AOK065V65X2

650V αSiC Silicon Carbide Power MOSFET

Features

- Proprietary αSiC 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 Qrr

Product Summary

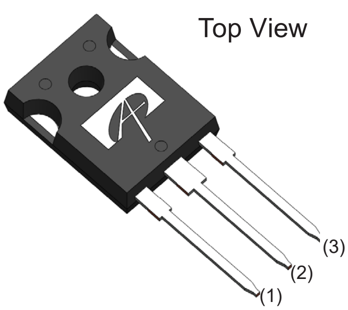
V_{DS} @ $T_{J, max}$	650V
I_{DM}	85A
$R_{DS(ON), typ}$	65mΩ
Q_{rr}	104nC
E_{OSS} @ 400V	11µJ
100% UIS Tested	

Applications

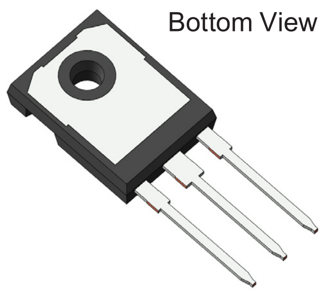
- Renewable
- EV Charger
- Solar Inverters
- Industrial
- UPS
- SMPS
- Motor Drives

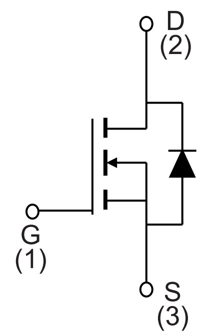
Pin Configuration

Top View



Bottom View





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

Absolute Maximum Ratings

T_A = 25°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
$V_{GS,OP,TRANS}$		Max Transient(A)	-8/+20	
$V_{GS,OP}$		Recommended Operating(B)	-5/+15	
I_D	Continuous Drain Current	T_C = 25°C	40.3	A
		T_C = 100°C	29.6	
I_{DM}	Pulsed Drain Current(C)		85	
E_{AS}	Single Pulsed Avalanche Energy(D)		250	mJ
P_D	Power Dissipation(C)		187.5	W
T_J, T_{STG}	Junction and Storage Temperature Range		-55 to 175	°C
T_L	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

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

Electrical Characteristics

T_A = 25°C, unless otherwise noted

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC							
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	I_D=250µA, V_{GS}=0V, T_J=25°C		650			V
		I_D=250µA, V_{GS}=0V, T_J=150°C			650		V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=650V, V_{GS}=0V				50	µA
I_{GSS}	Gate-Source Leakage Current	V_{DS}=0V, V_{GS}=+15/-5V				±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=10mA		1.8	2.8	3.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=15V, I_D=10A	T_J = 25°C		65	85	mΩ
			T_J= 150°C		90		mΩ
g_{fs}	Forward Transconductance	V_{DS}=20V, I_D=20V			12		S
V_{SD}	Diode Forward Voltage	I_S=10A,V_{GS}=-5V			4.1	5	V
DYNAMIC							
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=400V, f=1MHz			1733		pF
C_{oss}	Output Capacitance				98		pF
C_{rss}	Reverse Transfer Capacitance				5.8		pF
E_{oss}	Coss Stored Energy				11		µJ
R_G	Gate Resistance	f=1MHz		0.9	1.7	2.5	Ω
SWITCHING							
Q_g	Total Gate Charge	V_{GS}=-5/+15V, V_{DS}=400V, I_D=20A			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}=0V/+15V, V_{DS}=400V, I_D=20A, R_G=2.5Ω La = 120µH FWD: AOK065V65X2			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				131.5		µJ
E_{off}	Turn-Off Energy				8.9		µJ
E_{tot}	Total Switching Energy				140.4		µJ
t_{rr}	Body Diode Reverse Recovery Time	I_F=13.2A,dI/dt=1200A/µs, V_{DS}=400V=33ns			33		ns
I_{rm}	Peak Reverse Recovery Current	I_F=13.2A,dI/dt=750A/µs, V_{DS}=400V=6.4A			6.4		A
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=13.2A,dI/dt=750A/µs, V_{DS}=400V=104nC			104		nC

Notes:
A. < 1% duty cycle, f >1Hz
B. Device can be operated at V_{GS}=0/15V. Actual operating V_{GS} 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°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=5mH, I_{AS}=4.3A, R_G=25Ω, Starting T_J=25°C.
E. The value of $R_{\theta JA}$ is measured with the device in a still air environment with T_A =25°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°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°C. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

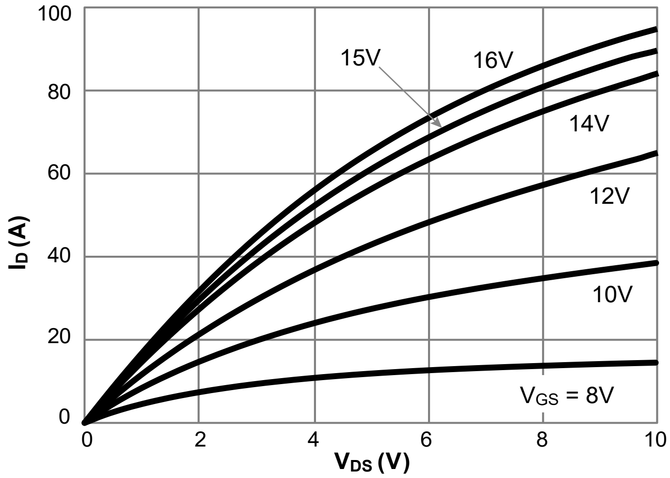


Figure 1. On-Region Characteristics T_J = 25°C

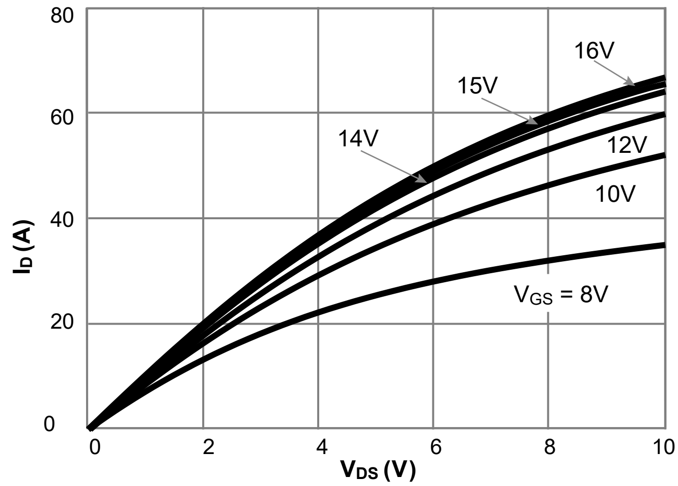


Figure 2. On-Region Characteristics T_J = 175°C

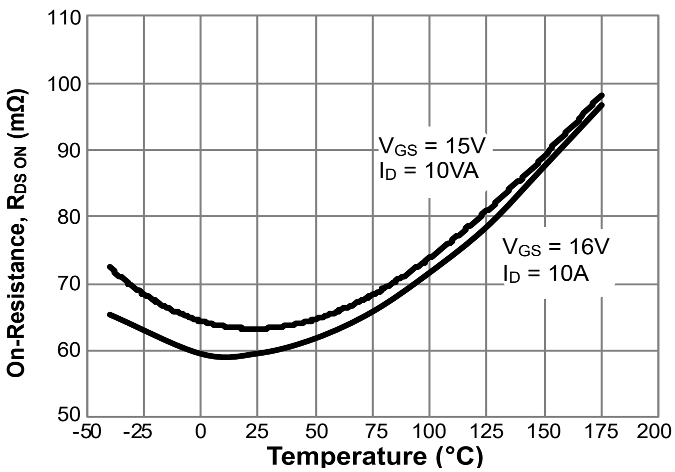


Figure 3. On-Resistance vs. Junction Temperature

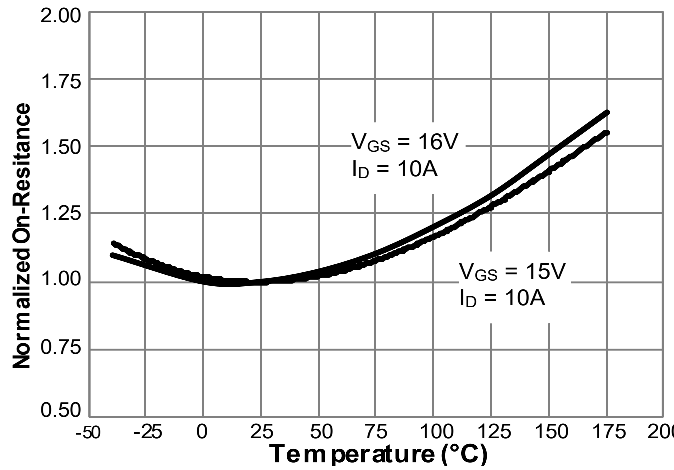


Figure 4. Normalized On-Resistance vs. Junction Temperature

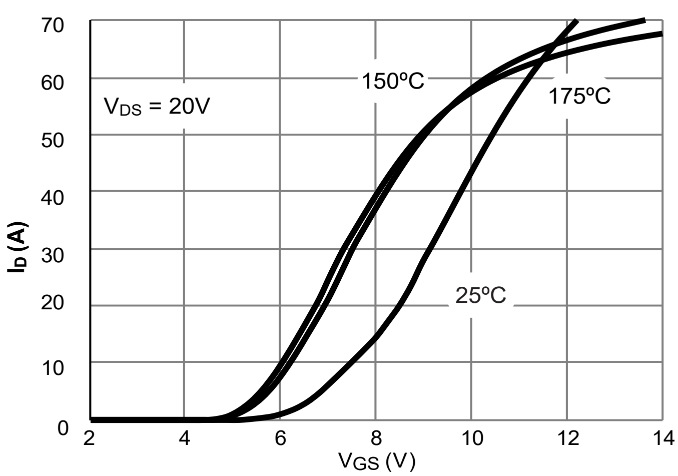


Figure 5. Transfer Characteristics

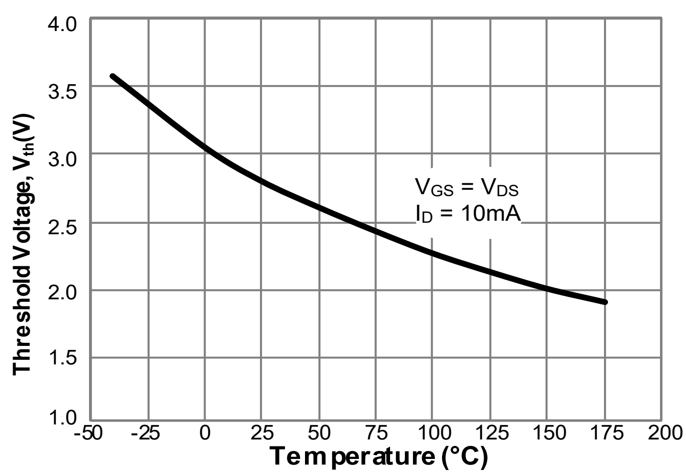


Figure 6. Threshold Voltage vs. Junction Temperature

Typical Electrical and Thermal Characteristics

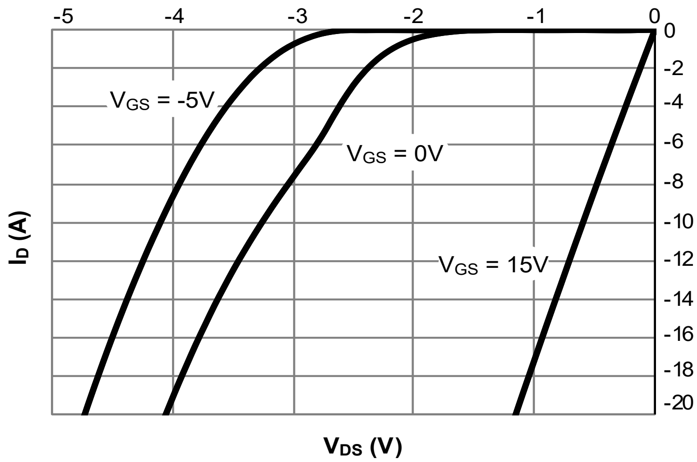


Figure 7. Body-Diode Characteristics at 25°C

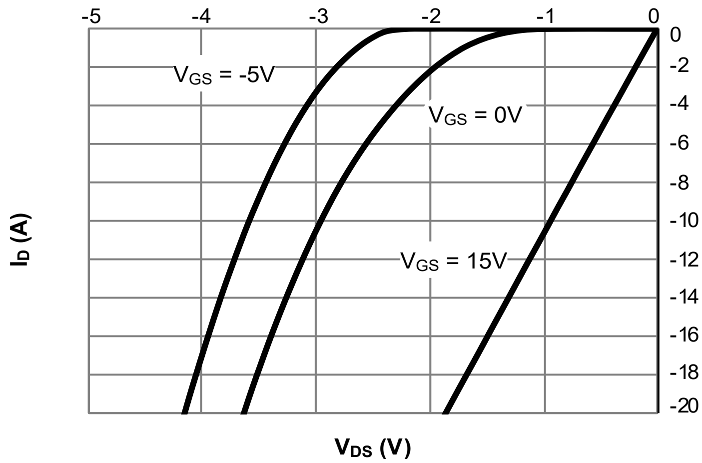


Figure 8. Body-Diode Characteristics at 175°C

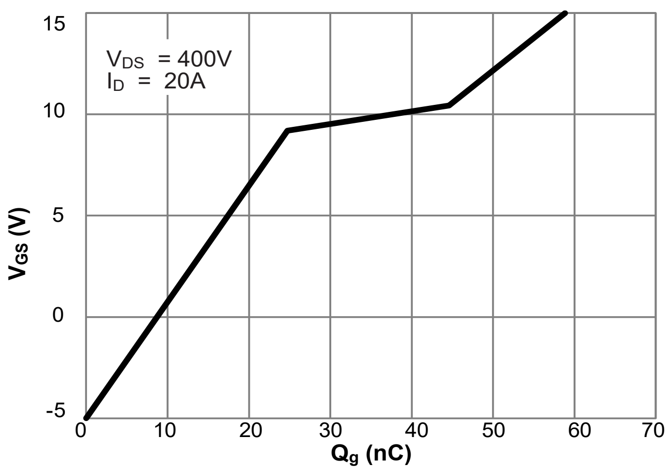


Figure 9. Gate-Charge Characteristics

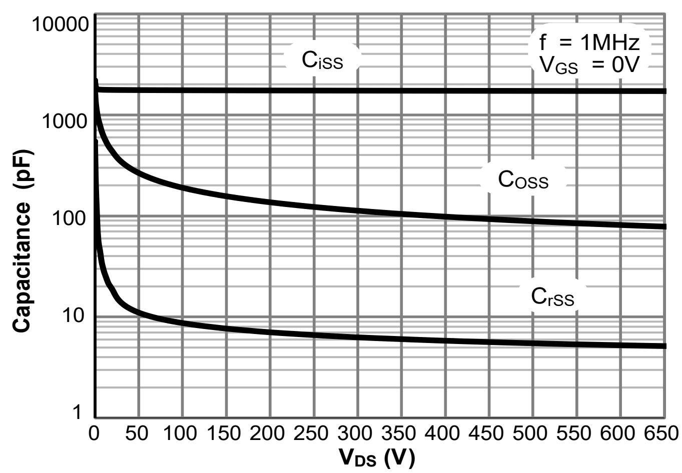


Figure 10. Capacitance Characteristics

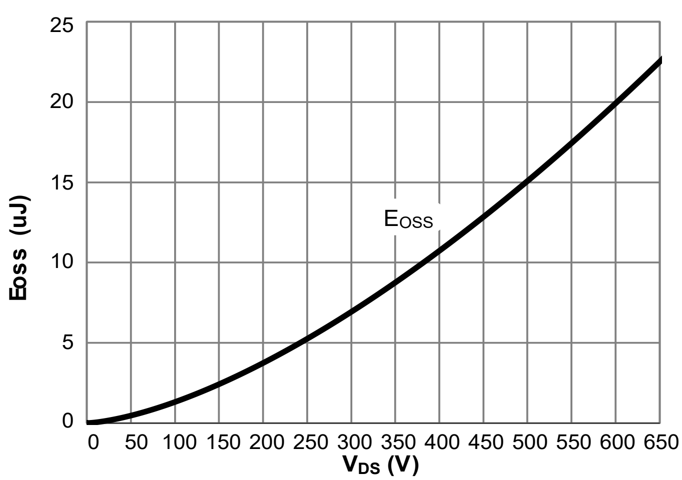


Figure 11. Coss Stored Energy

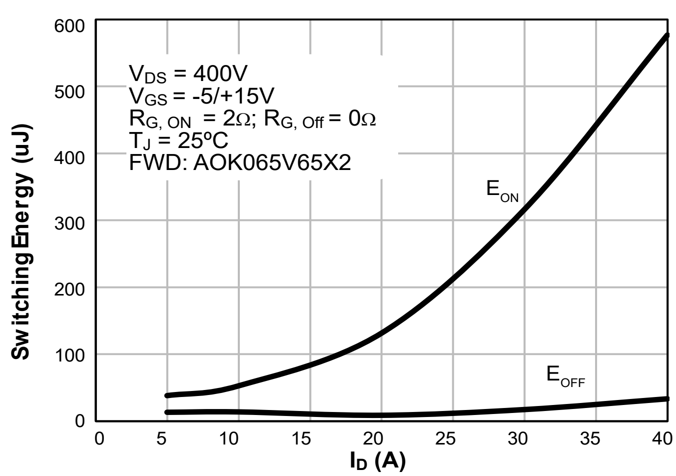


Figure 12. Switching Energy vs. Drain Current

Typical Electrical and Thermal Characteristics

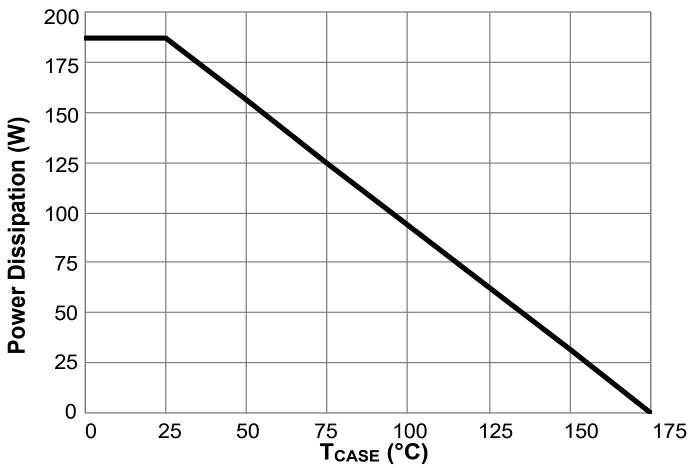


Figure 13. Switching Energy vs. Drain Current

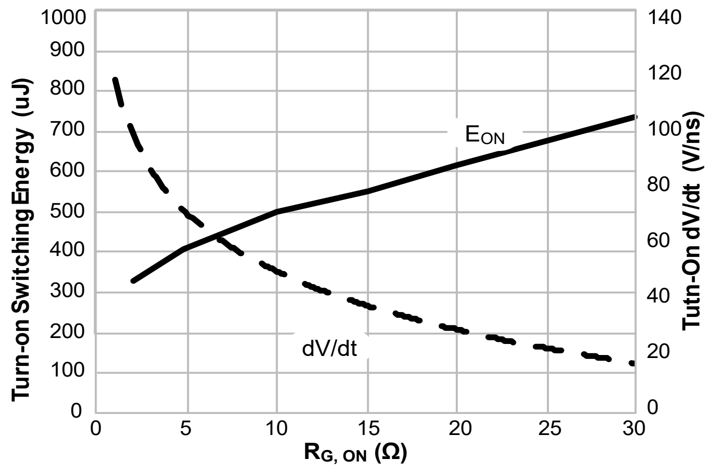


Figure 14. Power De-rating (Note I)

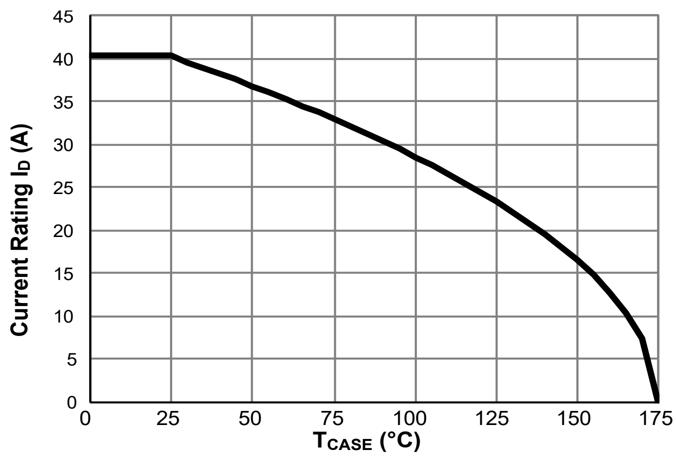


Figure 15. Current De-rating (Note I)

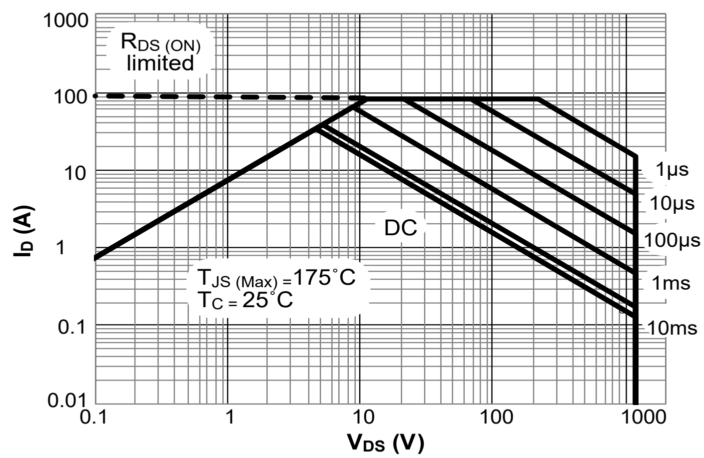


Figure 16. Maximum Forward Biased Safe Operating Area for AOK065V65X2 (Note I)

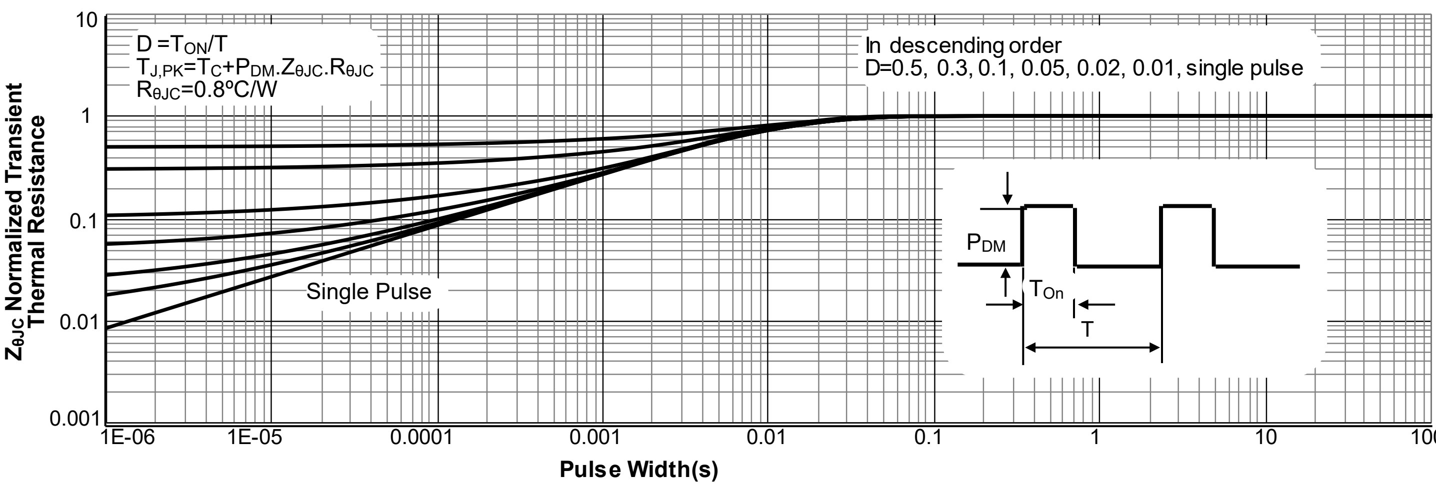


Figure 17. Normalized Maximum Transient Thermal Impedance for AOK065V65X2 (Note I)

Test Circuits and Waveforms

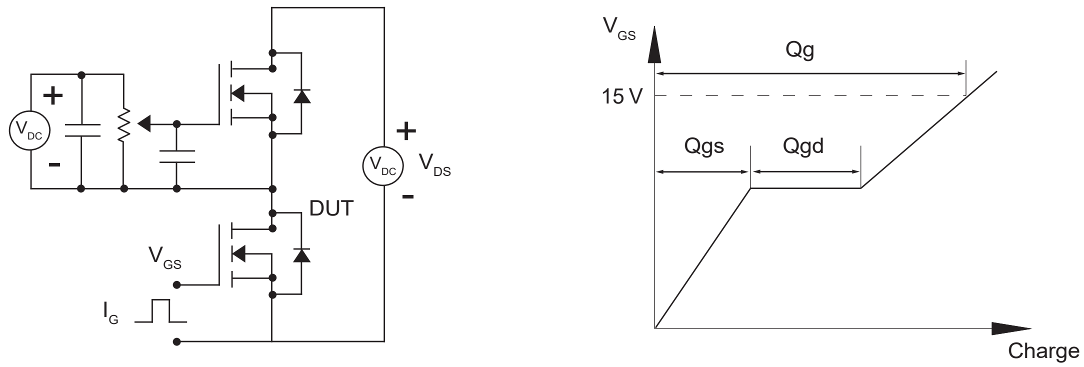


Figure 18. Gate Charge Test Circuits and Waveforms

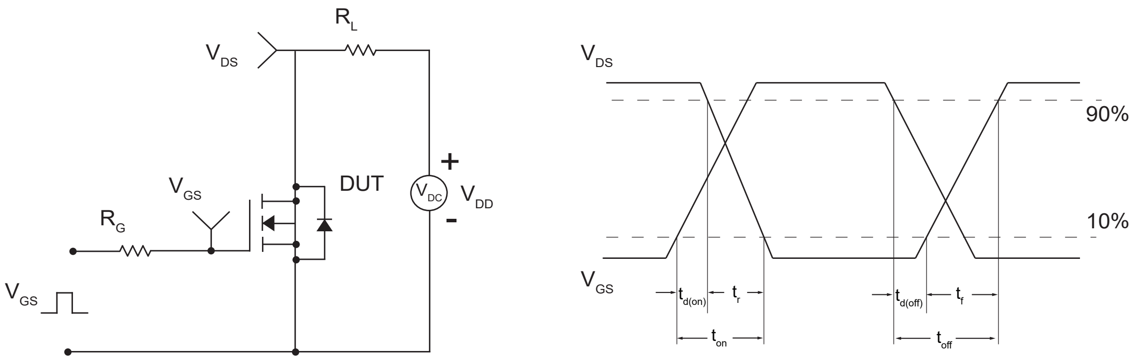


Figure 19. Resistive Switching Test Circuit and Waveforms

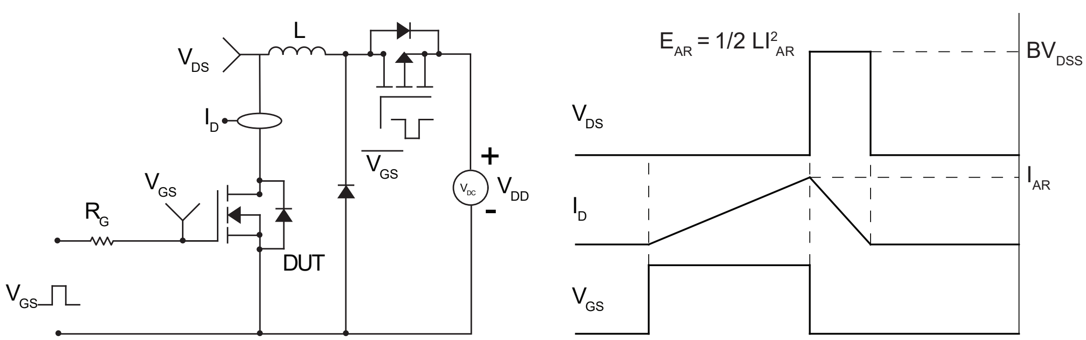


Figure 20. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms

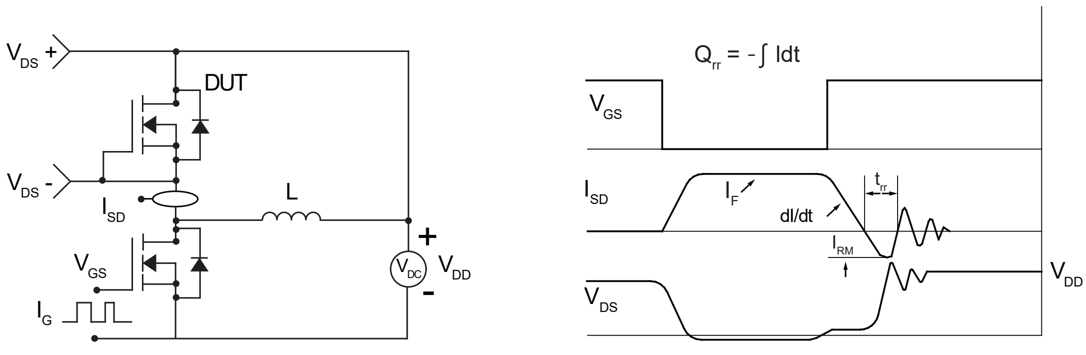
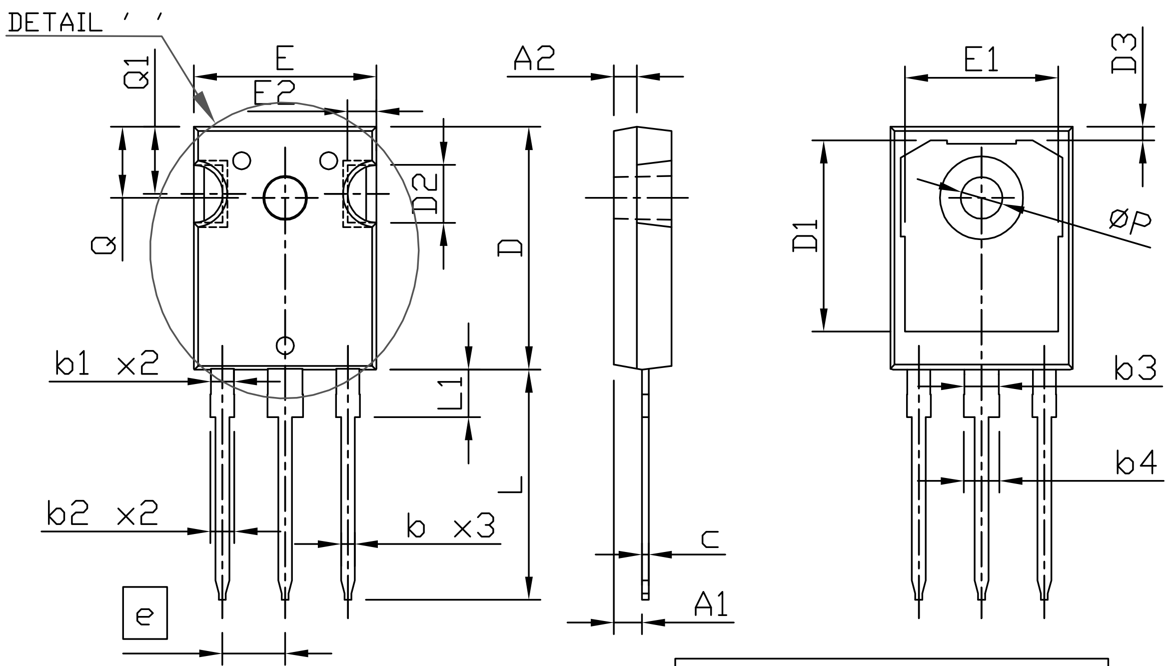
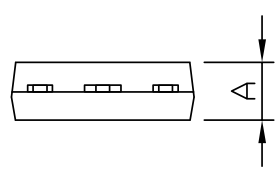
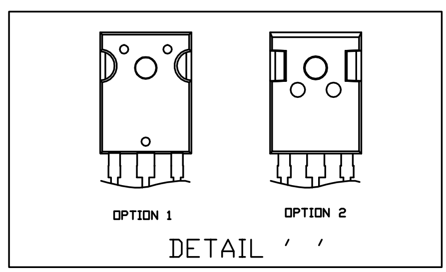


Figure 21. Diode Recovery Test Circuits and Waveforms

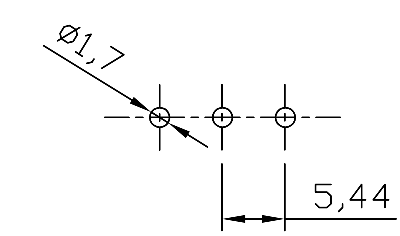
Package Dimensions, TO247-3L







RECOMMENDED LAND PATTERN



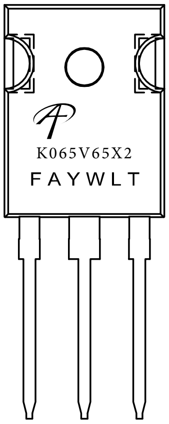
UNIT: mm

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
ØP	3.55	3.60	3.70	0.140	0.142	0.146

NOTE
1. PAKCAGE 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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2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.