

General Description

The AO4938 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The two MOSFETs make a compact and efficient switch and synchronous rectifier combination for use in DC-DC converters. A monolithically integrated Schottky diode in parallel with the synchronous MOSFET to boost efficiency further.

Product Summary

FET1(N-Channel)

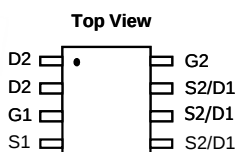
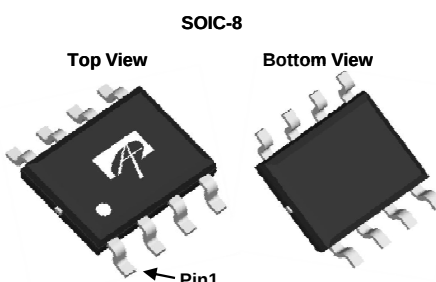
$V_{DS} = 30V$
 $I_D = 8.8A$ ($V_{GS} = 10V$)
 $R_{DS(ON)}$
 $< 16m\Omega$ ($V_{GS} = 10V$)
 $< 22m\Omega$ ($V_{GS} = 4.5V$)

100% UIS Tested
 100% R_g Tested

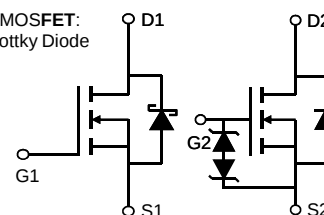
FET2(N-Channel)

$V_{DS} = 30V$
 $I_D = 8A$ ($V_{GS} = 10V$)
 $R_{DS(ON)}$
 $< 19m\Omega$ ($V_{GS} = 10V$)
 $< 28m\Omega$ ($V_{GS} = 4.5V$)

ESD Protected
 100% UIS Tested
 100% R_g Tested



SRFET™
 Soft Recovery MOSFET:
 Integrated Schottky Diode



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

Parameter	Symbol	Max FET1	Max FET2	Units
Drain-Source Voltage	V_{DS}	30	30	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	8.8	8	A
$T_A = 25^\circ C$				
Current		7.1	6.5	
$T_A = 70^\circ C$				
Pulsed Drain Current ^C	I_{DM}	60	40	
Avalanche Current ^C	I_{AS}, I_{AR}	21	13	A
Avalanche energy $L = 0.3mH$ ^C	E_{AS}, E_{AR}	66	25	mJ
Power Dissipation ^B	P_D	2	2	W
$T_A = 25^\circ C$				
$T_A = 70^\circ C$		1.3	1.3	
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150		$^\circ C$

Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	48	62.5	$^\circ C/W$
$t \leq 10s$				
Maximum Junction-to-Ambient ^{A,D}	$R_{\theta JA}$	74	90	$^\circ C/W$
Steady-State				
Maximum Junction-to-Lead	$R_{\theta JL}$	32	40	$^\circ C/W$
Steady-State				

FET1 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	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V T _J =125°C			0.1 20	mA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} =±20V			100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =250μA	1.1	1.65	2.2	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	60			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =8.8A T _J =125°C		13.3	16	mΩ
		V _{GS} =4.5V, I _D =7A		20	25	mΩ
				18	22	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =8.8A		29		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.41	0.5	V
I _S	Maximum Body-Diode + Schottky Continuous Current				3.5	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz		1267	1600	pF
C _{oss}	Output Capacitance			308		pF
C _{rss}	Reverse Transfer Capacitance			118		pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz		1.3	2.0	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =8.8A		21	30	nC
Q _g (4.5V)	Total Gate Charge			10.4		nC
Q _{gs}	Gate Source Charge			3		nC
Q _{gd}	Gate Drain Charge			3.6		nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =1.7Ω, R _{GEN} =3Ω		5.2		ns
t _r	Turn-On Rise Time			3.8		ns
t _{D(off)}	Turn-Off DelayTime			21.2		ns
t _f	Turn-Off Fall Time			4.4		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =8.8A, dI/dt=300A/μs		11.2	15	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =8.8A, dI/dt=300A/μs		10.5		nC

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° 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(MAX)}=150° C, using ≤ 10s junction-to-ambient thermal resistance.

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 lead R_{θJL} and lead 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-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(MAX)}=150° C. The SOA curve provides a single pulse rating.

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FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

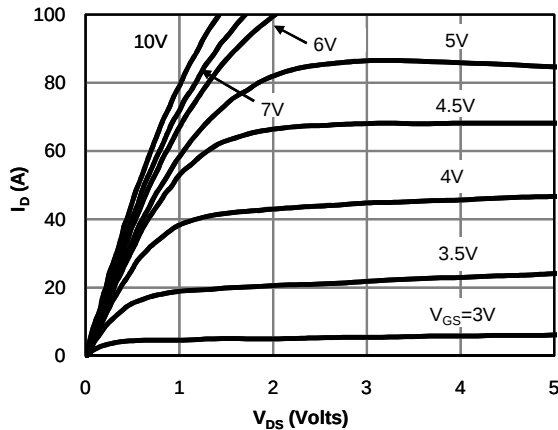


Fig 1: On-Region Characteristics (Note E)

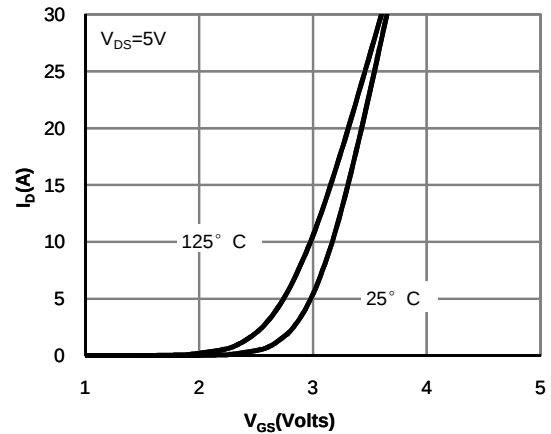


Figure 2: Transfer Characteristics (Note E)

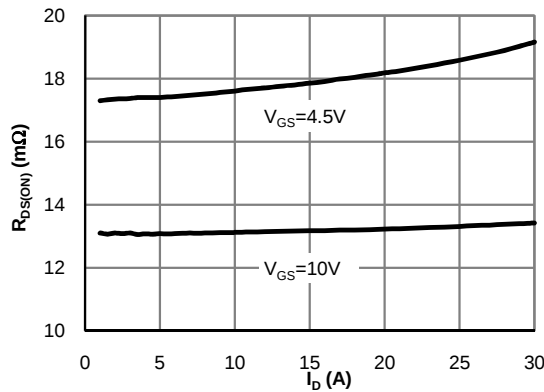


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

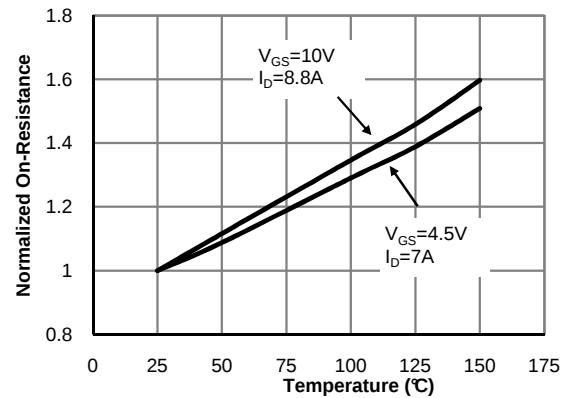


Figure 4: On-Resistance vs. Junction Temperature (Note E)

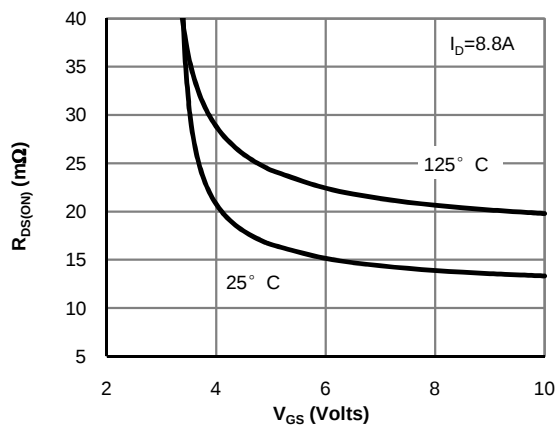


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

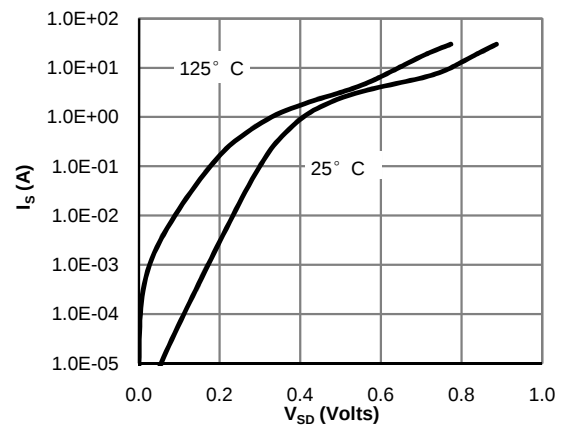
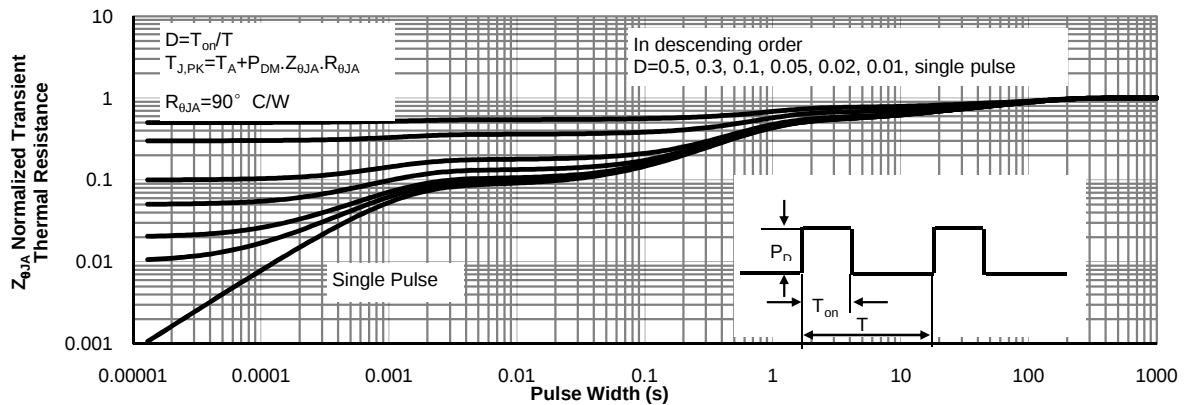
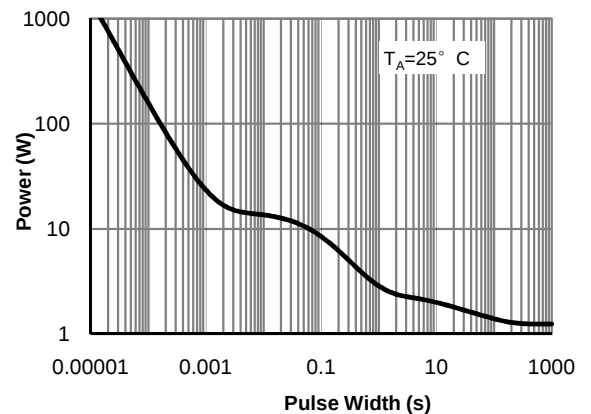
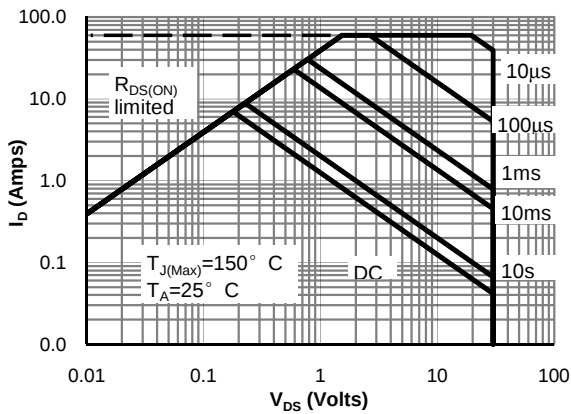
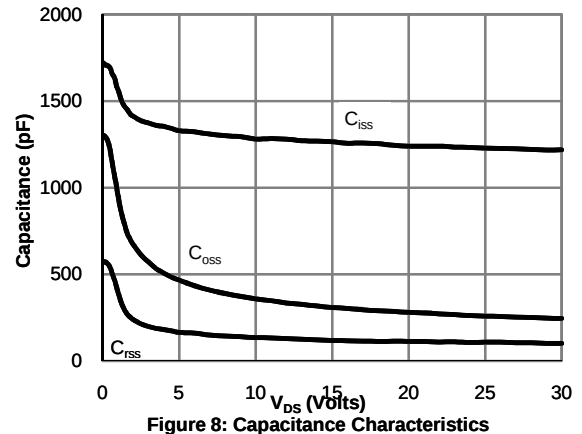
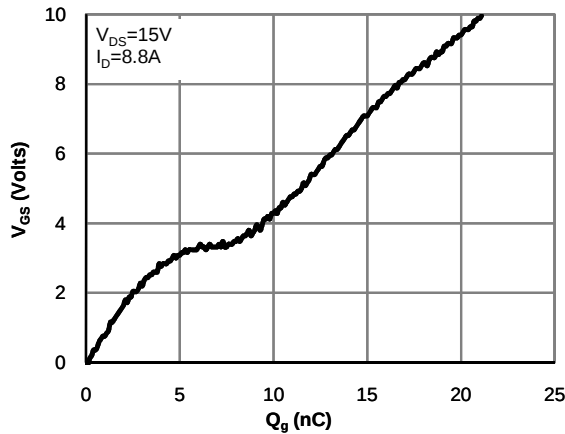


Figure 6: Body-Diode Characteristics (Note E)

FET1: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



FET2 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	30			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =30V, V _{GS} =0V T _J =55°C			1 5	μA
I _{GSS}	Gate-Body leakage current	V _{DS} =0V, V _{GS} = ±16V			10	μA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} I _D =250μA	1.2	1.8	2.4	V
I _{D(ON)}	On state drain current	V _{GS} =10V, V _{DS} =5V	40			A
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} =10V, I _D =8A T _J =125°C		15.5 21	19 25	mΩ
		V _{GS} =4.5V, I _D =4A		18.6	28	mΩ
g _{FS}	Forward Transconductance	V _{DS} =5V, I _D =8A		30		S
V _{SD}	Diode Forward Voltage	I _S =1A, V _{GS} =0V		0.75	1	V
I _S	Maximum Body-Diode Continuous Current				2.5	A
DYNAMIC PARAMETERS						
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =15V, f=1MHz	600	740	888	pF
C _{oss}	Output Capacitance		77	110	145	pF
C _{rss}	Reverse Transfer Capacitance		50	82	115	pF
R _g	Gate resistance	V _{GS} =0V, V _{DS} =0V, f=1MHz	0.5	1.1	1.7	Ω
SWITCHING PARAMETERS						
Q _g (10V)	Total Gate Charge	V _{GS} =10V, V _{DS} =15V, I _D =8A	12	15	18	nC
Q _g (4.5V)	Total Gate Charge		6	7.5	9	nC
Q _{gs}	Gate Source Charge		2	2.5	3	nC
Q _{gd}	Gate Drain Charge		2	3	5	nC
t _{D(on)}	Turn-On DelayTime	V _{GS} =10V, V _{DS} =15V, R _L =1.8Ω, R _{GEN} =3Ω		5		ns
t _r	Turn-On Rise Time			3.5		ns
t _{D(off)}	Turn-Off DelayTime			19		ns
t _f	Turn-Off Fall Time			3.5		ns
t _{rr}	Body Diode Reverse Recovery Time	I _F =8A, dI/dt=500A/μs	6	8	10	ns
Q _{rr}	Body Diode Reverse Recovery Charge	I _F =8A, dI/dt=500A/μs	14	18	22	nC

A. The value of R_{θJA} is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T_A=25° 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(MAX)}=150° C, using ≤ 10s junction-to-ambient thermal resistance.

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 lead R_{θJL} and lead 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-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(MAX)}=150° C. The SOA curve provides a single pulse rating.

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FET2: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

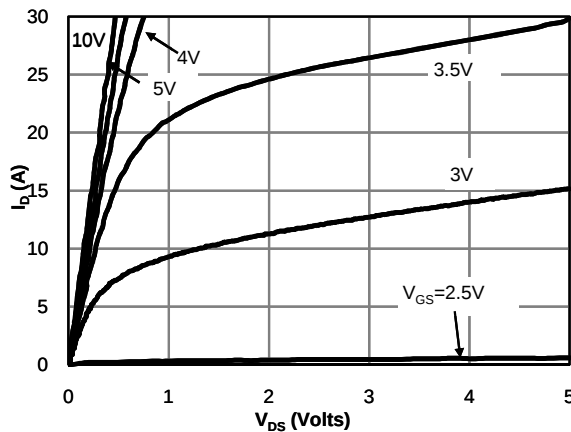


Fig 1: On-Region Characteristics (Note E)

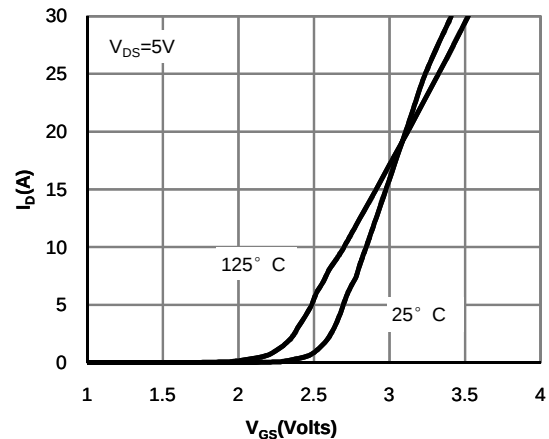


Figure 2: Transfer Characteristics (Note E)

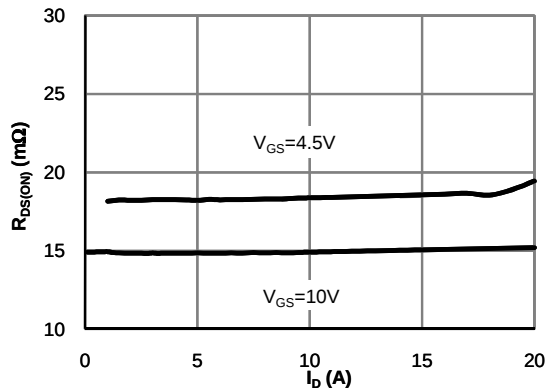


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

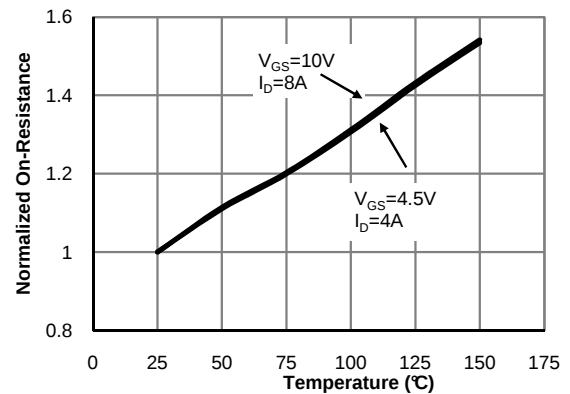


Figure 4: On-Resistance vs. Junction Temperature (Note E)

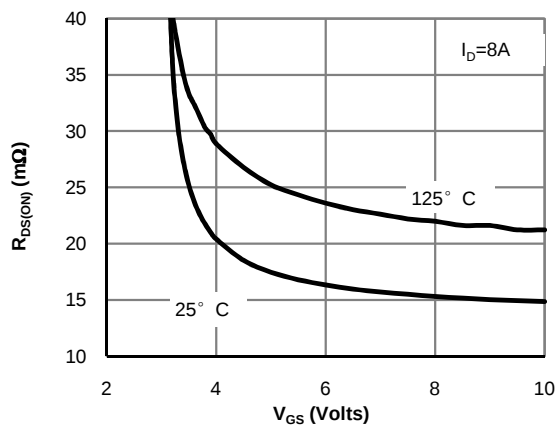


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

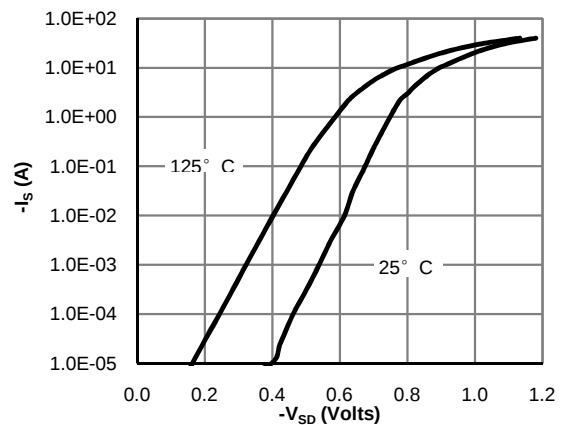
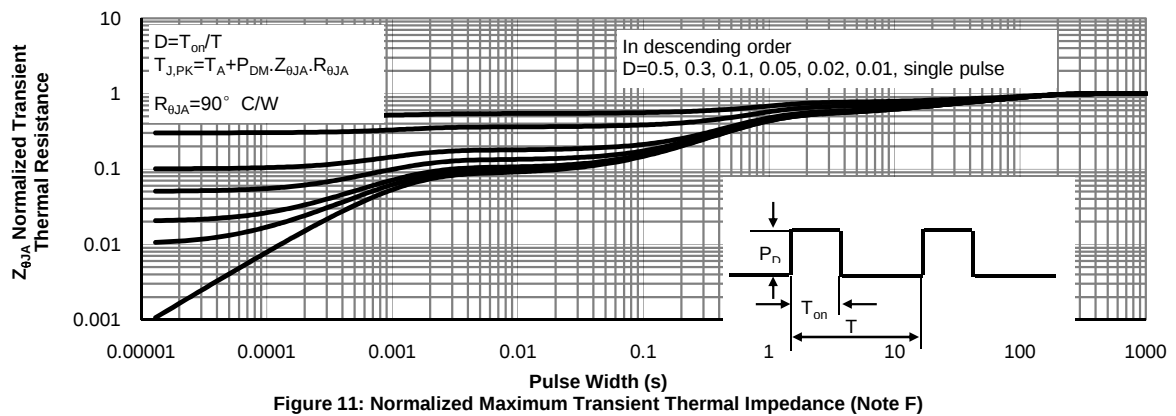
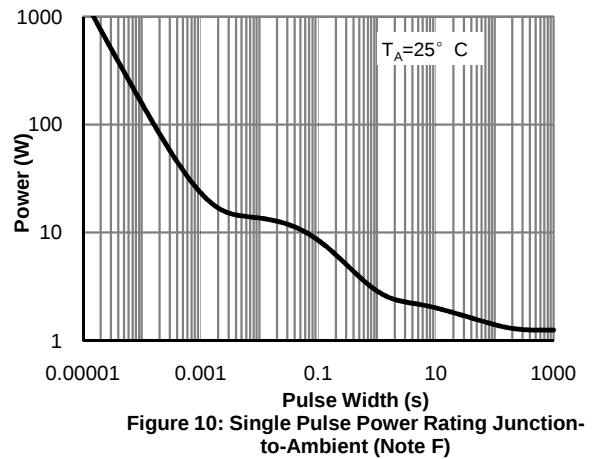
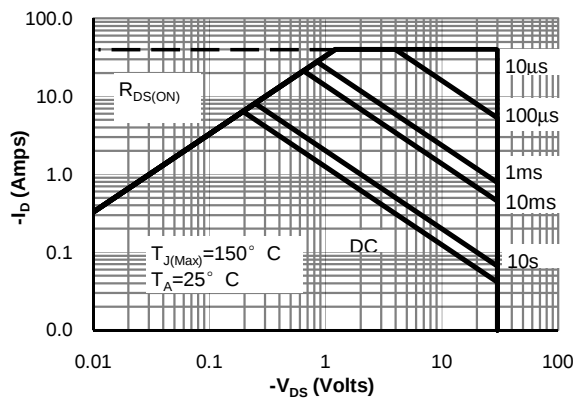
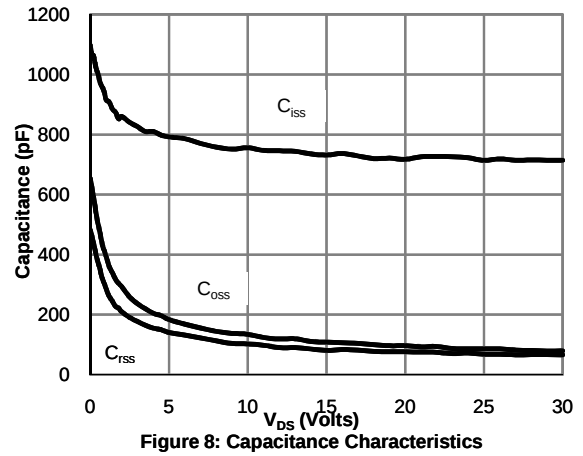
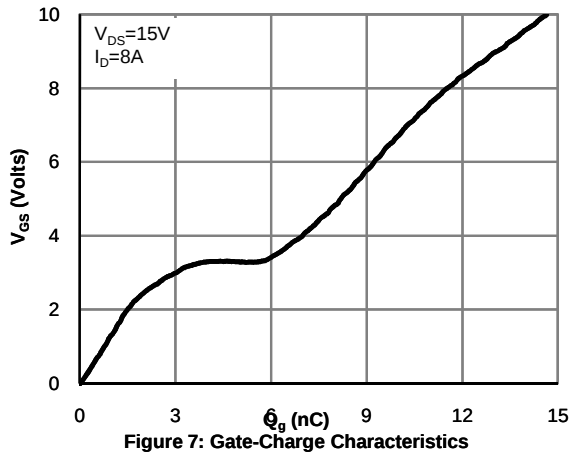
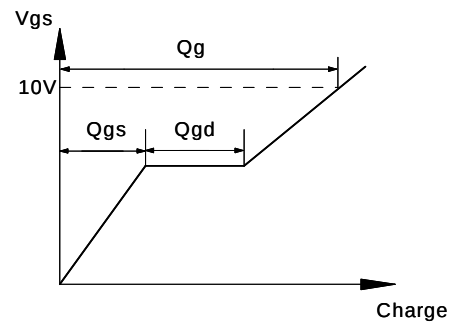
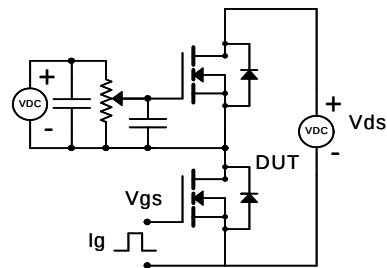


Figure 6: Body-Diode Characteristics (Note E)

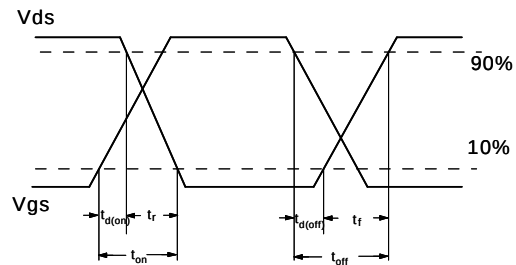
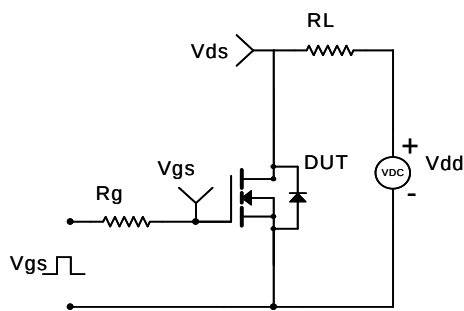
FET2: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



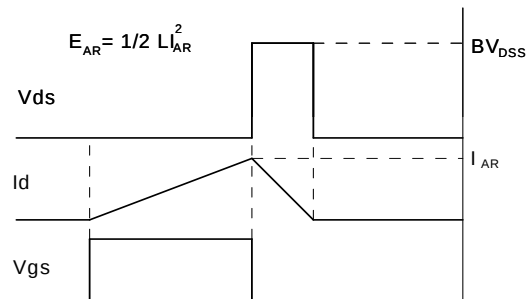
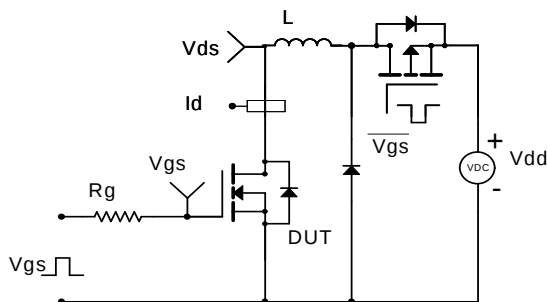
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

