ALPHA & OMEGA SEMICONDUCTOR

AOT12N40

400V,11A N-Channel MOSFET

General Description

The AOT12N40 is fabricated using an advanced high voltage MOSFET process that is designed to deliver high levels of performance and robustness in popular AC-DC applications.By providing low $R_{DS(on)}$, C_{iss} and C_{rss} along with guaranteed avalanche capability this part can be adopted quickly into new and existing offline power supply designs.

For Halogen Free add "L" suffix to part number: AOT12N40L

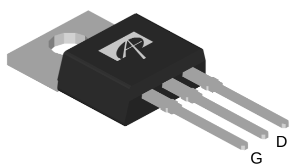
Product Summary

V_{DS}	500V@150℃
I_D (at V_{GS}=10V)	11A
$R_{DS(ON)}$ (at V_{GS}=10V)	<0.59Ω

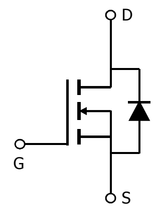
100% UIS Tested
100% R_g Tested

RoHS Compliant

Top View
TO-220



AOT12N40



Absolute Maximum Ratings T_A=25℃ unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	400	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current	T_C=25℃	I_D	11	A
	T_C=100℃		7	
Pulsed Drain Current [C]		I_{DM}	28	
Avalanche Current [C]		I_{AR}	3.5	A
Repetitive avalanche energy [C]		E_{AR}	184	mJ
Single pulsed avalanche energy [G]		E_{AS}	368	mJ
Peak diode recovery dv/dt		dv/dt	5	V/ns
Power Dissipation [B]	T_C=25℃	P_D	184	W
	Derate above 25°C		1.5	W/ °C
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	℃
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300	℃

Thermal Characteristics

Parameter	Symbol	Typical	Maximum	Units
Maximum Junction-to-Ambient [A,D]	$R_{\theta JA}$	54	65	℃/W
Maximum Case-to-sink [A]	$R_{\theta CS}$	-	0.5	℃/W
Maximum Junction-to-Case	$R_{\theta JC}$	0.56	0.68	℃/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	400			V
		I_D=250µA, V_{GS}=0V, T_J=150°C		500		
BV_{DSS} /ΔTJ	Zero Gate Voltage Drain Current	ID=250µA, VGS=0V		0.4		V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=400V, V_{GS}=0V			1	µA
		V_{DS}=320V, T_J=125°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	3.3	3.9	4.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=6A		0.49	0.59	Ω
g_{FS}	Forward Transconductance	V_{DS}=40V, I_D=6A		10		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.72	1	V
I_S	Maximum Body-Diode Continuous Current				11	A
I_{SM}	Maximum Body-Diode Pulsed Current				28	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz	740	925	1110	pF
C_{oss}	Output Capacitance		70	100	130	pF
C_{rss}	Reverse Transfer Capacitance		3.5	6.4	9.0	pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz	1.4	2.9	4.5	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=10V, V_{DS}=320V, I_D=12A	13	17	21	nC
Q_{gs}	Gate Source Charge			5.4		nC
Q_{gd}	Gate Drain Charge			5.7		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=200V, I_D=12A, R_G=25Ω		25		ns
t_r	Turn-On Rise Time			57		ns
$t_{D(off)}$	Turn-Off DelayTime			41		ns
t_f	Turn-Off Fall Time			32		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=12A,dI/dt=100A/µs,V_{DS}=100V	180	235	290	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=12A,dI/dt=100A/µs,V_{DS}=100V	1.9	2.4	2.9	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}=3.5A, V_{DD}=150V, R_G=25Ω, Starting T_J=25°C

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

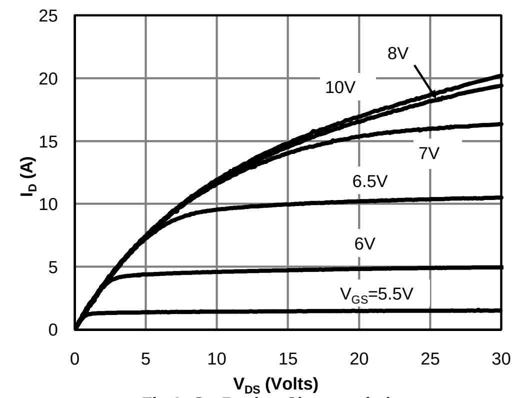


Fig 1: On-Region Characteristics

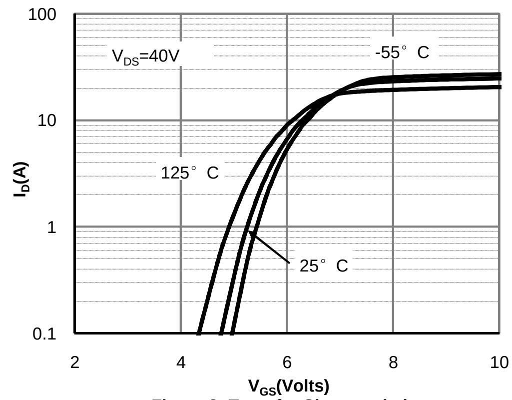


Figure 2: Transfer Characteristics

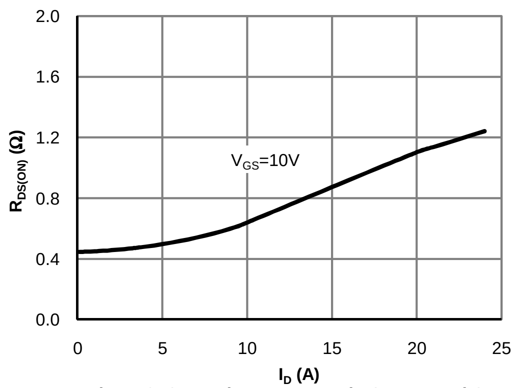


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

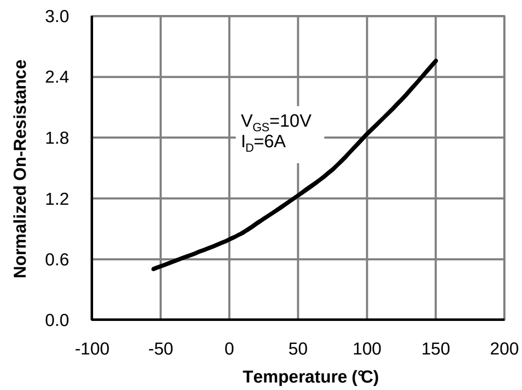


Figure 4: On-Resistance vs. Junction Temperature

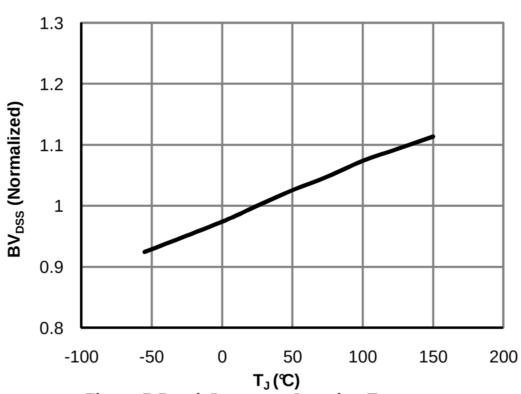


Figure 5:Break Down vs. Junction Temparature

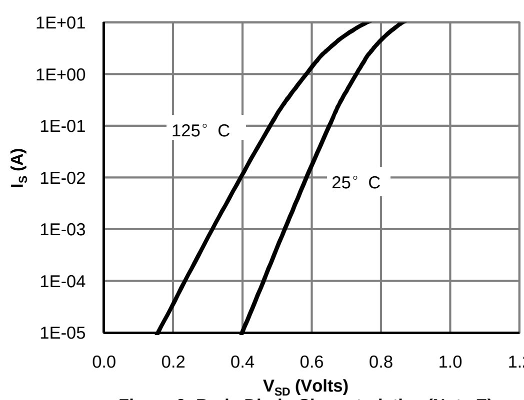


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

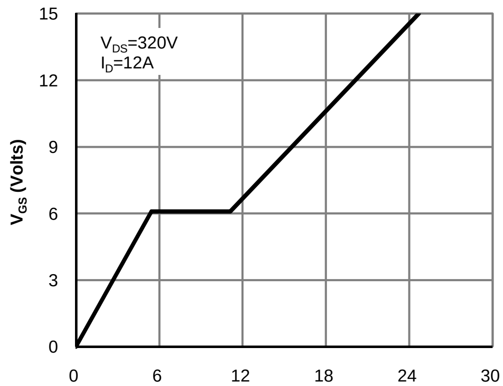


Figure 7: Gate-Charge Characteristics

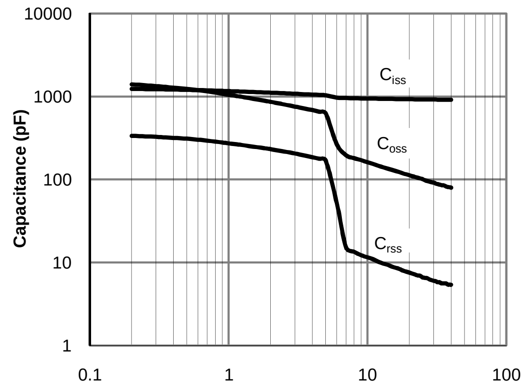


Figure 8: Capacitance Characteristics

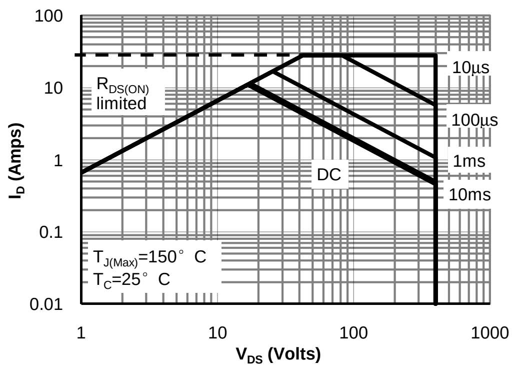


Figure 9: Maximum Forward Biased Safe Operating Area for AOT12N40 (Note F)

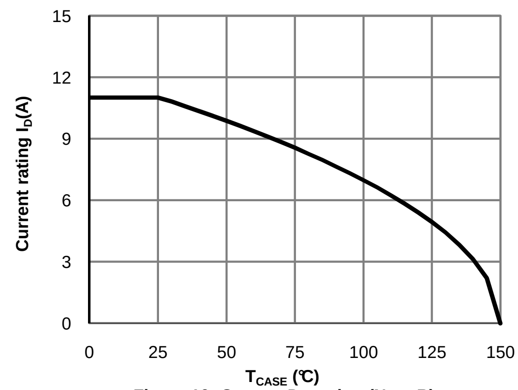


Figure 10: Current De-rating (Note B)

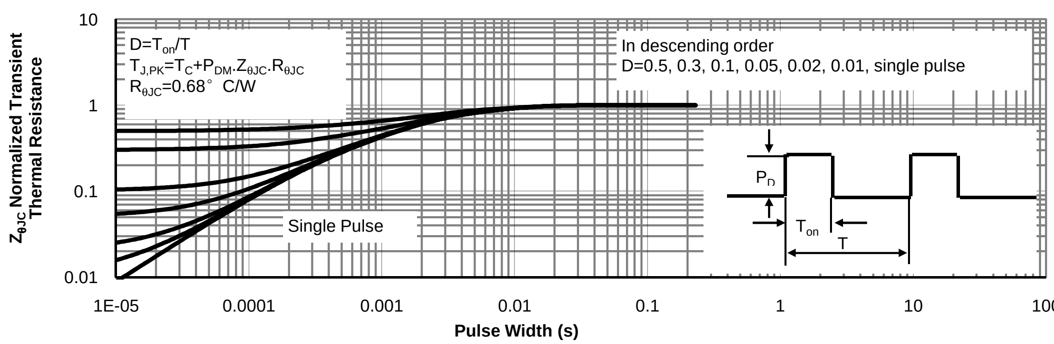
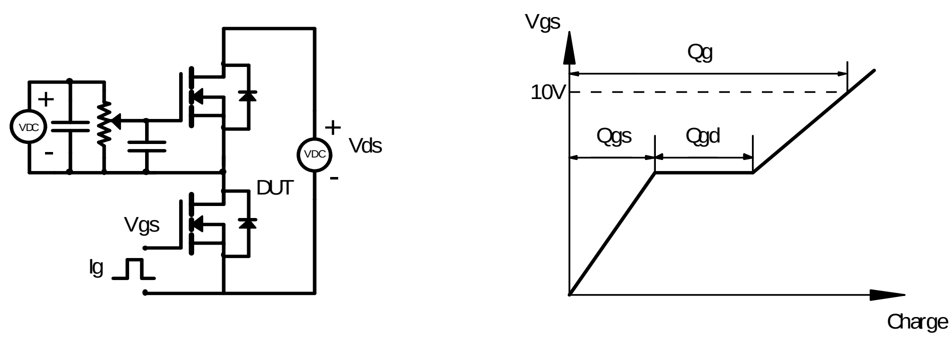
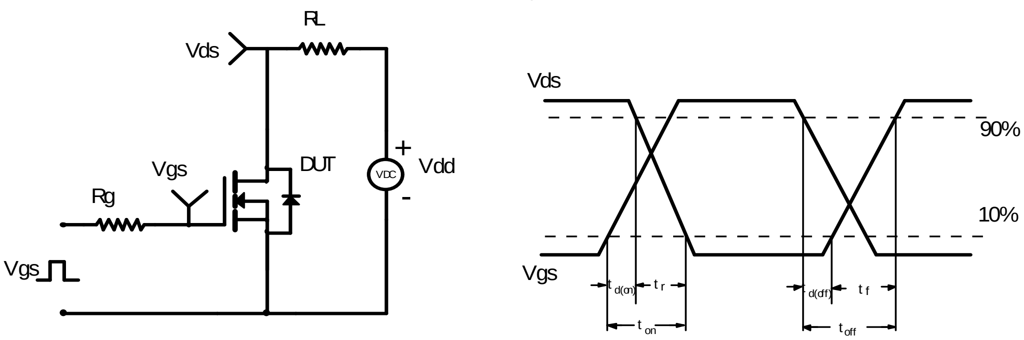


Figure 11: Normalized Maximum Transient Thermal Impedance for AOT12N40(Note F)

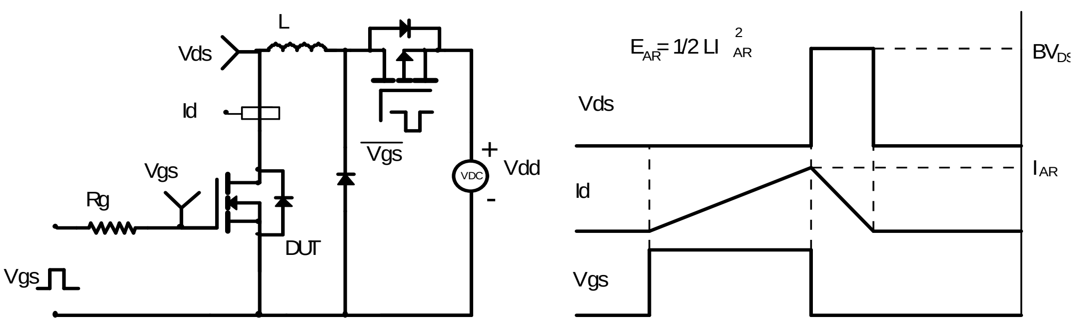
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms