

## 650V 41mohm Super-Junction Power MOSFET AKS65N410WAMF-A

### Description:

This SJ device integrated with fast-recovery diode provides good FOM factor, EMI-Friendly for customer application. Qualified AEC-Q101, PPAP capable.

### Features:

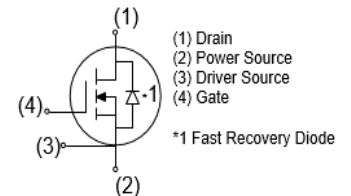
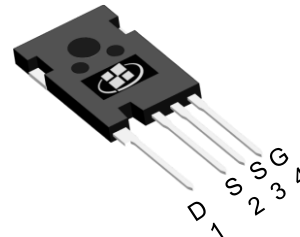
- Low FOM  $R_{DS(ON)} \times Q_g$
- RoHS compliant
- Halogen-free
- 100% UIS tested
- EMI-Friendly
- AEC-Q101 Qualified
- PPAP capable.

### Applications:

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- LED Light
- On Board Charger(OBC)

### Key Performance Parameters:

Parameter	Value	Unit
$V_{DS}$	650	V
$R_{DS(ON), max} @ V_{GS} = 10 V$	41	m $\Omega$
$I_D$	62	A



### Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AKS65N410WAMF-A	TO-247-4L	S65N410WAMF	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 ( $T_C = 25^\circ\text{C}$ ) <sup>(Note 1)</sup>	62	A
	Drain Current - Continuous ( $T_C = 100^\circ\text{C}$ )	39	A
$I_{DM}$	Drain Current - Pulsed <sup>(Note 2)</sup>	248	A
$V_{GS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(Note 3)</sup>	1656	mJ
dv/dt	MOSFET dv/dt ruggedness	80	V/ns
	Reverse diode dv/dt	80	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	416	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	0.3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Steady State <sup>(Note 4)</sup>	35	$^\circ\text{C}/\text{W}$

**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.  $L = 23 \text{ mH}$ ,  $V_{DD} = 150 \text{ V}$ ,  $I_{AS} = 12 \text{ A}$ ,  $R_g = 50 \Omega$ , Starting  $T_J = 25^\circ\text{C}$ , guarantee by design
4. Mount on minimum PCB layout

Electrical Characteristics ( $T_J = 25^\circ\text{C}$ unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Static Characteristics</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$			2	$\mu\text{A}$
$I_{GSS}$	Gate Leakage Current	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold voltage	$V_{DS} = V_{GS}, I_D = 3.3\text{ mA}$	3	3.8	4.5	V
$R_{DS(ON)}$	Drain-Source on-state resistance	$V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		34	41	m $\Omega$
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$		6665		pF
$C_{oss}$	Output Capacitance			265		pF
$C_{rss}$	Reverse Transfer Capacitance			0.8		pF
$C_{o(er)}$	Effective output capacitance, energy related	$V_{DS} = 0\dots 400\text{ V}, V_{GS} = 0\text{ V}$		276		pF
$C_{o(tr)}$	Effective output capacitance, time related	$V_{DS} = 0\dots 400\text{ V}, V_{GS} = 0\text{ V},$ $I_D = \text{constant}$		1360		pF
$R_g$	Gate Resistance	$f = 1\text{ MHz}$		1.7		$\Omega$
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn On Delay Time	$V_{DD} = 400\text{ V}, R_L = 10\ \Omega,$ $V_{GS} = 10\text{ V}, R_G = 5\ \Omega$		52		ns
$t_r$	Rise Time			24		ns
$t_{d(off)}$	Turn Off Delay Time			100		ns
$t_f$	Fall Time			3		ns
$Q_g$	Total Gate Charge	$V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $V_{GS} = 10\text{ V}$		170		nC
$Q_{gs}$	Gate-Source Charge			38		nC
$Q_{gd}$	Gate-Drain Charge			80		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Body-Diode Forward Current				62	A
$I_{SM}$	Maximum Pulsed Body-Diode Forward Current				248	A
$V_{SD}$	Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 25\text{ A}$		0.83		V
$t_{rr}$	Reverse recovery time	$V_{DD} = 400\text{ V}, I_D = 50\text{ A},$ $di/dt = 100\text{ A}/\mu\text{S}$		180		ns
$Q_{rr}$	Reverse recovery charge			945		nC
$I_{rrm}$	Peak Reverse Recovery Current			10		A

# Electrical Characteristics Diagrams

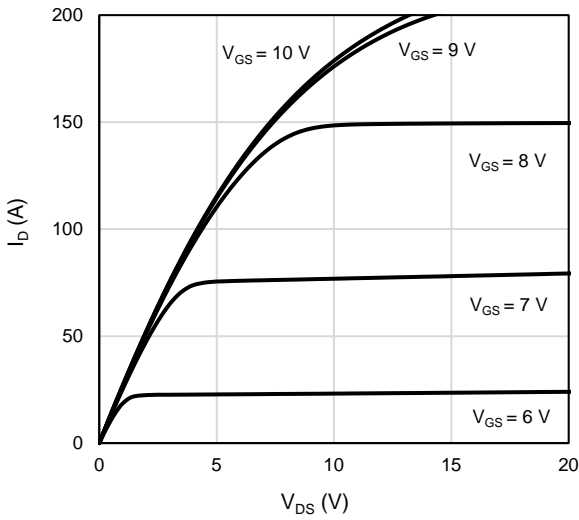


Figure 1: On-Region Characteristics

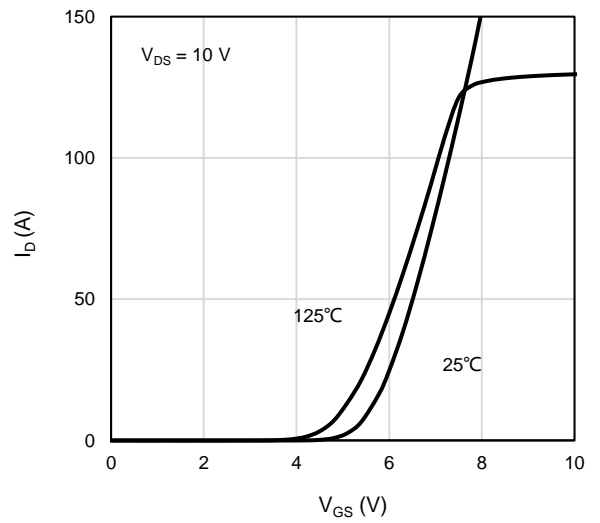


Figure 2: Transfer Characteristics

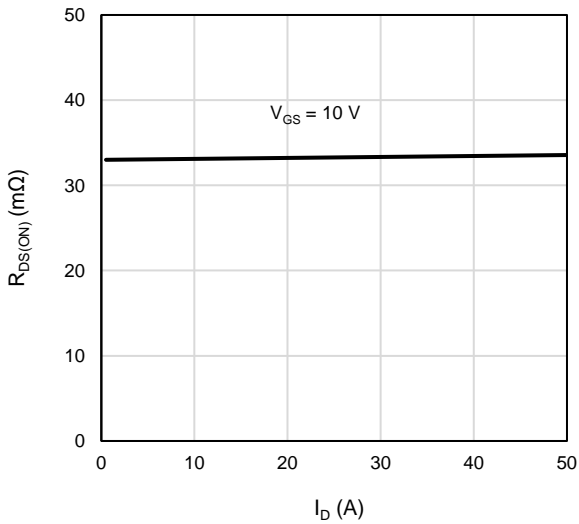


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

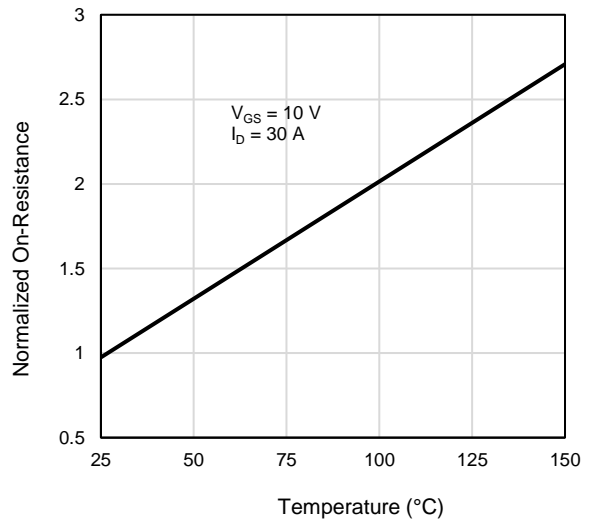


Figure 4: On-Resistance vs. Junction Temperature

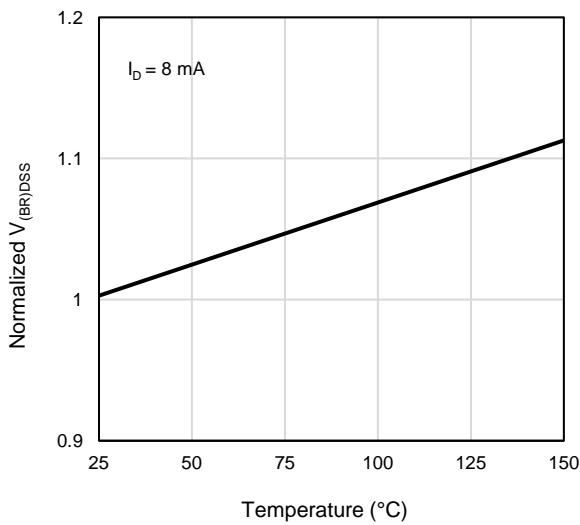


Figure 5: Breakdown Voltage vs. Junction Temperature

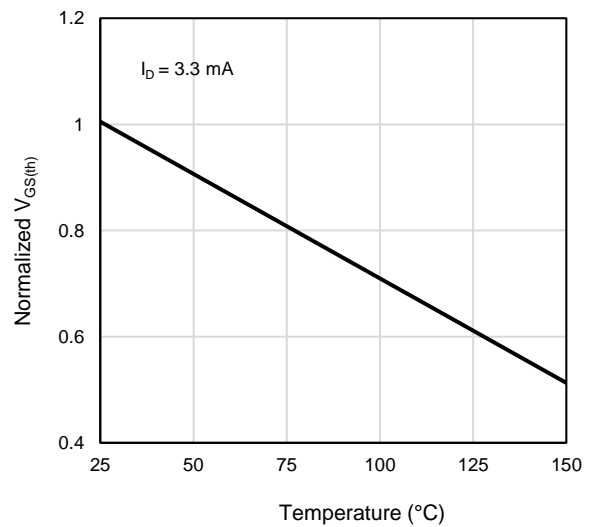


Figure 6: Threshold Voltage vs. Junction Temperature

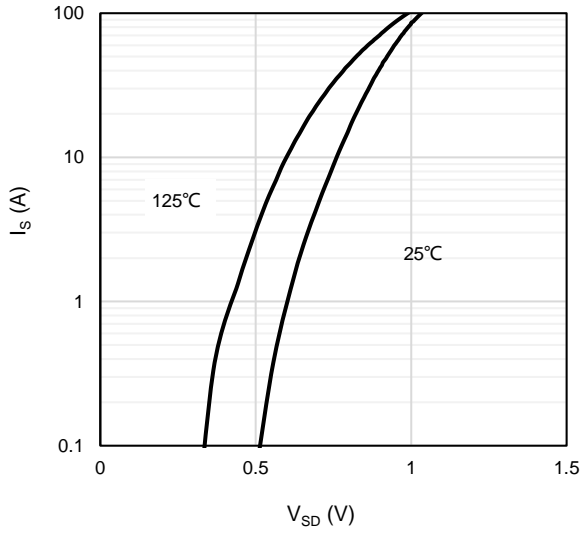


Figure 7: Body-Diode Characteristics

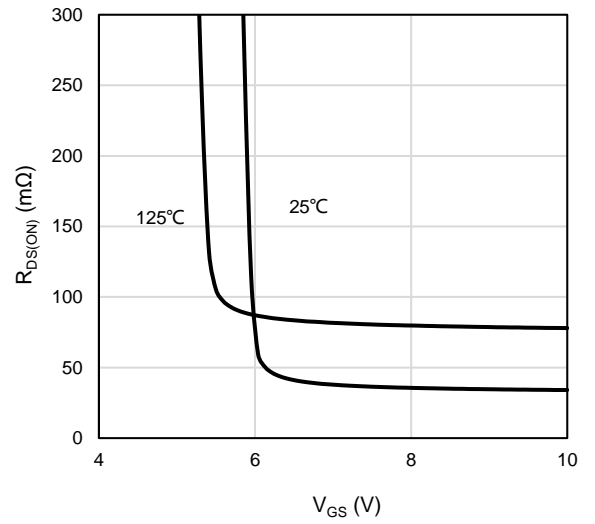


Figure 8: On-Resistance vs. Gate-Source Voltage

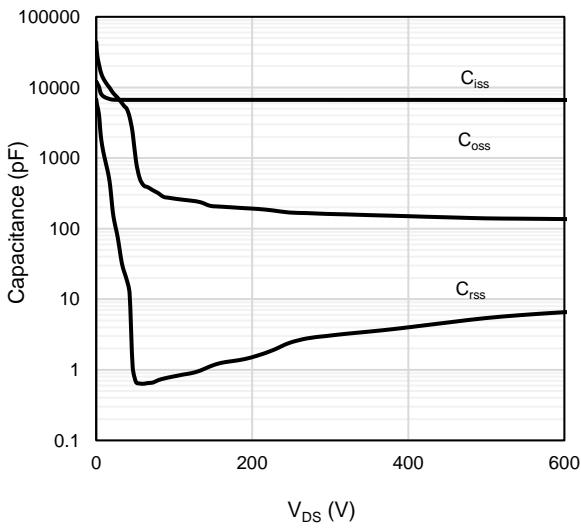


Figure 9: Capacitance Characteristics

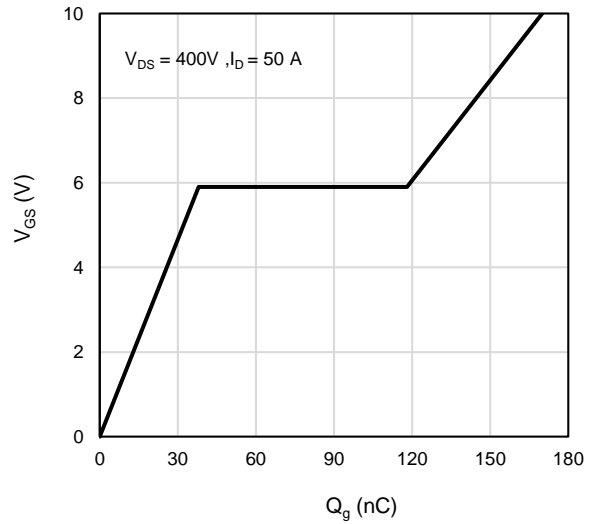


Figure 10: Gate-Charge Characteristics

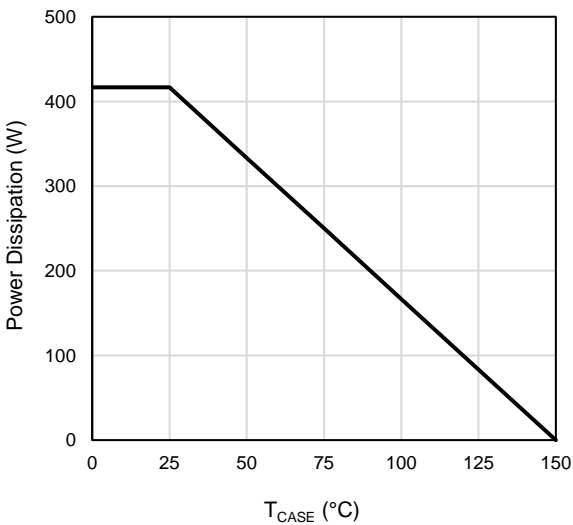


Figure 11: Power De-rating

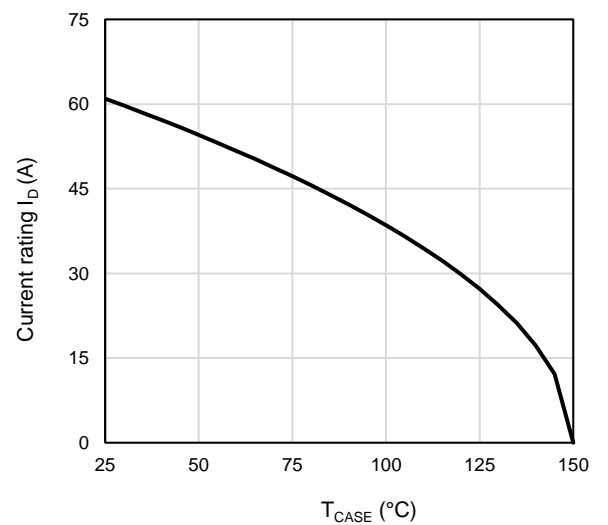


Figure 12: Current De-rating

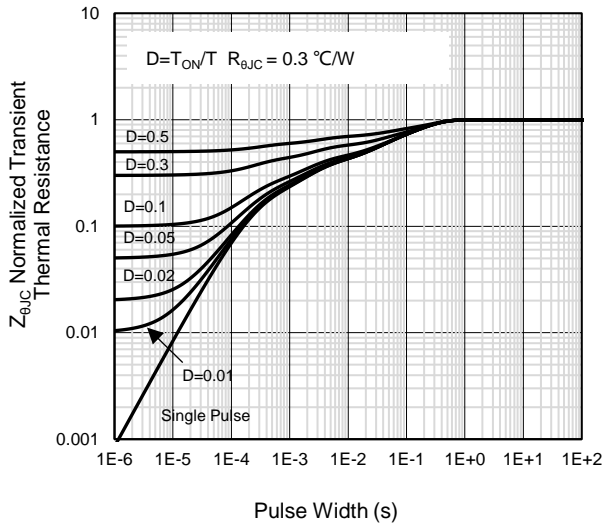


Figure 13: Normalized Maximum Transient Thermal Impedance

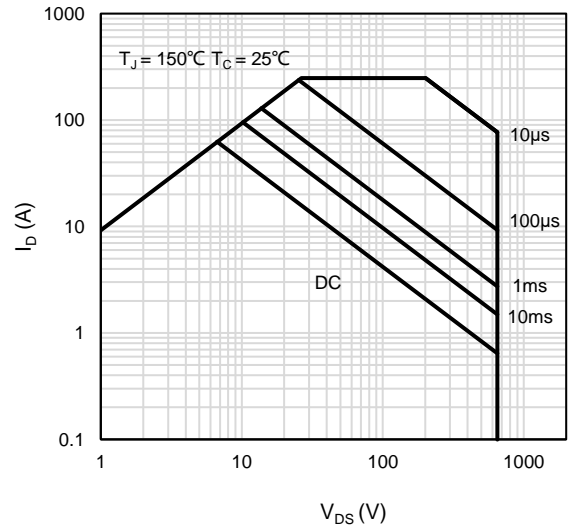
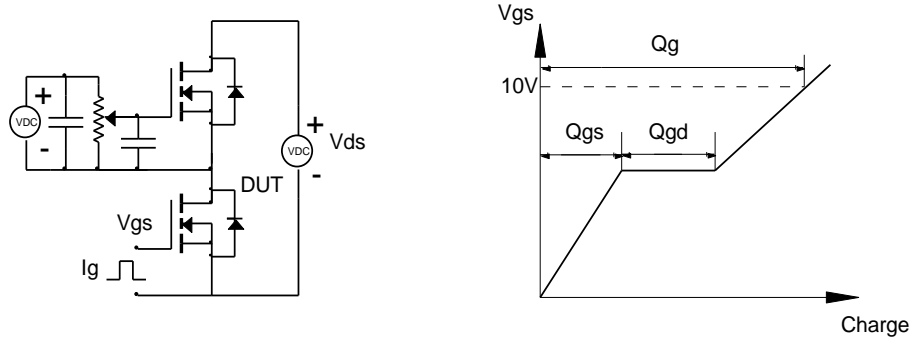


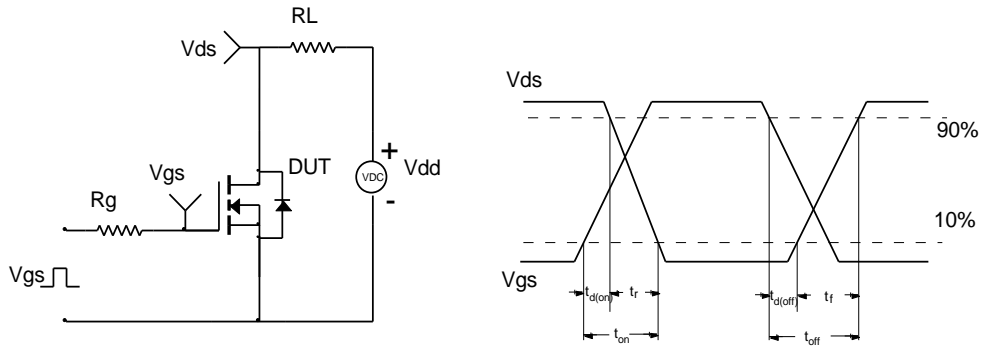
Figure 14: Maximum Forward Biased Safe Operating Area

# Test Circuit and Waveform

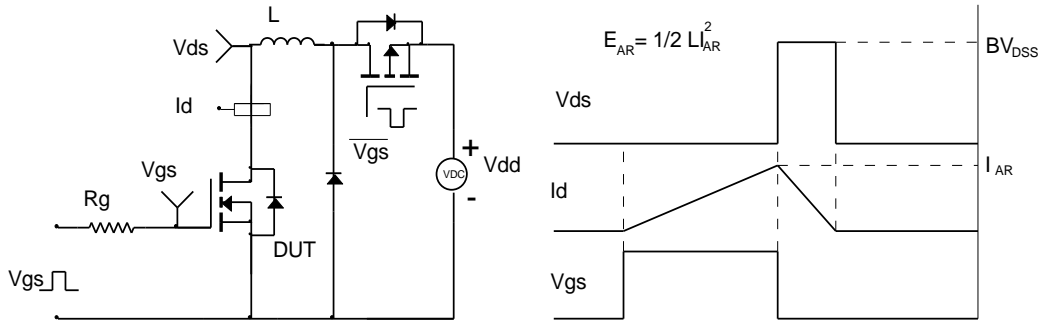
Gate Charge Test Circuit & Waveform



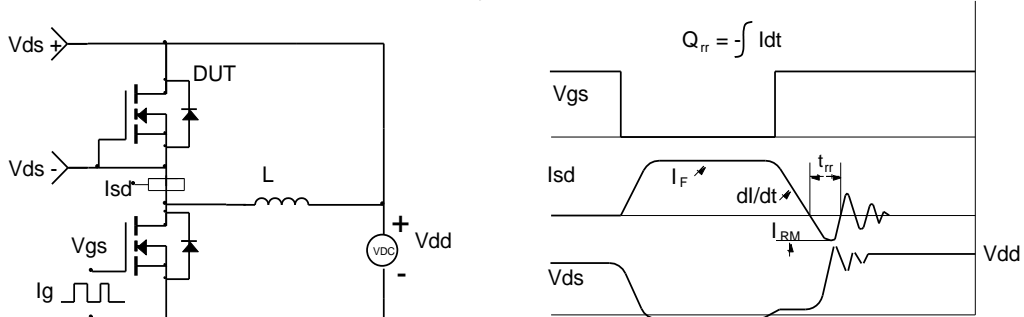
Resistive Switching Test Circuit & Waveforms



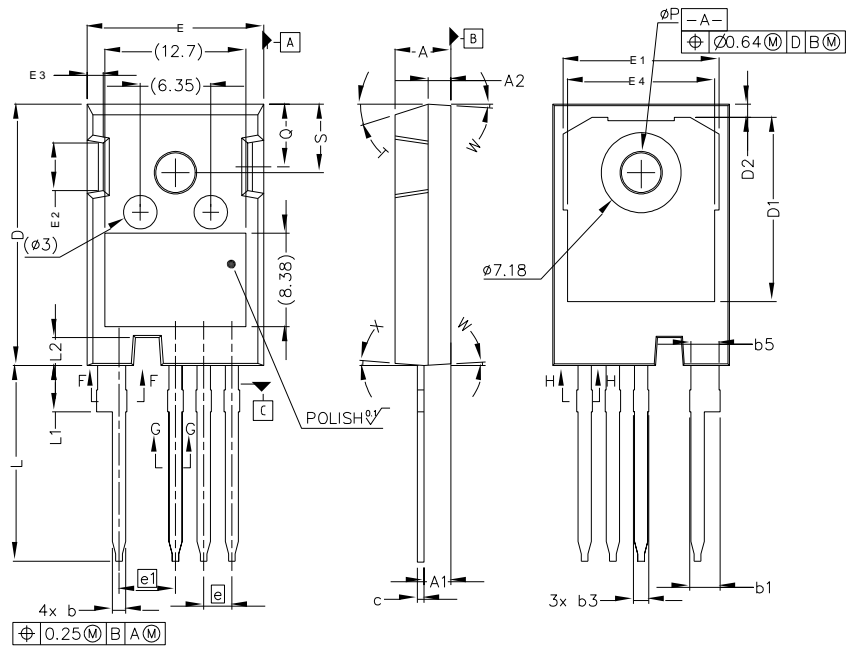
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



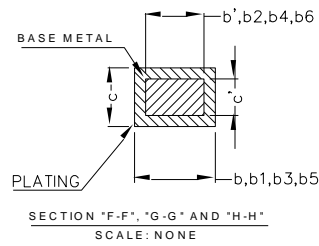
Diode Recovery Test Circuit & Waveforms



Package Outlines



SYMBOL	MILLIMETERS	
	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	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
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	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
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



S65N410WAMF  
KYWWZZZ

Note:

S65N410WAMF = Product Name Code

KYWWZZZ = Date code

Contact ALKAIDSEMI sales for detail information

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## Revision History

Revision	Released	Remark
Rev.1.0	2023	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.

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