



ALPHA & OMEGA
SEMICONDUCTOR

AOTF380A60CL/AOT380A60CL/AOB380A60CL

600V, α MOS5™ N-Channel Power Transistor

General Description

- Proprietary α MOS5™ technology
- Low $R_{DS(ON)}$
- Optimized switching parameters for better EMI performance
- Enhanced body diode for robustness and fast reverse recovery

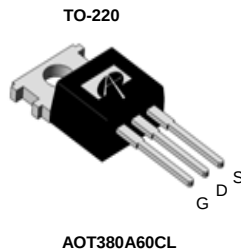
Applications

- SMPS with PFC, Flyback and LLC topologies
- Silver ATX ,adapter, TV, lighting, Server power

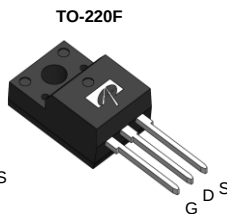
Product Summary

$V_{DS} @ T_{j,max}$	700V
I_{DM}	44A
$R_{DS(ON),max}$	< 0.38 Ω
$Q_{g,typ}$	18nC
$E_{oss} @ 400V$	2.6 μ J

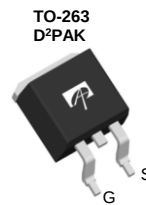
100% UIS Tested
100% R_g Tested



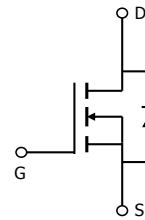
AOT380A60CL



AOTF380A60CL



AOB380A60CL



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOT380A60CL	TO-220	Tube	1000
AOTF380A60CL	TO-220F	Tube	1000
AOB380A60CL	TO263	Tape and reel	800

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	AOT(B)380A60CL	AOTF380A60CL	Units
Drain-Source Voltage	V_{DS}	600		V
Gate-Source Voltage	V_{GS}	± 20		V
Gate-Source Voltage (dynamic) AC ($f > 1\text{Hz}$)	V_{GS}	± 30		V
Continuous Drain Current	$T_C=25^\circ\text{C}$	11	11*	A
	$T_C=100^\circ\text{C}$	7.2	7.2*	
Pulsed Drain Current ^C	I_{DM}	44		
Avalanche Current ^C	I_{AR}	2.5		A
Repetitive avalanche energy ^C	E_{AR}	3.1		mJ
Single pulsed avalanche energy ^G ($T_J=25^\circ\text{C}$, $V_{GS}=10\text{V}$, $I_L=2\text{A}$ pk, $L=105\text{mH}$, $R_{GS}=25\Omega$)	E_{AS}	210		mJ
MOSFET dv/dt ruggedness	dv/dt	100		V/ns
Peak diode recovery dv/dt		20		
Power Dissipation ^B	$T_C=25^\circ\text{C}$	131	27	W
	Derate above 25°C	1.0	0.2	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		$^\circ\text{C}$
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	T_L	300		$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	AOT(B)380A60CL	AOTF380A60CL	Units
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	65	65	$^\circ\text{C/W}$
Maximum Case-to-sink ^A	$R_{\theta CS}$	0.5	--	$^\circ\text{C/W}$
Maximum Junction-to-Case	$R_{\theta JC}$	0.95	4.6	$^\circ\text{C/W}$

* Drain current limited by maximum junction temperature.

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
B _V 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		
B _V DSS /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D =250μA, V _{GS} =0V		0.44		V/°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	2.6	3.2	3.8	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =5.5A		0.33	0.38	Ω
g _{FS}	Forward Transconductance	V _{DS} =10V, I _D =5.5A		9.3		S
V _{SD}	Diode Forward Voltage	I _S =5.5A, V _{GS} =0V		0.85	1.2	V
I _S	Maximum Body-Diode Continuous Current				11	A
I _{SM}	Maximum Body-Diode Pulsed Current ^C				44	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =100V, f=1MHz		955		pF
C _{oss}	Output Capacitance			29		pF
C _{o(er)}	Effective output capacitance, energy related ^H	V _{GS} =0V, V _{DS} =0 to 480V, f=1MHz		30		pF
C _{o(tr)}	Effective output capacitance, time related ^I			122		pF
C _{rss}	Reverse Transfer Capacitance	V _{GS} =0V, V _{DS} =100V, f=1MHz		2.4		pF
R _g	Gate resistance	f=1MHz		4.8		Ω
SWITCHING PARAMETERS						
Q _g	Total Gate Charge	V _{GS} =10V, V _{DS} =480V, I _D =5.5A		18		nC
Q _{gs}	Gate Source Charge			7		nC
Q _{gd}	Gate Drain Charge			4.5		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =400V, I _D =5.5A, R _G =5Ω		20		ns
t _r	Turn-On Rise Time			13		ns
t _{D(off)}	Turn-Off DelayTime			43		ns
t _f	Turn-Off Fall Time			16		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =5.5A, dI/dt=100A/μs, V _{DS} =400V		251		ns
I _{rm}	Peak Reverse Recovery Current			19		A
Q _{rr}	Body Diode Reverse Recovery Charge			3.1		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. This is the absolute maximum rating. Parts are 100% tested at T_J=25° C, L=60mH, I_{AS}=1A, V_{DD}=150V, R_G=25Ω.

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

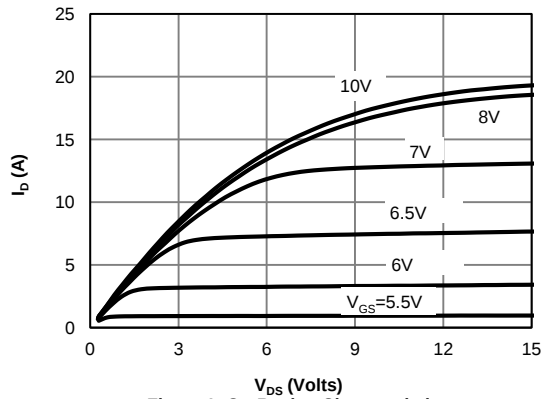


Figure 1: On-Region Characteristics

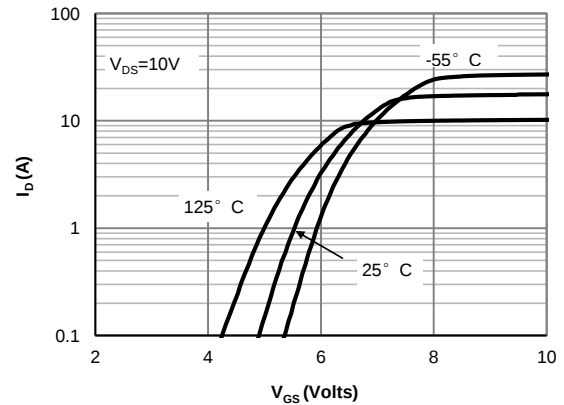


Figure 2: Transfer Characteristics

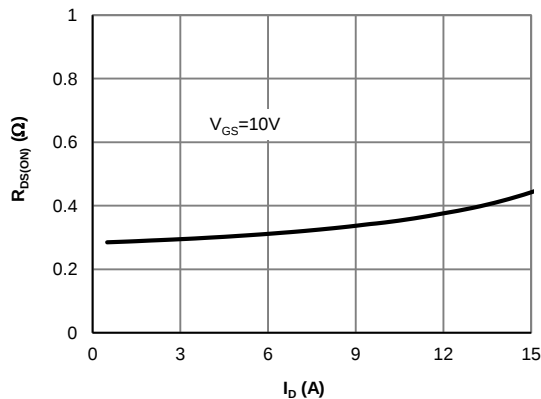


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

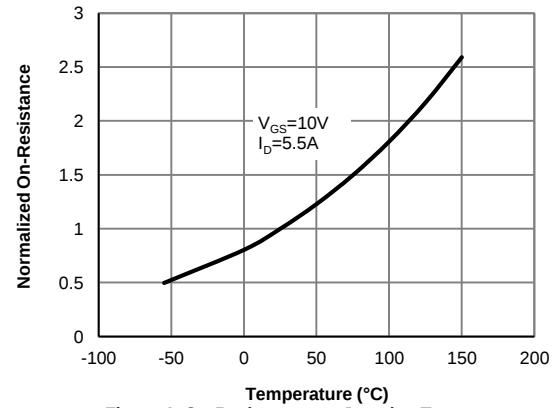


Figure 4: On-Resistance vs. Junction Temperature

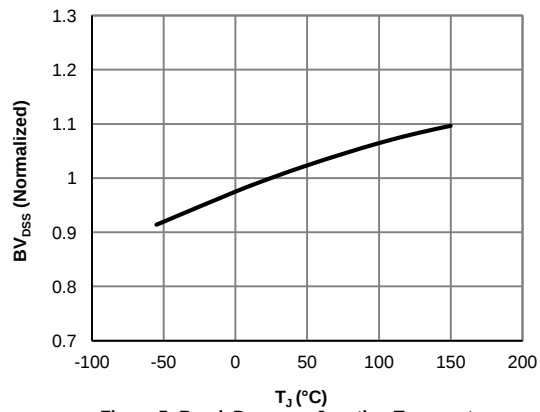


Figure 5: Break Down vs. Junction Temperature

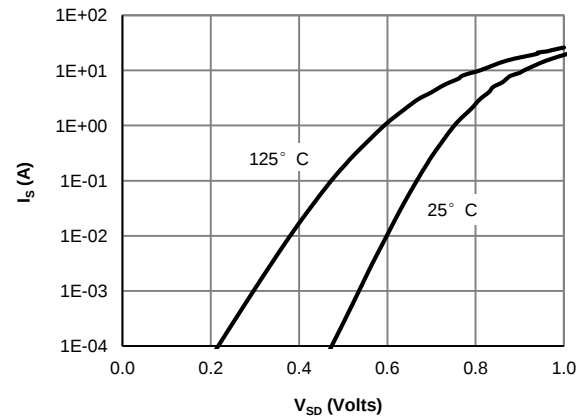


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

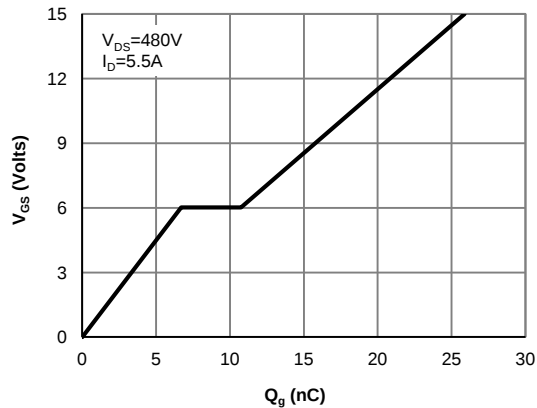


Figure 7: Gate-Charge Characteristics

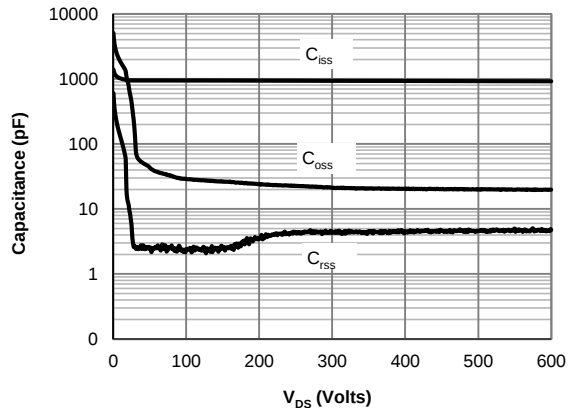


Figure 8: Capacitance Characteristics

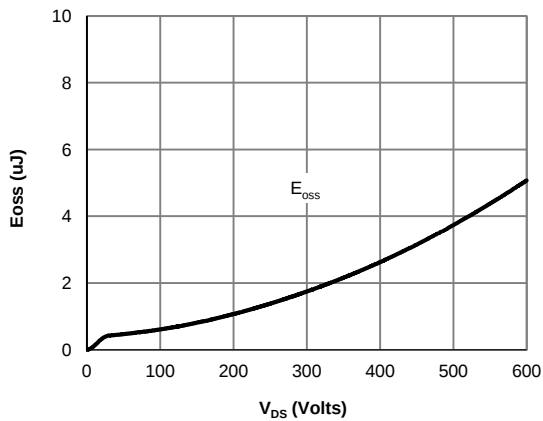


Figure 9: C_{oss} stored Energy

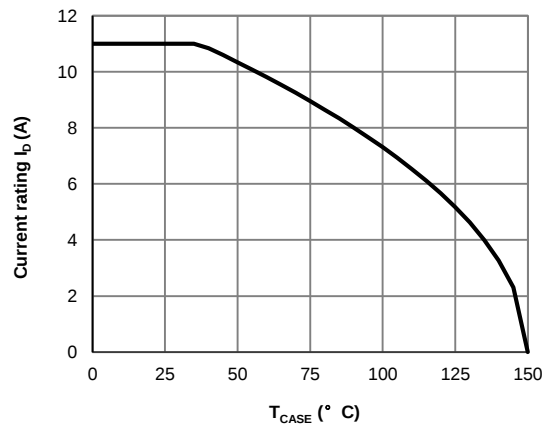


Figure 10: Current De-rating (Note F)

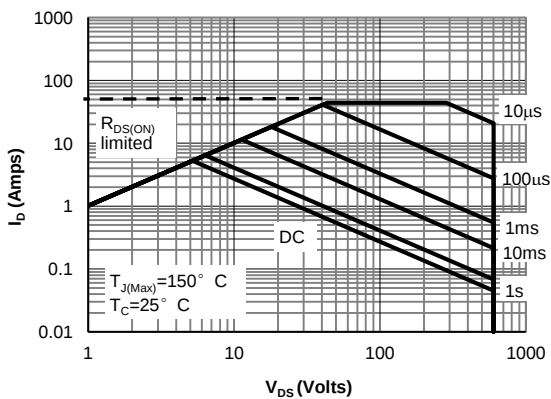


Figure 11: Maximum Forward Biased Safe Operating Area for AOTF380A60CL (Note F)

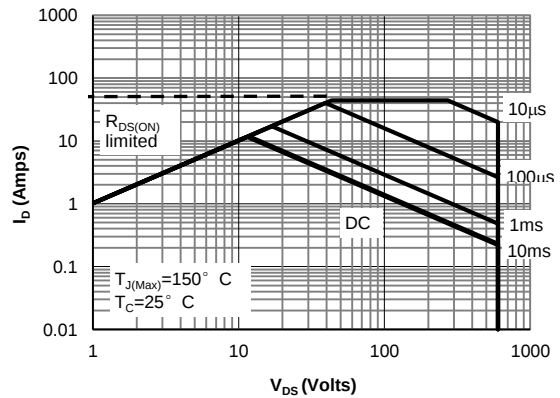


Figure 12: Maximum Forward Biased Safe Operating Area for AOT(B)380A60CL (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

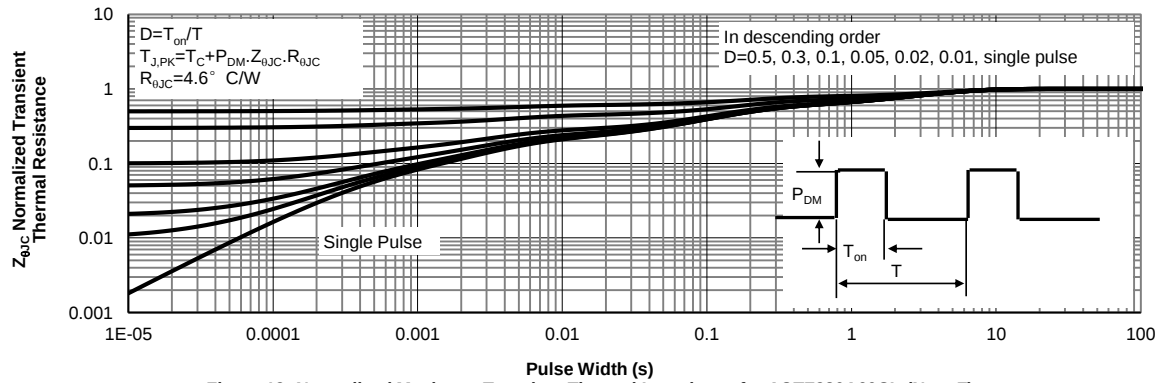


Figure 13: Normalized Maximum Transient Thermal Impedance for AOTF380A60CL (Note F)

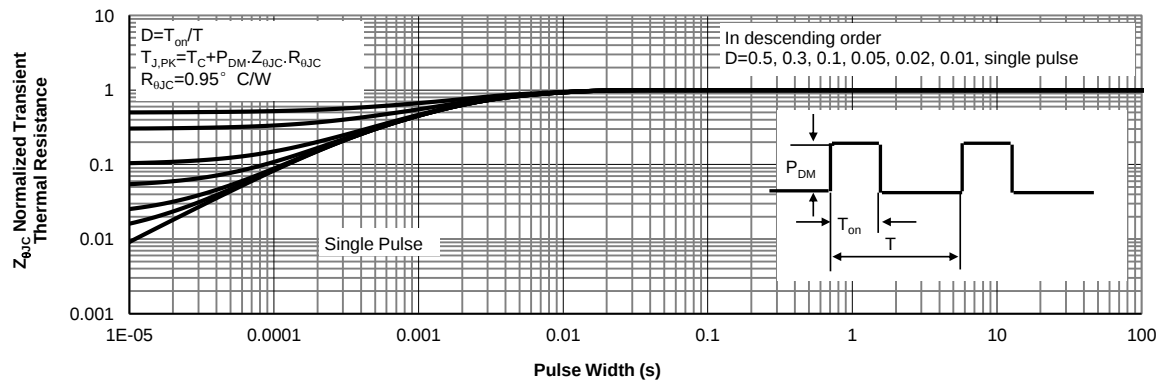
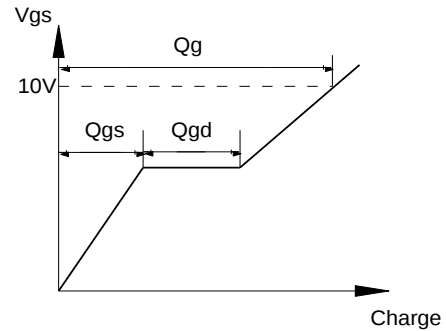
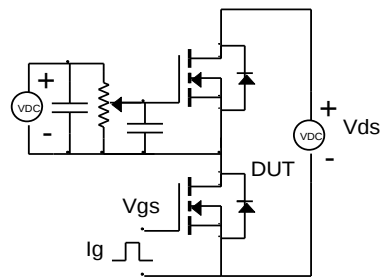
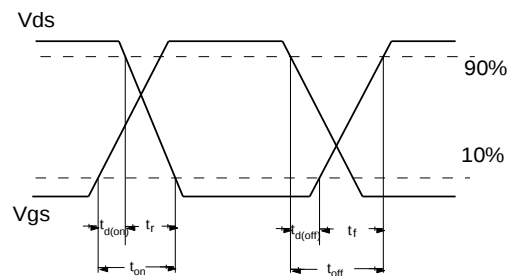
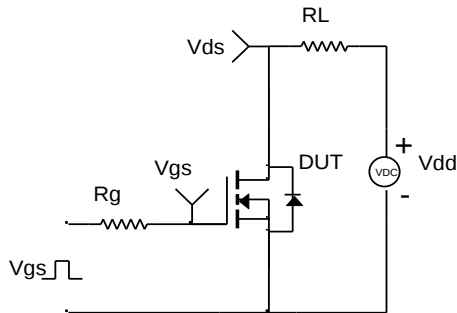


Figure 14: Normalized Maximum Transient Thermal Impedance for AOT(B)380A60CL (Note F)

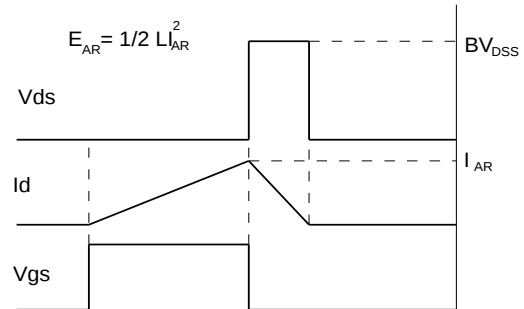
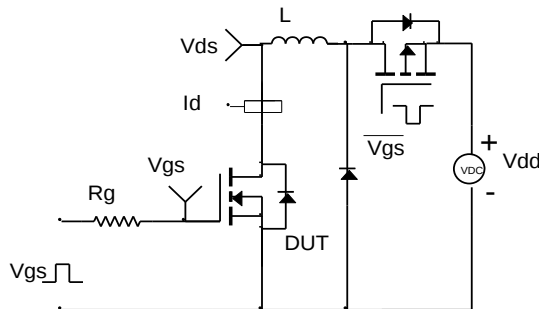
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

