ALPHA & OMEGA SEMICONDUCTOR

AOK53S60

600V 53A αMOS™ Power Transistor

General Description

The AOK53S60 has been fabricated using the advanced αMOS™ high voltage process that is designed to deliver high levels of performance and robustness in switching applications.
By providing low $R_{DS(on)}$, Q_g and E_{OSS} along with guaranteed avalanche capability this part can be adopted quickly into new and existing offline power supply designs.

Product Summary

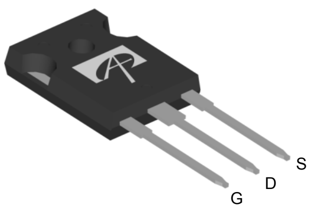
V_{DS} @ $T_{j,max}$	700V
I_{DM}	215A
$R_{DS(ON),max}$	0.07Ω
$Q_{g,typ}$	59nC
E_{oss} @ 400V	15µJ

100% UIS Tested
100% R_g Tested

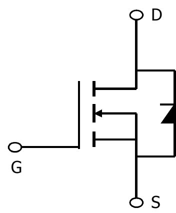
RoHS Compliant

Top View

TO247



AOK53S60



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK53S60	TO-247	Tube	240

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOK53S60	Units
Drain-Source Voltage		V_{DS}	600	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	T_C=25°C	I_D	53	A
	T_C=100°C		33	
Pulsed Drain Current [C]		I_{DM}	215	
Avalanche Current [C]		I_{AR}	9.5	A
Repetitive avalanche energy [C]		E_{AR}	45	mJ
Single pulsed avalanche energy [G]		E_{AS}	1688	mJ
Power Dissipation [B]	T_C=25°C	P_D	520	W
	Derate above 25°C		4.2	W/ °C
MOSFET dv/dt ruggedness		dv/dt	100	V/ns
Peak diode recovery dv/dt			20	
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 [J]		T_L	300	°C

Thermal Characteristics

Parameter	Symbol	AOK53S60	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	$R_{\theta JC}$	0.24	°C/W

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	650	700	-	
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=600V, V_{GS}=0V	-	-	1	µA
		V_{DS}=480V, T_J=150°C	-	10	-	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±30V	-	-	±100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=5V, I_D=250µA	2.5	3.2	3.8	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=26.5A, T_J=25°C	-	0.058	0.07	Ω
		V_{GS}=10V, I_D=26.5A, T_J=150°C	-	0.155	0.185	Ω
V_{SD}	Diode Forward Voltage	I_S=26.5A, V_{GS}=0V, T_J=25°C	-	0.84	-	V
I_S	Maximum Body-Diode Continuous Current		-	-	53	A
I_{SM}	Maximum Body-Diode Pulsed Current		-	-	215	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=100V, f=1MHz	-	3034	-	pF
C_{oss}	Output Capacitance		-	222	-	pF
$C_{o(er)}$	Effective output capacitance, energy related [H]	VGS=0V, V_{DS}=0 to 480V, f=1MHz	-	170	-	pF
$C_{o(tr)}$	Effective output capacitance, time related [I]		-	524	-	pF
C_{rss}	Reverse Transfer Capacitance	VGS=0V, V_{DS}=100V, f=1MHz	-	3	-	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	-	1.8	-	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=480V, I_D=26.5A	-	59	-	nC
Q_{gs}	Gate Source Charge		-	17	-	nC
Q_{gd}	Gate Drain Charge		-	19	-	nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=400V, I_D=26.5A, R_G=25Ω	-	48	-	ns
t_r	Turn-On Rise Time		-	102	-	ns
$t_{D(off)}$	Turn-Off DelayTime		-	215	-	ns
t_f	Turn-Off Fall Time		-	122	-	ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=26.5A, dI/dt=100A/µs, V_{DS}=400V	-	664	-	ns
I_{rm}	Peak Reverse Recovery Current	I_F=26.5A, dI/dt=100A/µs, V_{DS}=400V	-	36	-	A
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=26.5A, dI/dt=100A/µs, V_{DS}=400V	-	14	-	µC

A. The value of $R_{\theta JA}$ 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 $R_{\theta JA}$ is the sum of the thermal impedance from junction to case $R_{\theta JC}$ and case to ambient.
E. The static characteristics in Figures 1 to 6 are obtained using <300 µs 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}=7.5A, V_{DD}=150V, 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% $V_{(BR)DSS}$.
J. Wavesoldering only allowed at leads.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

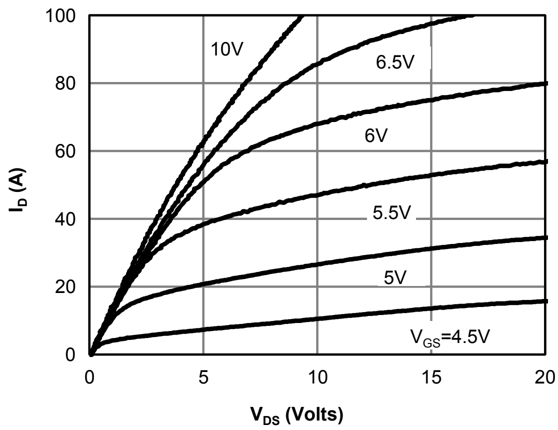


Figure 1: On-Region Characteristics@25°C

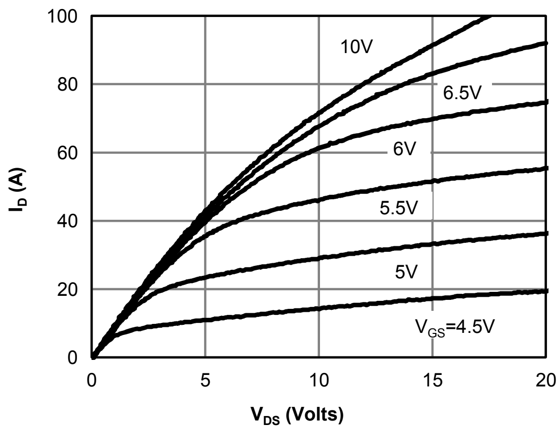


Figure 2: On-Region Characteristics@125°C

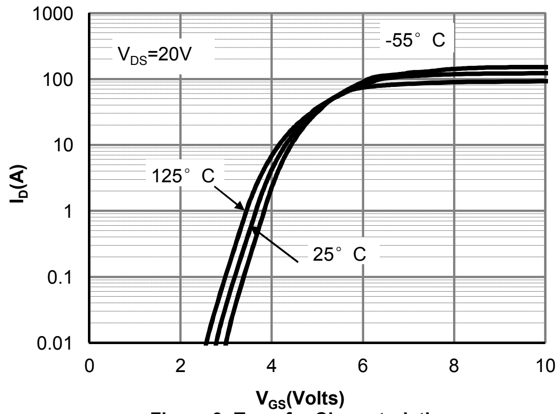


Figure 3: Transfer Characteristics

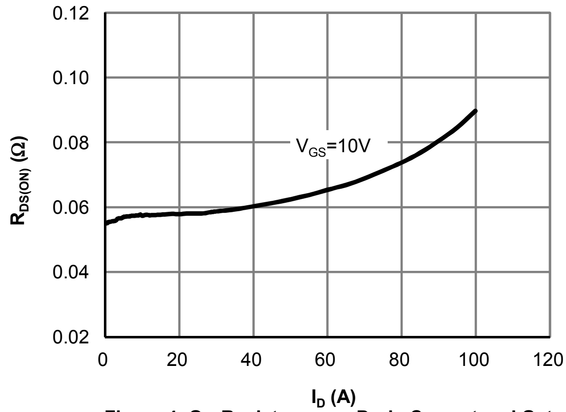


Figure 4: On-Resistance vs. Drain Current and Gate Voltage

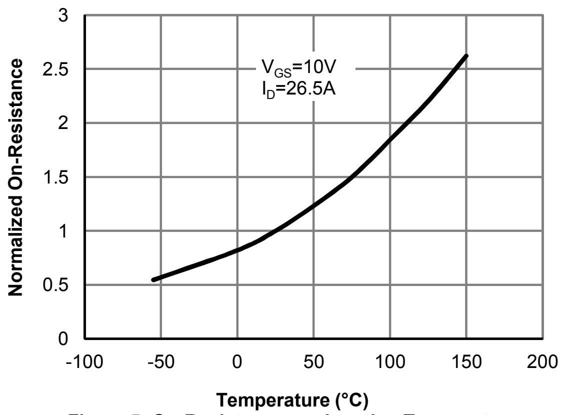


Figure 5: On-Resistance vs. Junction Temperature

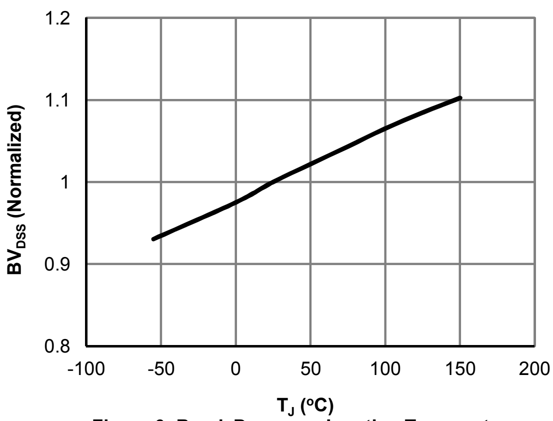


Figure 6: Break Down vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

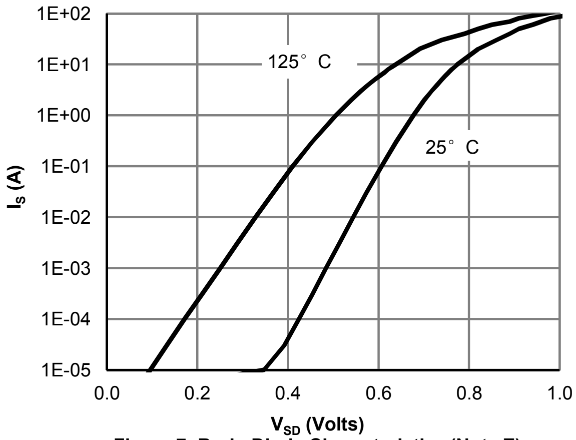


Figure 7: Body-Diode Characteristics (Note E)

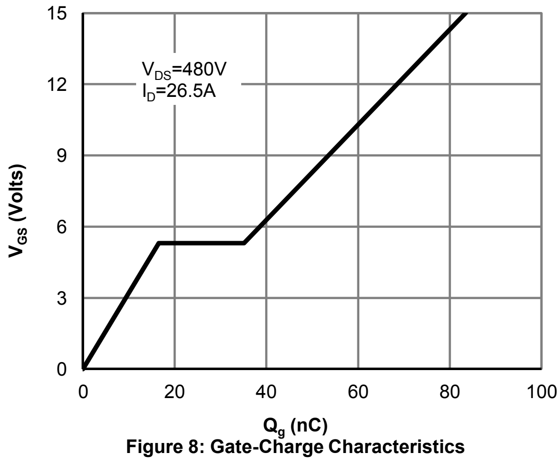


Figure 8: Gate-Charge Characteristics

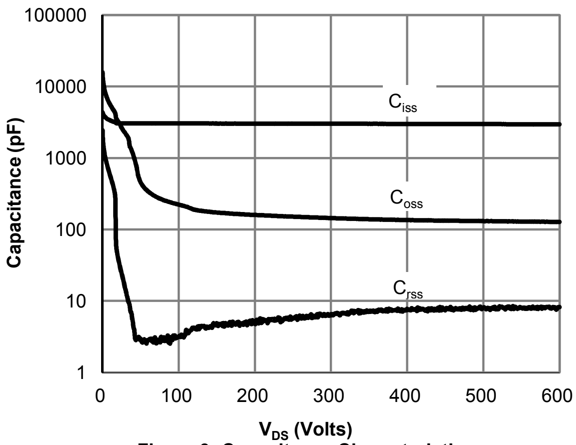


Figure 9: Capacitance Characteristics

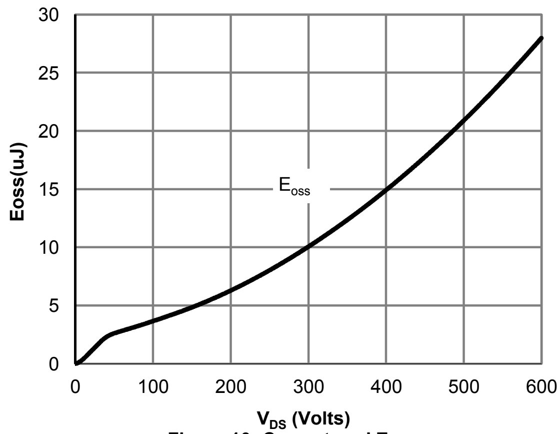


Figure 10: Coss stroed Energy

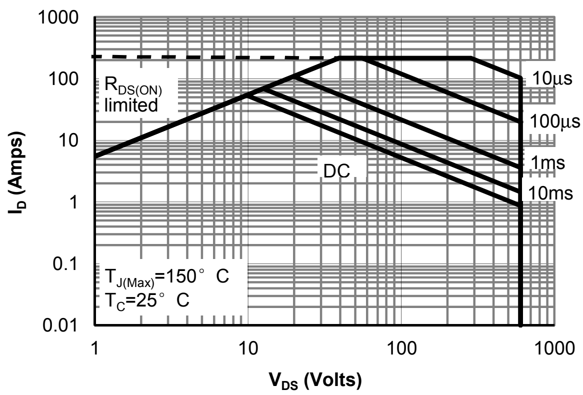


Figure 11: Maximum Forward Biased Safe Operating Area for AOK53S60 (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

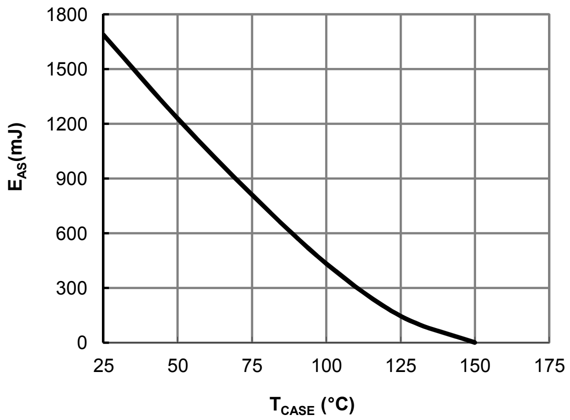


Figure 12: Avalanche energy

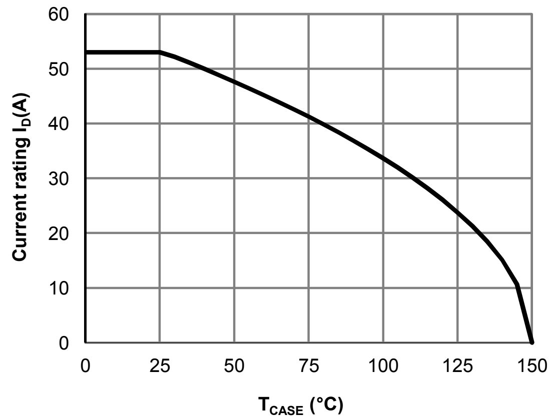


Figure 13: Current De-rating (Note B)

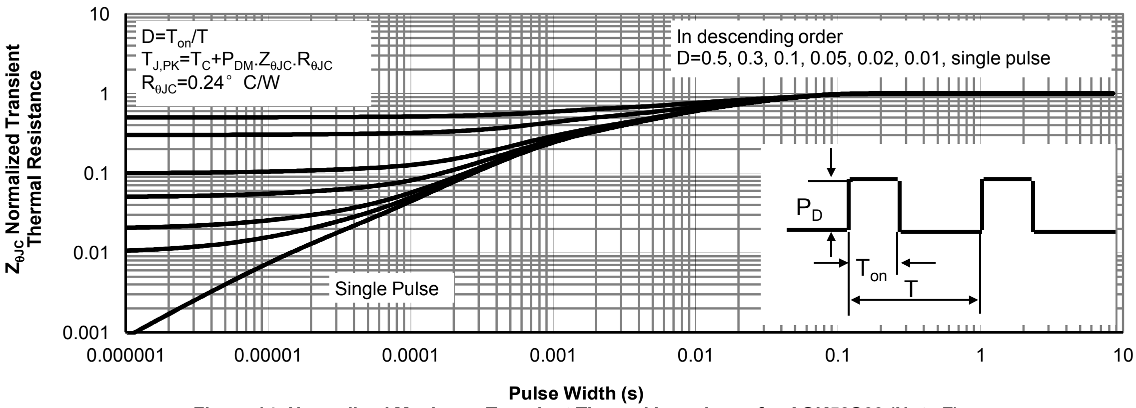
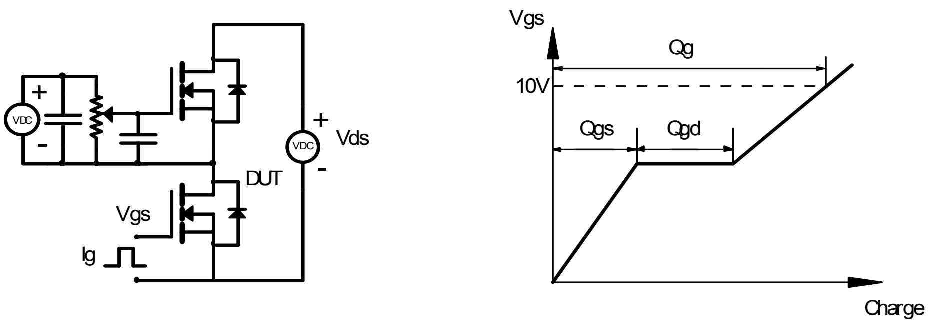
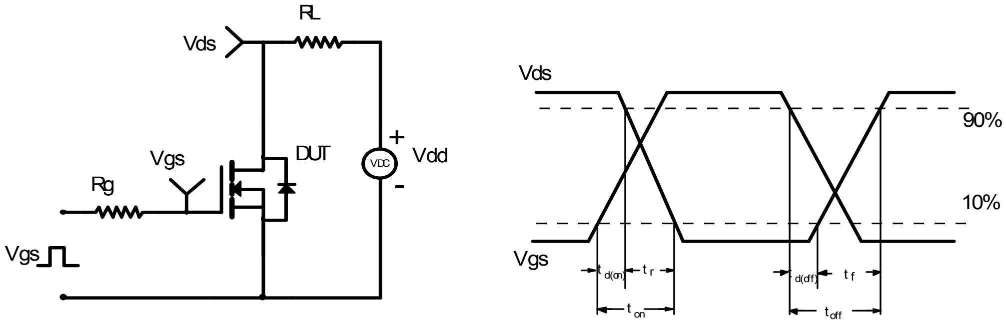


Figure 14: Normalized Maximum Transient Thermal Impedance for AOK53S60 (Note F)

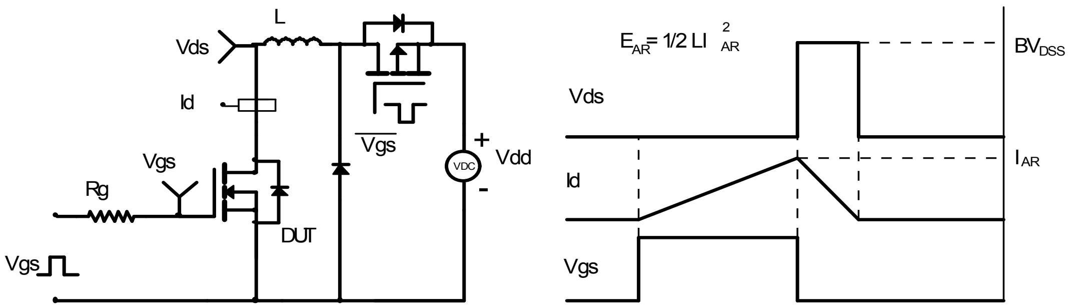
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms