ALPHA & OMEGA SEMICONDUCTOR

AO4928

Asymmetric Dual N-Channel Enhancement Mode Field Effect Transistor

SRFET ™

General Description

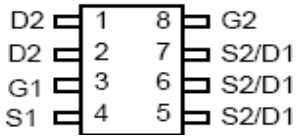
The AO4928 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The two MOSFETs make a compact and efficient switch and synchronous rectifier combination for use in DC-DC converters. A monolithically integrated Schottky diode in parallel with the synchronous MOSFET to boost efficiency further. *Standard Product AO4928 is Pb-free (meets ROHS & Sony 259 specifications). AO4928L is a Green Product ordering option. AO4928L and AO4928 are electrically identical.*

Features

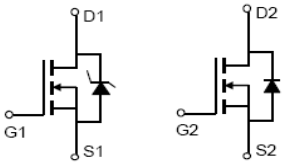
FET1	FET2	
V_{DS} (V) = 30V	V_{DS}(V) = 30V	
I_D = 9A	I_D=7.3A	(V_{GS} = 10V)
$R_{DS(ON)}$ < 16mΩ	<24mΩ	(V_{GS} = 10V)
$R_{DS(ON)}$ < 19.5mΩ	<29mΩ	(V_{GS} = 4.5V)

UIS TESTED!
Rg,Ciss,Coss,Crss Tested

SOIC-8



SRFET™
Soft **R**ecovery MOS**FET**:
Integrated Schottky Diode



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Max FET1	Max FET2	Units
Drain-Source Voltage		V_{DS}	30	30	V
Gate-Source Voltage		V_{GS}	±12	±12	V
Continuous Drain Current [A]	T_A=25°C	I_{DSM}	9.0	7.3	A
	T_A=70°C		7.2	5.9	
Pulsed Drain Current [B]		I_{DM}	40	40	
Avalanche Current [C]		I_{AR}	16	12	A
Repetitive avalanche energy L=0.3mH [C]		E_{AR}	38	22	mJ
Power Dissipation	T_A=25°C	P_{DSM}	2.0	2.0	W
	T_A=70°C		1.3	1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	°C

Thermal Characteristics FET1

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		74	90	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	32	40	°C/W

Thermal Characteristics FET2

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient [A]	Steady-State		74	90	°C/W
Maximum Junction-to-Lead [C]	Steady-State	$R_{\theta JL}$	32	40	°C/W

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}=24V, V_{GS}=0V		0.01	0.1	mA
		T_J=125°C		5	10	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±12V			0.1	µA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA	1.5	1.85	2.4	V
$I_{D(ON)}$	On state drain current	V_{GS}=4.5V, V_{DS}=5V	40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=9A		13.2	16	mΩ
		T_J=125°C		20.5	25.6	
		V_{GS}=4.5V, I_D=7A		15.7	19.5	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=9A		64		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.4	0.6	V
I_S	Maximum Body-Diode + Schottky Continuous Current				4.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		1450	1885	pF
C_{oss}	Output Capacitance			224		pF
C_{rss}	Reverse Transfer Capacitance			92		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		1.6	3	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=15V, I_D=9A		24.0	31	
Q_g(4.5V)	Total Gate Charge			12.0		nC
Q_{gs}	Gate Source Charge			3.9		nC
Q_{gd}	Gate Drain Charge			4.2		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=1.7Ω, R_{GEN}=3Ω		5.5		ns
t_r	Turn-On Rise Time			4.7		ns
$t_{D(off)}$	Turn-Off DelayTime			24.0		ns
t_f	Turn-Off Fall Time			4.0		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=9A, dI/dt=300A/µs		10	13	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=9A, dI/dt=300A/µs		6.8		nC

A: The value of $R_{\theta JA}$ is measured with the device in a still air environment with T_A =25°C. The power dissipation P_{DSM} and current rating I_{DSM} are based on $T_{J(MAX)}$=150°C, using t ≤ 10s junction-to-ambient thermal resistance.

B: Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=150°C.

C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

Rev0:Sept 2006

FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

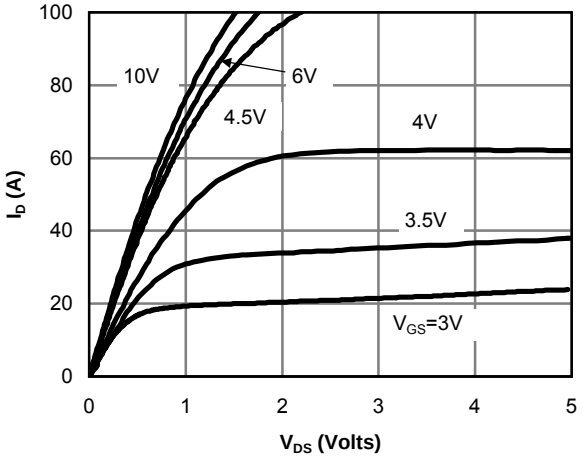


Figure 1: On-Region Characteristics

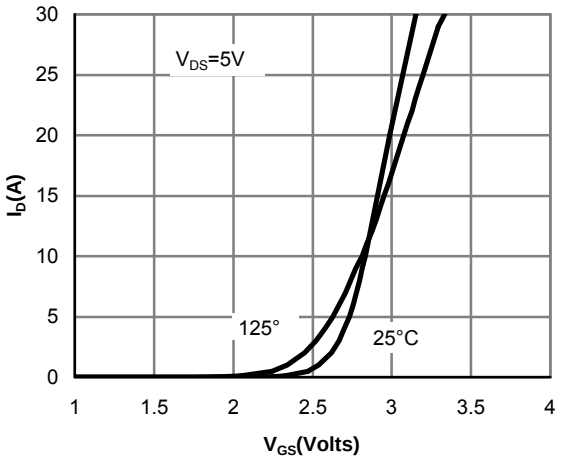


Figure 2: Transfer Characteristics

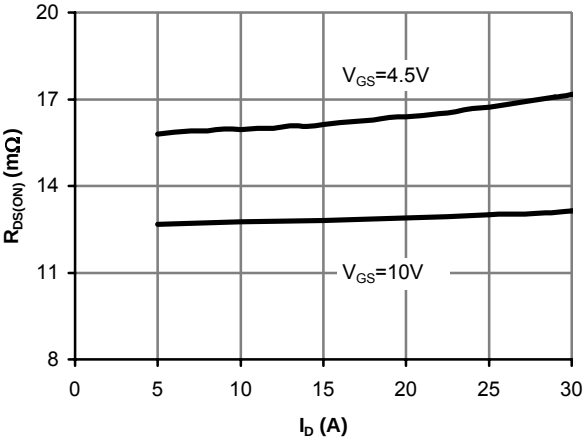


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

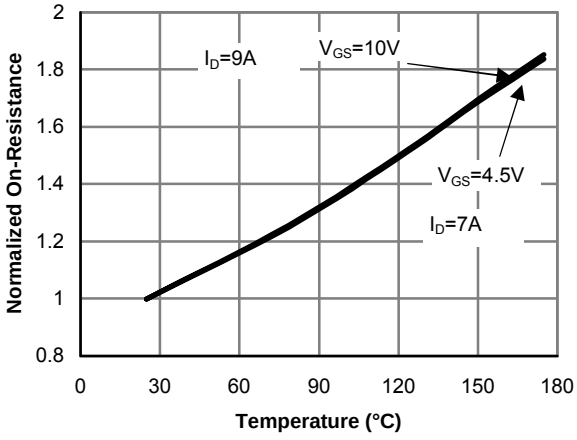


Figure 4: On-Resistance vs. Junction Temperature

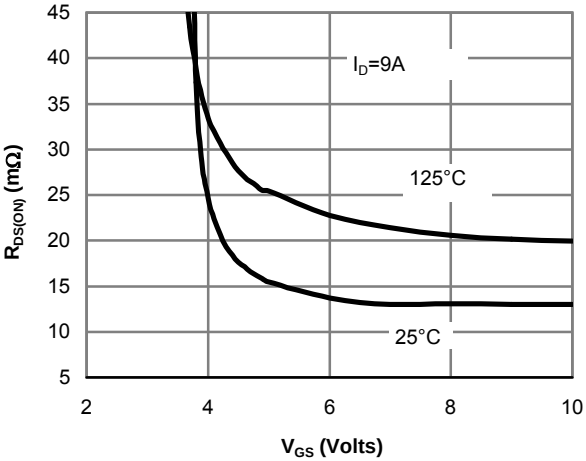


Figure 5: On-Resistance vs. Gate-Source Voltage

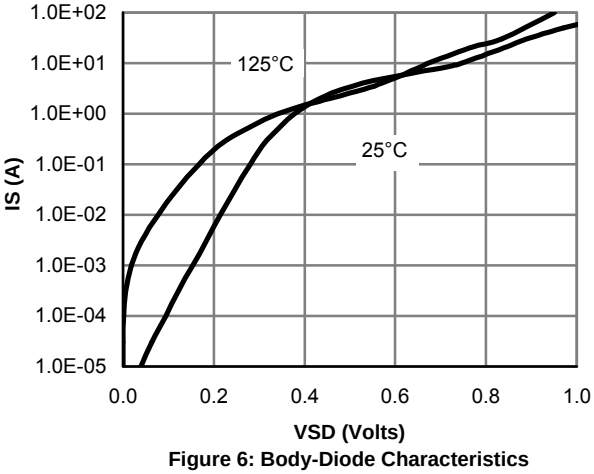


Figure 6: Body-Diode Characteristics

FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

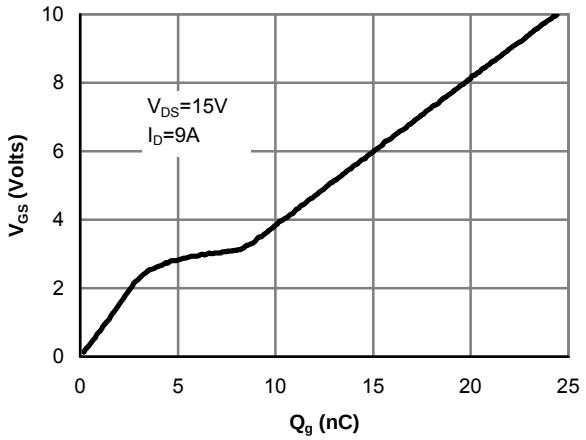


Figure 7: Gate-Charge Characteristics

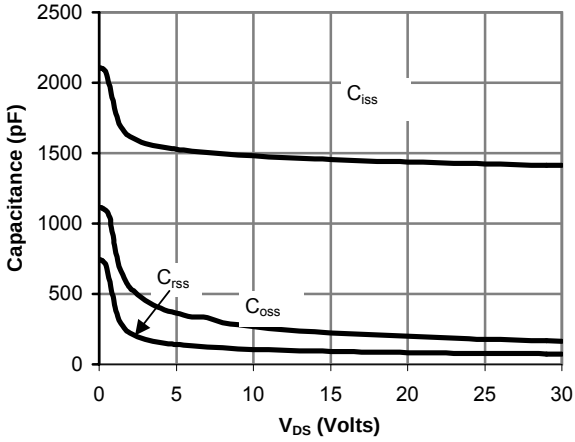


Figure 8: Capacitance Characteristics

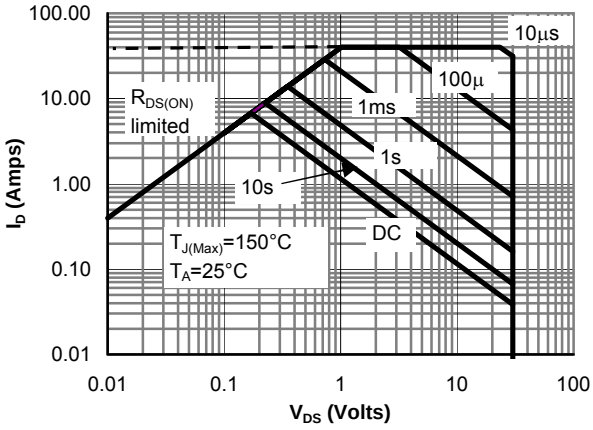


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

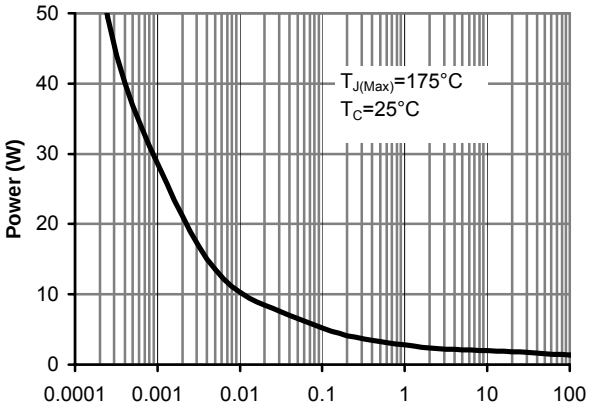


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

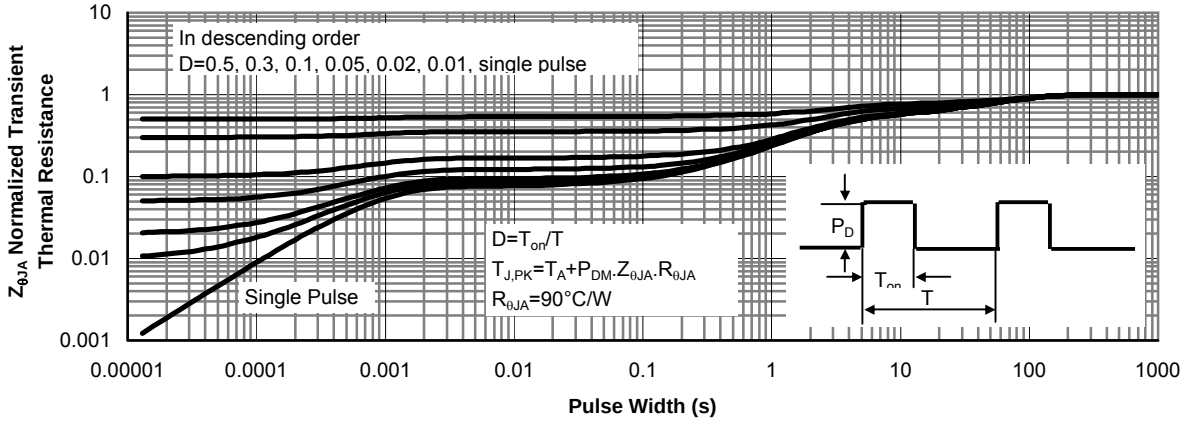


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

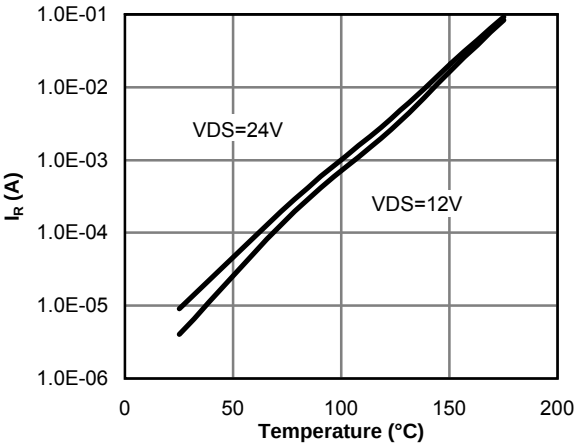


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

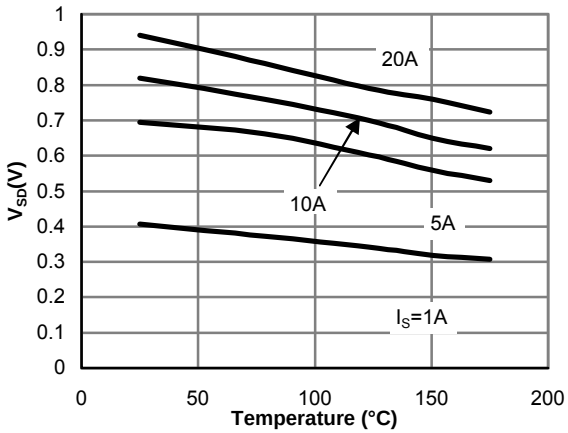


Figure 13: Diode Forward voltage vs. Junction Temperature

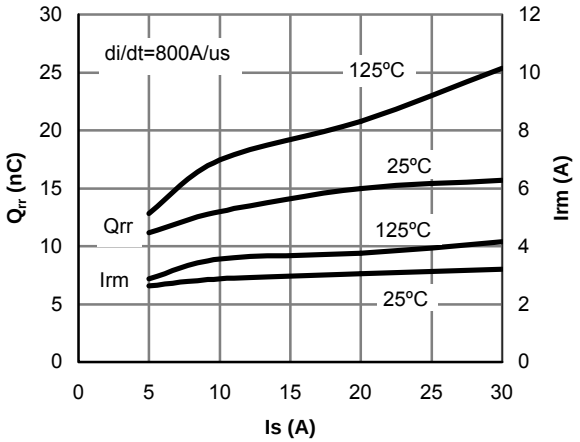


Figure 14: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

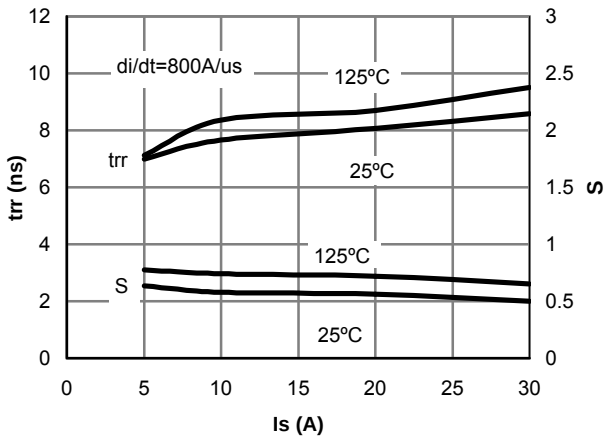


Figure 15: Diode Reverse Recovery Time and Soft Coefficient vs. Conduction Current

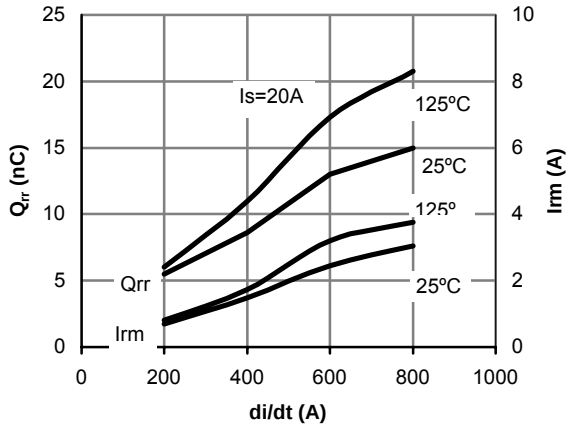


Figure 16: Diode Reverse Recovery Charge and Peak Current vs. di/dt

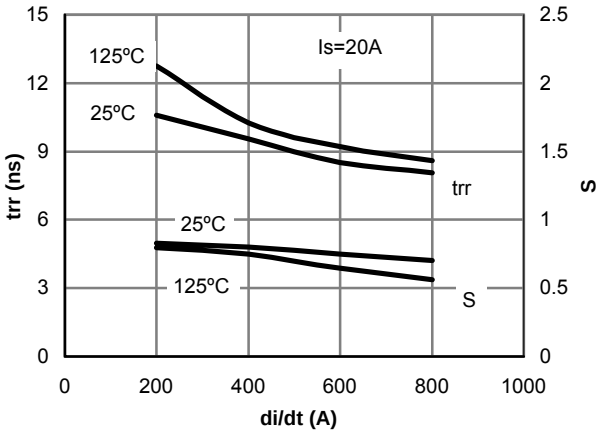


Figure 17: Diode Reverse Recovery Time and Soft Coefficient vs. di/dt

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}=24V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}= ±12V			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS} I_D=250µA	0.7	1	1.5	V
$I_{D(ON)}$	On state drain current	V_{GS}=4.5V, V_{DS}=5V	40			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=7.3A		20	24	mΩ
		T_J=125°C		30.0	36	
		V_{GS}=4.5V, I_D=6A		23.4	29	mΩ
		V_{GS}=2.5V, I_D=5.5A		35.4	48	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=7.3A		26		S
V_{SD}	Diode Forward Voltage	I_S=1A,V_{GS}=0V		0.71	1	V
I_S	Maximum Body-Diode Continuous Current				4.5	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=15V, f=1MHz		900	1100	pF
C_{oss}	Output Capacitance			88		pF
C_{rss}	Reverse Transfer Capacitance			65		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		0.95	1.5	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	V_{GS}=4.5V, V_{DS}=15V, I_D=7.3A		10		nC
Q_{gs}	Gate Source Charge			1.8		nC
Q_{gd}	Gate Drain Charge			3.75		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=15V, R_L=2.1Ω, R_{GEN}=6Ω		3.2		ns
t_r	Turn-On Rise Time			3.5		ns
$t_{D(off)}$	Turn-Off DelayTime			21.5		ns
t_f	Turn-Off Fall Time			2.7		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=7.3A, dI/dt=100A/µs		16.8		ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=7.3A, dI/dt=100A/µs		8		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in^2 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. The current rating is based on the t≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

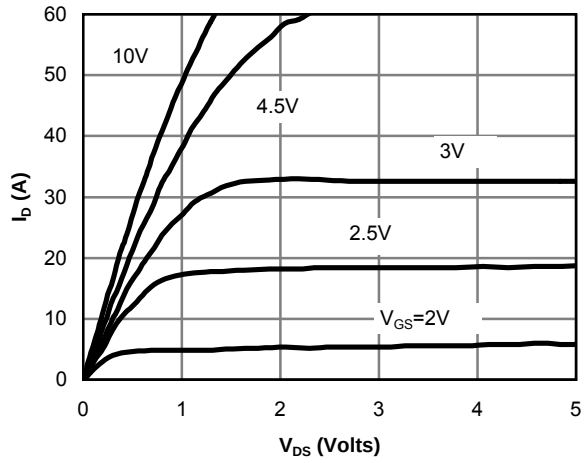
C. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to lead $R_{\theta JL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300µs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in^2 FR-4 board with 2oz. Copper, in a still air environment with T_A=25°C. The SOA curve provides a single pulse rating.

Rev 0 : Sept 2006

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



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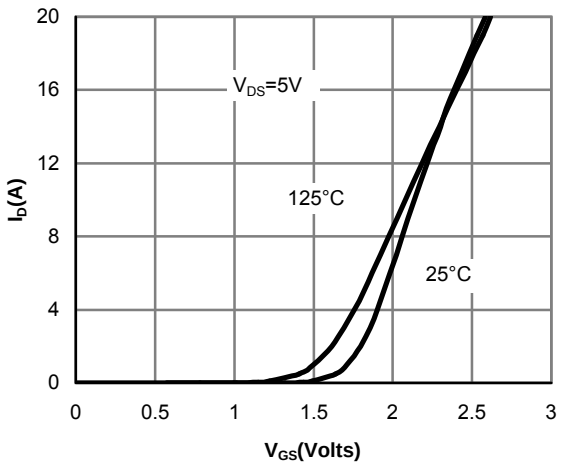


Figure 2: Transfer Characteristics

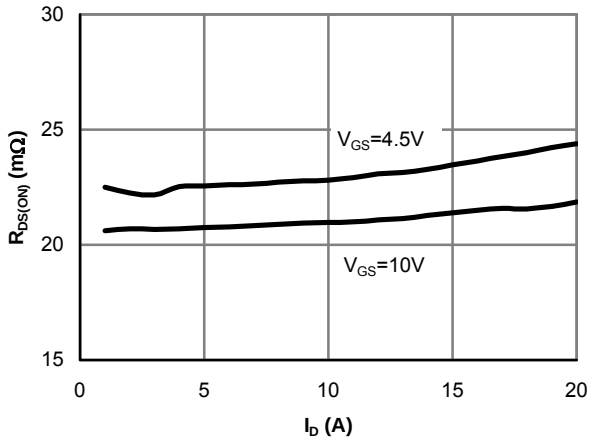
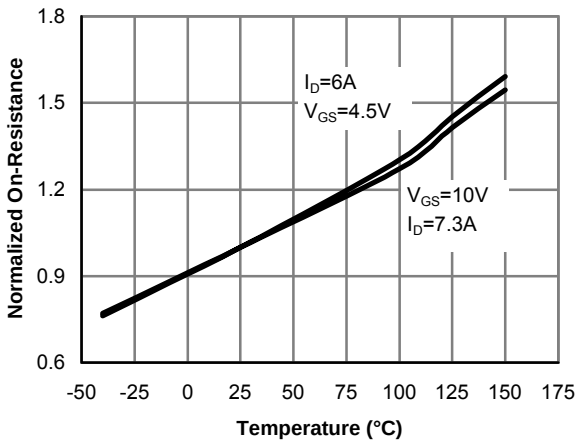


Figure 3: On-Resistance vs. Drain Current and Gate Voltage



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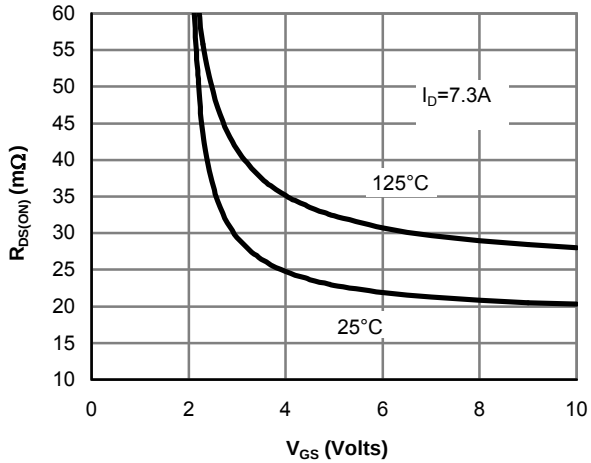


Figure 5: On-Resistance vs. Gate-Source Voltage

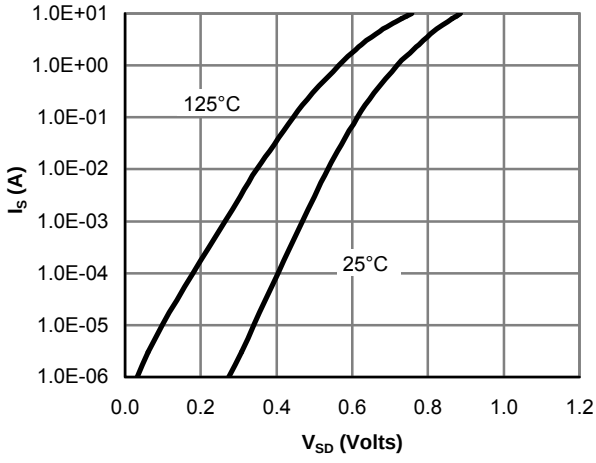


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

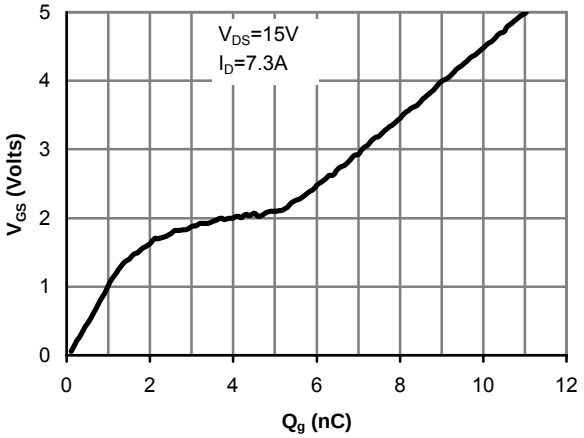
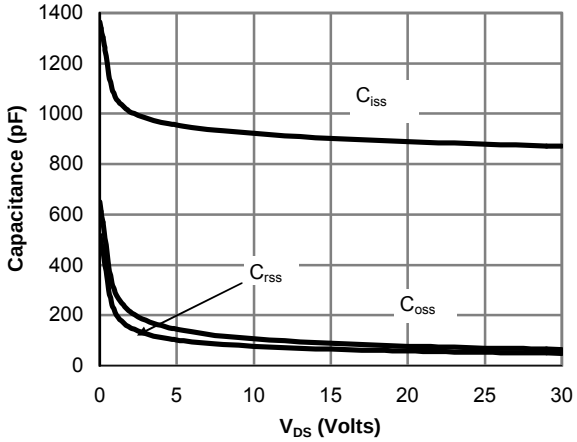


Figure 7: Gate-Charge Characteristics



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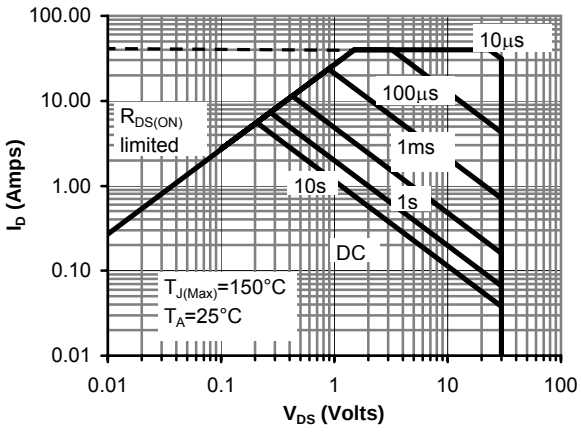

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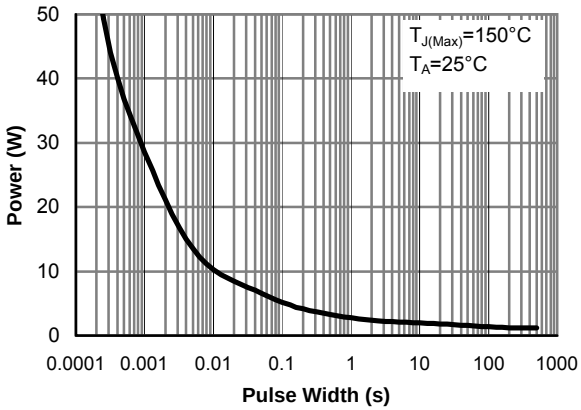

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

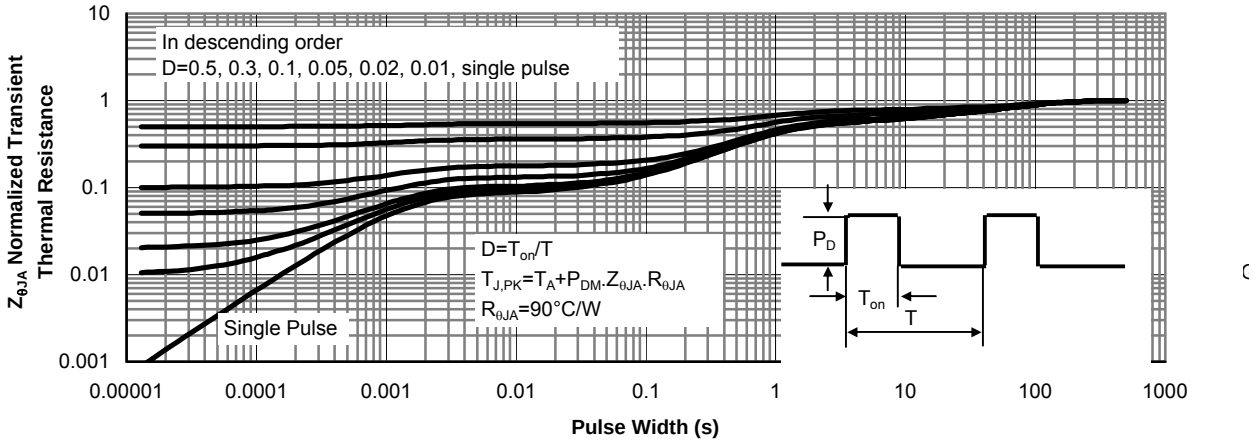

Figure 11: Normalized Maximum Transient Thermal Impedance