



ALPHA & OMEGA
SEMICONDUCTOR

AO4606

30V Complementary MOSFET

General Description

The AO4606 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

Product Summary

N-Channel

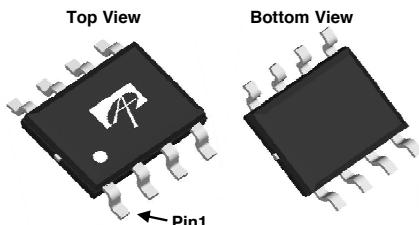
$V_{DS} = 30V$
 $I_D = 6A$ ($V_{GS} = 10V$)
 $R_{DS(ON)} < 30m\Omega$ ($V_{GS} = 10V$)
 $< 42m\Omega$ ($V_{GS} = 4.5V$)
100% UIS Tested
100% R_g Tested

P-Channel

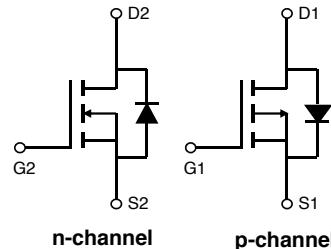
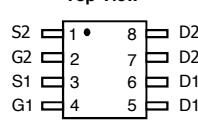
$-30V$
 $-6.5A$ ($V_{GS} = -10V$)
 $R_{DS(ON)} < 28m\Omega$ ($V_{GS} = -10V$)
 $< 44m\Omega$ ($V_{GS} = -4.5V$)
100% UIS Tested
100% R_g Tested



SOIC-8



Top View



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

Parameter	Symbol	Max n-channel	Max p-channel	Units
Drain-Source Voltage	V_{DS}	30	-30	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current ^A	I_D	6	-6.5	A
Current ^B		5	-5.3	
Pulsed Drain Current ^C	I_{DM}	30	-30	
Avalanche Current ^C	I_{AS}, I_{AR}	10	23	A
Avalanche energy L=0.1mH ^C	E_{AS}, E_{AR}	5	26	mJ
Power Dissipation ^B	P_D	2	2	W
Power Dissipation ^B		1.3	1.3	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		°C

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient ^{A,D}		74	90	°C/W
Maximum Junction-to-Lead	$R_{\theta JL}$	32	40	°C/W

N-Channel 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	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=30\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1	μA
					5	
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm20\text{V}$			±100	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.2	1.8	2.4	V
$I_{D(\text{ON})}$	On state drain current	$V_{GS}=10\text{V}, V_{DS}=5\text{V}$	30			A
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=6\text{A}$ $T_J=125^\circ\text{C}$		25	30	$\text{m}\Omega$
				40	48	
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.76	1	V
I_S	Maximum Body-Diode Continuous Current				2.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$	200	255	310	pF
C_{oss}	Output Capacitance		30	45	60	pF
C_{rss}	Reverse Transfer Capacitance		20	35	50	pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	1.6	3.25	4.9	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, I_D=6\text{A}$	4	5.2	6	nC
$Q_g(4.5\text{V})$	Total Gate Charge		2	2.55	3	nC
Q_{gs}	Gate Source Charge			0.85		nC
Q_{gd}	Gate Drain Charge			1.3		nC
$t_{D(\text{on})}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=2.5\Omega, R_{\text{GEN}}=3\Omega$		4.5		ns
t_r	Turn-On Rise Time			2.5		ns
$t_{D(\text{off})}$	Turn-Off DelayTime			14.5		ns
t_f	Turn-Off Fall Time			3.5		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=6\text{A}, dI/dt=100\text{A}/\mu\text{s}$		8.5	12	ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=6\text{A}, dI/dt=100\text{A}/\mu\text{s}$		2.2	3	nC

A. The value of R_{iJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{ C}$. 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 $\leq 10\text{s}$ junction-to-ambient thermal resistance.

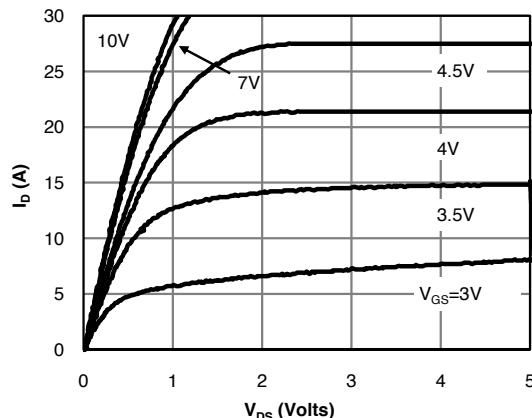
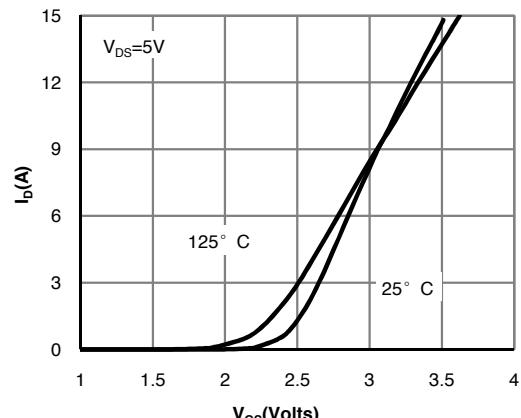
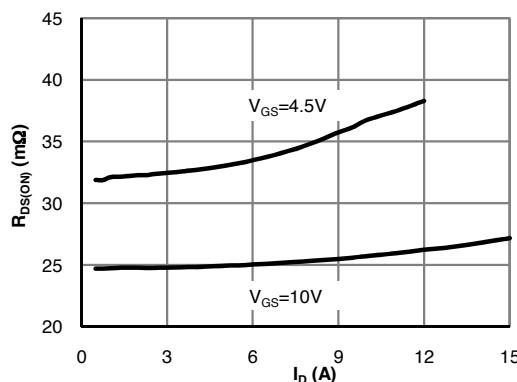
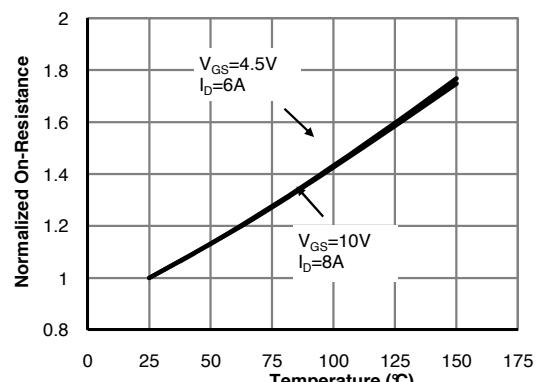
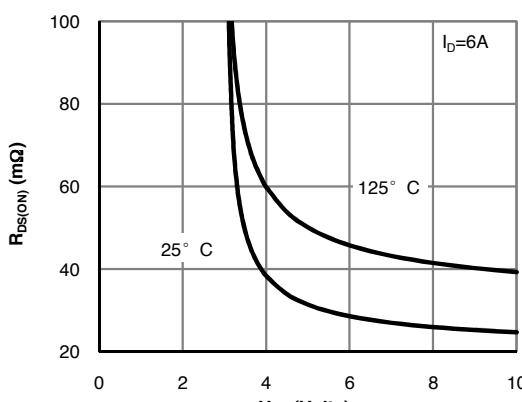
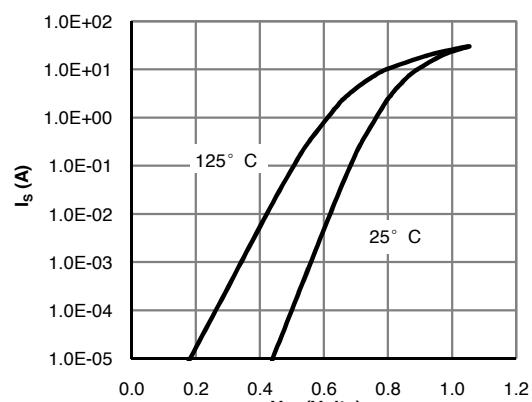
C. Repetitive rating, pulse width limited by junction temperature $T_{J(\text{MAX})}=150^\circ\text{ C}$. Ratings are based on low frequency and duty cycles to keep initial $T_J=25^\circ\text{ C}$.

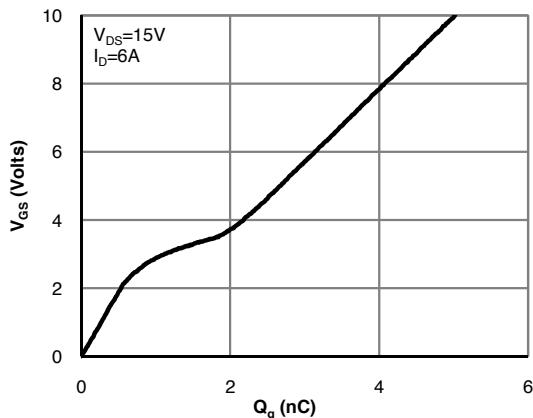
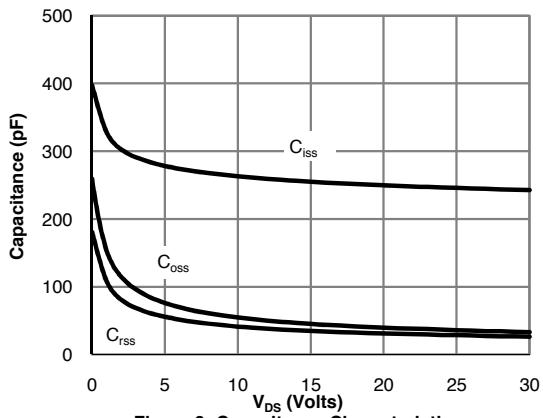
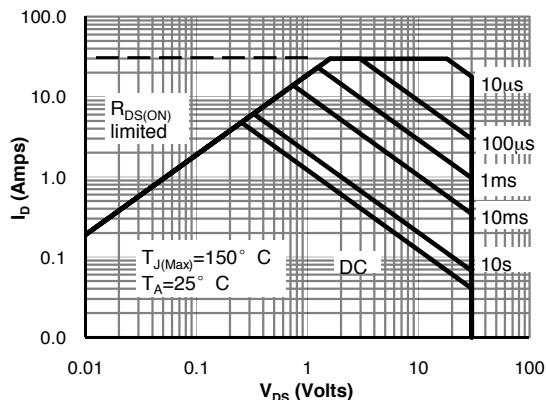
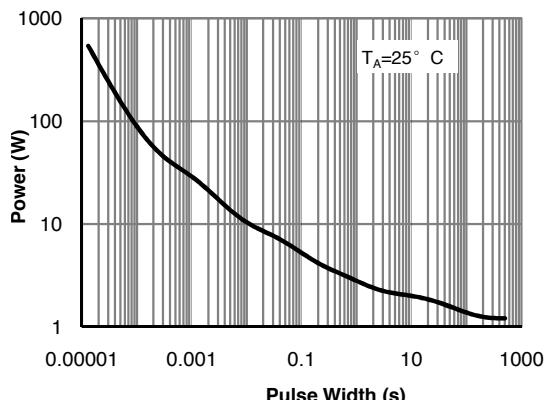
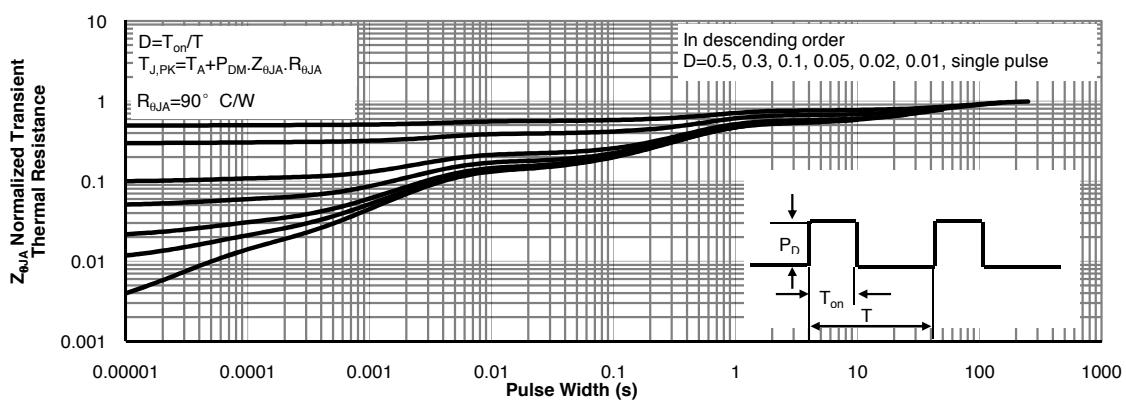
D. The R_{iJA} is the sum of the thermal impedance from junction to lead R_{iJL} and lead to ambient.

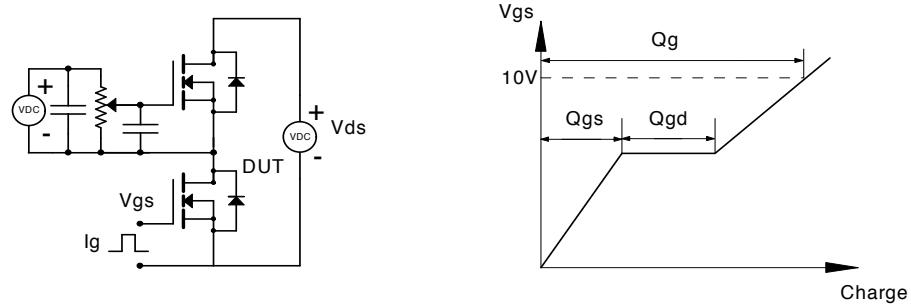
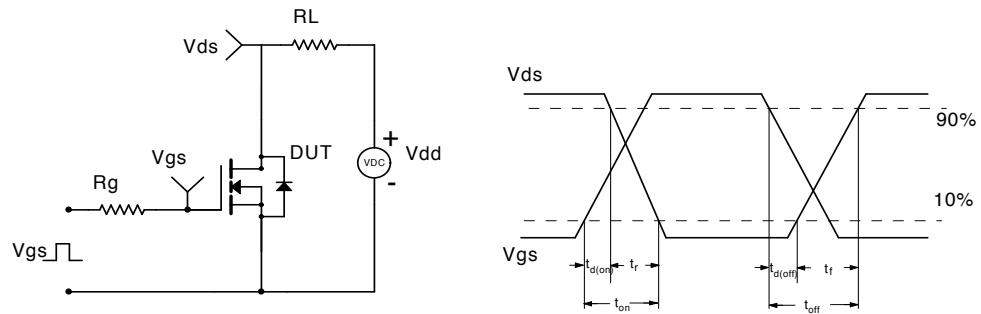
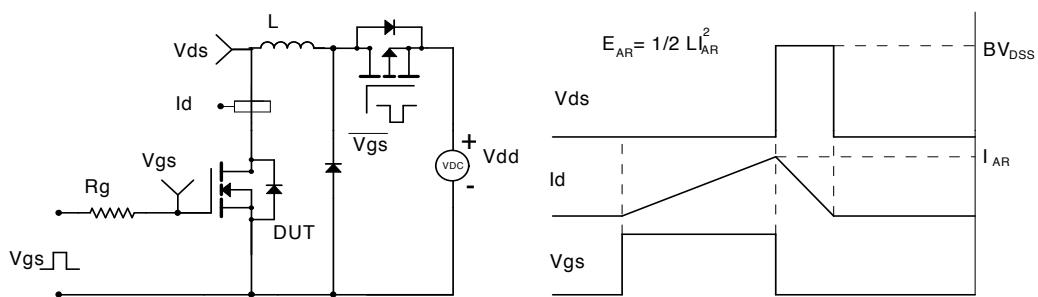
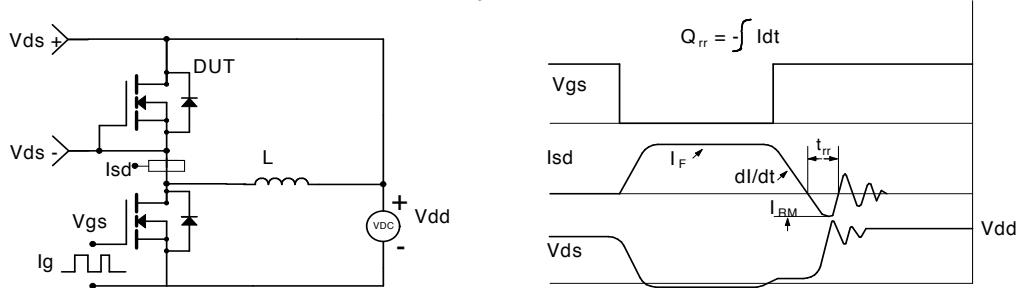
E. The static characteristics in Figures 1 to 6 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(\text{MAX})}=150^\circ\text{ C}$. The SOA curve provides a single pulse rating.

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N-Channel: 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)

N-Channel: 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-Ambient (Note F)

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

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

Diode Recovery Test Circuit & Waveforms




P-Channel 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	$I_D=-250\mu\text{A}, V_{GS}=0\text{V}$	-30			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=-30\text{V}, V_{GS}=0\text{V}$			-1	μA
			$T_J=55^\circ\text{C}$		-5	
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm20\text{V}$			±100	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu\text{A}$	-1.3	-1.85	-2.4	V
$I_{D(\text{ON})}$	On state drain current	$V_{GS}=-10\text{V}, V_{DS}=-5\text{V}$	-30			A
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=-10\text{V}, I_D=-6.5\text{A}$		22	28	$\text{m}\Omega$
			$T_J=125^\circ\text{C}$	32	40	
		$V_{GS}=-4.5\text{V}, I_D=-5\text{A}$		34	44	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}, I_D=-6.5\text{A}$		18		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}, V_{GS}=0\text{V}$		-0.8	-1	V
I_S	Maximum Body-Diode Continuous Current				-2.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=-15\text{V}, f=1\text{MHz}$		760		pF
C_{oss}	Output Capacitance			140		pF
C_{rss}	Reverse Transfer Capacitance			95		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	1.5	3.2	5	Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=-15\text{V}, I_D=-6.5\text{A}$		13.6	16	nC
$Q_g(4.5\text{V})$	Total Gate Charge			6.7	8	nC
Q_{gs}	Gate Source Charge			2.5		nC
Q_{gd}	Gate Drain Charge			3.2		nC
$t_{D(\text{on})}$	Turn-On DelayTime	$V_{GS}=10\text{V}, V_{DS}=-15\text{V}, R_L=2.3\Omega, R_{\text{GEN}}=3\Omega$		8		ns
t_r	Turn-On Rise Time			6		ns
$t_{D(\text{off})}$	Turn-Off DelayTime			17		ns
t_f	Turn-Off Fall Time			5		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-6.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		15		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-6.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		9.7		nC

A. The value of R_{JJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. 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 $\leq 10\text{s}$ junction-to-ambient thermal resistance.

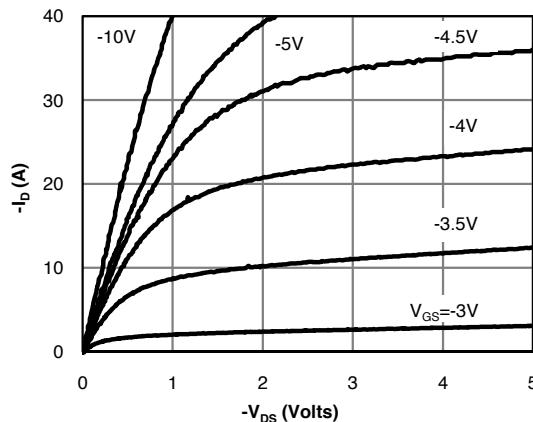
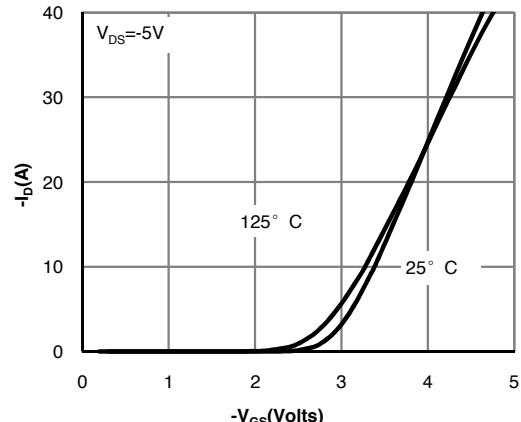
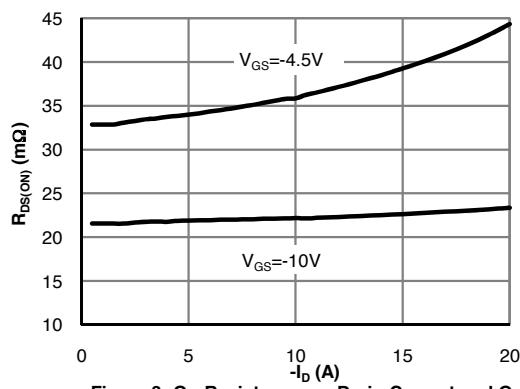
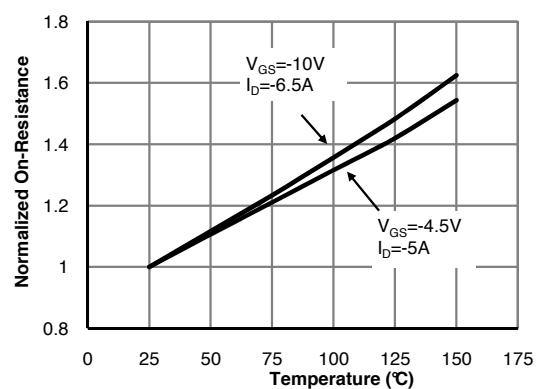
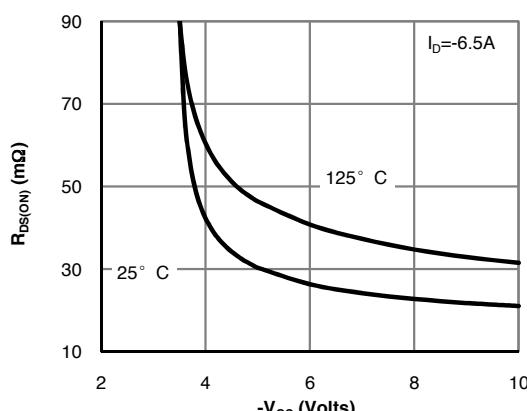
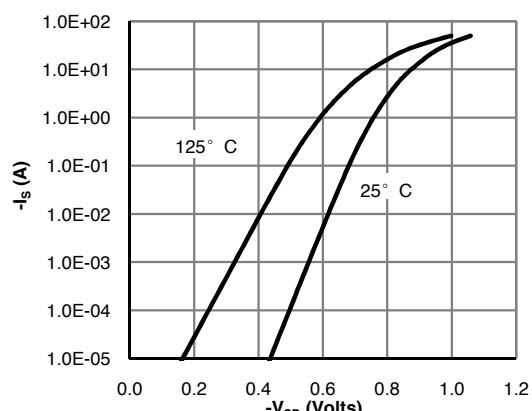
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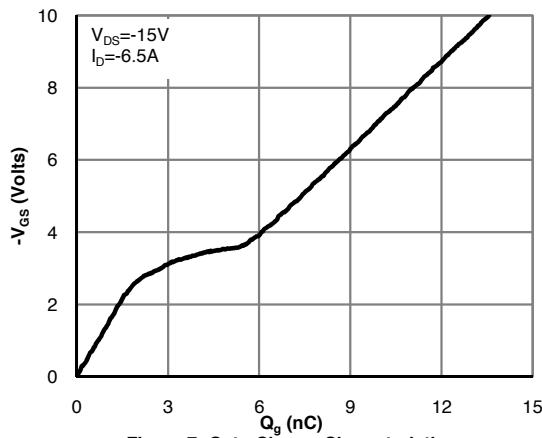
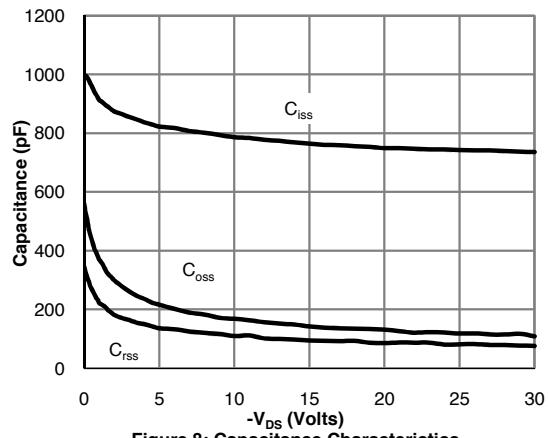
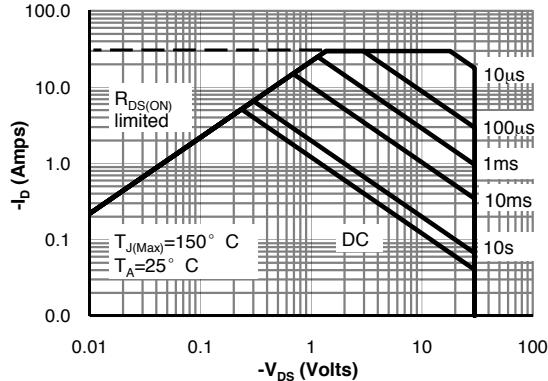
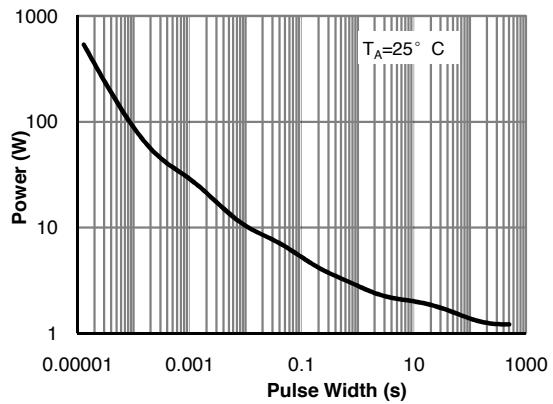
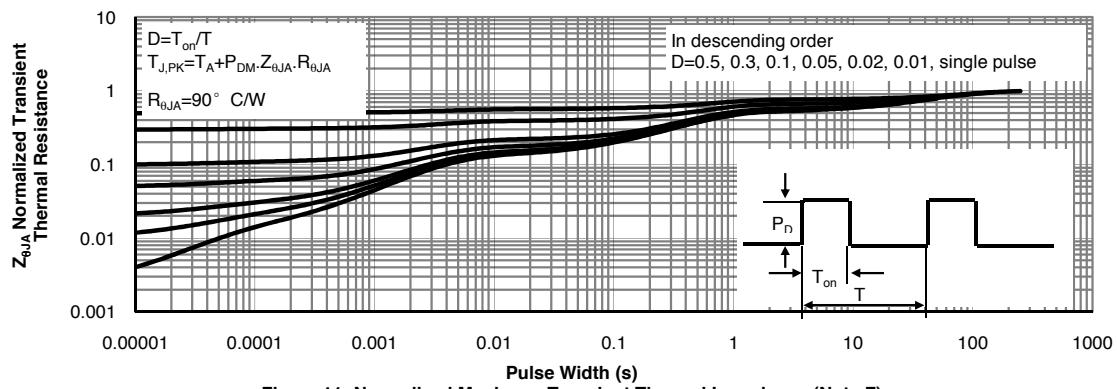
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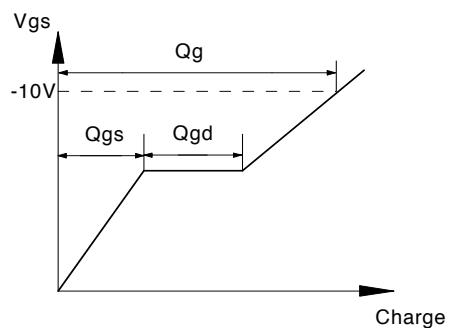
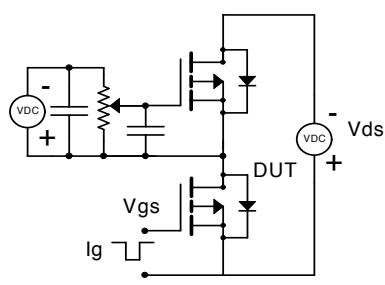
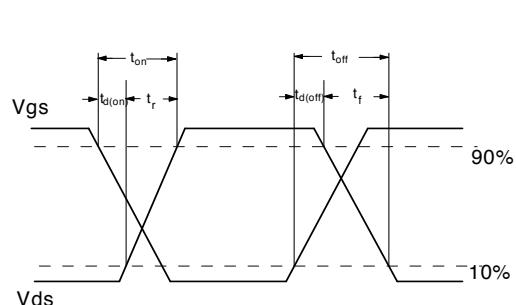
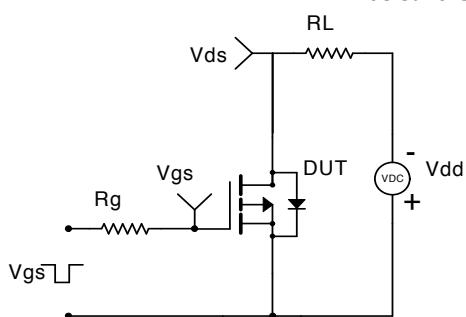
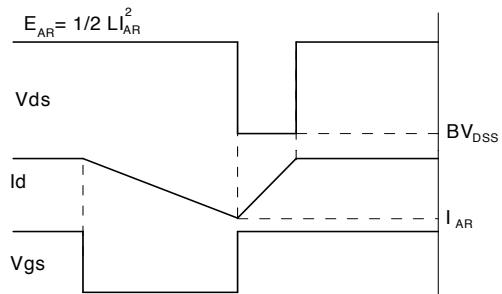
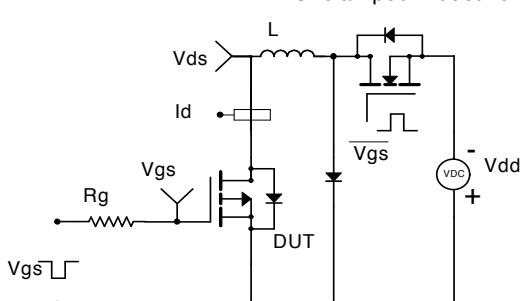
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