ALPHA & OMEGA SEMICONDUCTOR

AOK160A60
600V, αMOS5™ N-Channel Power Transistor

General Description

- Proprietary αMOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

Applications

- SMPS with PFC, Flyback and LLC topologies
- Micro inverter with DC/AC inverter topology

Product Summary

V_{DS} @ $T_{j,max}$	700V
I_{DM}	96A
$R_{DS(ON),max}$	< 0.16Ω
$Q_{g,typ}$	46nC
E_{oss} @ 400V	4.9µJ

100% UIS Tested
100% R_g Tested

RoHS Compliant

Top View
TO-247
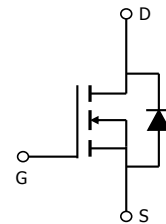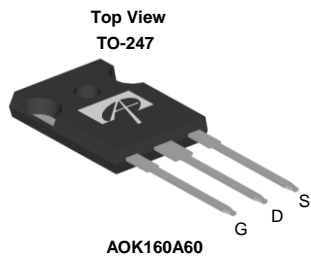
AOK160A60

Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK160A60	TO247	Tube	240

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOK160A60	Units
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current	T_C=25°C	I_D	24	A
	T_C=100°C		15	
Pulsed Drain Current [C]		I_{DM}	96	
Avalanche Current [C]		I_{AR}	6	A
Repetitive avalanche energy [C]		E_{AR}	18	mJ
Single pulsed avalanche energy [G]		E_{AS}	172	mJ
MOSFET dv/dt ruggedness		dv/dt	100	V/ns
Peak diode recovery dv/dt			20	
Power Dissipation [B]	T_C=25°C	P_D	250	W
	Derate above 25°C		2.0	W/°C
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300	°C

Thermal Characteristics

Parameter	Symbol	AOK160A60	Units
Maximum Junction-to-Ambient [A,D]	$R_{\theta JA}$	40	°C/W
Maximum Case-to-sink [A]	$R_{\theta CS}$	0.5	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	0.5	°C/W

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Electrical Characteristics (T$_J$=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV$_{DSS}$	Drain-Source Breakdown Voltage	I$_D$=250μA, V$_{GS}$=0V, T$_J$=25°C	600			V
		I$_D$=250μA, V$_{GS}$=0V, T$_J$=150°C		700		
BV$_{DSS}$/ΔTJ	Breakdown Voltage Temperature Coefficient	I$_D$=250μA, V$_{GS}$=0V		0.53		V/^{o}C
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=600V, V$_{GS}$=0V			1	μA
		V$_{DS}$=480V, T$_J$=125°C			10	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$=±20V			±100	nA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=5V, I$_D$=250μA		3		V
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=12A		0.14	0.16	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$=10V, I$_D$=12A		20		S
V$_{SD}$	Diode Forward Voltage	I$_S$=12A,V$_{GS}$=0V		0.87	1.2	V
I$_S$	Maximum Body-Diode Continuous Current				24	A
I$_{SM}$	Maximum Body-Diode Pulsed Current ^{C}				96	A
DYNAMIC PARAMETERS						
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=100V, f=1MHz		2340		pF
C$_{oss}$	Output Capacitance			62		pF
C$_{o(er)}$	Effective output capacitance, energy related ^{H}	V$_{GS}$=0V, V$_{DS}$=0 to 480V, f=1MHz		56		pF
C$_{o(tr)}$	Effective output capacitance, time related ^{I}			233		pF
C$_{rss}$	Reverse Transfer Capacitance	V$_{GS}$=0V, V$_{DS}$=100V, f=1MHz		1.3		pF
R$_g$	Gate resistance	f=1MHz		5.4		Ω
SWITCHING PARAMETERS						
Q$_g$	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=480V, I$_D$=12A		46		nC
Q$_{gs}$	Gate Source Charge			17		nC
Q$_{gd}$	Gate Drain Charge			14		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=400V, I$_D$=12A, R$_G$=5Ω		34		ns
t$_r$	Turn-On Rise Time			29		ns
t$_{D(off)}$	Turn-Off DelayTime			63		ns
t$_f$	Turn-Off Fall Time			19		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=12A, dI/dt=100A/μs, V$_{DS}$=400V		387		ns
I$_{rm}$	Peak Reverse Recovery Current			30		A
Q$_{rr}$	Body Diode Reverse Recovery Charge			7.3		μC

A. The value of R$_{θJA}$ is measured with the device in a still air environment with T$_A$=25° C.

B. The power dissipation P$_D$ is based on T$_{J(MAX)}$=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C. Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=150° C, Ratings are based on low frequency and duty cycles to keep initial T$_J$ =25° C.

D. The R$_{θJA}$ is the sum of the thermal impedance from junction to case R$_{θJC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
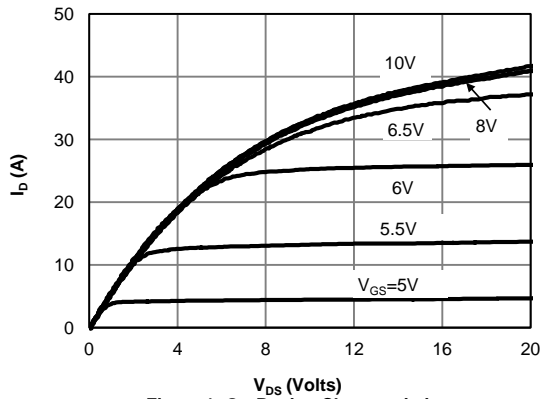
G. L=60mH, I$_{AS}$=2.4A, R$_G$=25Ω, Starting T$_J$=25° C.

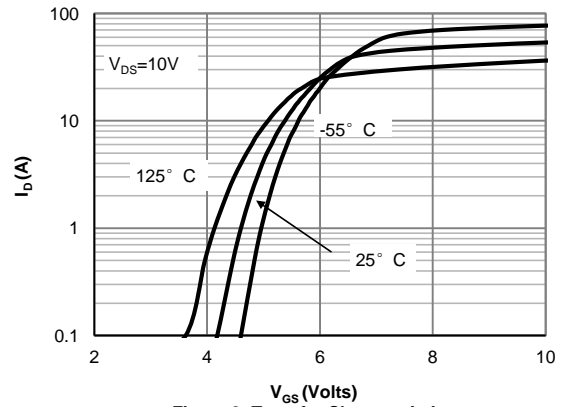H. C$_{o(er)}$ is a fixed capacitance that gives the same stored energy as C$_{oss}$ while V$_{DS}$ is rising from 0 to 80% V$_{(BR)DSS}$.

I. C$_{o(tr)}$ is a fixed capacitance that gives the same charging time as C$_{oss}$ while V$_{DS}$ is rising from 0 to 80% V$_{(BR)DSS}$.
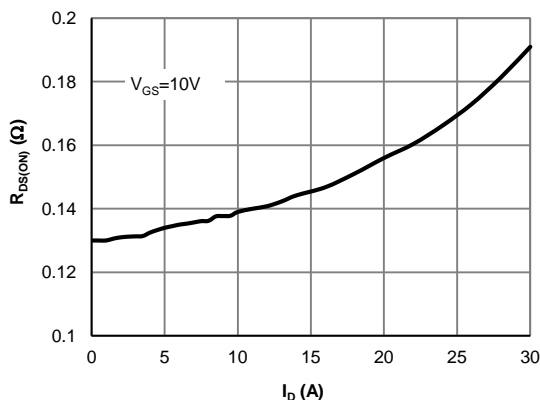
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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

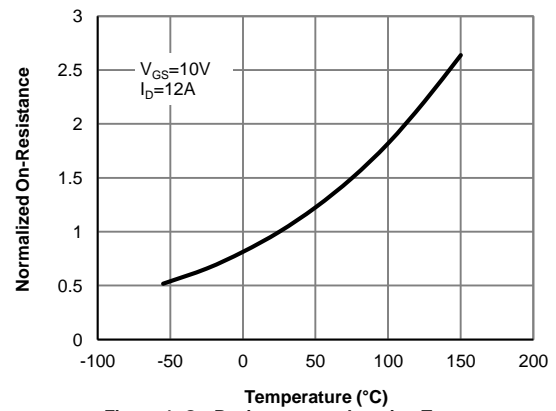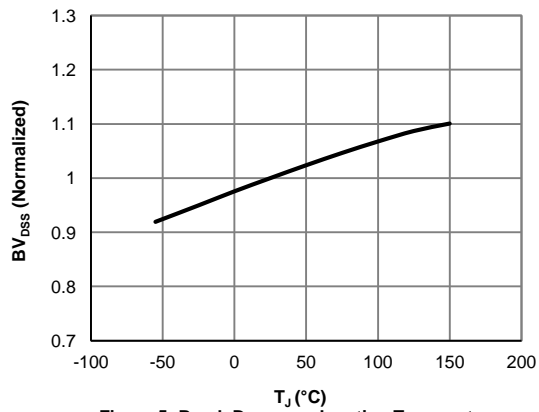
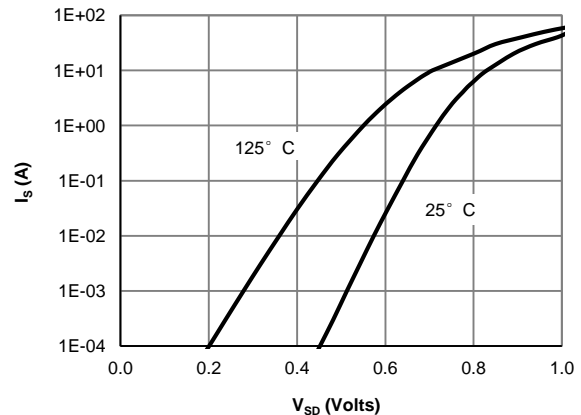Figure 1: On-Region Characteristics

Figure 2: Transfer Characteristics

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

Figure 4: On-Resistance vs. Junction Temperature

Figure 5: Break Down vs. Junction Temparature

Figure 6: Body-Diode Characteristics
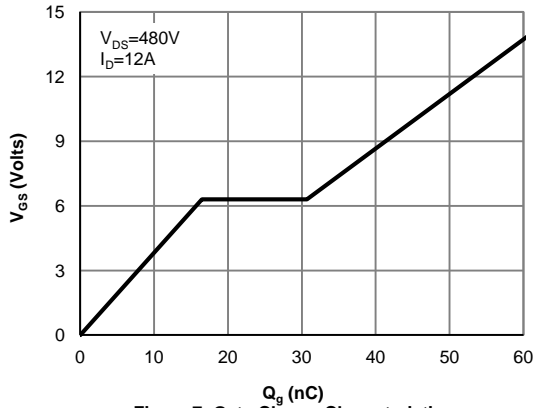
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
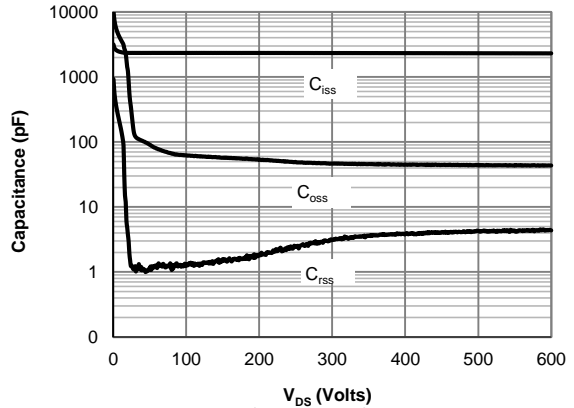

Figure 7: Gate-Charge Characteristics

Figure 8: Capacitance Characteristics
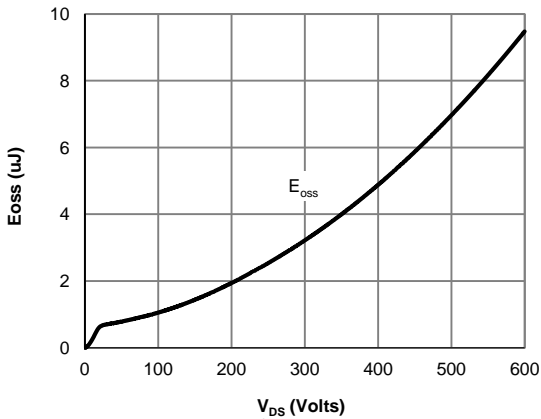
Figure 9: Coss stored Energy
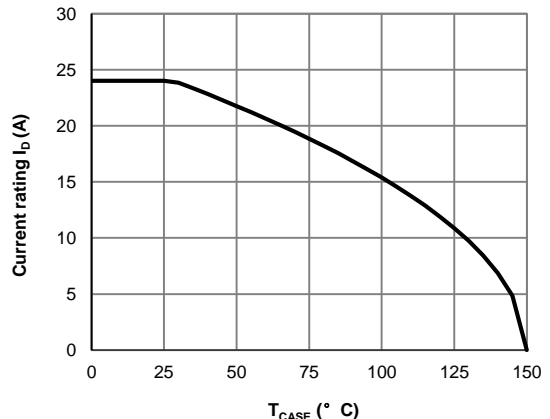
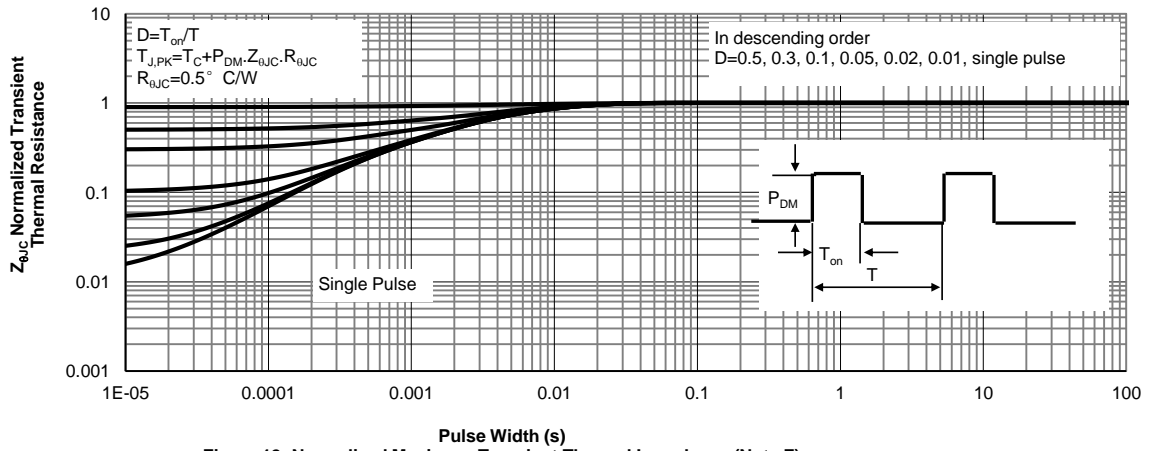Figure 10: Current De-rating (Note F)
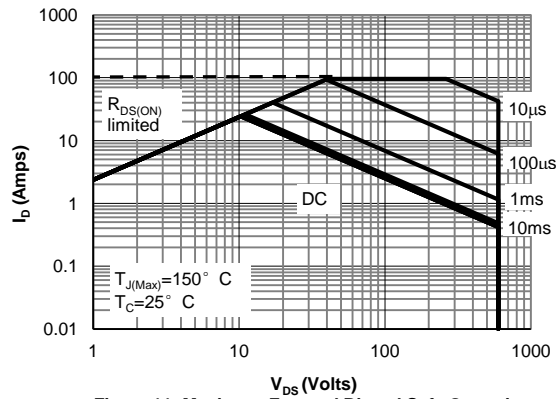
Figure 11: Maximum Forward Biased Safe Operating Area (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

$D=T_{on}/T$
$T_{J,PK}=T_C+P_{DM}.Z_{\theta JC}.R_{\theta JC}$
$R_{\theta JC}=0.5°$ C/W

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

Single Pulse

$Z_{\theta JC}$ Normalized Transient Thermal Resistance

Pulse Width (s)
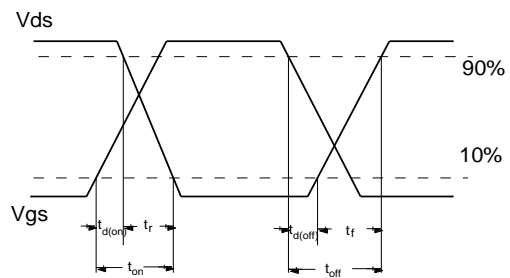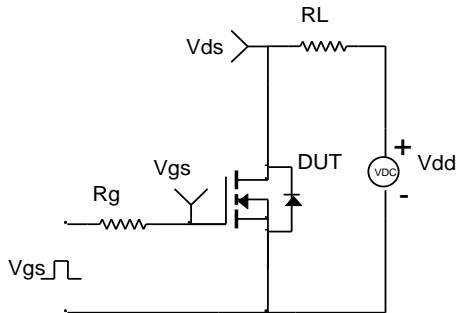
Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)
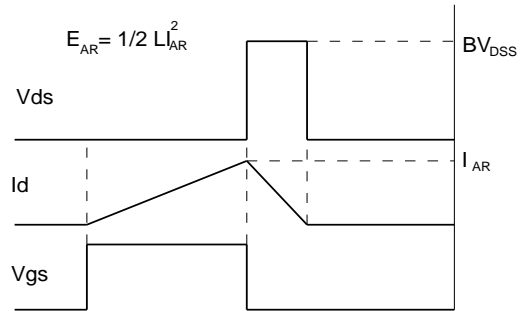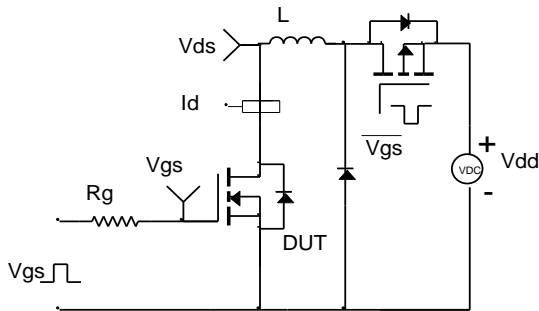
P_{DM}

T_{on}

T

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Gate Charge Test Circuit & Waveform
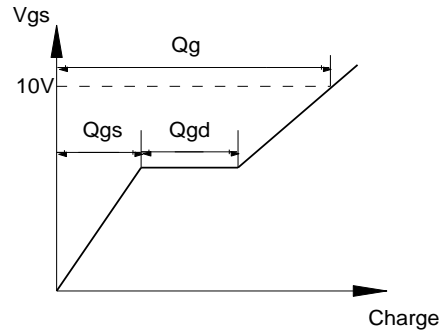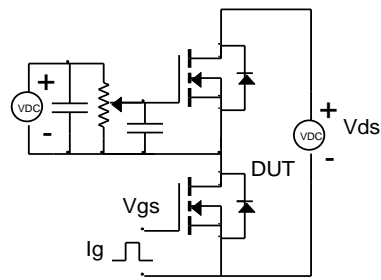
Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

$$E_{AR} = 1/2\ LI_{AR}^2$$

Diode Recovery Test Circuit & Waveforms

$$Q_{rr} = -\int I dt$$
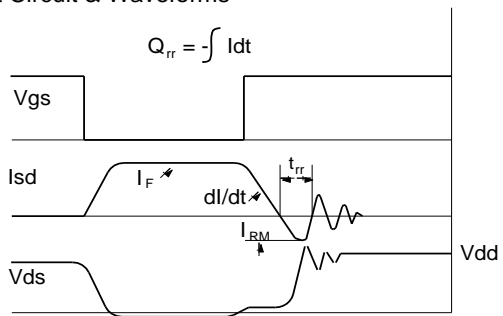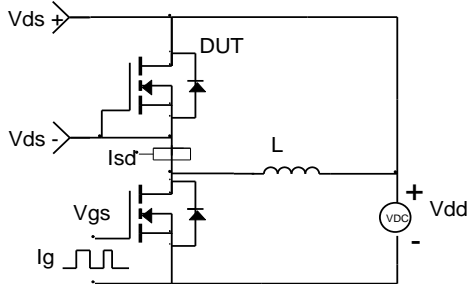
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>>AOS(万国半导体)