

## Features

- Proprietary  $\alpha$ SiC MOSFET technology
- Low loss, with low  $R_{DS, ON}$
- Fast switching with low  $R_G$  and low capacitance
- Optimized gate drive voltage ( $V_{GS} = 15V$ )
- Low reverse recovery diode ( $Q_{rr}$ )

## Applications

### Renewable

- EV Charger
- Solar Inverters

### Industrial

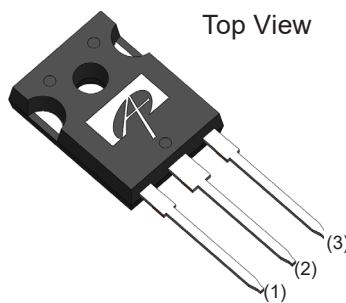
- UPS
- SMPS
- Motor Drives

## Product Summary

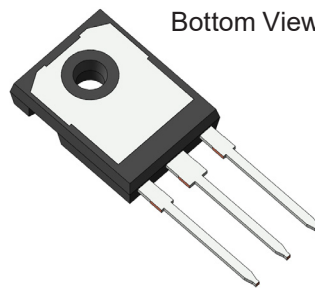
$V_{DS} @ T_{J, max}$	1200V
$I_{DM}$	40A
$R_{DS(ON), typ}$	150m $\Omega$
$Q_{rr}$	87.5nC
$E_{OSS} @ 800V$	18 $\mu$ J
100% UIS Tested	



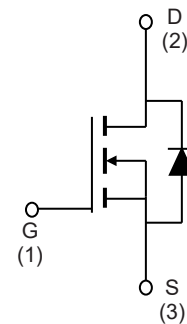
## Pin Configuration



Top View



Bottom View



Ordering Part Number	Package Type	Form	Shipping Quantity
AOK150V120X2	TO-247-3L	Tube	30/Tube

## Absolute Maximum Ratings

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

Symbol	Parameter	AOK150V120X2	Units
$V_{DS}$	Drain-Source Voltage	1200	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	$T_C = 25^\circ C$	20
		$T_C = 100^\circ C$	14
$I_{DM}$	Pulsed Drain Current <sup>(C)</sup>	40	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>(D)</sup>	180	mJ
$P_D$	Power Dissipation <sup>(C)</sup>	$T_C = 25^\circ C$	115
$T_J, T_{STG}$	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	AOK150V120X2	Units
R <sub>θJA</sub>	Maximum Junction-to-Ambient <sup>(E,F)</sup>	40	°C/W
R <sub>θJC</sub>	Maximum Junction-to-Case <sup>(G)</sup>	1.3	°C/W

## Electrical Characteristics

(T<sub>J</sub> = 25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
<b>STATIC PARAMETERS</b>							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C	1200			V	
		I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C		1200			
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 1200V, V <sub>GS</sub> = 0V			100	μA	
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>DS</sub> = 0V, V <sub>GS</sub> = +15/-5V			±100	nA	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 3.9mA	1.8	2.8	3.6	V	
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 15V, I <sub>D</sub> = 3.9A	T <sub>J</sub> = 25°C	150	195	mΩ	
			T <sub>J</sub> = 150°C	210			
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 20V, I <sub>D</sub> = 3.9A		5.7		S	
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> = 3.9A, V <sub>GS</sub> = -5V		4	5	V	
<b>DYNAMIC PARAMETERS</b>							
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 800V, f = 1 MHz		664		pF	
C <sub>oss</sub>	Output Capacitance			42.2		pF	
C <sub>rss</sub>	Reverse Transfer Capacitance			5.2		pF	
E <sub>oss</sub>	C <sub>oss</sub> Stored Energy			18		μJ	
R <sub>G</sub>	Gate Resistance	f = 1 MHz		2.1		Ω	
<b>SWITCHING PARAMETERS</b>							
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> = -5/+15V, V <sub>DS</sub> = 800V, I <sub>D</sub> = 3.9A		28.3		nC	
Q <sub>gs</sub>	Gate Source Charge			8.5		nC	
Q <sub>gd</sub>	Gate Drain Charge			14.1		nC	
t <sub>D(on)</sub>	Turn-On Delay Time	V <sub>GS</sub> = -5V/+15V, V <sub>DS</sub> = 800V, I <sub>D</sub> = 8.5A, R <sub>G,ON</sub> = 2Ω, R <sub>G,OFF</sub> = 0Ω		6.5		ns	
t <sub>r</sub>	Turn-On Rise Time			15.4		ns	
t <sub>D(off)</sub>	Turn-Off Delay Time			8.7		ns	
t <sub>f</sub>	Turn-Off Fall Time			9.3		ns	
E <sub>on</sub>	Turn-On Energy		L = 120 μH		88		μJ
E <sub>off</sub>	Turn-Off Energy		FWD: AOK150V120X2		23		μJ
E <sub>tot</sub>	Total Switching Energy			111		μJ	
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> = 8.5A, dI/dt = 1000A/us, V <sub>DS</sub> = 800V		39.5		ns	
I <sub>rm</sub>	Peak Reverse Recovery Current			4		A	
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge				87.5		nC

### Notes:

- t<sub>pulse</sub> < 1 μs, f > 1 Hz
- Device can be operated at V<sub>GS</sub> = 0/15V. Actual operating VGS will depend on application specifics such as parasitic inductance and dV/dt but should not exceed maximum ratings.
- The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub> = 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.
- L = 5mH, I<sub>AS</sub> = 8.5A, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C.
- The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub> = 25°C.
- The R<sub>θJA</sub> is the sum of the thermal impedance from junction to case R<sub>θJC</sub> and case to ambient.
- The value of R<sub>θJC</sub> is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub> = 175°C.
- The static characteristics in Figures 1 to 8 are obtained using < 300 μs pulses, duty cycle 0.5% max.
- These curves are based on R<sub>θJC</sub> which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J(MAX)</sub> = 175°C. The SOA curve provides a single pulse rating.

## Typical Characteristics and Thermal Characteristics

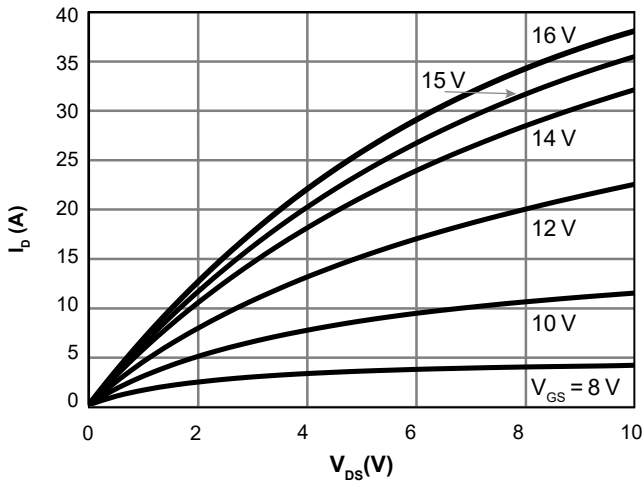


Figure 1. On-Region Characteristics  $T_j = 25^\circ\text{C}$

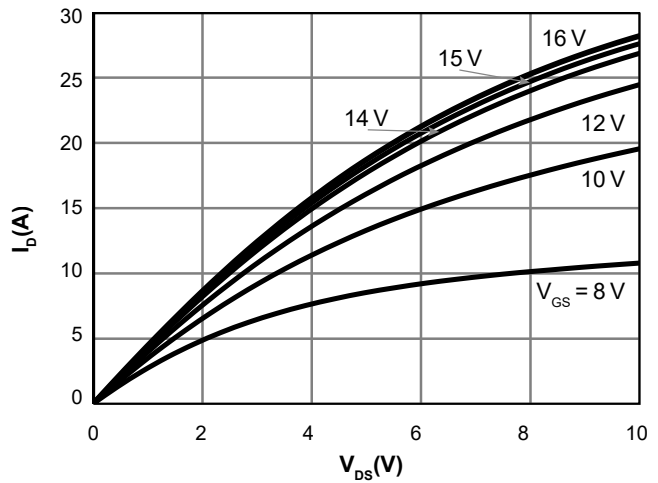


Figure 2. On-Region Characteristics  $T_j = 175^\circ\text{C}$

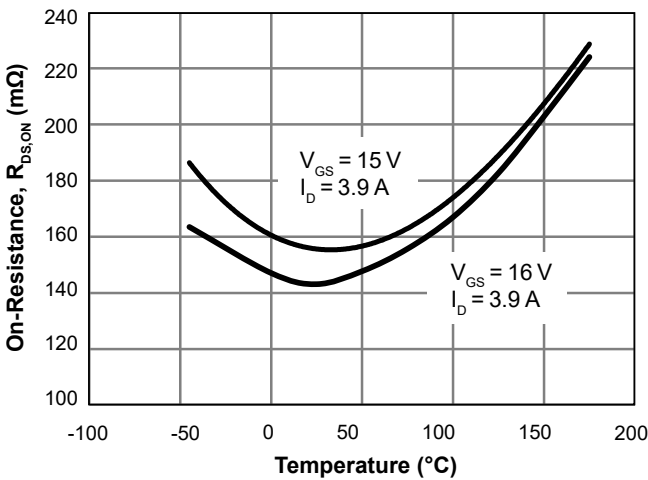


Figure 3. On-Resistance vs. Junction Temperature

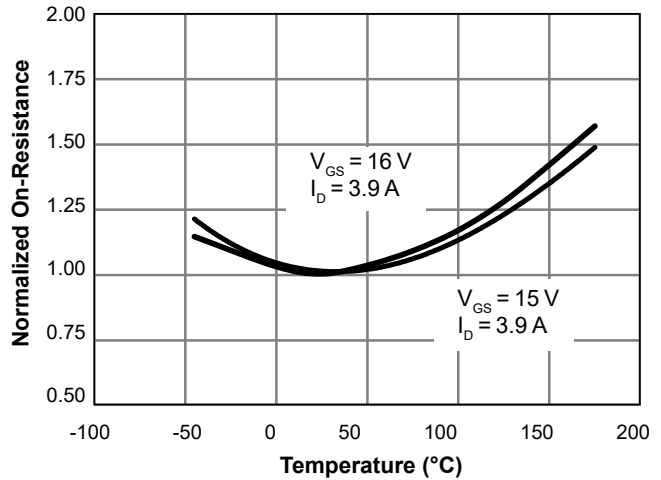


Figure 4. Normalized On-Resistance vs. Junction Temperature

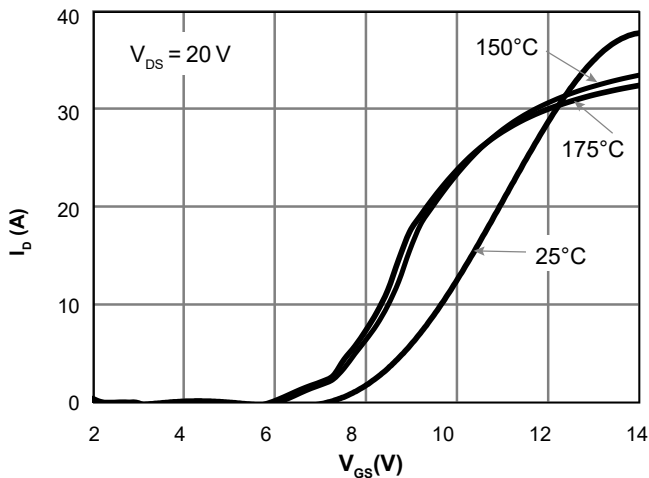


Figure 5. Transfer Characteristics

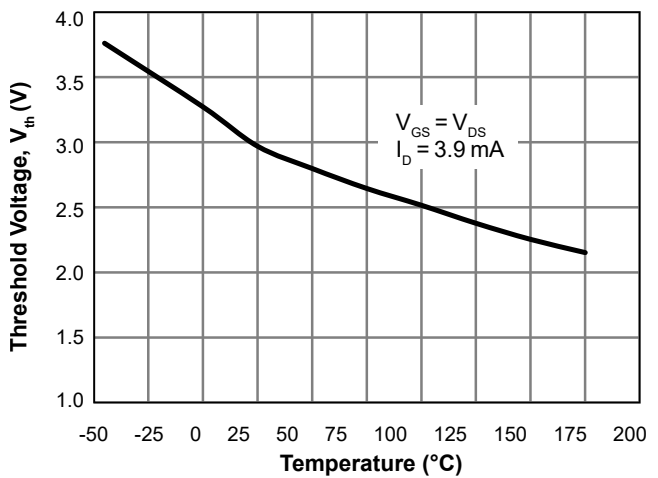


Figure 6. Threshold Voltage vs. Junction Temperature

Typical Characteristics and Thermal Characteristics (Continued)

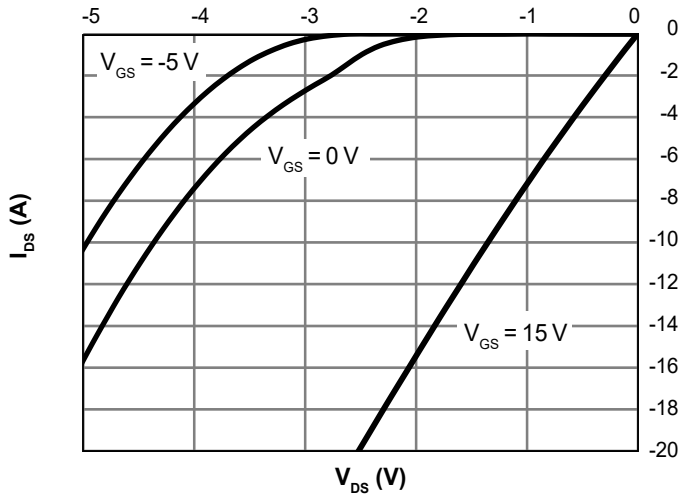


Figure 7. Body-Diode Characteristics at 25°C

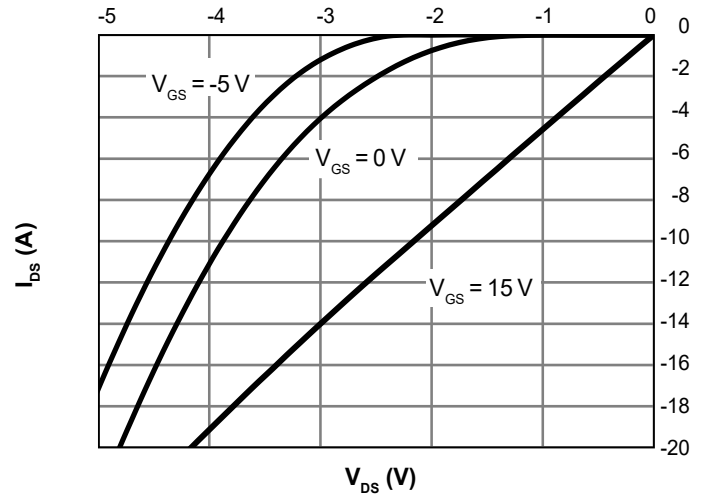


Figure 8. Body-Diode Characteristics at 175°C

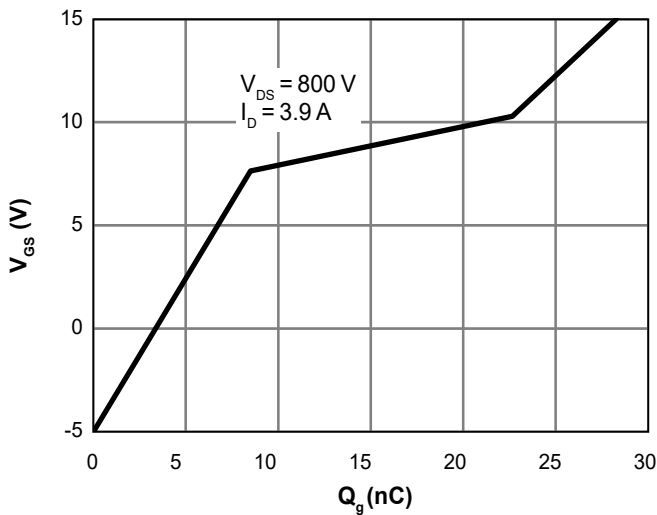


Figure 9. Gate-Charge Characteristics

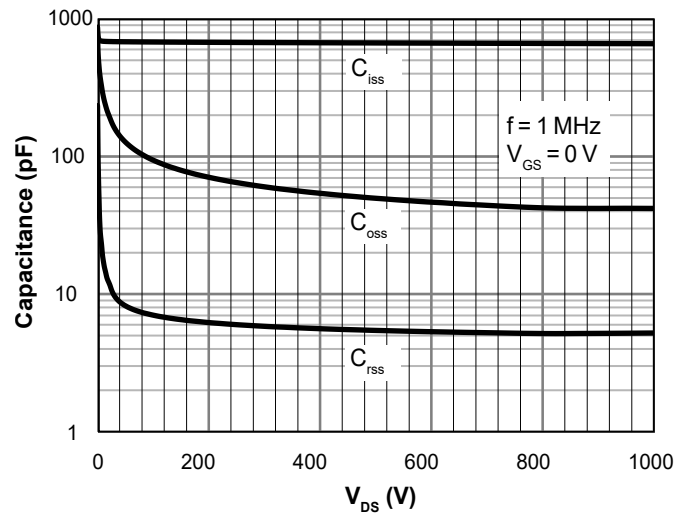


Figure 10. Capacitance Characteristics

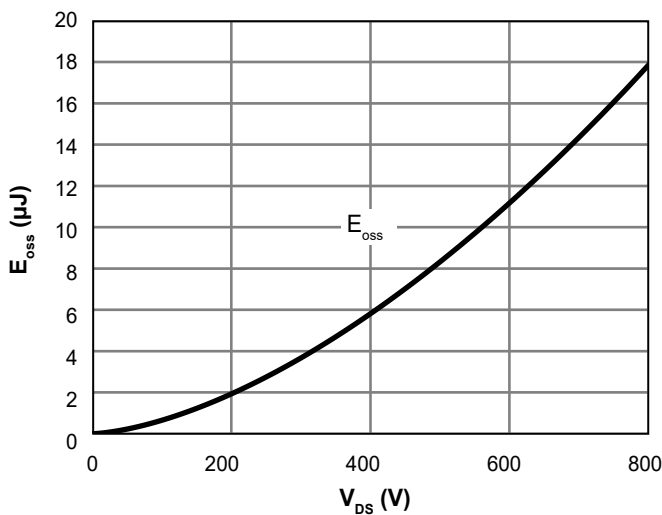


Figure 11.  $C_{OSS}$  Stored Energy

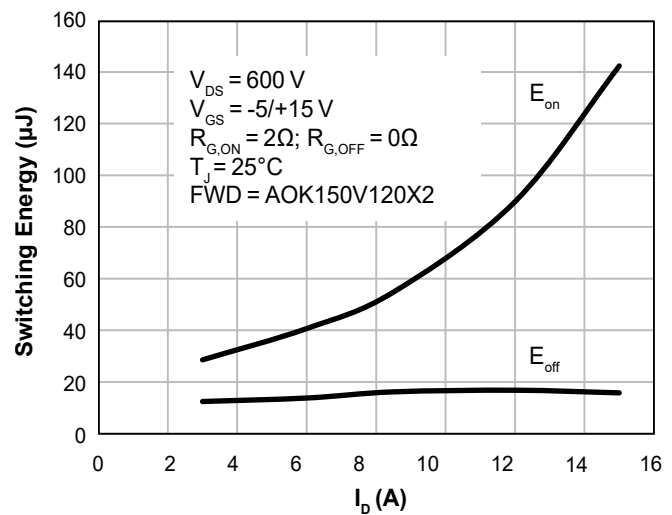


Figure 12. Switching Energy vs. Drain Current

Typical Characteristics and Thermal Characteristics (Continued)

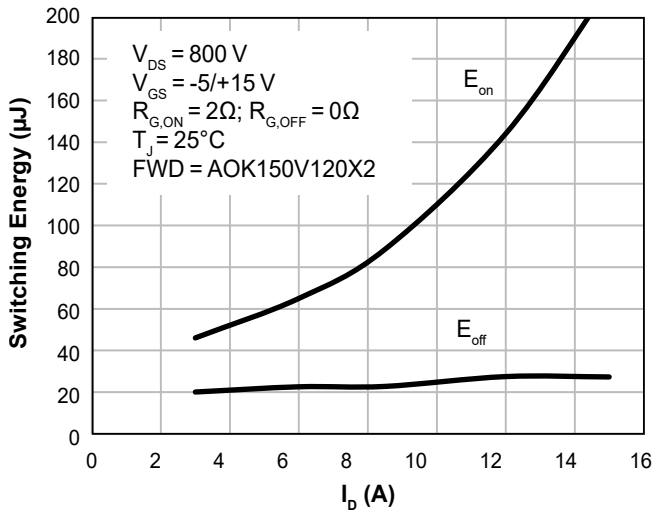


Figure 13. Switching Energy vs. Drain Current

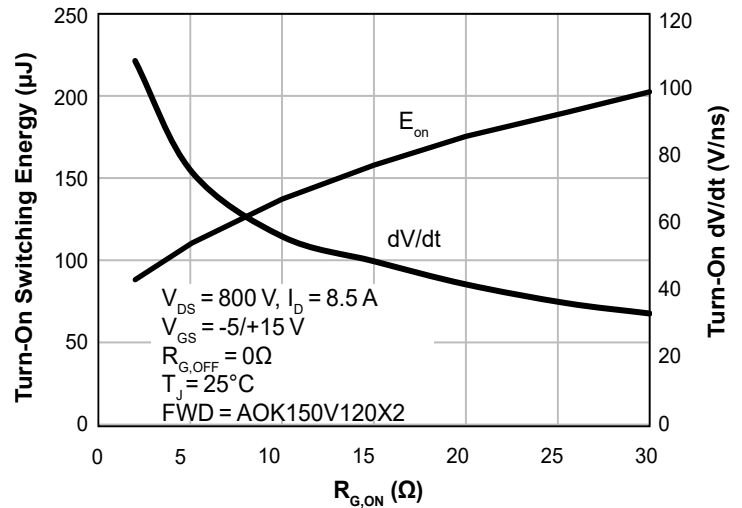


Figure 14. Turn-On Energy and dV/dt vs. External Gate Resistance

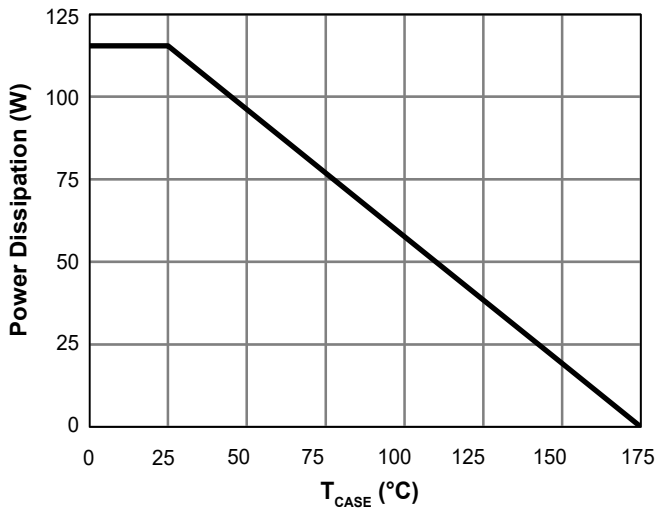


Figure 15. Power De-rating (Note I)

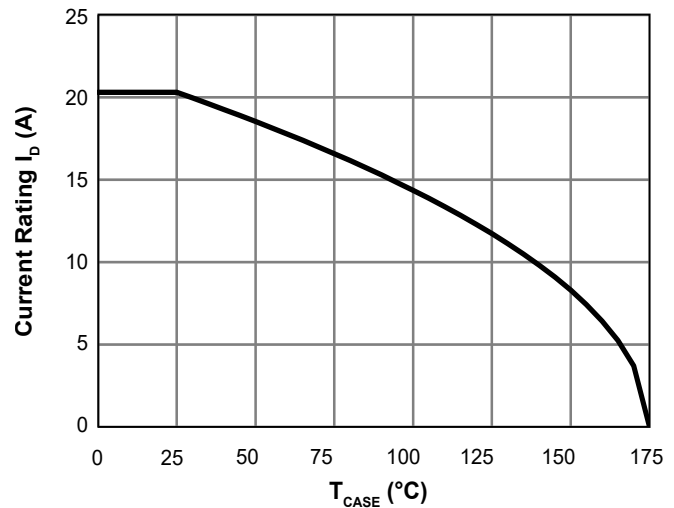


Figure 16. Current De-rating (Note I)

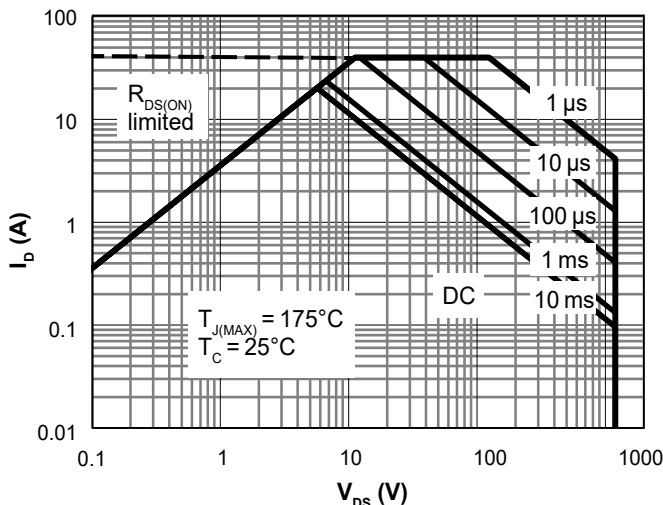


Figure 17. Maximum Forward Biased Safe Operating (Note I)

Typical Characteristics and Thermal Characteristics (Continued)

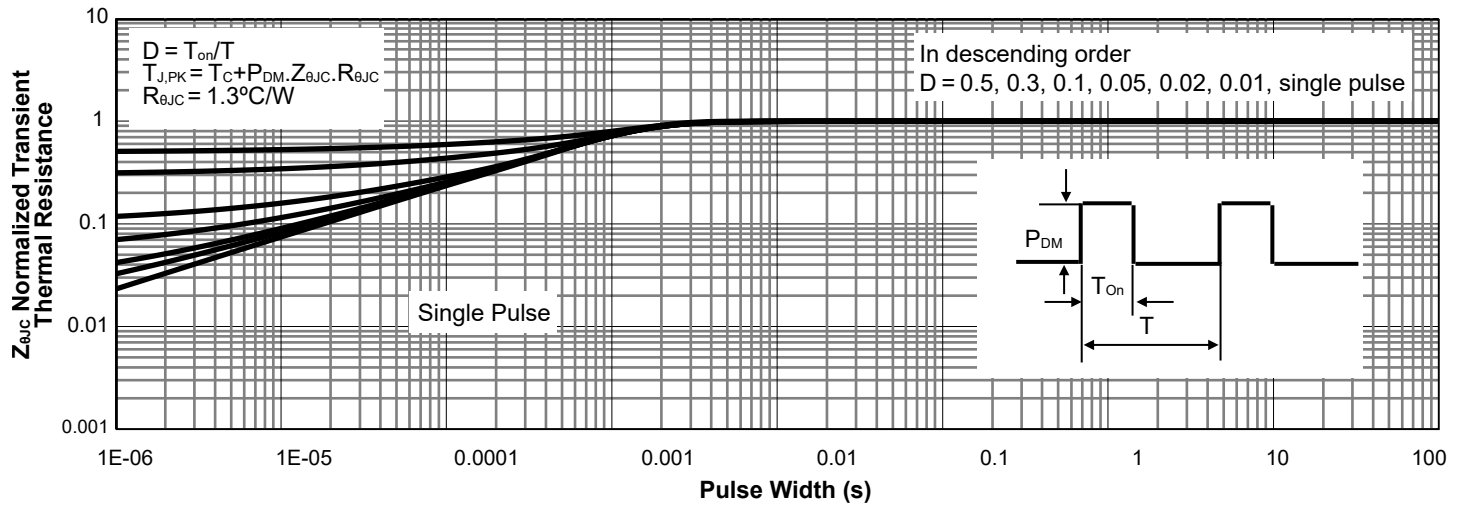


Figure 18. Normalized Maximum Transient Thermal Impedance for AOK150V120X2 (Note I)

## Test Circuits and Waveforms

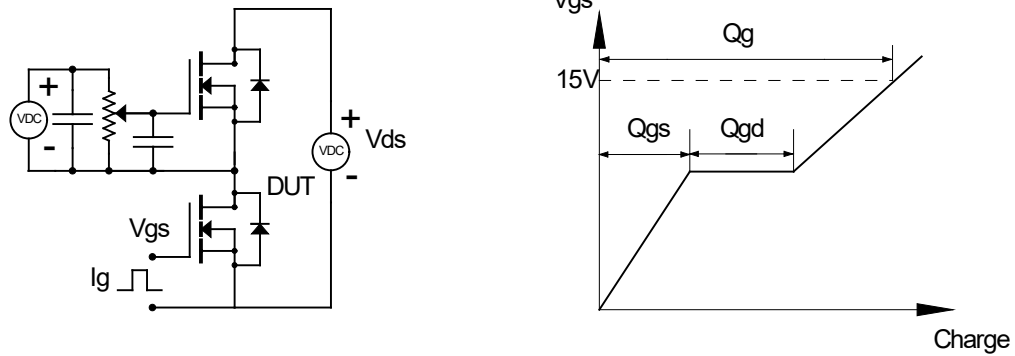


Figure 19. Gate Charge Test Circuits and Waveforms

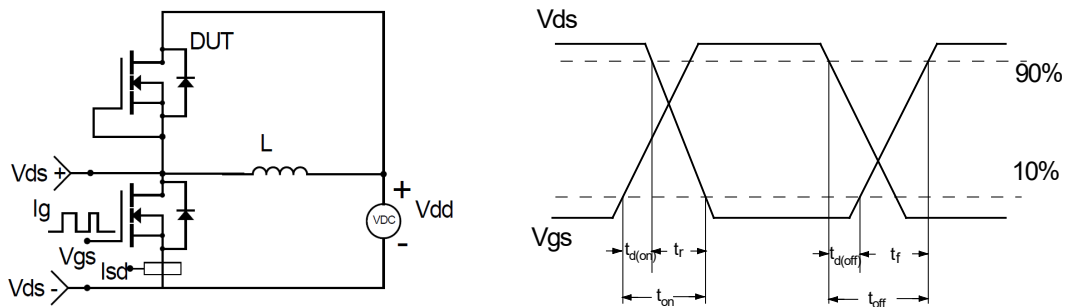


Figure 20. Inductive Switching Test Circuit and Waveforms

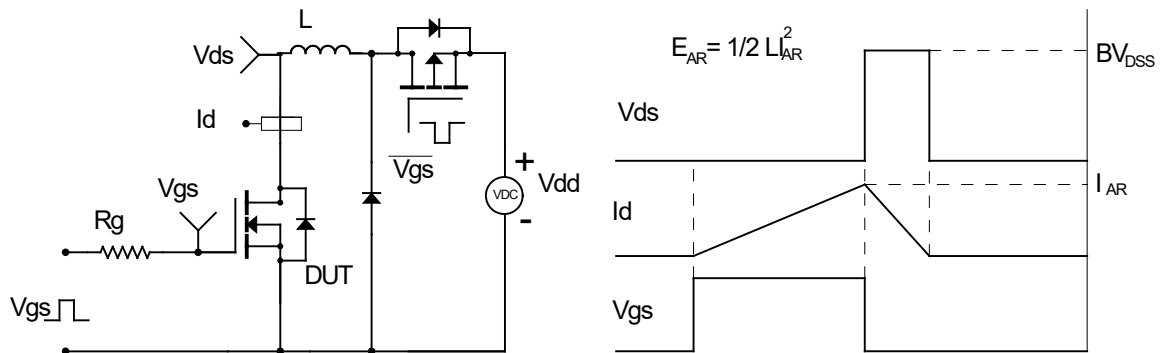


Figure 21. Unclamped Inductive Switching (UIS) Test Circuit and Waveforms

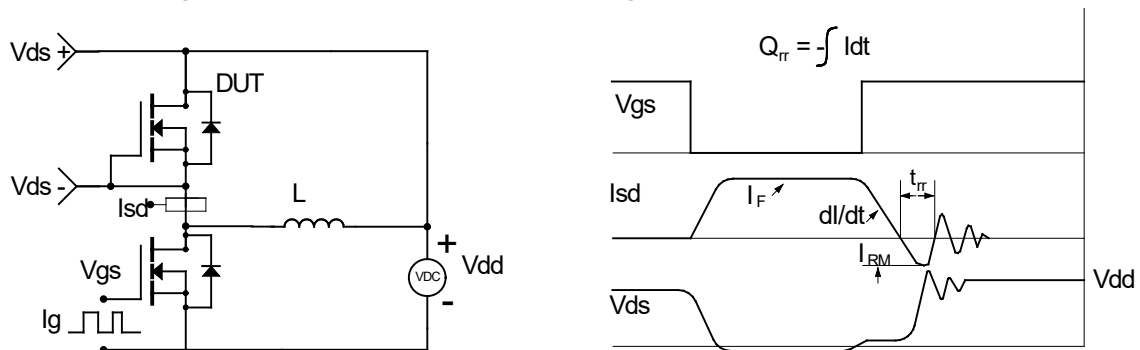
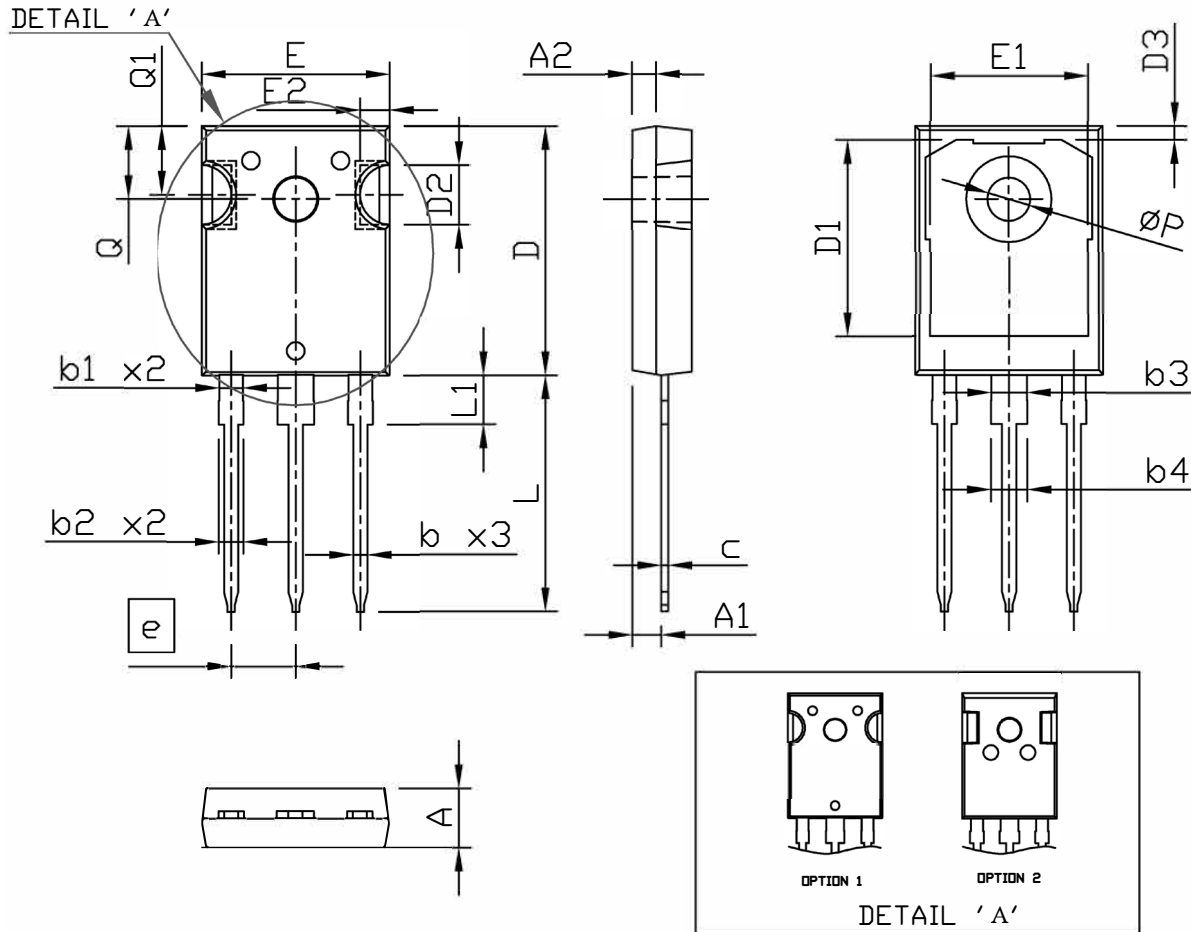
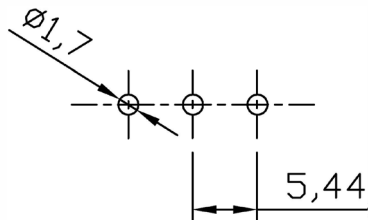


Figure 22. Diode Recovery Test Circuits and Waveforms

Package Dimensions, TO-247-3L



RECOMMENDED LAND PATTERN



UNIT: mm

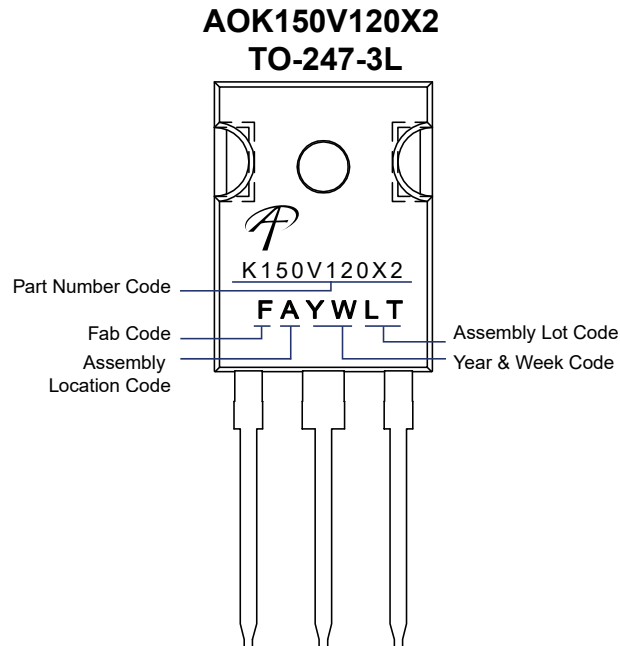
SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.90	5.00	5.10	0.193	0.197	0.201
A1	2.31	2.42	2.52	0.091	0.095	0.099
A2	1.90	2.00	2.10	0.075	0.079	0.083
b	1.16	1.22	1.27	0.046	0.048	0.050
b1	1.96	2.02	2.07	0.078	0.080	0.081
b2	2.00	2.10	2.20	0.079	0.083	0.087
b3	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. 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



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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.