



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AON7407**

**20V P-Channel MOSFET**

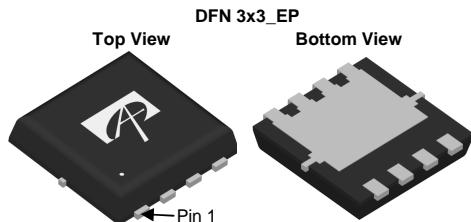
### General Description

The AON7407 combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . This device is ideal for load switch and battery protection applications.

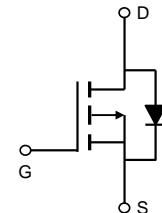
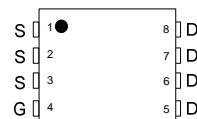
### Product Summary

$V_{DS}$	-20V
$I_D$ (at $V_{GS}=-4.5V$ )	-40A
$R_{DS(ON)}$ (at $V_{GS}=-4.5V$ )	< 9.5mΩ
$R_{DS(ON)}$ (at $V_{GS}=-2.5V$ )	< 12.5mΩ
$R_{DS(ON)}$ (at $V_{GS}=-1.8V$ )	< 18mΩ

100% UIS Tested  
100%  $R_g$  Tested



Top View



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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	-20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	V
Continuous Drain Current <sup>G</sup>	$I_D$	-40	A
$T_C=100^\circ\text{C}$		-29	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	-100	
Continuous Drain Current	$I_{DSM}$	-14.5	A
$T_A=70^\circ\text{C}$		-11.5	
Avalanche Current <sup>C</sup>	$I_{AS}, I_{AR}$	-40	A
Avalanche energy $L=0.1\text{mH}$ <sup>C</sup>	$E_{AS}, E_{AR}$	80	mJ
Power Dissipation <sup>B</sup>	$P_D$	29	W
$T_C=100^\circ\text{C}$		12	
Power Dissipation <sup>A</sup>	$P_{DSM}$	3.1	W
$T_A=70^\circ\text{C}$		2	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C

### Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	30	40	°C/W
Maximum Junction-to-Ambient <sup>A,D</sup>		60	75	°C/W
Maximum Junction-to-Case	$R_{\theta JC}$	3.5	4.2	°C/W

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=-250\mu\text{A}$ , $V_{GS}=0\text{V}$	-20			V
$I_{bss}$	Zero Gate Voltage Drain Current	$V_{DS}=-20\text{V}$ , $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	$\mu\text{A}$
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 8\text{V}$			$\pm 100$	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$	-0.3	-0.55	-0.9	V
$I_{D(\text{ON})}$	On state drain current	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-5\text{V}$	-100			A
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=-4.5\text{V}$ , $I_D=-14\text{A}$ $T_J=125^\circ\text{C}$		7.6	9.5	$\text{m}\Omega$
		$V_{GS}=-2.5\text{V}$ , $I_D=-13\text{A}$		10.5	13.5	$\text{m}\Omega$
		$V_{GS}=-1.8\text{V}$ , $I_D=-11\text{A}$		9.3	12.5	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=-5\text{V}$ , $I_D=-14\text{A}$		72		S
$V_{SD}$	Diode Forward Voltage	$I_S=-1\text{A}$ , $V_{GS}=0\text{V}$		-0.52	-1	V
$I_s$	Maximum Body-Diode Continuous Current				-35	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=-10\text{V}$ , $f=1\text{MHz}$	2795	3495	4195	pF
$C_{oss}$	Output Capacitance		365	528	690	pF
$C_{rss}$	Reverse Transfer Capacitance		255	425	595	pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		2.8	5.6	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g$	Total Gate Charge	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-10\text{V}$ , $I_D=-14\text{A}$	35	44	53	nC
$Q_{gs}$	Gate Source Charge			9		nC
$Q_{gd}$	Gate Drain Charge			11		nC
$t_{D(\text{on})}$	Turn-On Delay Time	$V_{GS}=-4.5\text{V}$ , $V_{DS}=-10\text{V}$ , $R_L=0.75\Omega$ , $R_{\text{GEN}}=3\Omega$		18		ns
$t_r$	Turn-On Rise Time			32		ns
$t_{D(\text{off})}$	Turn-Off Delay Time			136		ns
$t_f$	Turn-Off Fall Time			59		ns
$t_{rr}$	Body Diode Reverse Recovery Time	$I_F=-14\text{A}$ , $dI/dt=500\text{A}/\mu\text{s}$	26	33	40	ns
$Q_{rr}$	Body Diode Reverse Recovery Charge	$I_F=-14\text{A}$ , $dI/dt=500\text{A}/\mu\text{s}$	80	100	120	nC

A. The value of  $R_{\text{BJA}}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The Power dissipation  $P_{\text{DSM}}$  is based on  $R_{\text{BJA}}$   $t \leq 10\text{s}$  value and the maximum allowed junction temperature of  $150^\circ\text{C}$ . The value in any given application depends on the user's specific board design.

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  $R_{\text{BJA}}$  is the sum of the thermal impedance from junction to case  $R_{\text{JUC}}$  and case to ambient.

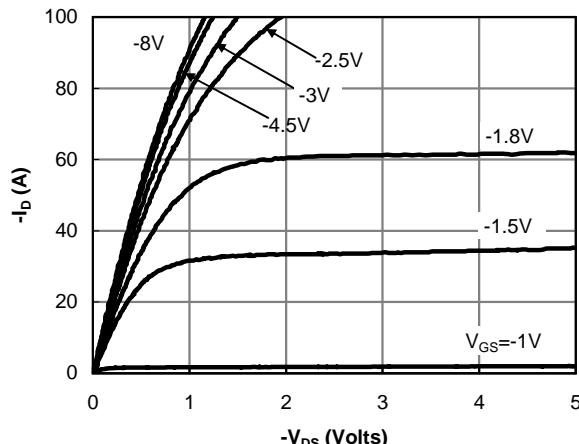
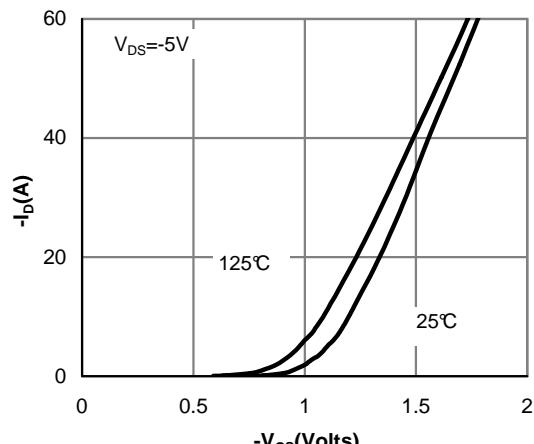
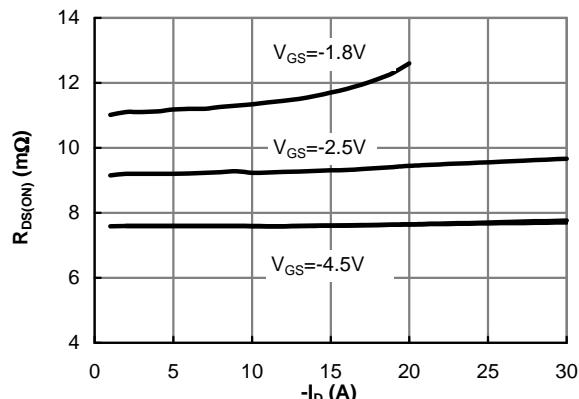
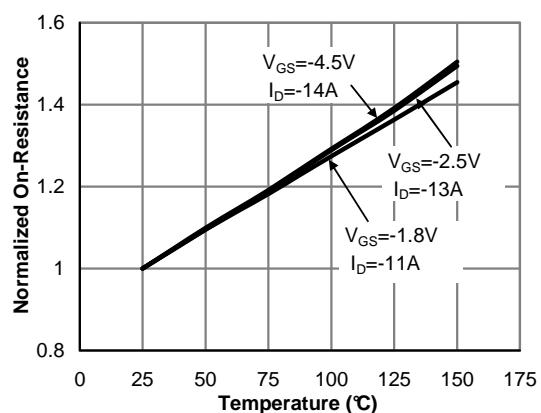
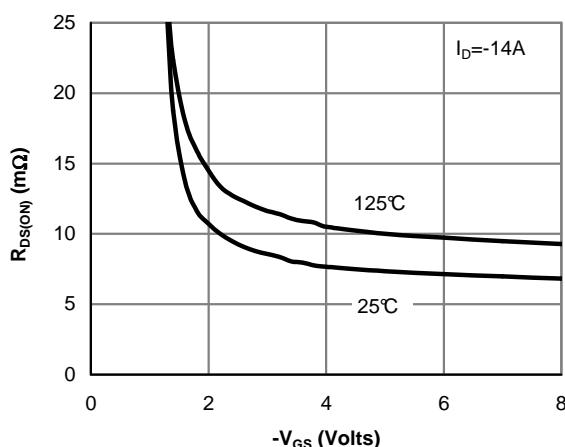
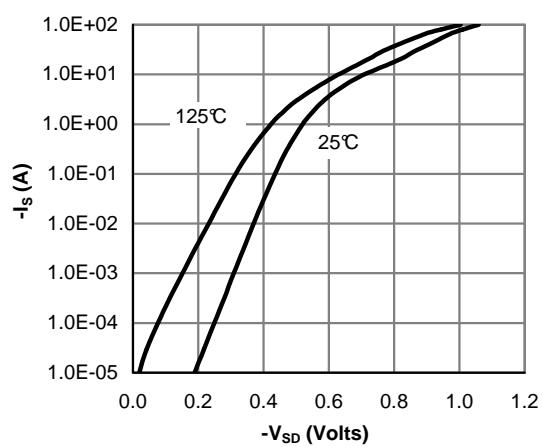
E. The static characteristics in Figures 1 to 6 are obtained using  $<300\mu\text{s}$  pulses, duty cycle 0.5% max.

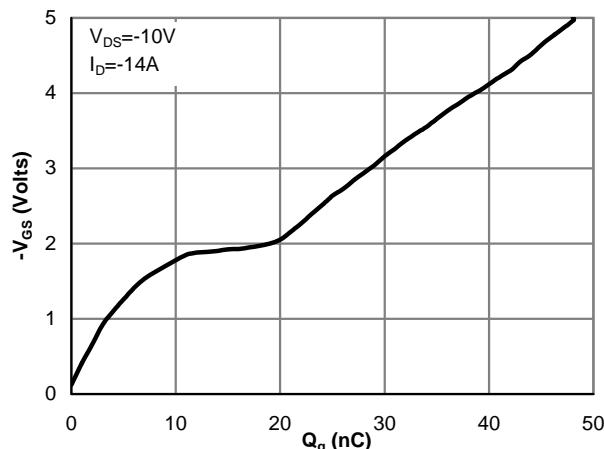
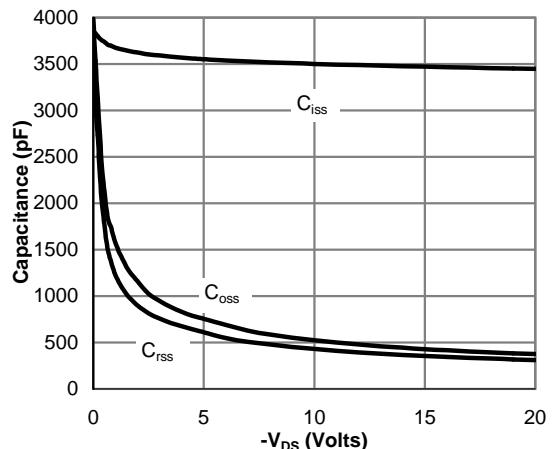
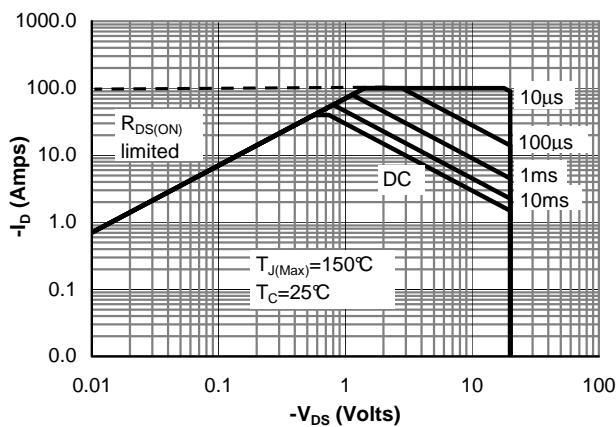
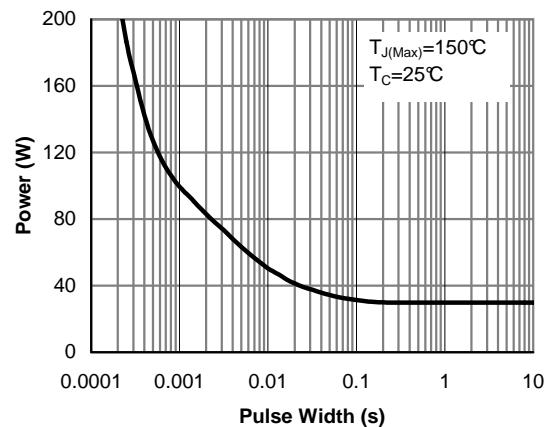
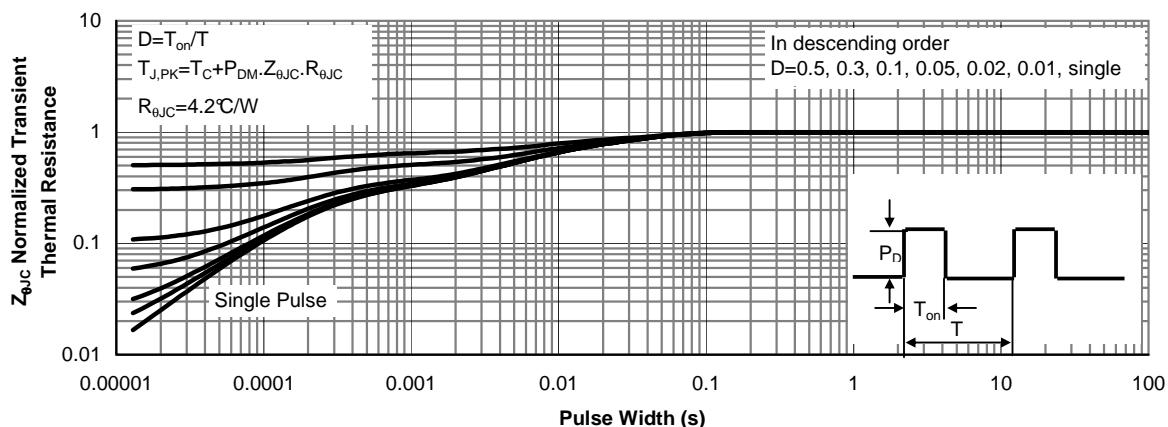
F. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of  $T_{J(\text{MAX})}=150^\circ\text{C}$ . The SOA curve provides a single pulse rating.

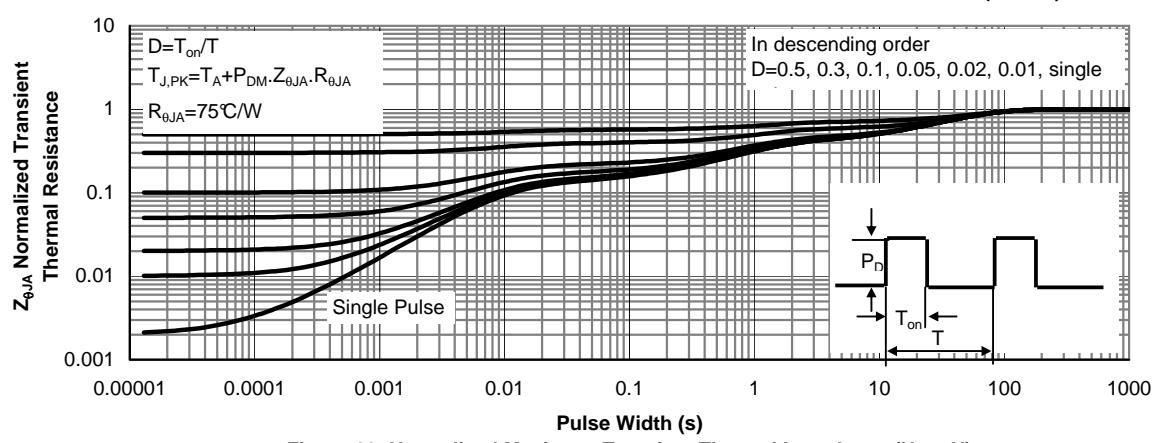
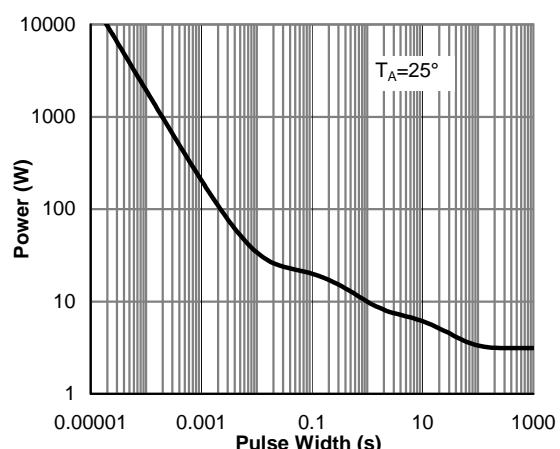
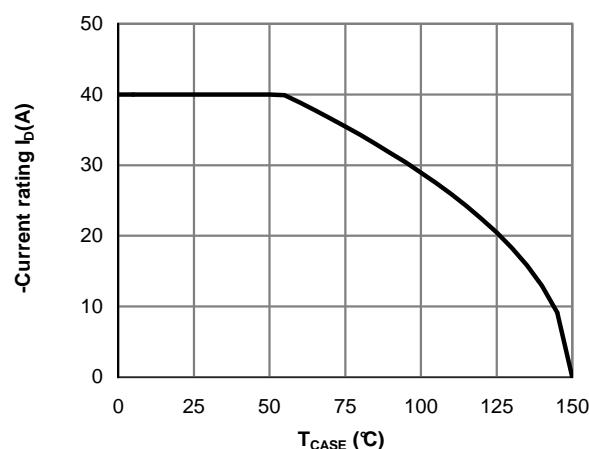
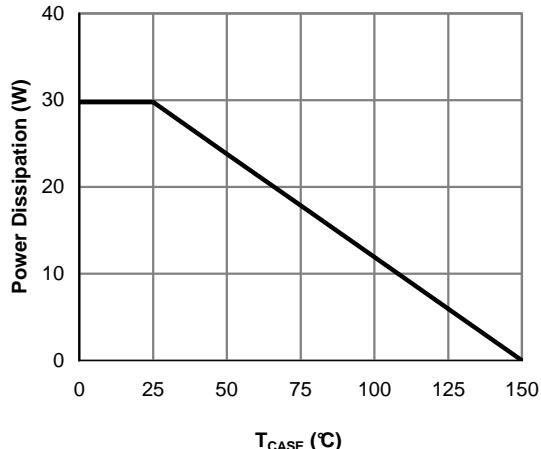
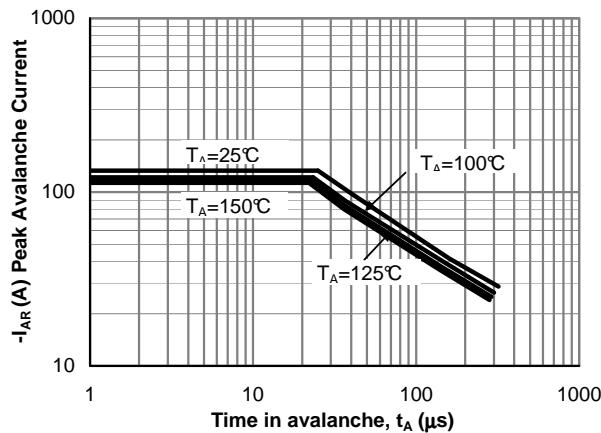
G. The maximum current rating is package limited.

H. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ .

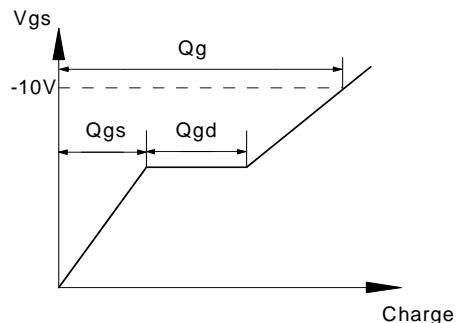
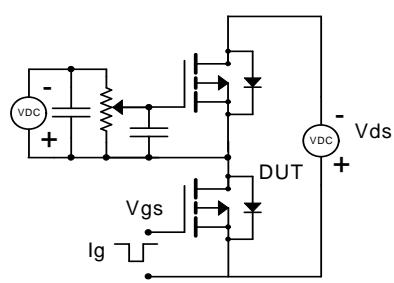
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**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Fig 1: On-Region Characteristics (Note E)**

**Figure 2: Transfer Characteristics (Note E)**

**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**

**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

**Figure 6: Body-Diode Characteristics (Note E)**

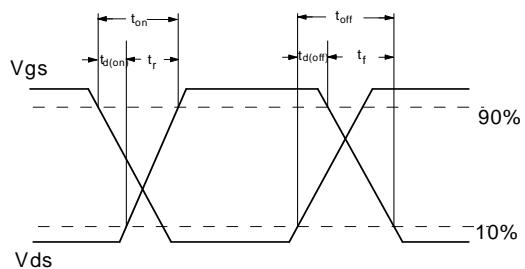
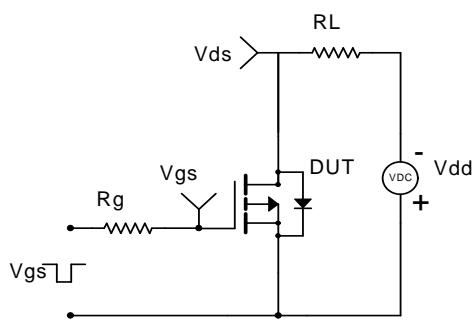
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 7: Gate-Charge Characteristics**

**Figure 8: Capacitance Characteristics**

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

**Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)**

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

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**


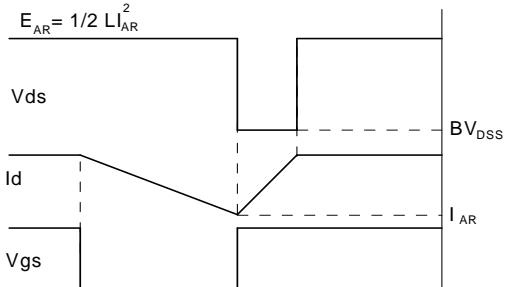
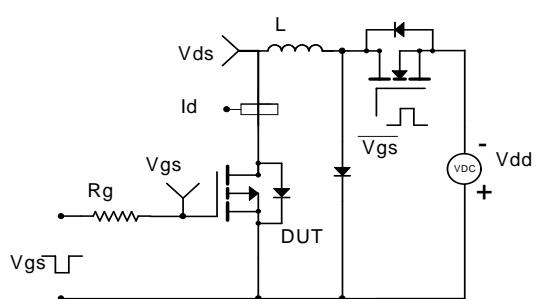
### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



### Diode Recovery Test Circuit & Waveforms

