

## Features

- Proprietary  $\alpha$ SiC MOSFET technology
- Low loss, fast switching speeds with low  $R_G$
- Optimized drive voltage ( $V_{GS} = 15V$ ) for broad driver compatibility
- Robust body diode and low  $Q_{rr}$

## Applications

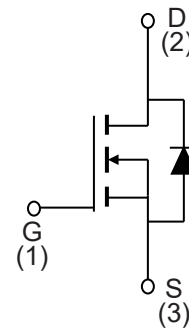
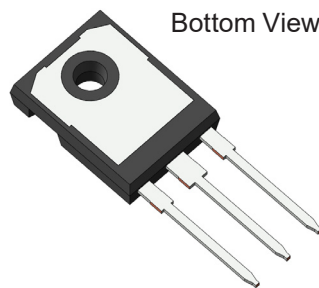
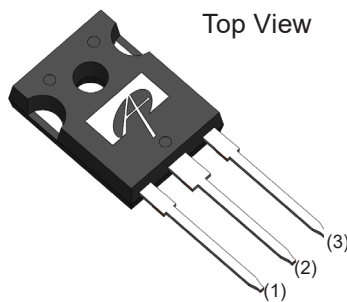
- Renewable
- EV Charger
- Solar Inverters
- Industrial
- UPS
- SMPS
- Motor Drives

## Product Summary

$V_{DS} @ T_{J, max}$	650V
$I_{DM}$	85A
$R_{DS(ON), typ}$	65m $\Omega$
$Q_{rr}$	104nC
$E_{OSS} @ 400V$	11 $\mu$ J
100% UIS Tested	



## Pin Configuration



Ordering Part Number	Package Type	Form	Shipping Quantity
AOK065V65X2	TO-247-3L	Tube	30/Tube

## Absolute Maximum Ratings

$T_A = 25^\circ C$ , unless otherwise noted

Symbol	Parameter	AOK065V120X2	Units
$V_{DS}$	Drain-Source Voltage	650	V
$V_{GS, MAX}$	Gate-Source Voltage	Maximum	-8/+18
$V_{GS, OP, TRANS}$		Max Transient <sup>(A)</sup>	-8/+20
$V_{GS, OP}$		Recommended Operating <sup>(B)</sup>	-5/+15
$I_D$	Continuous Drain Current	$T_C = 25^\circ C$	40.3
		$T_C = 100^\circ C$	29.6
$I_{DM}$	Pulsed Drain Current <sup>(C)</sup>	85	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(D)</sup>	250	mJ
$P_D$	Power Dissipation <sup>(C)</sup>	187.5	W
$T_J, T_{STG}$	Junction and Storage Temperature Range	-55 to 175	$^\circ C$
$T_L$	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	300	$^\circ C$

## Thermal Characteristics

Symbol	Parameter	AOK065V120X2	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient <sup>(E,F)</sup>	40	°C/W
$R_{\theta JC}$	Maximum Junction-to-Case <sup>(G)</sup>	0.8	°C/W

## Electrical Characteristics

$T_A = 25^\circ\text{C}$ , unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}, T_J=25^\circ\text{C}$	650			V
		$I_D=250\mu\text{A}, V_{GS}=0\text{V}, T_J=150^\circ\text{C}$		650		V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=650\text{V}, V_{GS}=0\text{V}$			50	$\mu\text{A}$
$I_{GSS}$	Gate-Source Leakage Current	$V_{DS}=0\text{V}, V_{GS}=+15/-5\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=10\text{mA}$	1.8	2.8	3.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=15\text{V}, I_D=10\text{A}$	$T_J = 25^\circ\text{C}$	65	85	$\text{m}\Omega$
			$T_J = 150^\circ\text{C}$	90		$\text{m}\Omega$
$g_{fs}$	Forward Transconductance	$V_{DS}=20\text{V}, I_D=20\text{V}$		12		S
$V_{SD}$	Diode Forward Voltage	$I_S=10\text{A}, V_{GS}=-5\text{V}$		4.1	5	V
<b>DYNAMIC</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=400\text{V}, f=1\text{MHz}$		1733		pF
$C_{oss}$	Output Capacitance			98		pF
$C_{riss}$	Reverse Transfer Capacitance			5.8		pF
$E_{oss}$	Coss Stored Energy			11		$\mu\text{J}$
$R_G$	Gate Resistance	$f=1\text{MHz}$		2.5		$\Omega$
<b>SWITCHING</b>						
$Q_g$	Total Gate Charge	$V_{GS}=-5/+15\text{V}, V_{DS}=400\text{V}, I_D=20\text{A}$		58.8		nC
$Q_{gs}$	Gate Source Charge			24.6		nC
$Q_{gd}$	Gate Drain Charge			19.7		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{GS}=0\text{V}/+15\text{V}, V_{DS}=400\text{V}, I_D=20\text{A}, R_G=2.5\Omega$		10.4		ns
$t_r$	Turn-On Rise Time			25.5		ns
$t_{d(off)}$	Turn-Off Delay Time			12.4		ns
$t_f$	Turn-Off Fall Time			3.9		ns
$E_{on}$	Turn-On Energy		$L_a = 120\mu\text{H}$		131.5	
$E_{off}$	Turn-Off Energy	FWD: AOK065V65X2		8.9		$\mu\text{J}$
$E_{tot}$	Total Switching Energy			140.4		$\mu\text{J}$
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=13.2\text{A}, dl/dt=1200\text{A}/\mu\text{s}, V_{DS}=400\text{V}=33\text{ns}$		33		ns
$I_{rm}$	Peak Reverse Recovery Current	$I_F=13.2\text{A}, dl/dt=750\text{A}/\mu\text{s}, V_{DS}=400\text{V}=6.4\text{A}$		6.4		A
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=13.2\text{A}, dl/dt=750\text{A}/\mu\text{s}, V_{DS}=400\text{V}=104\text{nC}$		104		nC

### Notes:

A. < 1% duty cycle,  $f > 1\text{Hz}$   
 B. Device can be operated at  $V_{GS}=0/15\text{V}$ . Actual operating VGS will depend on application specifics such as parasitic inductance and  $dV/dt$  but should not exceed maximum ratings.  
 C. The power dissipation  $P_D$  is based on  $T_{J(MAX)}=175^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.  
 D.  $L=5\text{mH}, I_{AS}=4.3\text{A}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$ .  
 E. The value of  $R_{\theta JA}$  is measured with the device in a still air environment with  $T_A=25^\circ\text{C}$ .

F. The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to case  $R_{\theta JC}$  and case to ambient.

G. The value of  $R_{\theta JC}$  is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(MAX)}=175^\circ\text{C}$ .

H. The static characteristics in Figures 1 to 8 are obtained using <300ms pulses, duty cycle 0.5% max.

I. These curves are based on  $R_{\theta JC}$  which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(MAX)}=175^\circ\text{C}$ . The SOA curve provides a single pulse rating.

## Typical Electrical and Thermal Characteristics

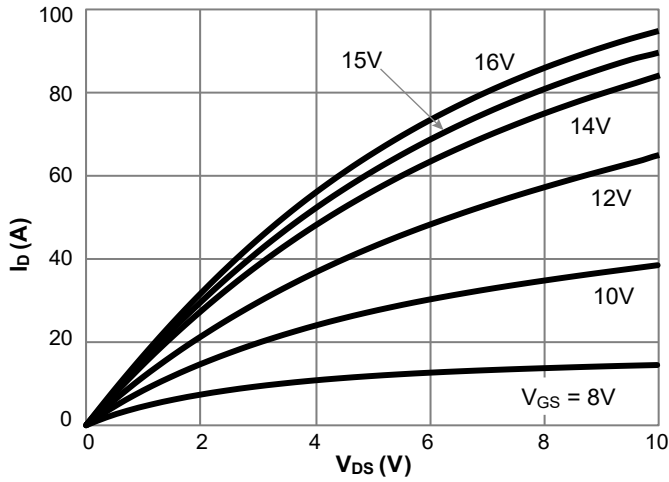


Figure 1. On-Region Characteristics  $T_J = 25^\circ\text{C}$

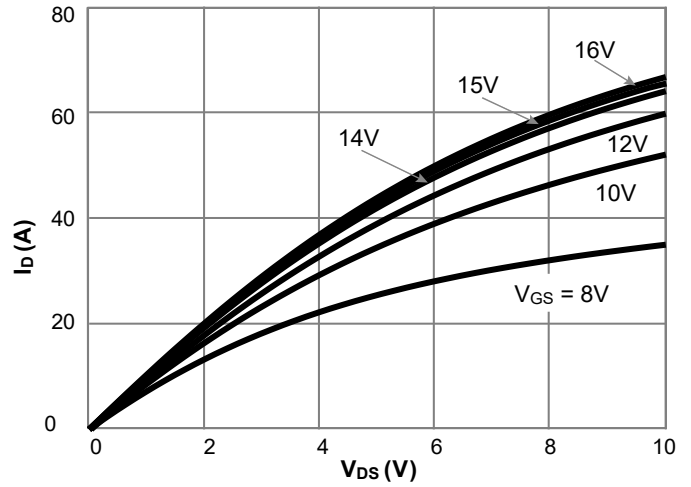


Figure 2. On-Region Characteristics  $T_J = 175^\circ\text{C}$

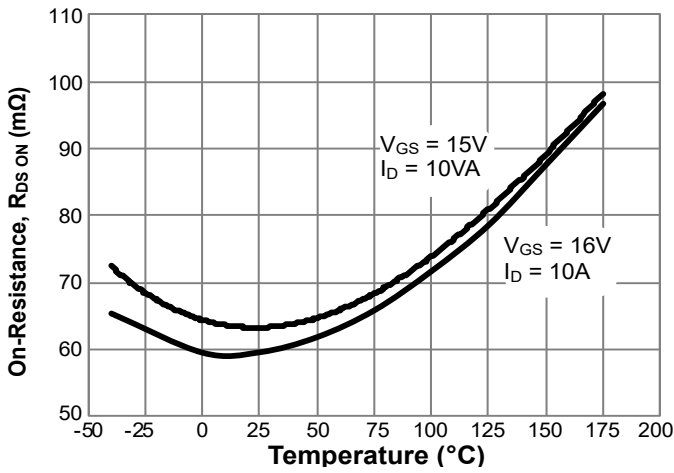


Figure 3. On-Resistance vs. Junction Temperature

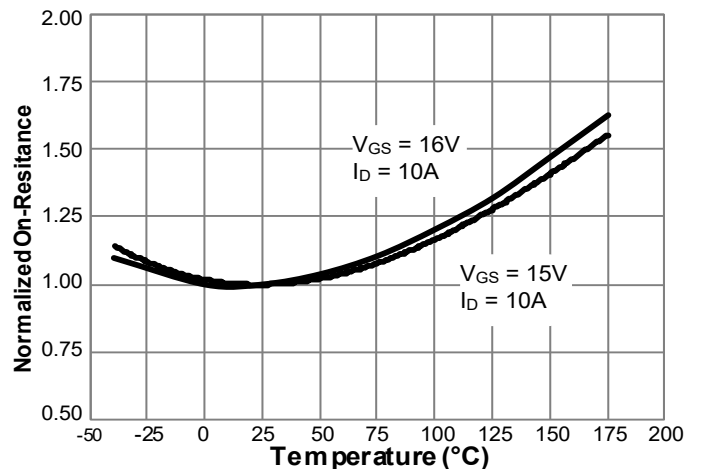


Figure 4. Normalized On-Resistance vs. Junction Temperature

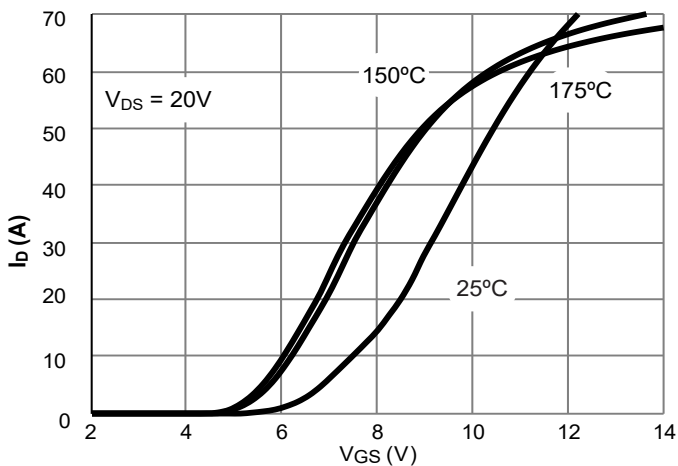


Figure 5. Transfer Characteristics

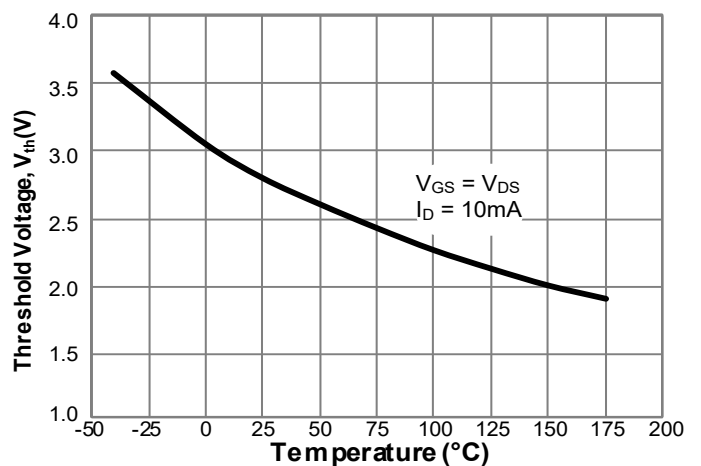


Figure 6. Threshold Voltage vs. Junction Temperature

## Typical Electrical and Thermal Characteristics

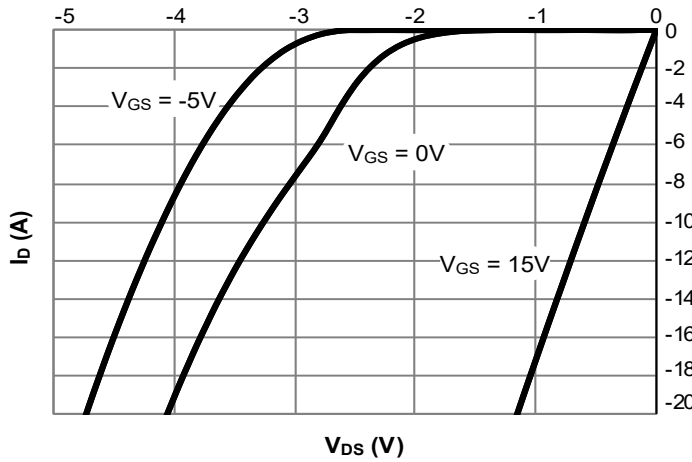


Figure 7. Body-Diode Characteristics at 25°C

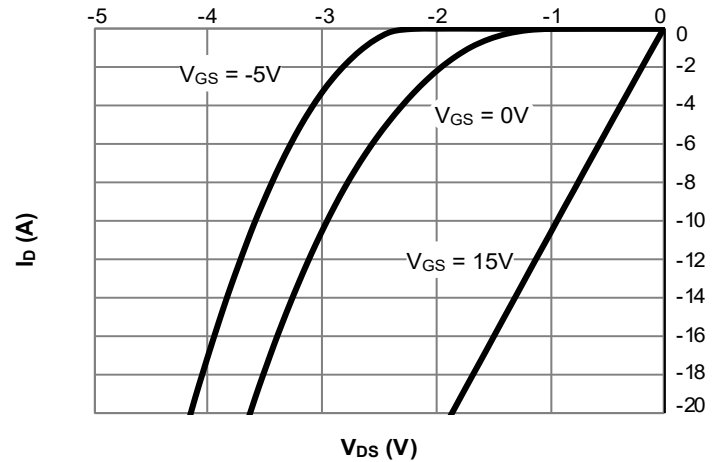


Figure 8. Body-Diode Characteristics at 175°C

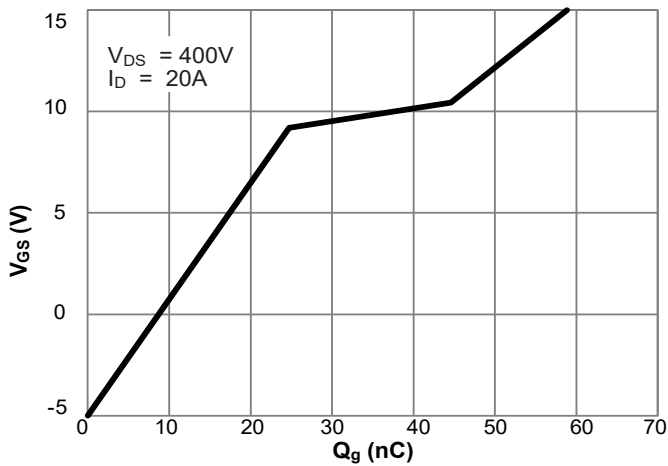


Figure 9. Gate-Charge Characteristics

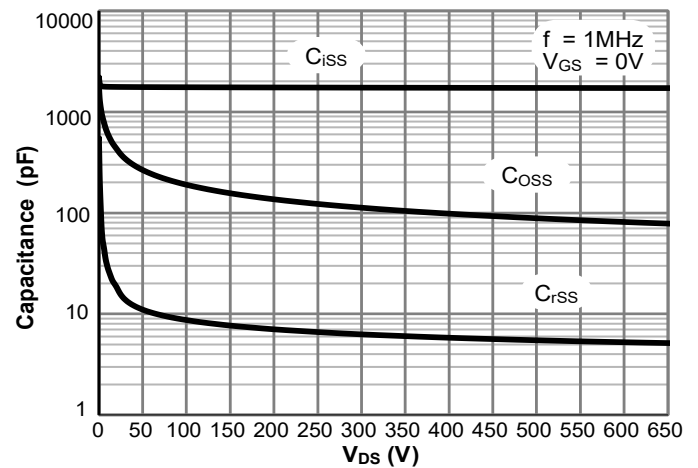


Figure 10. Capacitance Characteristics

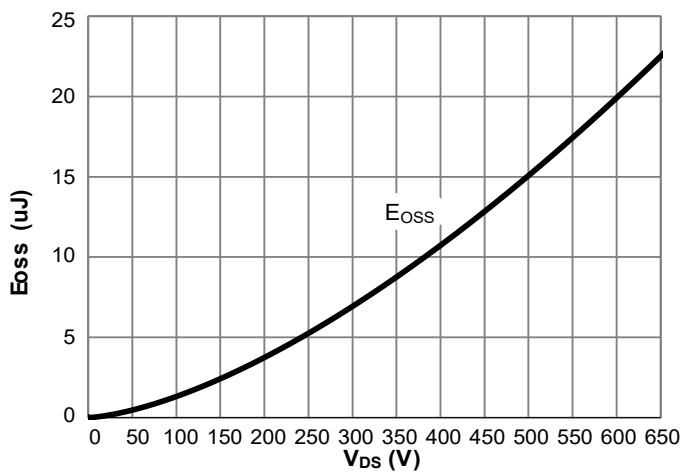


Figure 11. Coss Stored Energy

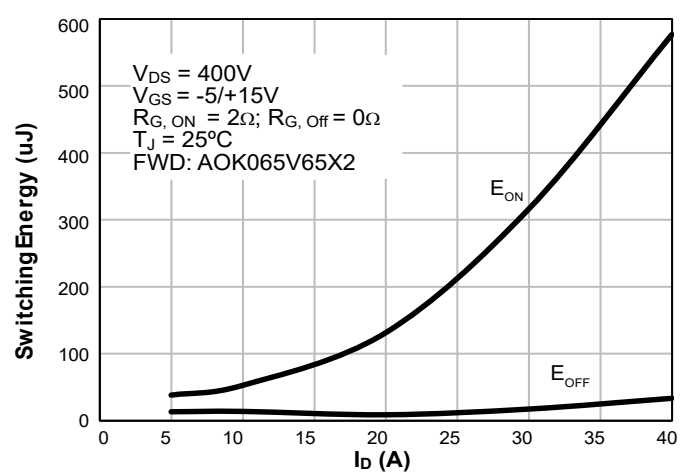


Figure 12. Switching Energy vs. Drain Current

# Typical Electrical and Thermal Characteristics

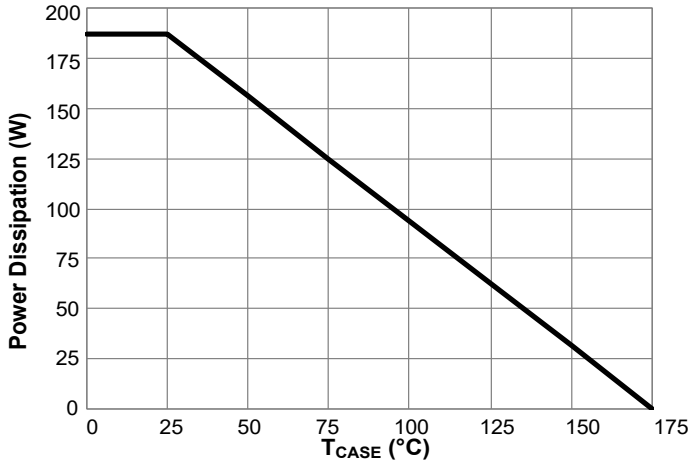


Figure 13. Switching Energy vs. Drain Current

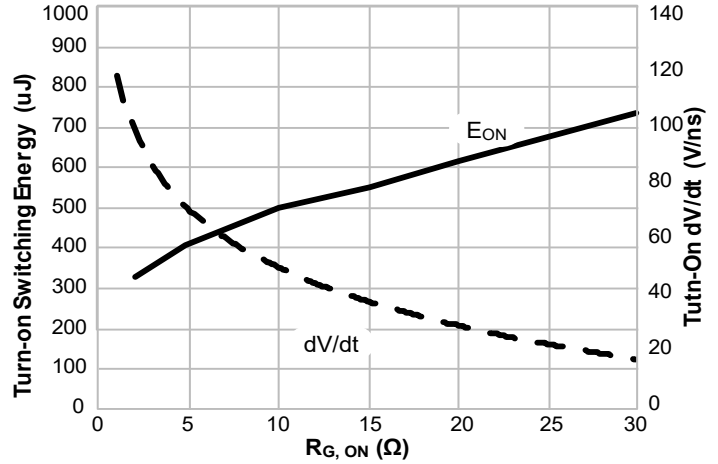


Figure 14. Power De-rating (Note I)

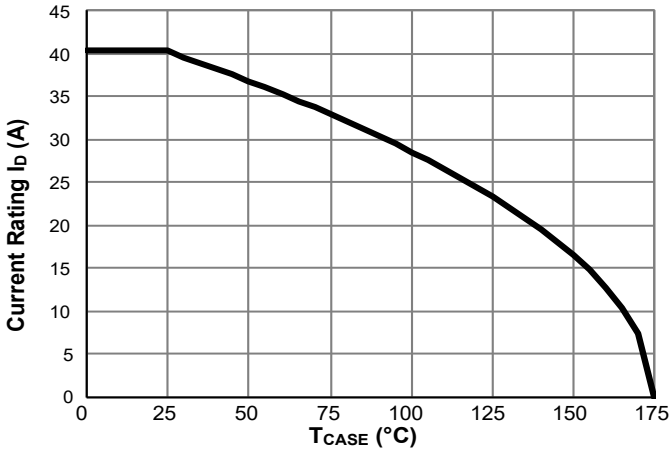


Figure 15. Current De-rating (Note I)

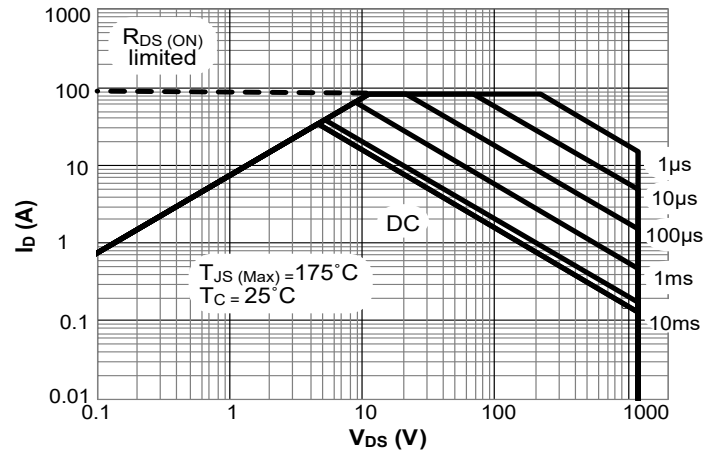


Figure 16. Maximum Forward Biased Safe Operating Area for AOK065V65X2 (Note I)

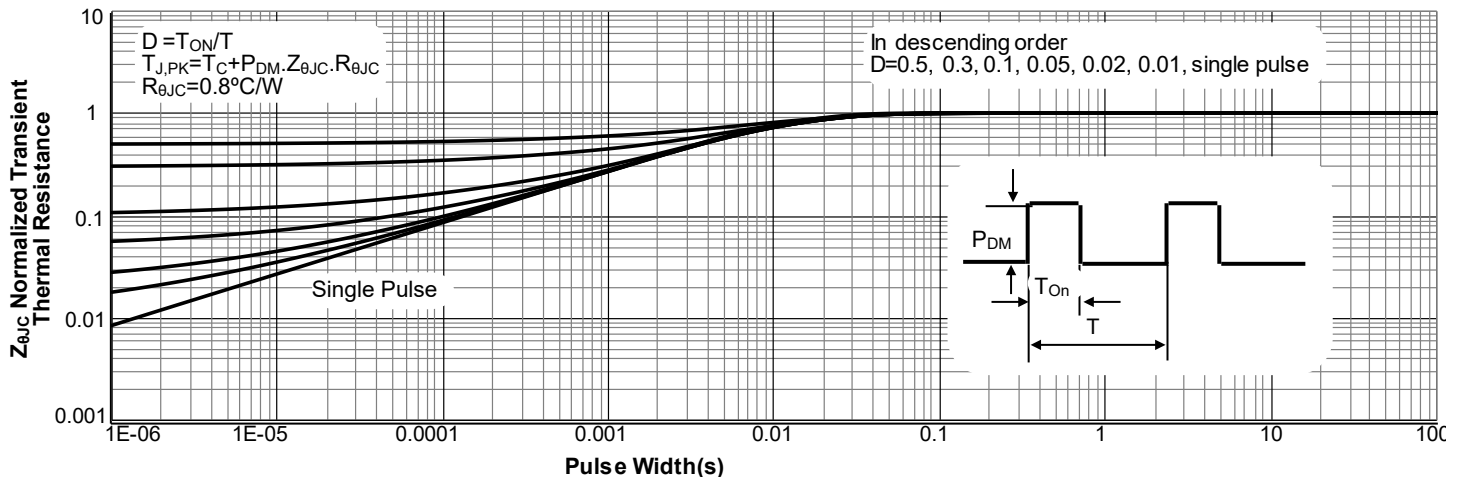
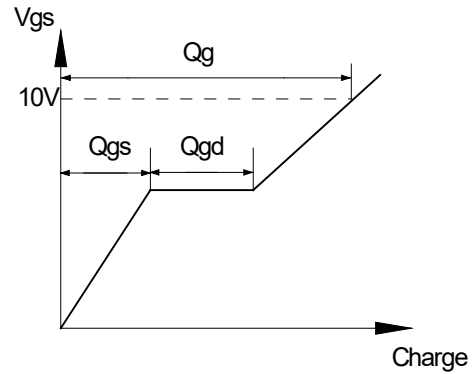
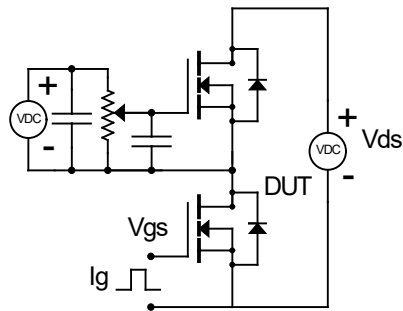


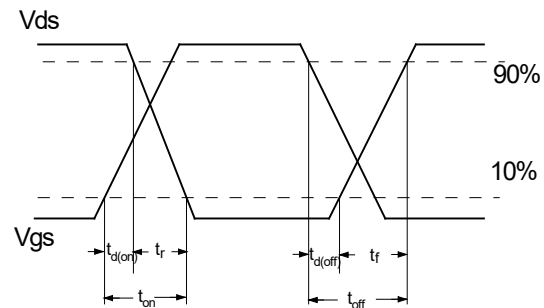
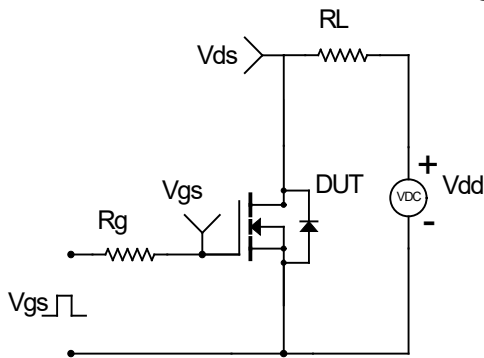
Figure 17. Normalized Maximum Transient Thermal Impedance for AOK065V65X2 (Note I)

## Test Circuits and Waveforms

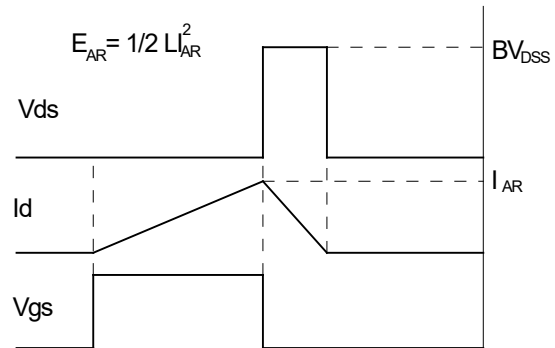
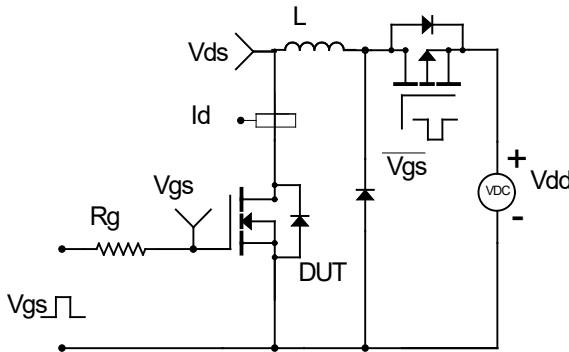
### Gate Charge Test Circuits and Waveforms



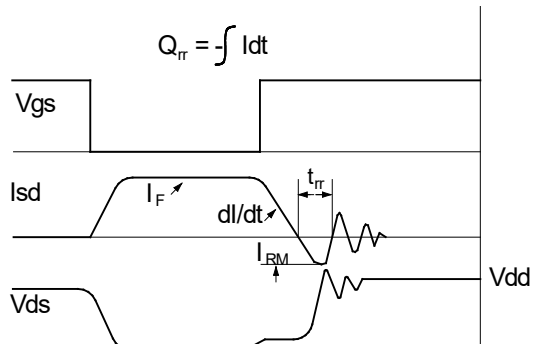
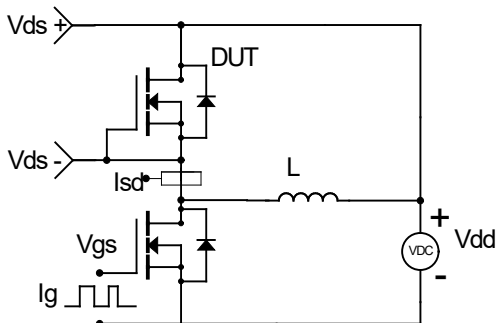
### Resistive Switching Test Circuit and Waveforms



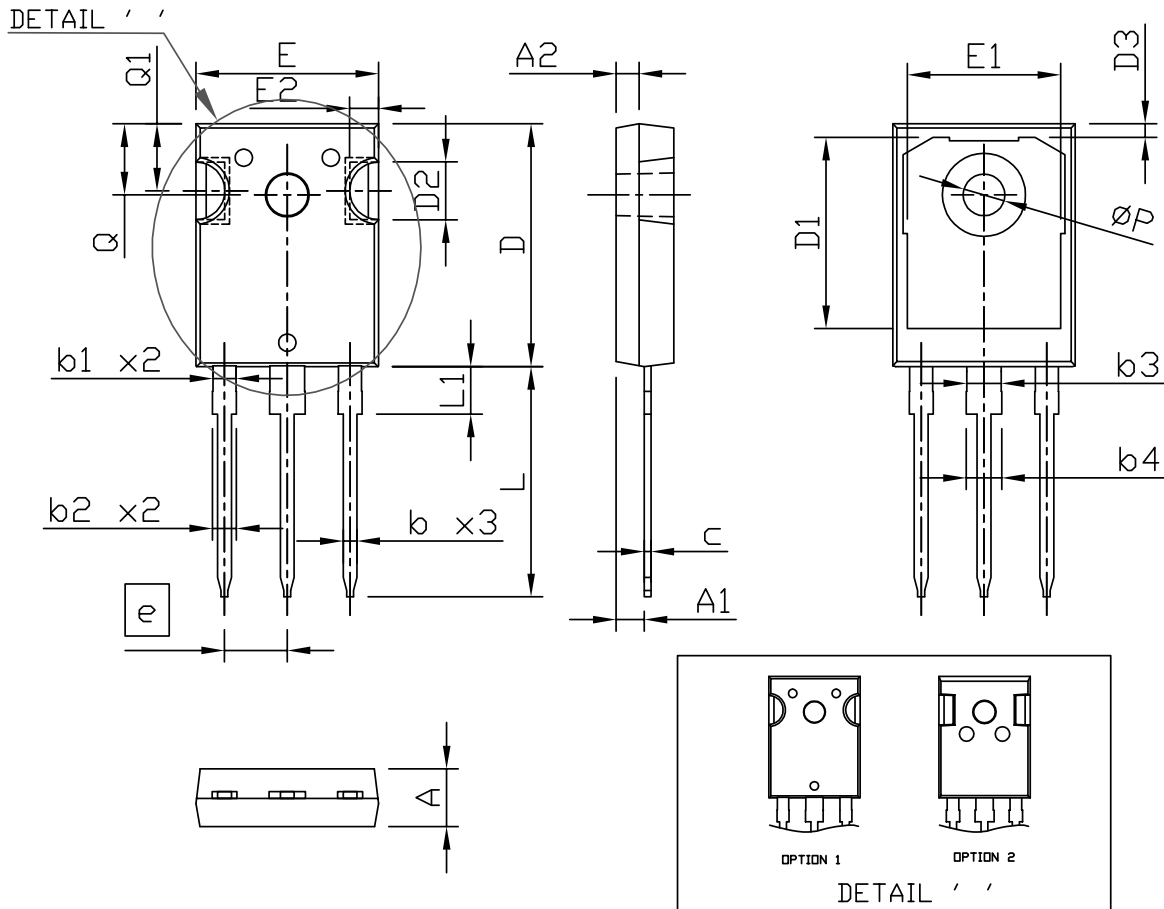
### Unclamped Inductive Switching (UIS) Test Circuit and Waveforms



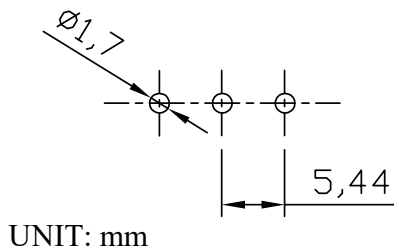
### Gate Charge Test Circuits and Waveforms



### Package Dimensions, TO247-3L



RECOMMENDED LAND PATTERN



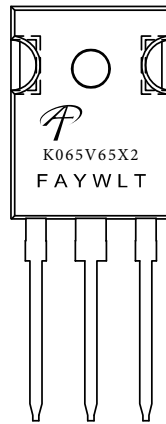
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.90	5.00	5.10	0.193	0.197	0.201
A1	2.31	2.42	2.52	0.091	0.095	0.099
A2	1.90	2.00	2.10	0.075	0.079	0.083
b	1.16	1.22	1.27	0.046	0.048	0.050
b1	1.96	2.02	2.07	0.078	0.080	0.081
b2	2.00	2.10	2.20	0.079	0.083	0.087
b3	2.96	3.02	3.07	0.117	0.119	0.121
b4	3.00	3.10	3.20	0.118	0.122	0.126
c	0.59	0.62	0.66	0.023	0.024	0.026
D	20.90	21.00	21.10	0.823	0.827	0.831
D1	16.25	16.55	16.85	0.640	0.652	0.663
D2	5.00 TYP			0.197 TYP		
D3	1.05	1.20	1.35	0.041	0.047	0.053
e	5.44 BSC			0.214 BSC		
E	15.70	15.80	15.90	0.618	0.622	0.626
E1	13.06	13.26	13.50	0.514	0.522	0.530
E2	2.50 TYP			0.098 TYP		
L	19.72	19.92	20.12	0.776	0.784	0.792
L1	---	---	4.30	---	---	0.169
Q	6.15 BSC			0.242 BSC		
Q1	5.60	5.80	6.00	0.220	0.228	0.236
∅P	3.55	3.60	3.70	0.140	0.142	0.146

**NOTE**

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.  
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
2. CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

## Part Marking

TO-247-3L



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