



ALPHA & OMEGA
SEMICONDUCTOR

AOT10T60P/AOB10T60P/AOTF10T60P

600V, 10A N-Channel MOSFET

General Description

- Trench Power AlphaMOS-II technology
- Low $R_{DS(on)}$
- Low C_{iss} and C_{rss}
- High Current Capability
- RoHS and Halogen Free Compliant

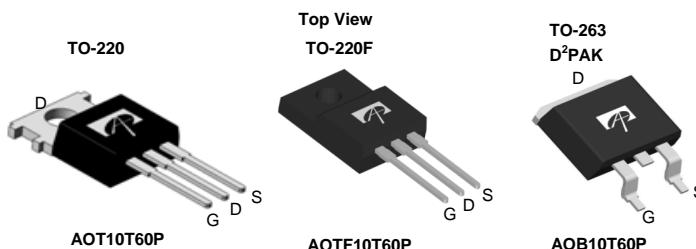
Product Summary

$V_{DS} @ T_{j,max}$	700V
I_{DM}	40A
$R_{DS(on),max}$	< 0.7Ω
$Q_{g,typ}$	26nC
$E_{oss} @ 400V$	3.5μJ

Applications

- General Lighting for LED and CCFL
- AC/DC Power supplies for Industrial, Consumer, and Telecom

100% UIS Tested
100% R_g Tested



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOT10T60PL	TO-220 Green	Tube	1000
AOB10T60PL	TO-263 Green	Tape & Reel	800
AOTF10T60P	TO-220F Pb Free	Tube	1000
AOTF10T60PL	TO-220F Green	Tube	1000

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

Parameter	Symbol	AOT(B)10T60P	AOTF10T60P	AOTF10T60PL	Units
Drain-Source Voltage	V_{DS}		600		V
Gate-Source Voltage	V_{GS}		± 30		V
Continuous Drain Current	I_D	10	10*	10*	A
$T_C=100^\circ\text{C}$		6.6	6.6*	6.6*	
Pulsed Drain Current ^C	I_{DM}	40			
Avalanche Current ^C $L=1\text{mH}$	I_{AR}		10		A
Repetitive avalanche energy ^C	E_{AR}		50		mJ
Single pulsed avalanche energy ^G	E_{AS}		480		mJ
MOSFET dv/dt ruggedness	dv/dt	50			V/ns
Peak diode recovery dv/dt ^J		15			
Power Dissipation ^B	P_D	208	43	33	W
$T_C=25^\circ\text{C}$		1.7	0.3	0.26	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	AOT(B)10T60P	AOTF10T60P	AOTF10T60PL	Units
Maximum Junction-to-Ambient ^{A,D}	R_{QJA}	65	65	65	°C/W
Maximum Case-to-sink ^A	R_{QCS}	0.5	--	--	°C/W
Maximum Junction-to-Case	R_{QJC}	0.6	2.9	3.8	°C/W

* Drain current limited by maximum junction temperature.

Electrical Characteristics ($T_J=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}, T_J=25^\circ\text{C}$	600			V
		$I_D=250\mu\text{A}, V_{GS}=0\text{V}, T_J=150^\circ\text{C}$		700		
$BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$		0.56		$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=600\text{V}, V_{GS}=0\text{V}$			1	μA
		$V_{DS}=480\text{V}, T_J=125^\circ\text{C}$			10	
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 30\text{V}$			± 100	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=5\text{V}, I_D=250\mu\text{A}$	3	4.3	5	V
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=5\text{A}$		0.58	0.7	Ω
g_{FS}	Forward Transconductance	$V_{DS}=40\text{V}, I_D=5\text{A}$		8.8		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.74	1	V
I_S	Maximum Body-Diode Continuous Current				10	A
I_{SM}	Maximum Body-Diode Pulsed Current ^C				40	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=100\text{V}, f=1\text{MHz}$		1595		pF
C_{oss}	Output Capacitance			56		pF
$C_{o(er)}$	Effective output capacitance, energy related ^H	$V_{GS}=0\text{V}, V_{DS}=0 \text{ to } 480\text{V}, f=1\text{MHz}$		42		pF
$C_{o(tr)}$	Effective output capacitance, time related ^I			74		pF
C_{rss}	Reverse Transfer Capacitance	$V_{GS}=0\text{V}, V_{DS}=100\text{V}, f=1\text{MHz}$		11		pF
R_g	Gate resistance	$f=1\text{MHz}$		1.7		Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=480\text{V}, I_D=10\text{A}$		26	40	nC
Q_{gs}	Gate Source Charge			8.1		nC
Q_{gd}	Gate Drain Charge			8.2		nC
$t_{D(on)}$	Turn-On Delay Time	$V_{GS}=10\text{V}, V_{DS}=300\text{V}, I_D=10\text{A}, R_G=25\Omega$		42		ns
t_r	Turn-On Rise Time			54		ns
$t_{D(off)}$	Turn-Off Delay Time			52		ns
t_f	Turn-Off Fall Time			24		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=10\text{A}, dI/dt=100\text{A}/\mu\text{s}, V_{DS}=100\text{V}$		497		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=10\text{A}, dI/dt=100\text{A}/\mu\text{s}, V_{DS}=100\text{V}$		7.3		μC

A. The value of $R_{\theta JA}$ is measured with the device in a still air environment with $T_A=25^\circ\text{C}$.

B. The power dissipation P_D is based on $T_{J(\text{MAX})}=150^\circ\text{C}$, 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 $T_{J(\text{MAX})}=150^\circ\text{C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{C}$.

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 ms 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 $T_{J(\text{MAX})}=150^\circ\text{C}$. The SOA curve provides a single pulse rating.

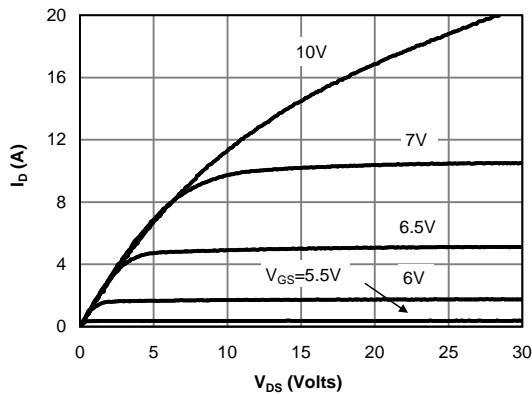
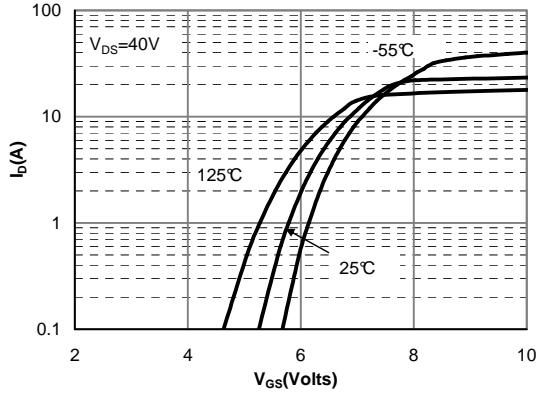
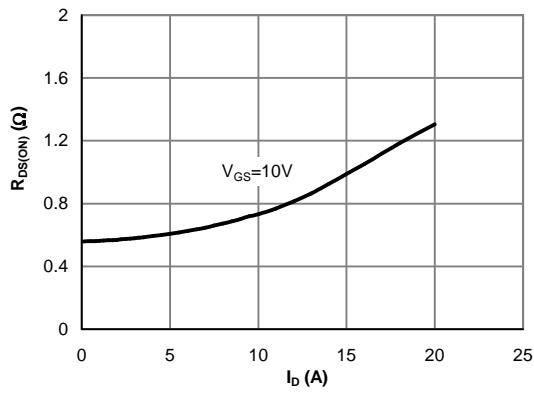
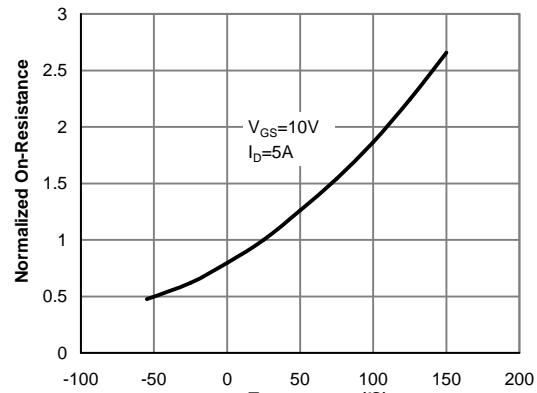
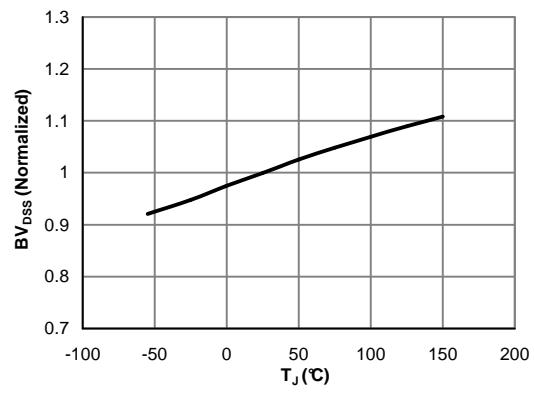
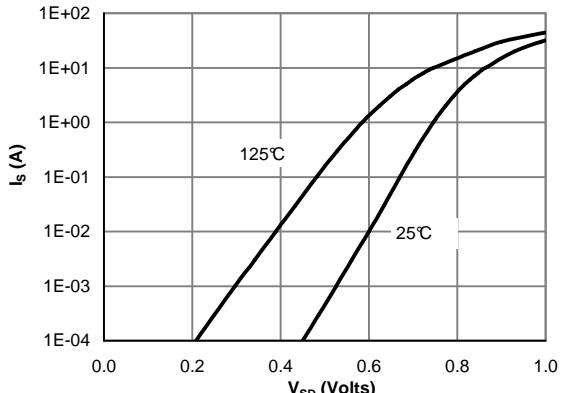
G. $L=60\text{mH}, I_{AS}=4\text{A}, V_{DD}=150\text{V}, R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$.

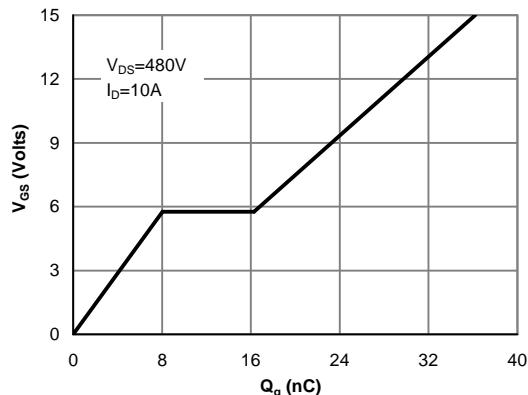
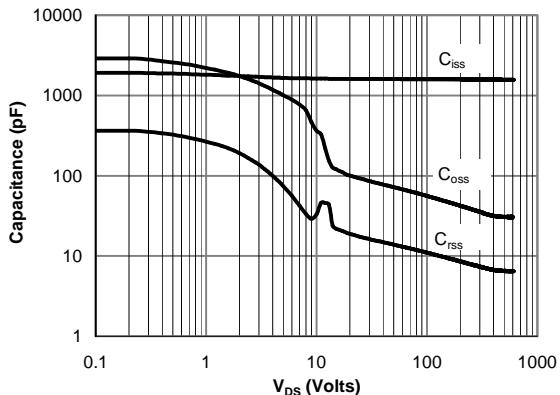
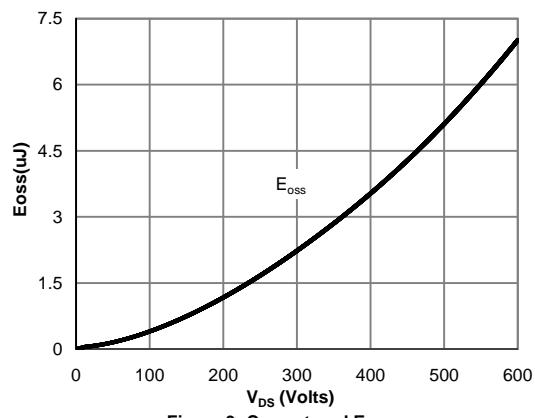
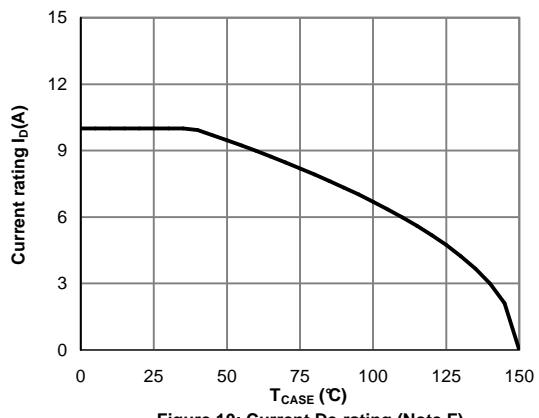
H. $C_{o(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 80% $V_{(BR)DSS}$.

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. $I_{SD} \leq I_D, dI/dt \leq 200\text{A}/\mu\text{s}, V_{DD}=400\text{V}, T_J \leq T_{J(\text{MAX})}$.

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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: Coss stored Energy

Figure 10: Current De-rating (Note F)

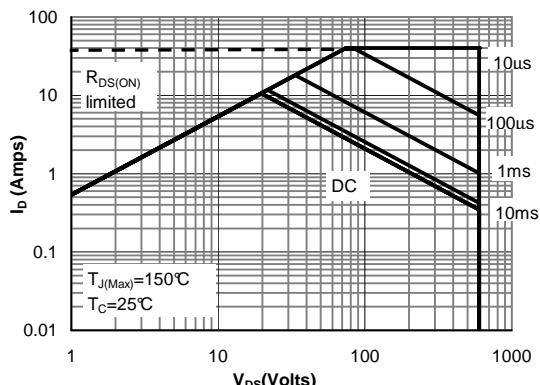
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS


Figure 11: Maximum Forward Biased Safe Operating Area for TO-220/TO-263 (Note F)

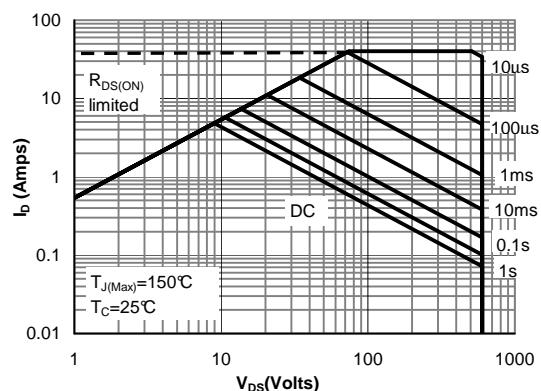


Figure 12: Maximum Forward Biased Safe Operating Area for TO-220F Pb Free (Note F)

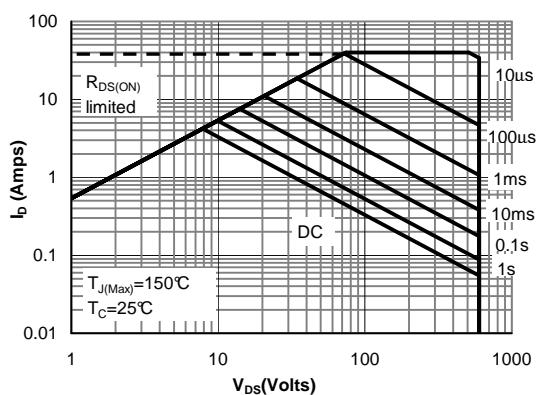


Figure 13: Maximum Forward Biased Safe Operating Area for TO-220F Green (Note F)

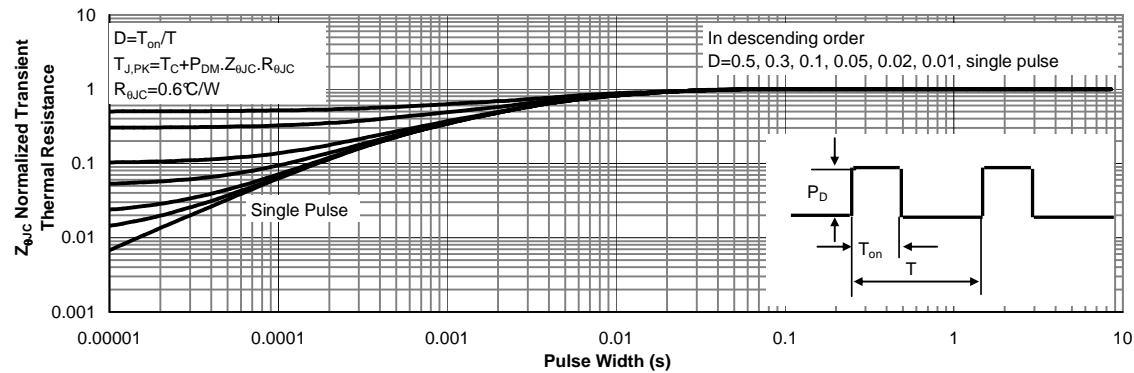
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS


Figure 14: Normalized Maximum Transient Thermal Impedance for TO-220/TO-263 (Note F)

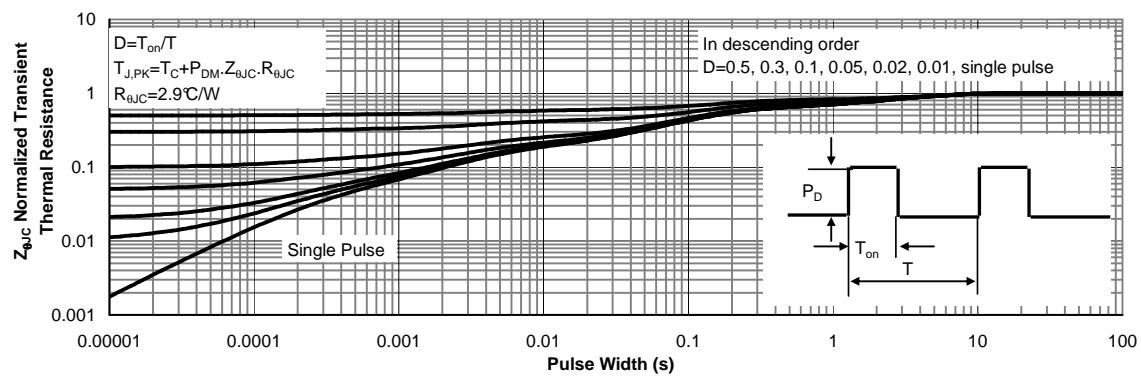


Figure 15: Normalized Maximum Transient Thermal Impedance for TO-220F Pb Free (Note F)

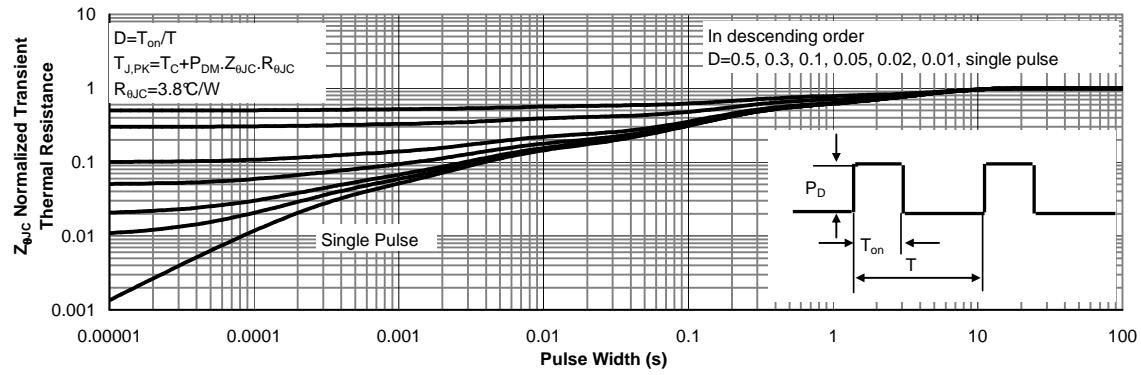
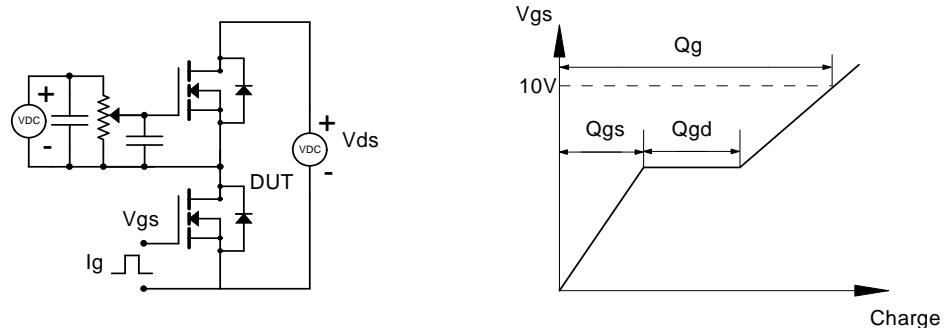
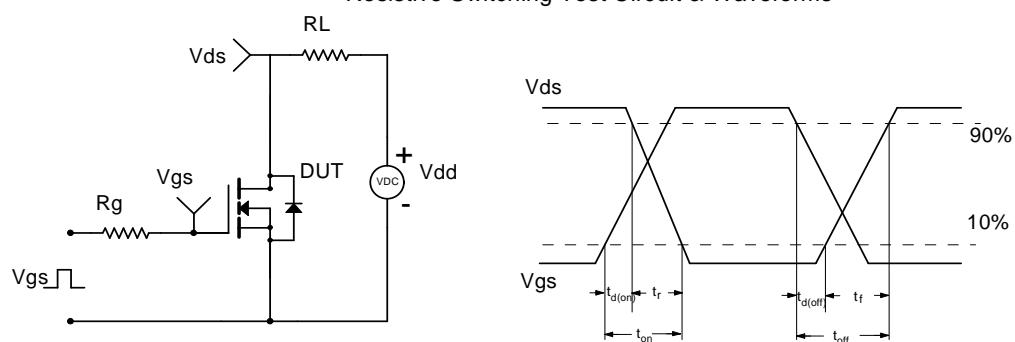
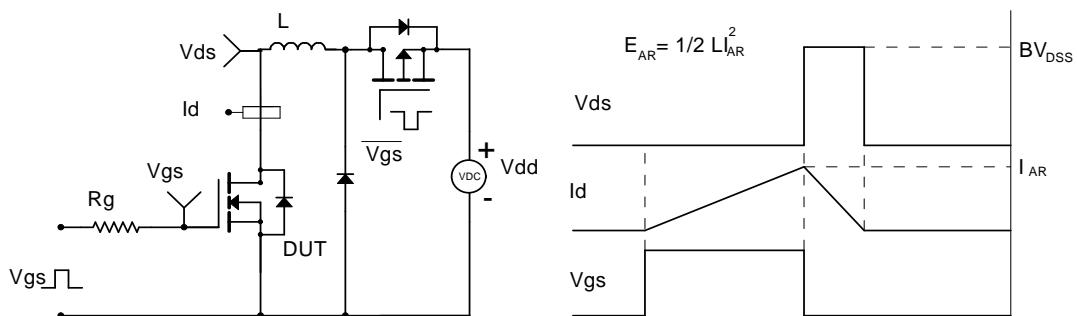


Figure 16: Normalized Maximum Transient Thermal Impedance for TO-220F Green (Note F)

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms
