



**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.*

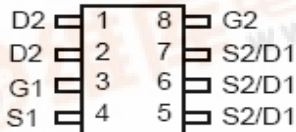
**Features**

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

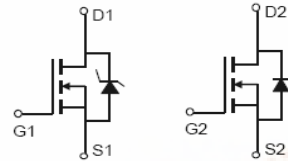
**UIS TESTED!**

**Rg,Ciss,Coss,Crss Tested**

**SOIC-8**



**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	$V_{GS}$	$\pm 12$	$\pm 12$	V
Continuous Drain Current <sup>A</sup>	$I_{DSM}$	$T_A=25^\circ C$	9.0	A
		$T_A=70^\circ C$	7.2	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	40	40	
Avalanche Current <sup>C</sup>	$I_{AR}$	16	12	A
Repetitive avalanche energy $L=0.3mH$ <sup>C</sup>	$E_{AR}$	38	22	mJ
Power Dissipation	$P_{DSM}$	$T_A=25^\circ C$	2.0	W
		$T_A=70^\circ C$	1.3	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ C$

**Thermal Characteristics FET1**

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>				
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	32	40	$^\circ C/W$

**Thermal Characteristics FET2**

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	$R_{\theta JA}$	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient <sup>A</sup>				
Maximum Junction-to-Lead <sup>C</sup>	$R_{\theta JL}$	32	40	$^\circ C/W$



FET1 Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V T <sub>J</sub> =125°C		0.01 5	0.1 10	mA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V			0.1	μA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	1.5	1.85	2.4	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	40			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =9A T <sub>J</sub> =125°C		13.2 20.5	16 25.6	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =7A		15.7	19.5	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =9A		64		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.4	0.6	V
I <sub>S</sub>	Maximum Body-Diode + Schottky Continuous Current				4.5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		1450	1885	pF
C <sub>oss</sub>	Output Capacitance			224		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			92		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		1.6	3	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub> (10V)	Total Gate Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =9A		24.0	31	
Q <sub>g</sub> (4.5V)	Total Gate Charge			12.0		nC
Q <sub>gs</sub>	Gate Source Charge			3.9		nC
Q <sub>gd</sub>	Gate Drain Charge			4.2		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =1.7Ω, R <sub>GEN</sub> =3Ω		5.5		ns
t <sub>r</sub>	Turn-On Rise Time			4.7		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			24.0		ns
t <sub>f</sub>	Turn-Off Fall Time			4.0		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =9A, dI/dt=300A/μs		10	13	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =9A, dI/dt=300A/μs		6.8		nC

A: The value of R<sub>θJA</sub> is measured with the device in a still air environment with T<sub>A</sub>=25°C. The power dissipation P<sub>DSM</sub> and current rating I<sub>DSM</sub> are based on T<sub>J(MAX)</sub>=150°C, using t ≤ 10s junction-to-ambient thermal resistance.

B: Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C.

C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> 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<sub>J</sub>=25°C. The SOA curve provides a single pulse rating.

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FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

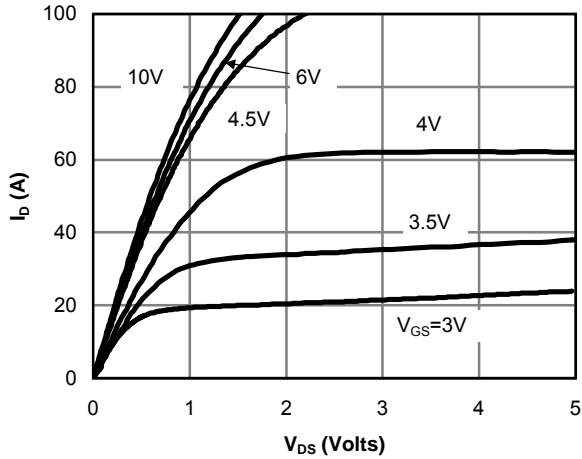


Figure 1: On-Region Characteristics

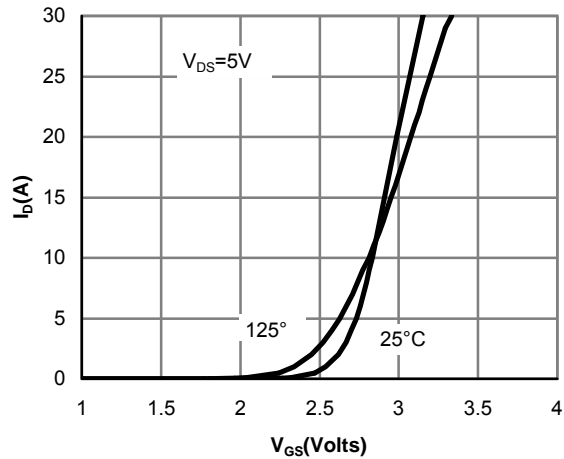


Figure 2: Transfer Characteristics

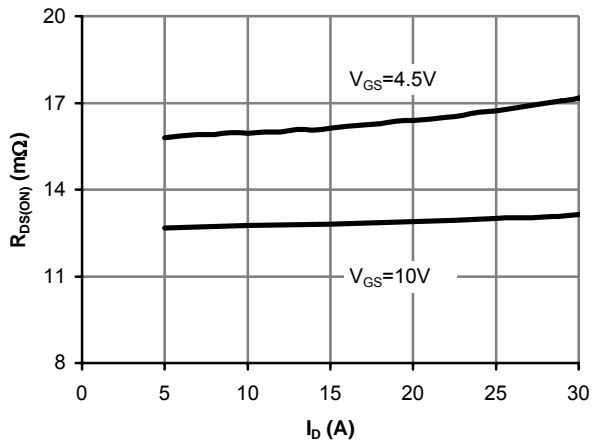


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

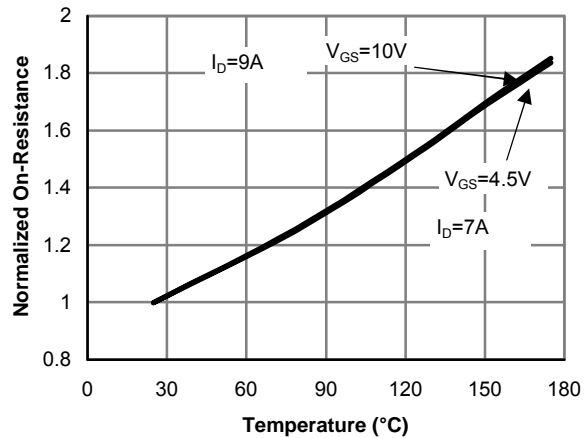


Figure 4: On-Resistance vs. Junction Temperature

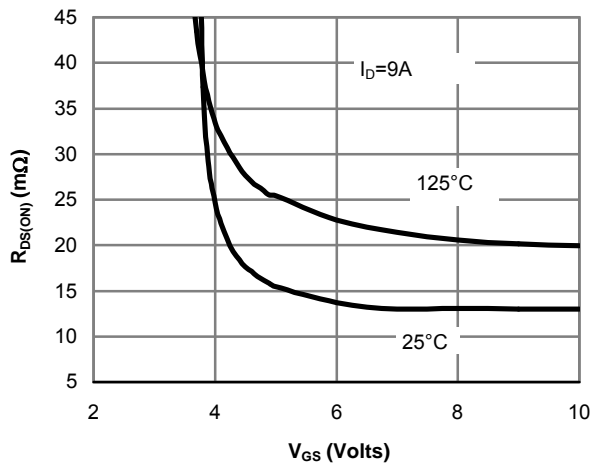


Figure 5: On-Resistance vs. Gate-Source Voltage

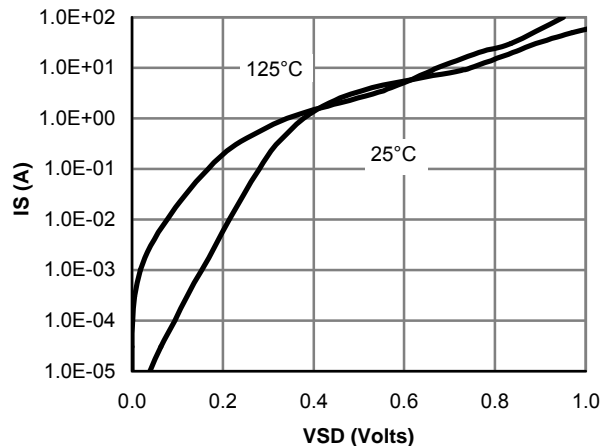


Figure 6: Body-Diode Characteristics

FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

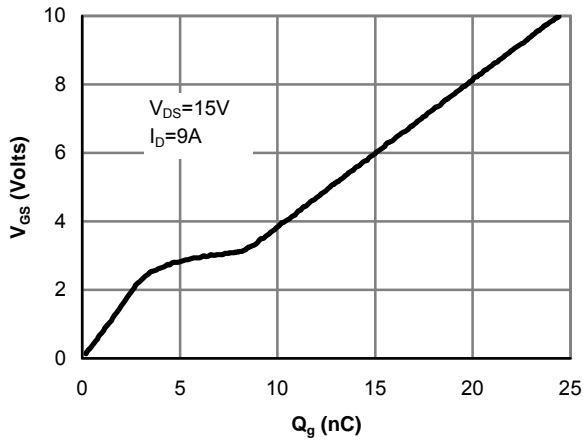


Figure 7: Gate-Charge Characteristics

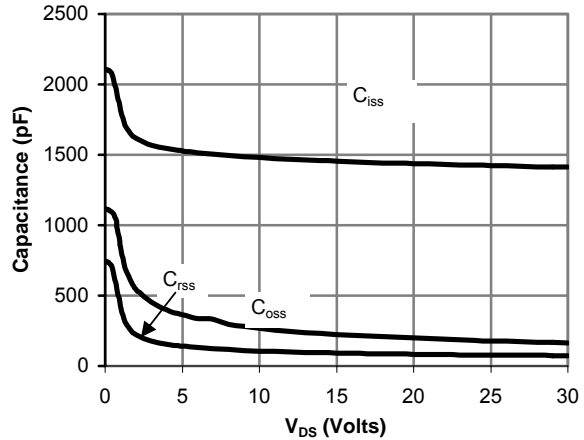


Figure 8: Capacitance Characteristics

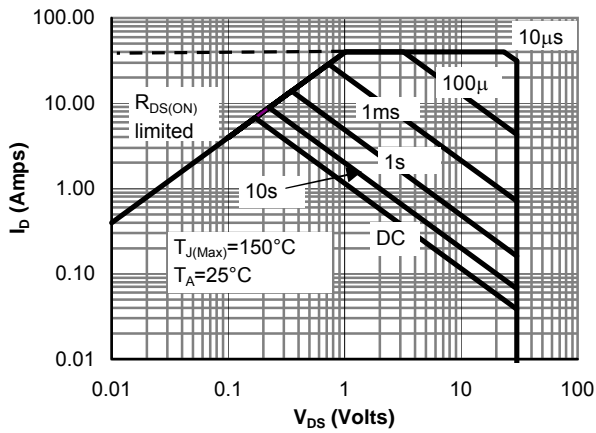


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

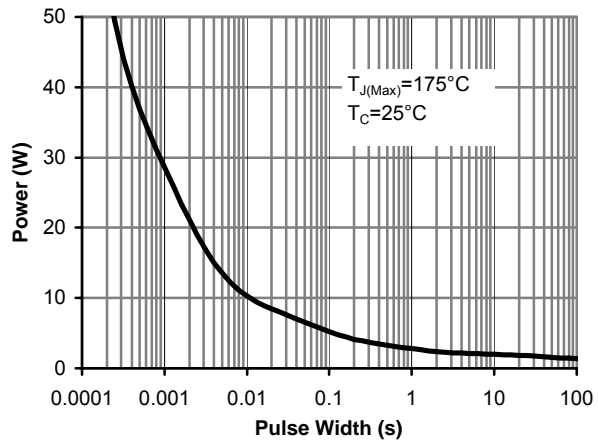


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

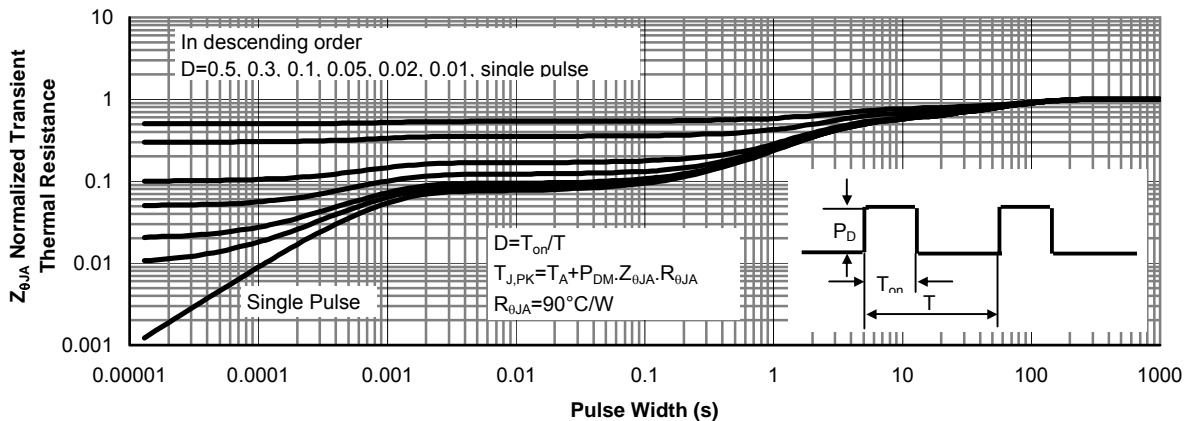


Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)

FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

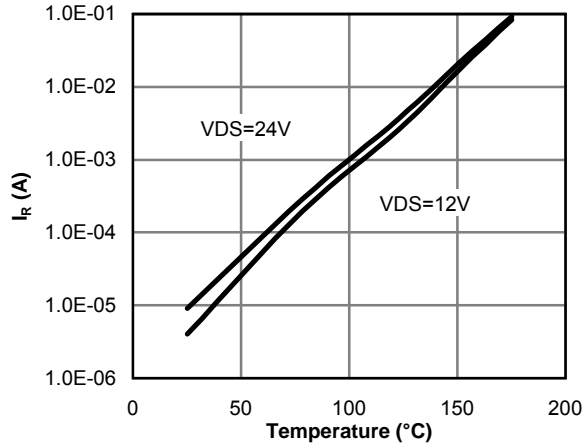


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

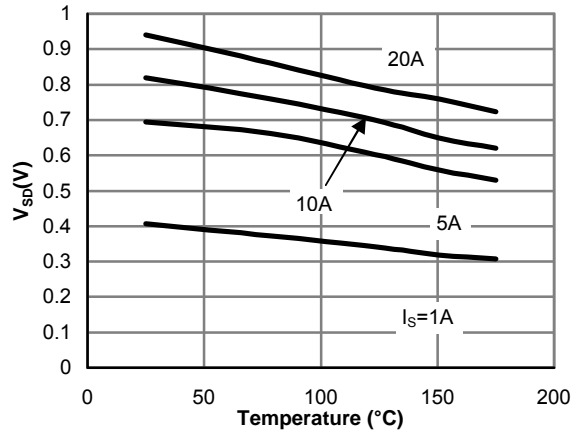


Figure 13: Diode Forward voltage vs. Junction Temperature

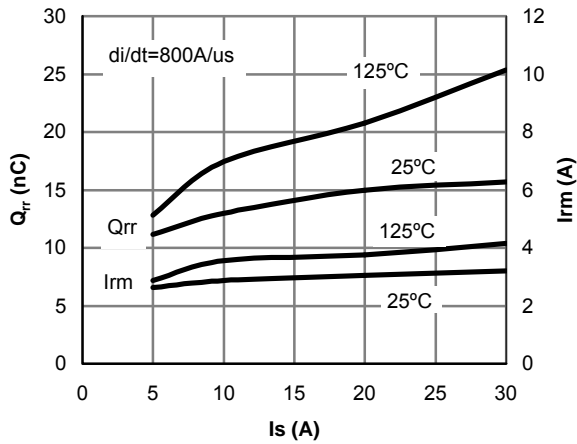


Figure 14: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current

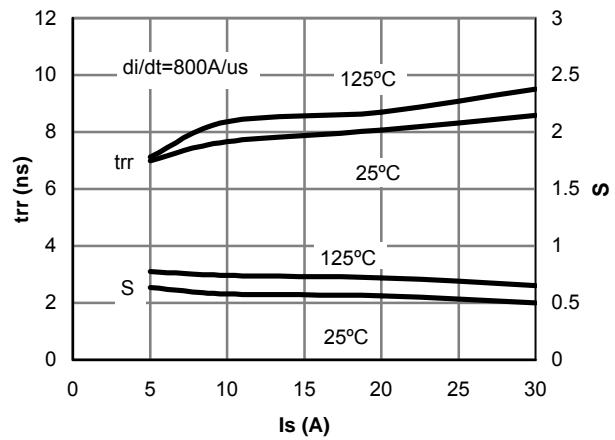


Figure 15: Diode Reverse Recovery Time and Soft Coefficient vs. Conduction Current

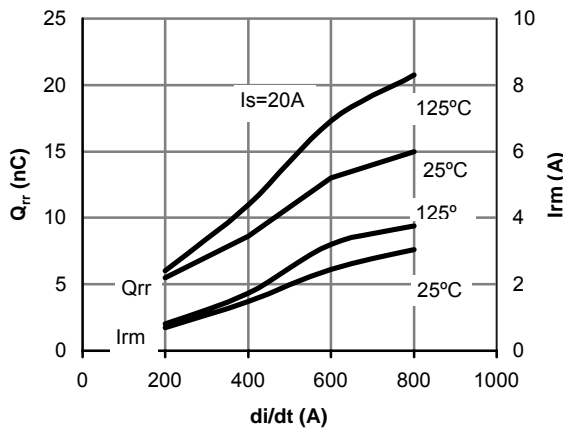


Figure 16: Diode Reverse Recovery Charge and Peak Current vs. di/dt

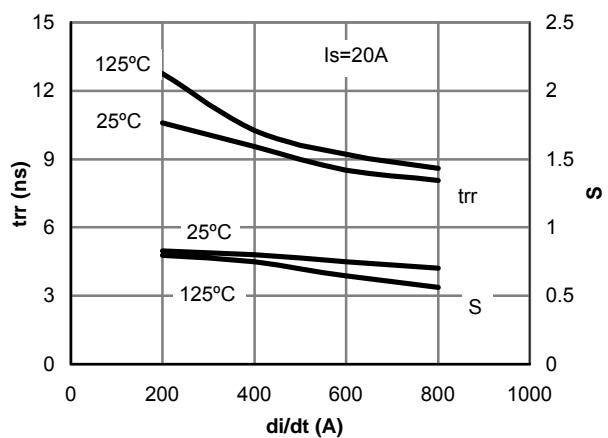


Figure 17: Diode Reverse Recovery Time and Soft Coefficient vs. di/dt

FET2 Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	30			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =24V, V <sub>GS</sub> =0V T <sub>J</sub> =55°C			1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±12V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	0.7	1	1.5	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V	40			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =7.3A T <sub>J</sub> =125°C		20 30.0	24 36	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A		23.4	29	mΩ
		V <sub>GS</sub> =2.5V, I <sub>D</sub> =5.5A		35.4	48	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =7.3A		26		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.71	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				4.5	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>ISS</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		900	1100	pF
C <sub>OSS</sub>	Output Capacitance			88		pF
C <sub>RSS</sub>	Reverse Transfer Capacitance			65		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		0.95	1.5	Ω
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge	V <sub>GS</sub> =4.5V, V <sub>DS</sub> =15V, I <sub>D</sub> =7.3A		10		nC
Q <sub>gs</sub>	Gate Source Charge			1.8		nC
Q <sub>gd</sub>	Gate Drain Charge			3.75		nC
t <sub>D(on)</sub>	Turn-On DelayTime	V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =2.1Ω, R <sub>GEN</sub> =6Ω		3.2		ns
t <sub>r</sub>	Turn-On Rise Time			3.5		ns
t <sub>D(off)</sub>	Turn-Off DelayTime			21.5		ns
t <sub>f</sub>	Turn-Off Fall Time			2.7		ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =7.3A, dI/dt=100A/μs		16.8		ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =7.3A, dI/dt=100A/μs		8		nC

A: The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The value in any given application depends on the user's specific board design. The current rating is based on the t<sub>s</sub> ≤ 10s thermal resistance rating.

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

C: The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> 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<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25°C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

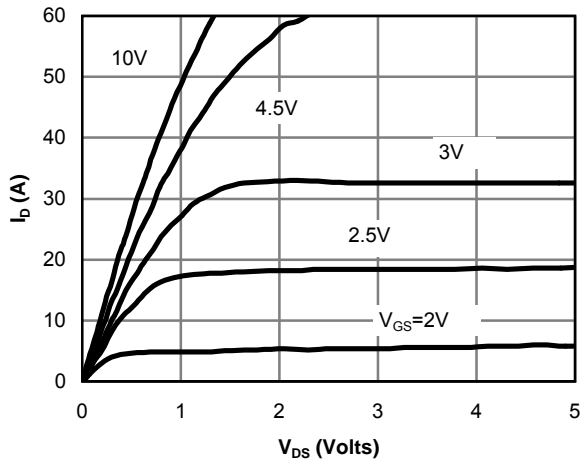


Figure 1: On-Region Characteristics

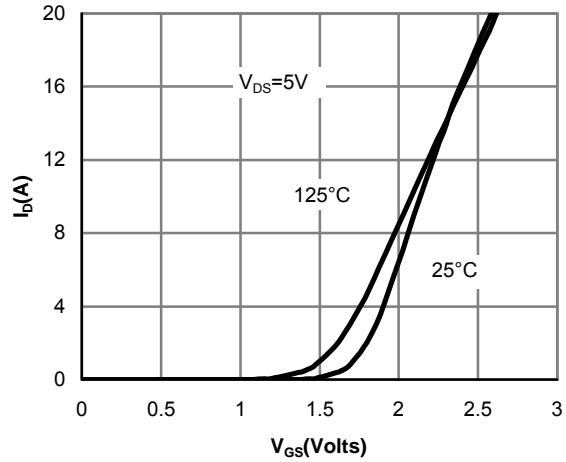


Figure 2: Transfer Characteristics

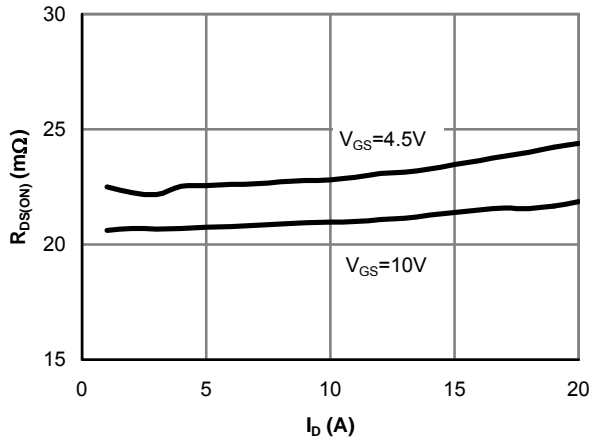


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

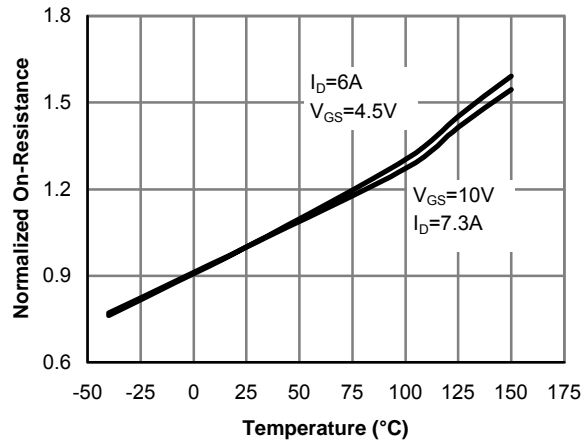


Figure 4: On-Resistance vs. Junction Temperature

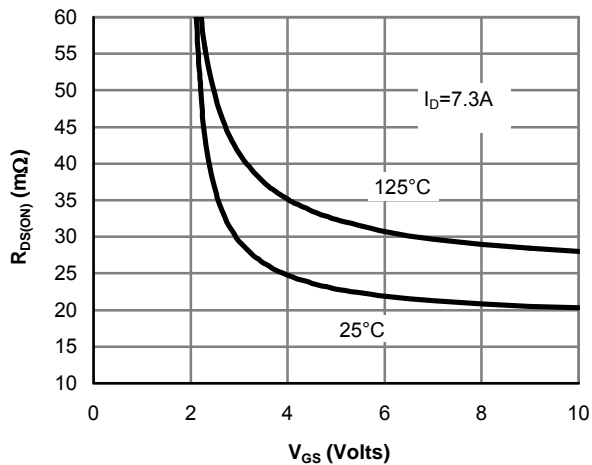


Figure 5: On-Resistance vs. Gate-Source Voltage

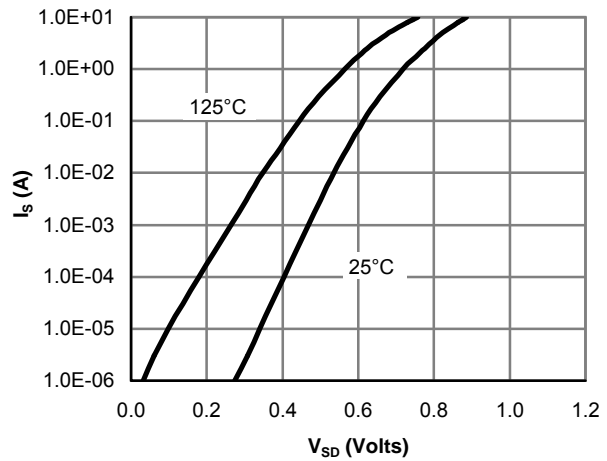


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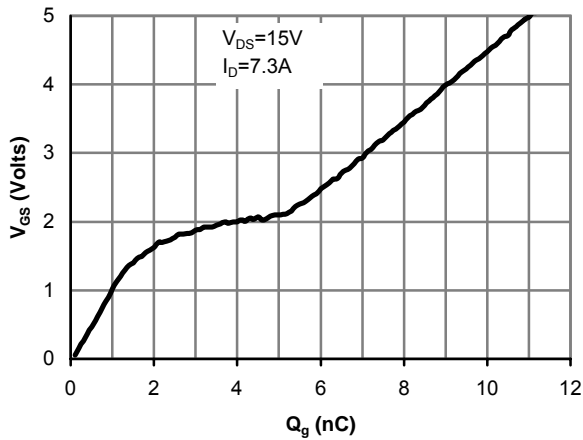


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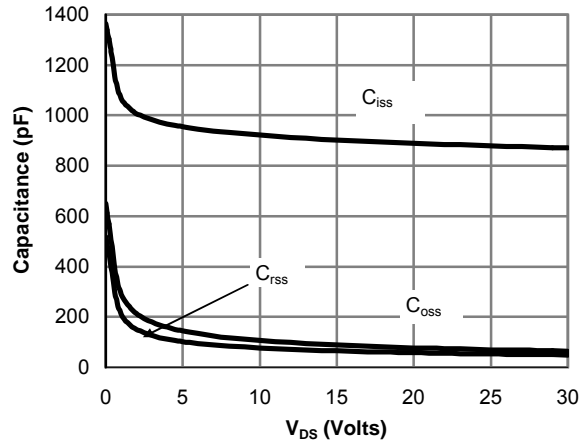


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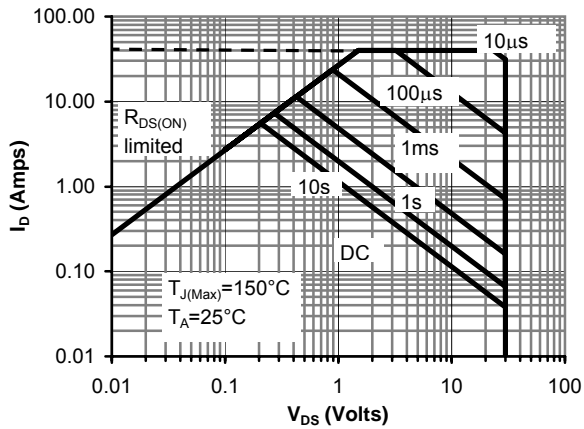


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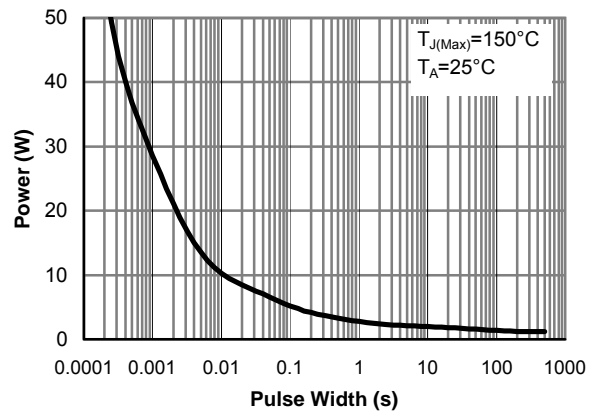


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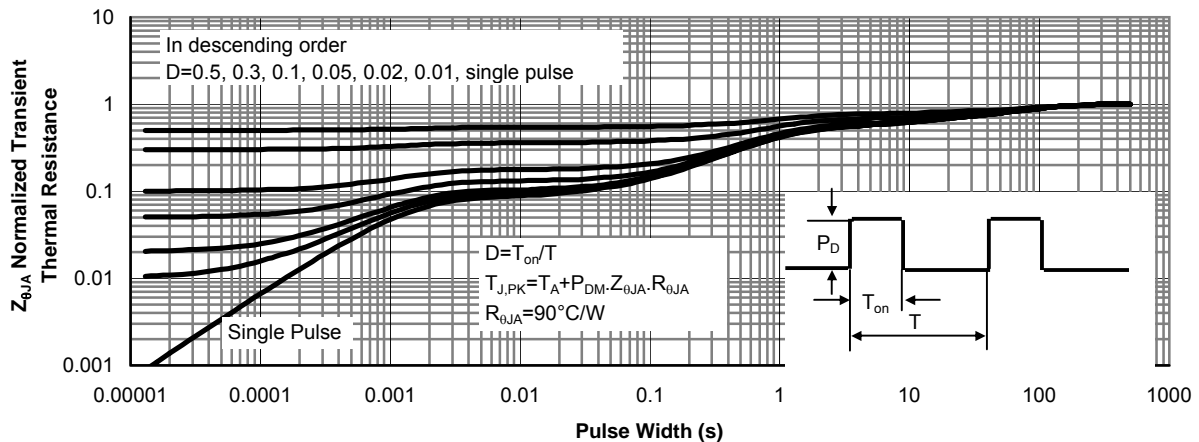


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