

# 40V 0.9mohm N-channel SGT MOSFET

## AK1G4N009GAL

### Description:

This N channel SGT MOSFET has been designed to very low on-state resistance and maintain superior switching performance, especially for high efficiency power management applications.

### Features:

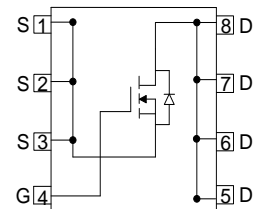
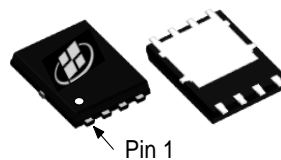
- Low  $R_{DS(ON)}$
- RoHS compliant
- Halogen-free

### Applications:

- Battery Management System
- Motor Drivers
- DC-DC Converter

### Key Performance Parameters:

Parameter	Value	Unit
$V_{DS}$	40	V
$R_{DS(ON), max} @ V_{GS} = 10 V$	0.9	m $\Omega$
$I_D$	260	A



### Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK1G4N009GAL	PDFN5X6	1G4N009GAL	Tape Reel	5000 per reel

## Maximum Ratings ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Units
$V_{DS}$	Drain - Source Voltage	40	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) <sup>(Note 1)</sup>	260	A
	Drain Current - Continuous ( $T_C = 100^\circ\text{C}$ )	164	A
$I_{DM}$	Drain Current - Pulsed <sup>(Note 2)</sup>	780	A
$V_{GS}$	Gate - Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(Note 3)</sup>	625	mJ
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	100	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	1.25	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady State <sup>(Note 4)</sup>	45	$^\circ\text{C}/\text{W}$

### Notes:

1. The max drain current rating is silicon limited
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3.  $L = 0.5 \text{ mH}$ ,  $V_{DD} = 35 \text{ V}$ ,  $I_{AS} = 50 \text{ A}$ ,  $R_g = 50 \text{ } \Omega$ , Starting  $T_J = 25 \text{ } ^\circ\text{C}$
4. Mount on minimum PCB layout

Electrical Characteristics (T <sub>J</sub> = 25°C unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Static Characteristics</b>						
V <sub>(BR)DSS</sub>	Drain - Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V,			1	μA
I <sub>GSS</sub>	Gate Leakage Current	V <sub>GS</sub> = ± 20 V, V <sub>DS</sub> = 0 V			±100	nA
V <sub>GS(th)</sub>	Gate Threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	2	3	V
R <sub>DS(on)</sub>	Drain - Source on - state resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 50 A		0.65	0.9	mΩ
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 50 A		1.25	1.6	
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, f = 1 MHz		5715		pF
C <sub>oss</sub>	Output Capacitance			2480		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			38		pF
R <sub>g</sub>	Gate Resistance	f = 1 MHz		1.5		Ω
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn On Delay Time	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 1 Ω, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 1.1 Ω		15		ns
t <sub>r</sub>	Rise Time			32		ns
t <sub>d(off)</sub>	Turn Off Delay Time			39		ns
t <sub>f</sub>	Fall Time			17		ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 50 A, V <sub>GS</sub> = 10 V		78		nC
Q <sub>gs</sub>	Gate - Source Charge			19		nC
Q <sub>gd</sub>	Gate - Drain Charge			16		nC
<b>Drain - Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Body - Diode Forward Current				260	A
I <sub>SM</sub>	Maximum Pulsed Body - Diode Forward Current				780	A
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 50 A		0.77		V
t <sub>rr</sub>	Reverse recovery time	V <sub>DD</sub> = 20 V, I <sub>D</sub> = 20 A, di/dt = 100 A/μs		88		ns
Q <sub>rr</sub>	Reverse recovery charge			143		nC
I <sub>rrm</sub>	Peak Reverse Recovery Current			2.8		A

# Electrical Characteristics Diagrams

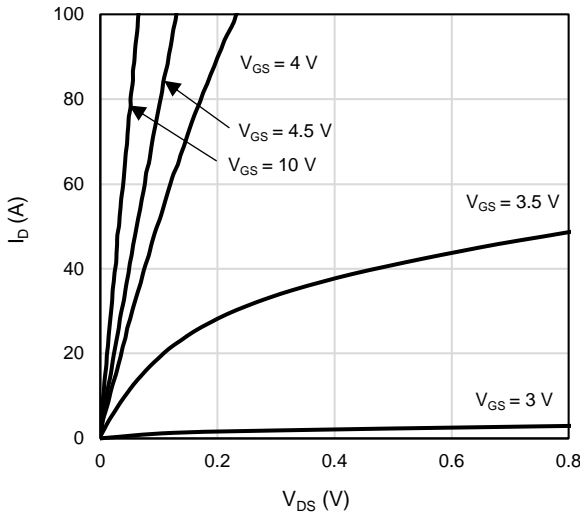


Figure 1: On-Region Characteristics

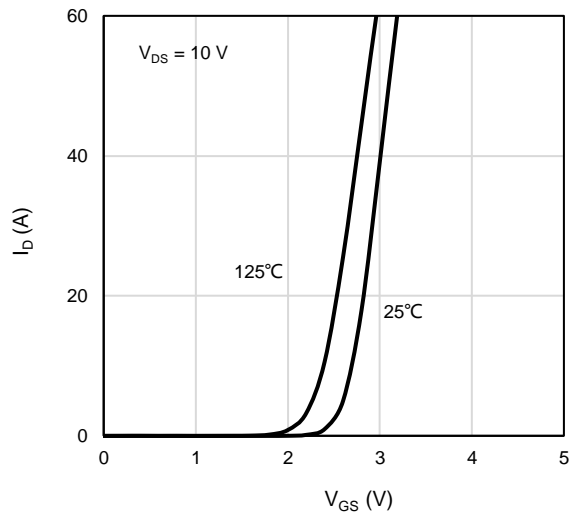


Figure 2: Transfer Characteristics

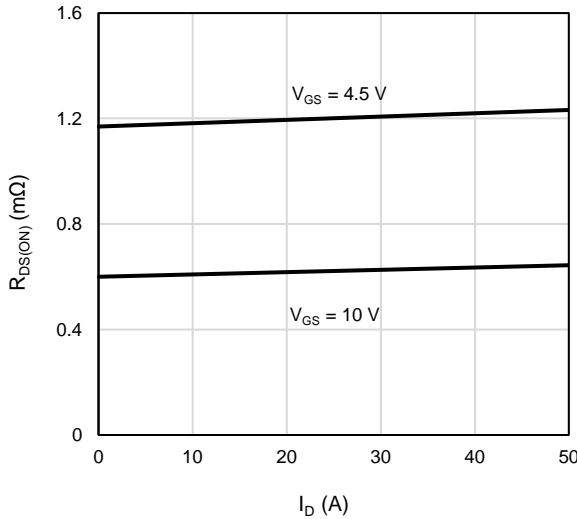


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

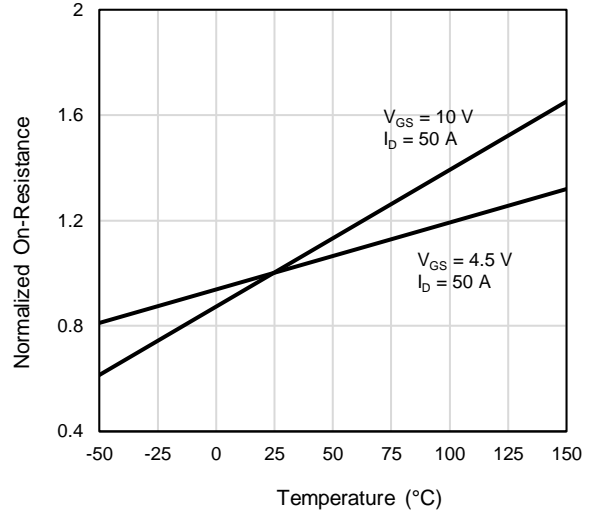


Figure 4: On-Resistance vs. Junction Temperature

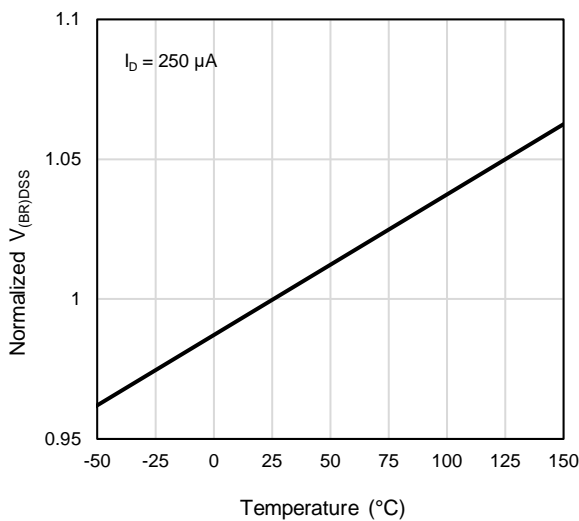


Figure 5: Breakdown Voltage vs. Junction Temperature

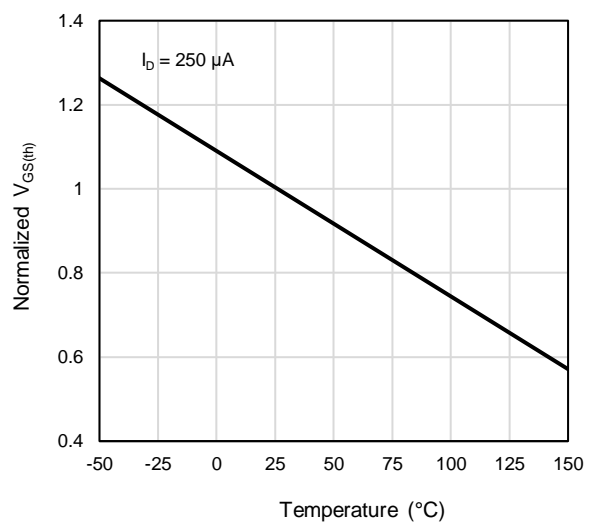


Figure 6: Threshold Voltage vs. Junction Temperature

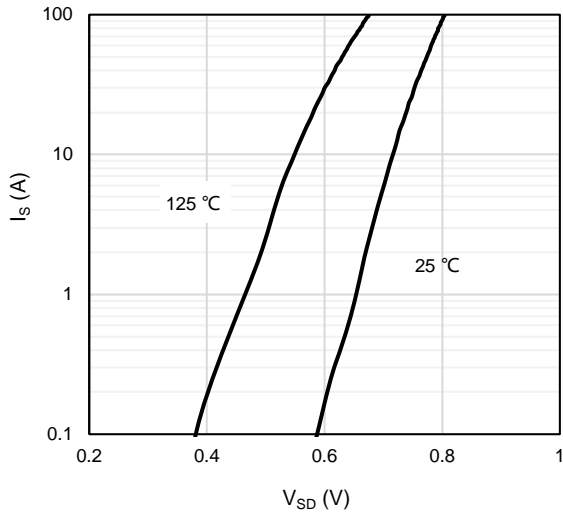


Figure 7: Body-Diode Characteristics

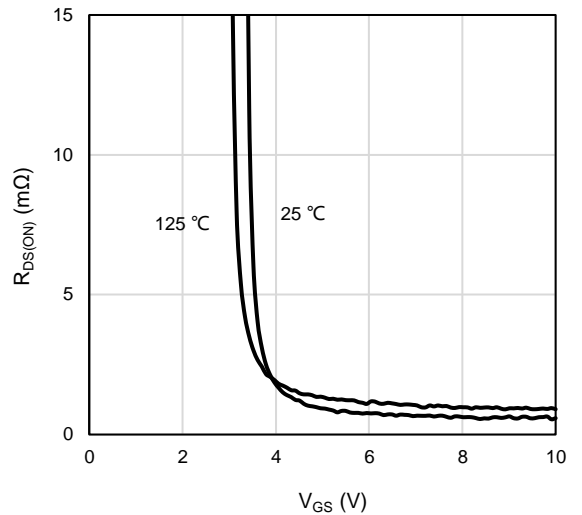


Figure 8: On-Resistance vs. Gate-Source Voltage

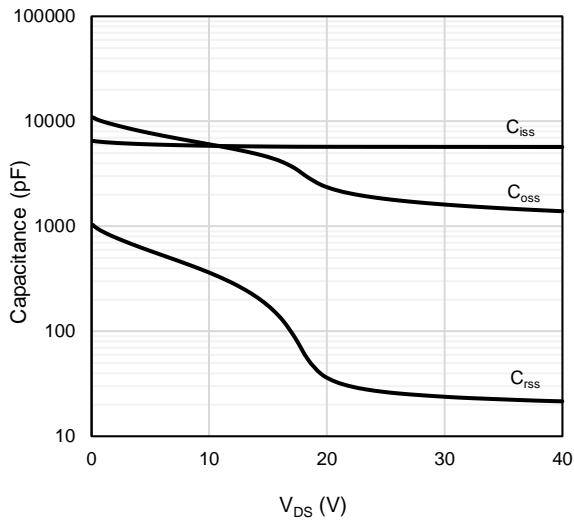


Figure 9: Capacitance Characteristics

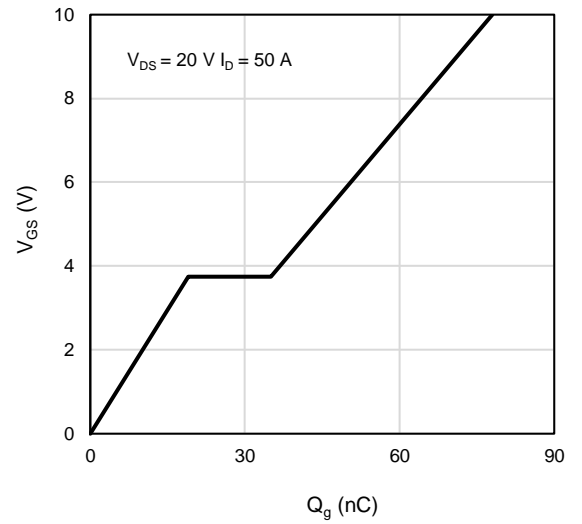


Figure 10: Gate-Charge Characteristics

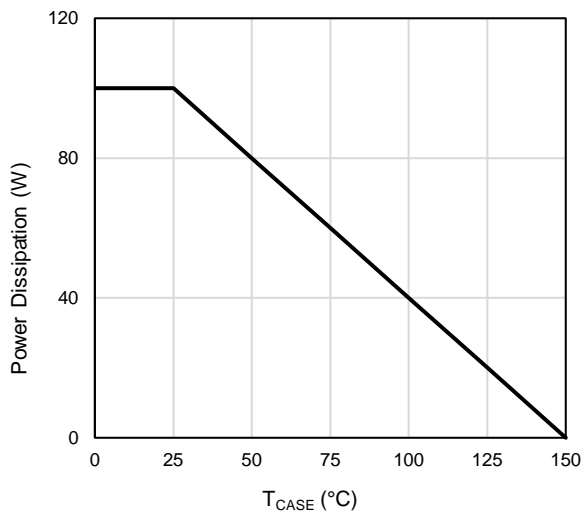


Figure 11: Power De-rating

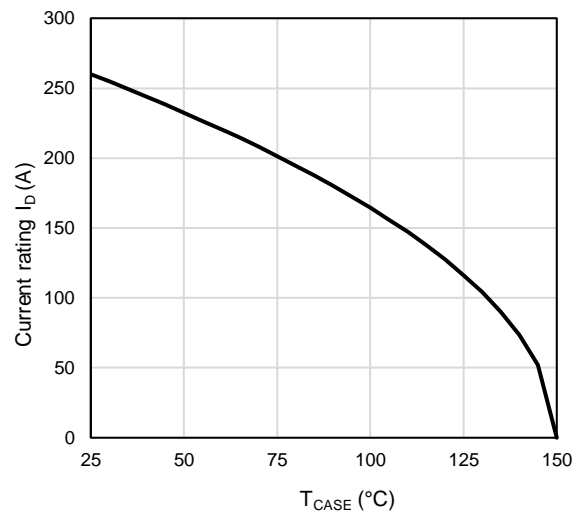


Figure 12: Current De-rating

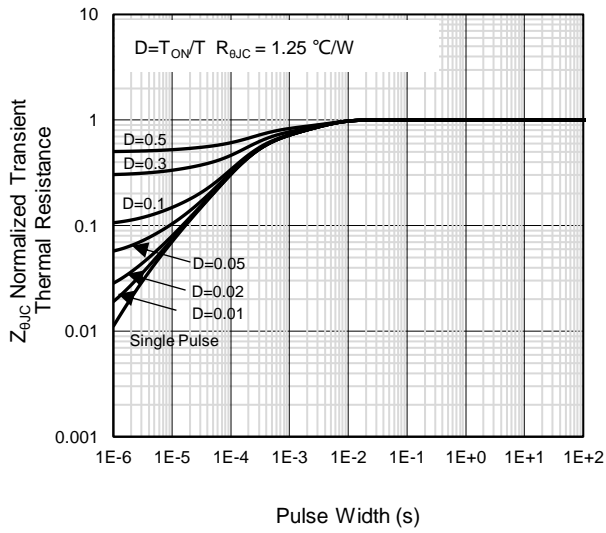


Figure 13: Normalized Maximum Transient Thermal Impedance

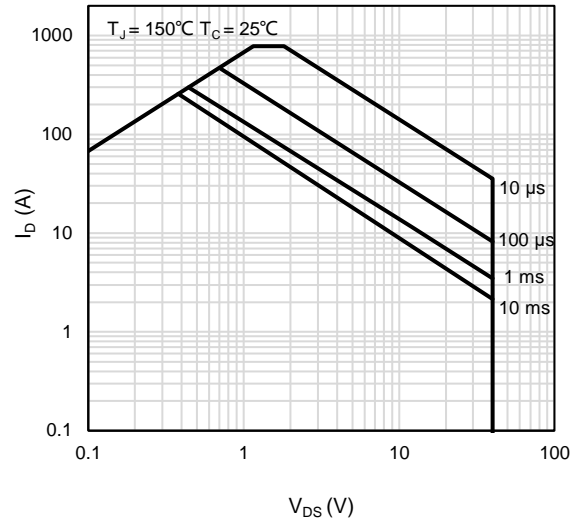
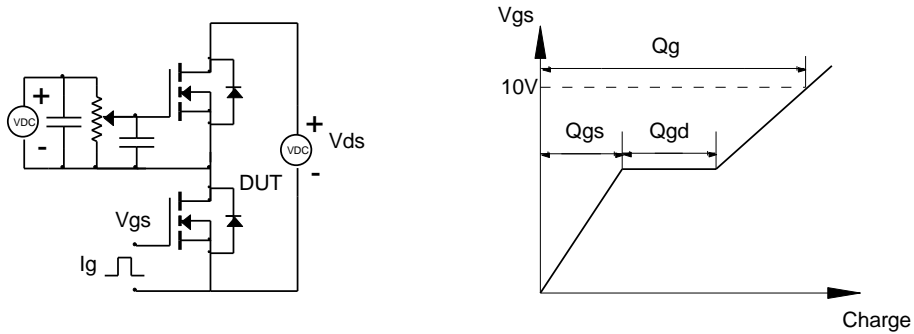


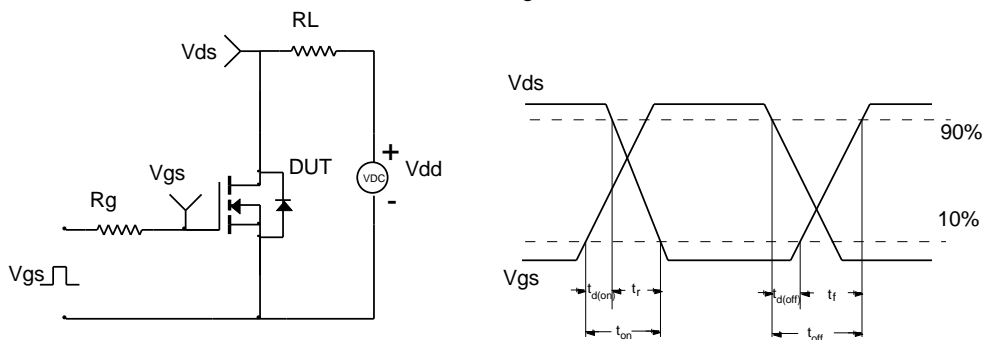
Figure 14: Maximum Forward Biased Safe Operating Area

# Test Circuit and Waveform

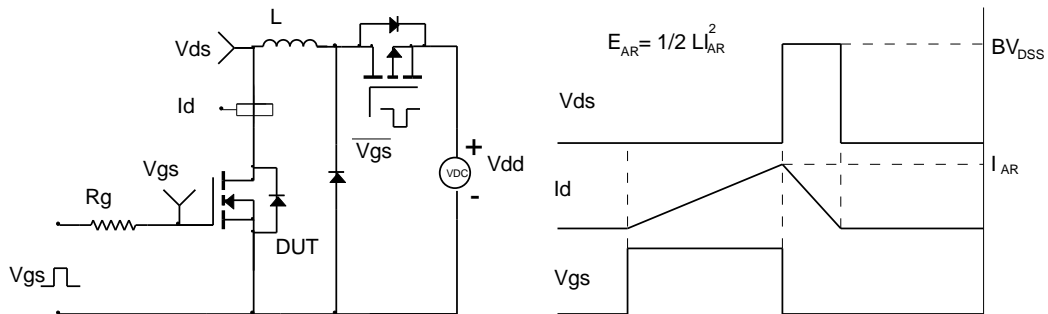
Gate Charge Test Circuit & Waveform



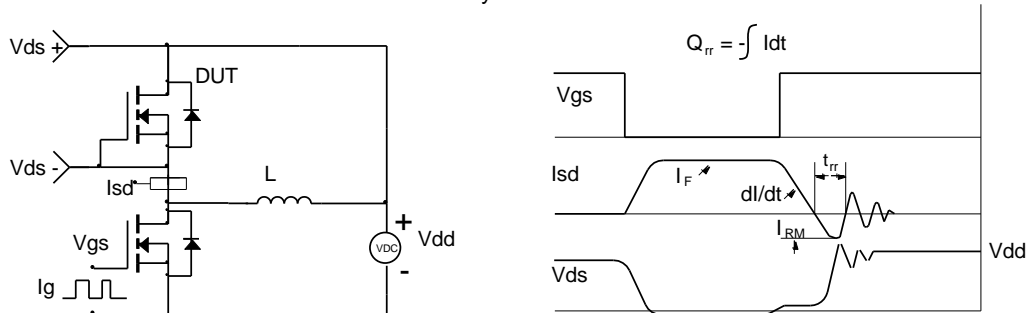
Resistive Switching Test Circuit & Waveforms



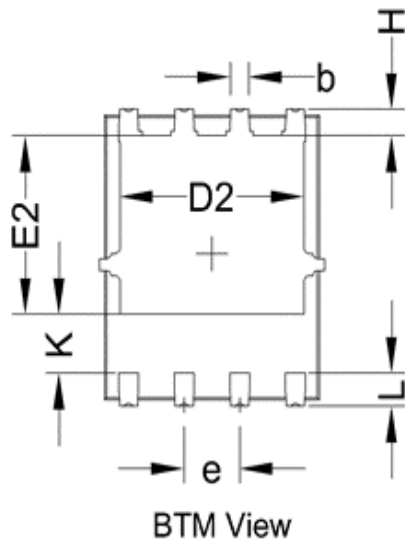
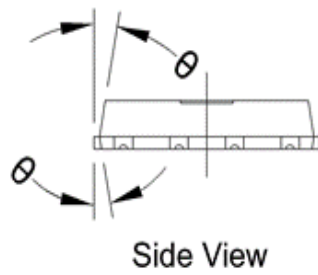
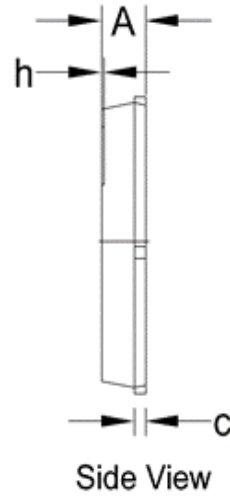
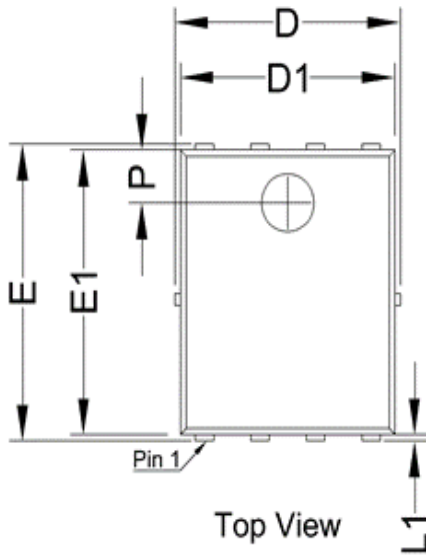
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Outlines

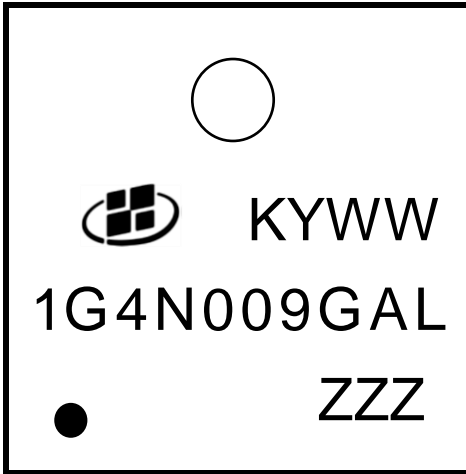


SYMBOL	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.32	0.42	0.52
c	0.21	0.25	0.34
D	5.00	5.15	5.30
D1	4.80	4.90	5.00
D2	4.10	4.20	4.30
e	1.27BSC		
E	6.00	6.15	6.30
E1	5.80	5.90	6.00
E2	3.60	3.70	3.80
H	0.45	0.55	0.65
h	-	-	0.10
K	1.17	-	-
L	0.58	0.68	0.78
L1	0.05	0.13	0.21
θ	8°	10°	12°
P	1.05	1.10	1.15

Unit in mm



### Marking Information



Note:

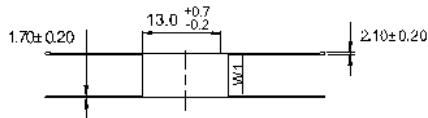
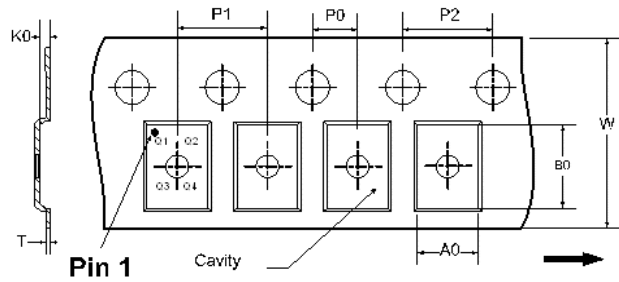
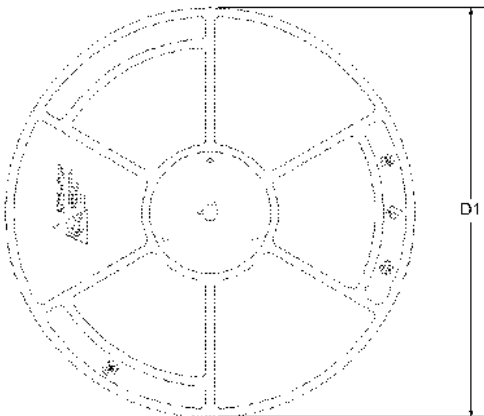
1G4N009GAL = Product Name Code

KYWW = Date code

ZZZ = Date code  
Contact ALKAIDSEMI sales for detail information

### Tape & Reel Information

REEL DIMENSIONS



- A0: Dimension designed to accommodate the component width
- B0: Dimension designed to accommodate the component length
- K0: Dimension designed to accommodate the component thickness
- W: Overall width of the carrier tape
- P0: Pitch between successive cavity centers and sprocket hole
- P1: Pitch between successive cavity centers
- P2: Pitch between sprocket hole
- T: Tape material thickness
- D1: Reel Diameter
- W1: Reel Width

PDFN 5X6										
DIMENSIONS(Unit:mm)										
Reel	D1	W1								Material
	330	12.4								Hips
Tape	P0	P1	P2	W	A0	B0	K0	T	Pin 1 Quadrant	Material
	2	8	4	12	6.3	5.3	1.2	0.25	Q1	PC

## 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.

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.