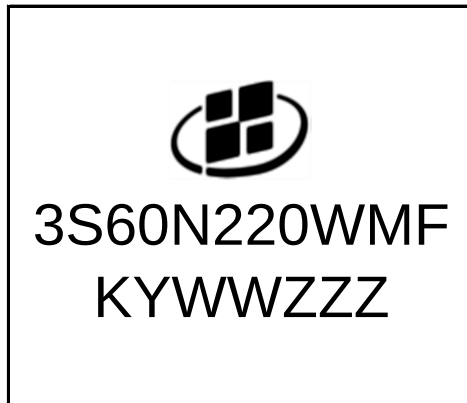
Package Outlines



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



Note:

3S60N220WMF = Product Name Code

KYWWZZZ = Date code

Contact ALKAIDSEMI sales for detail information

Revision History

Revision	Release Date	Remark
Rev.1.1	2023/8/25	

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.