



Rev 6: May 2005

## AO4914

### Dual N-Channel Enhancement Mode Field Effect Transistor with Schottky Diode



#### General Description

The AO4914 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 Schottky diode is co-packaged in parallel with the synchronous MOSFET to boost efficiency further. AO4914 is Pb-free (meets ROHS & Sony 259 specifications). AO4914L is a Green Product ordering option. AO4914 and AO4914L are electrically identical.

#### Features

##### Q1

$V_{DS} (V) = 30V$

$I_D = 8.5A$

$R_{DS(ON)} < 18m\Omega$

$R_{DS(ON)} < 28m\Omega$

##### Q2

$V_{DS}(V) = 30V$

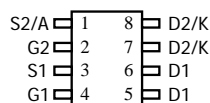
$I_D = 8.5A$

$<18m\Omega$  ( $V_{GS} = 10V$ )

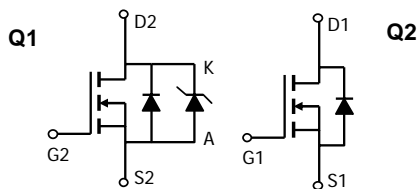
$<28m\Omega$  ( $V_{GS} = 4.5V$ )

#### SCHOTTKY

$V_{DS} (V) = 30V$ ,  $I_F = 3A$ ,  $V_F < 0.5V @ 1A$



SOIC-8



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

Parameter	Symbol	Max Q1	Max Q2	Units
Drain-Source Voltage	$V_{DS}$	30	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current <sup>A</sup>	$T_A=25^\circ C$	8.5	8.5	A
	$T_A=70^\circ C$	6.6	6.6	
Pulsed Drain Current <sup>B</sup>	$I_{DM}$	30	30	
Power Dissipation	$T_A=25^\circ C$	2	2	W
	$T_A=70^\circ C$	1.28	1.28	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	-55 to 150	$^\circ C$

Parameter	Symbol	Maximum Schottky	Units
Reverse Voltage	$V_{DS}$	30	V
Continuous Forward Current <sup>A</sup>	$T_A=25^\circ C$	3	A
	$T_A=70^\circ C$	2.2	
Pulsed Diode Forward Current <sup>B</sup>	$I_{FM}$	20	
Power Dissipation <sup>A</sup>	$T_A=25^\circ C$	2	W
	$T_A=70^\circ C$	1.28	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$

**AO4912, AO4912L**

Parameter: Thermal Characteristics MOSFET Q1		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	t ≤ 10s	R <sub>θJA</sub>	48	62.5	°C/W
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		74	110	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	R <sub>θJL</sub>	35	40	
Parameter: Thermal Characteristics MOSFET Q2		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup>	t ≤ 10s	R <sub>θJA</sub>	48	62.5	°C/W
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		74	110	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	R <sub>θJL</sub>	35	40	
Thermal Characteristics Schottky					
Maximum Junction-to-Ambient <sup>A</sup>	t ≤ 10s	R <sub>θJA</sub>	47.5	62.5	°C/W
Maximum Junction-to-Ambient <sup>A</sup>	Steady-State		71	110	
Maximum Junction-to-Lead <sup>C</sup>	Steady-State	R <sub>θJL</sub>	32	40	

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^{\circ}C$ . The value in any a given application depends on the user's specific board design. The current rating is based on the  $t \leq 10s$  thermal resistance rating.

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

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

D: The static characteristics in Figures 1 to 6 are obtained using 80  $\mu s$  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  $T_A=25^{\circ}C$ . The SOA curve provides a single pulse rating.

F: The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.

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**Q1 Electrical Characteristics ( $T_J=25^{\circ}\text{C}$  unless otherwise noted)**

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$	30			V
$I_{DSS}$	Zero Gate Voltage Drain Current. (Set by Schottky leakage)	$V_R=30\text{V}$		0.007	0.05	mA
		$V_R=30\text{V}$ , $T_J=125^{\circ}\text{C}$		3.2	10	
		$V_R=30\text{V}$ , $T_J=150^{\circ}\text{C}$		12	20	
$I_{GSS}$	Gate-Body leakage current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	1	1.8	3	V
$I_{D(ON)}$	On state drain current	$V_{GS}=10\text{V}$ , $V_{DS}=5\text{V}$	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}$ , $I_D=8.5\text{A}$		15.5	18	m $\Omega$
		$T_J=125^{\circ}\text{C}$		22.3	27	
		$V_{GS}=4.5\text{V}$ , $I_D=6\text{A}$		23	28	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=8.5\text{A}$		23		S
$V_{SD}$	Diode + Schottky Forward Voltage	$I_S=1\text{A}$ , $V_{GS}=0\text{V}$		0.45	0.5	V
$I_S$	Maximum Body-Diode + Schottky Continuous Current				3.5	A
<b>DYNAMIC PARAMETERS</b>						
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}$ , $V_{DS}=15\text{V}$ , $f=1\text{MHz}$		971	1165	pF
$C_{oss}$	Output Capacitance (FET + Schottky)			190		pF
$C_{rss}$	Reverse Transfer Capacitance			110		pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$		0.7	0.85	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}$ , $V_{DS}=15\text{V}$ , $I_D=8.5\text{A}$		19.2	23	nC
$Q_g(4.5\text{V})$	Total Gate Charge			9.36	11.2	nC
$Q_{gs}$	Gate Source Charge			2.6		nC
$Q_{gd}$	Gate Drain Charge			4.2		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=10\text{V}$ , $V_{DS}=15\text{V}$ , $R_L=1.8\Omega$ , $R_{GEN}=3\Omega$		5.2	7.5	ns
$t_r$	Turn-On Rise Time			4.4	6.5	ns
$t_{D(off)}$	Turn-Off DelayTime			17.3	26	ns
$t_f$	Turn-Off Fall Time			3.3	5	ns
$t_{rr}$	Body Diode + Schottky Reverse Recovery Time	$I_F=8.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		18.8	23	ns
$Q_{rr}$	Body Diode + Schottky Reverse Recovery Charge	$I_F=8.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$		9.2	11	nC

A: The value of  $R_{\theta JA}$  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 value in any a given application depends on the user's specific board design. The current rating is based on the  $t \leq 10\text{s}$  thermal resistance rating.

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

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

D: The static characteristics in Figures 1 to 6 are obtained using 80 $\mu\text{s}$  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  $T_A=25^{\circ}\text{C}$ . The SOA curve provides a single pulse rating.

F: The Schottky appears in parallel with the MOSFET body diode, even though it is a separate chip. Therefore, we provide the net forward drop, capacitance and recovery characteristics of the MOSFET and Schottky. However, the thermal resistance is specified for each chip separately.

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Q1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

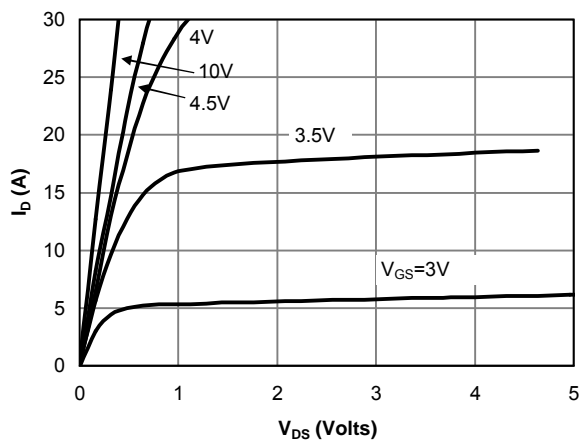


Fig 1: On-Region Characteristics

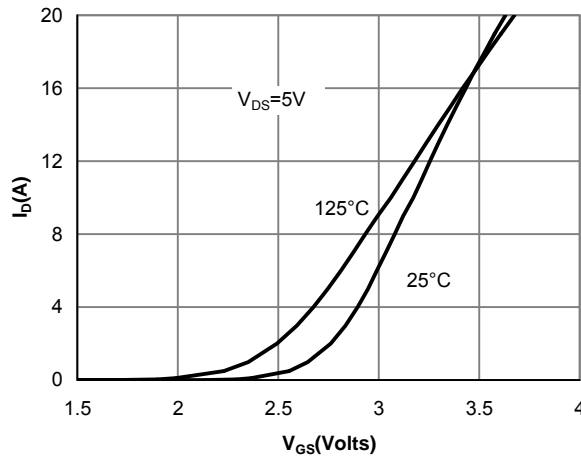


Figure 2: Transfer Characteristics

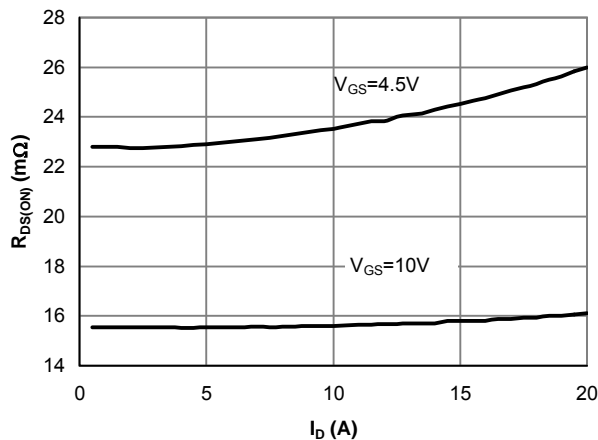


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

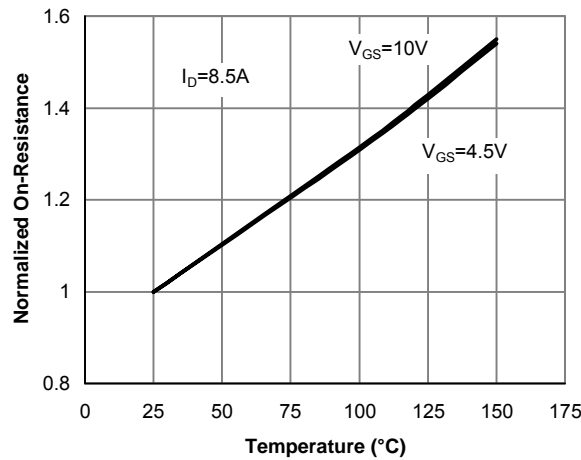


Figure 4: On-Resistance vs. Junction Temperature

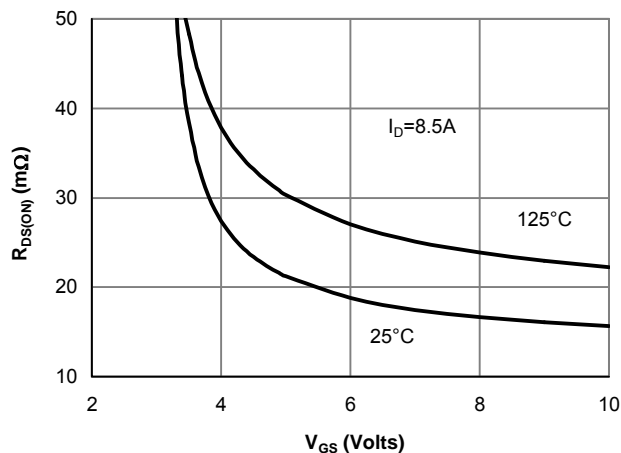


Figure 5: On-Resistance vs. Gate-Source Voltage

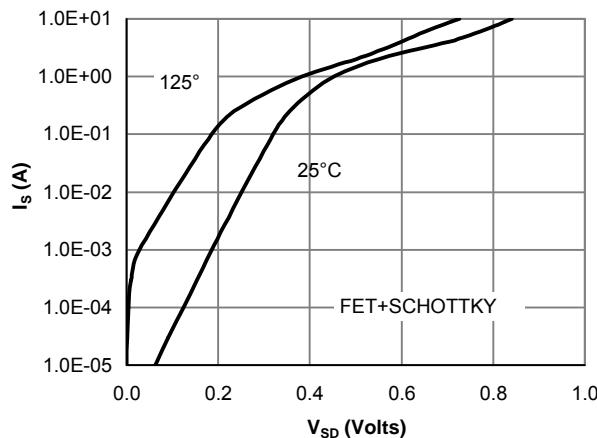


Figure 6: Body-Diode Characteristics (Note F)

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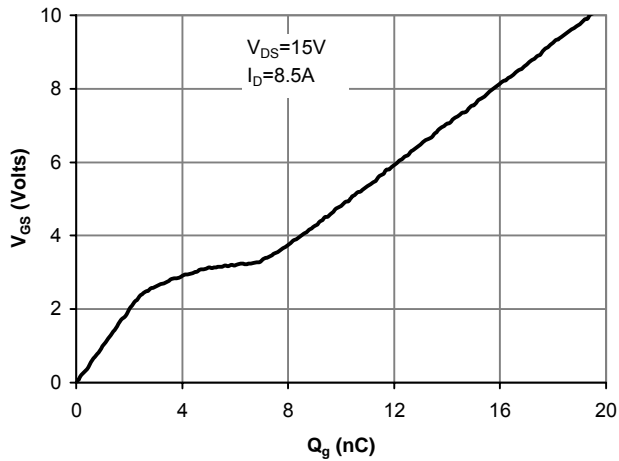


Figure 7: Gate-Charge Characteristics

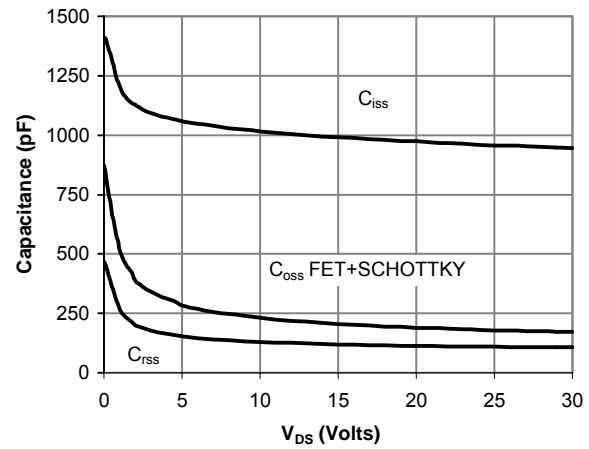


Figure 8: Capacitance Characteristics

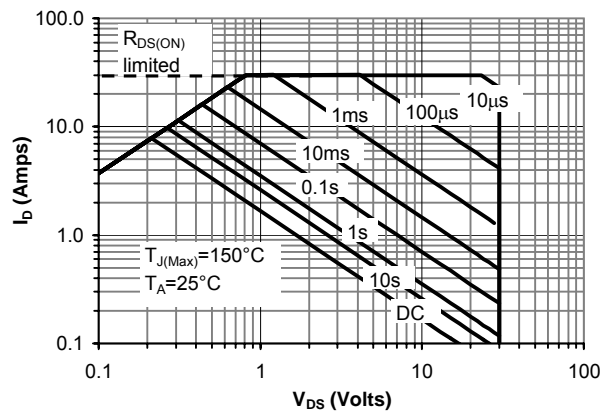


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

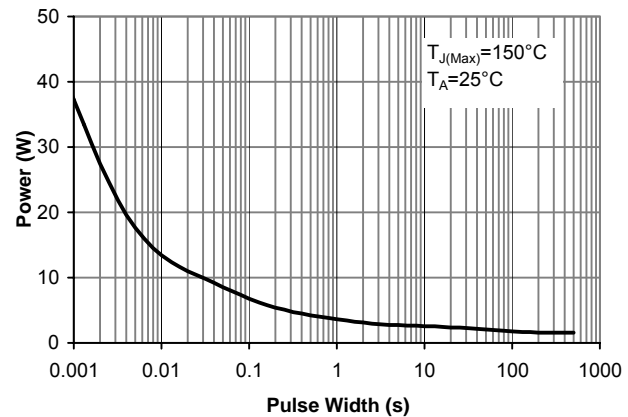


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

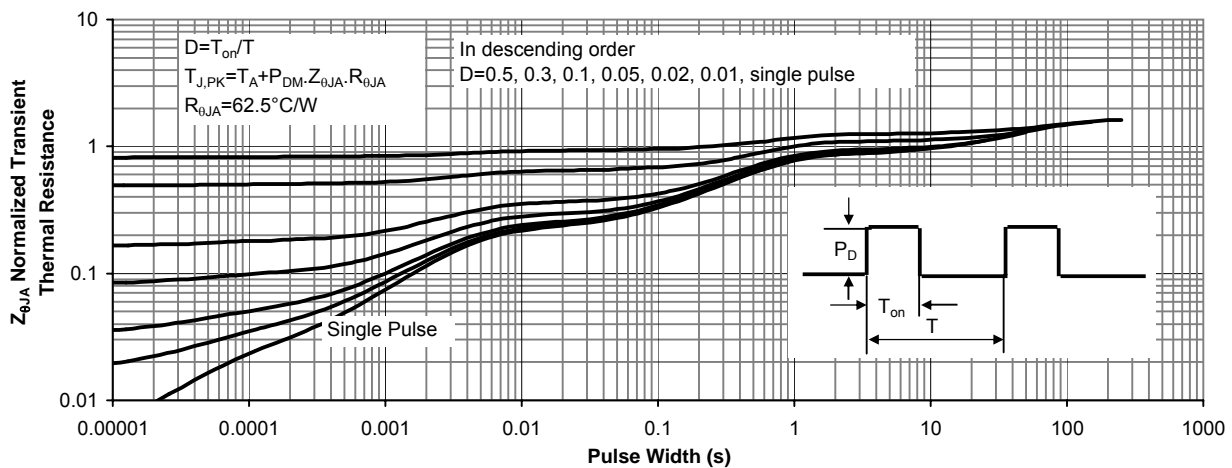


Figure 11: Normalized Maximum Transient Thermal Impedance

**Q2 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		0.003	1 5	μA
I <sub>GSS</sub>	Gate-Body leakage current	V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	1	1.8	3	V
I <sub>D(ON)</sub>	On state drain current	V <sub>GS</sub> =10V, V <sub>DS</sub> =5V	30			A
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =8.5A T <sub>J</sub> =125°C		15.5 22.3	18 27	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =6A		23	28	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =5V, I <sub>D</sub> =8.5A		23		S
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A, V <sub>GS</sub> =0V		0.75	1	V
I <sub>S</sub>	Maximum Body-Diode Continuous Current				3	A
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz		1040	1250	pF
C <sub>oss</sub>	Output Capacitance			180		pF
C <sub>rss</sub>	Reverse Transfer Capacitance			110		pF
R <sub>g</sub>	Gate resistance	V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		0.7	0.85	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> =8.5A		19.2	23	nC
Q <sub>g</sub> (4.5V)	Total Gate Charge			9.36	11.2	nC
Q <sub>gs</sub>	Gate Source Charge			2.6		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> =1.8Ω, R <sub>GEN</sub> =3Ω		5.2	7.5	ns
t <sub>r</sub>	Turn-On Rise Time			4.4	6.5	ns
t <sub>D(off)</sub>	Turn-Off DelayTime			17.3	26	ns
t <sub>f</sub>	Turn-Off Fall Time			3.3	5	ns
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =8.5A, dI/dt=100A/μs		16.7	21	ns
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =8.5A, dI/dt=100A/μs		6.7	10	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 a 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 80μs 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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Q2 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

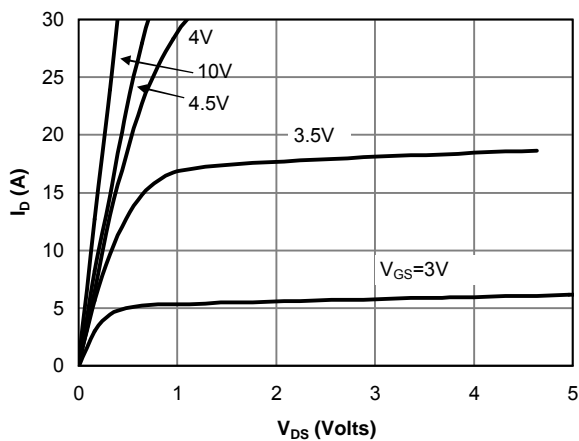


Fig 1: On-Region Characteristics

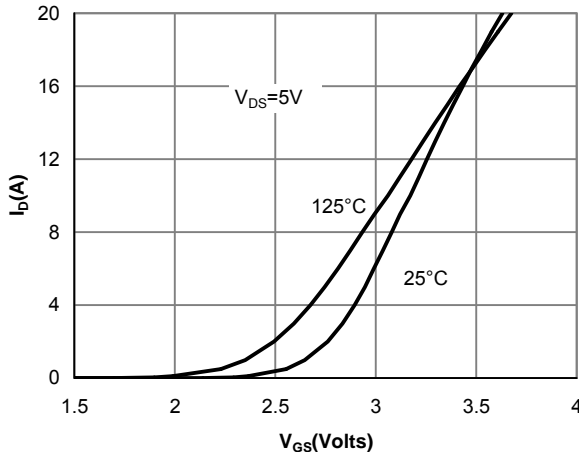


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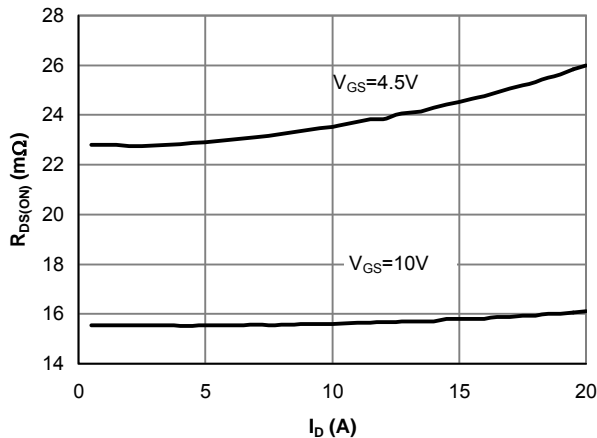


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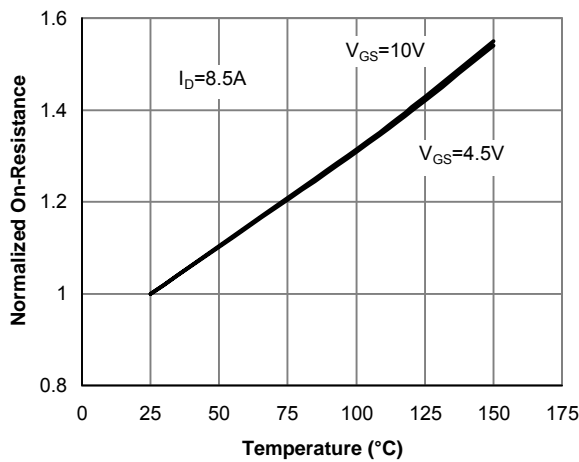


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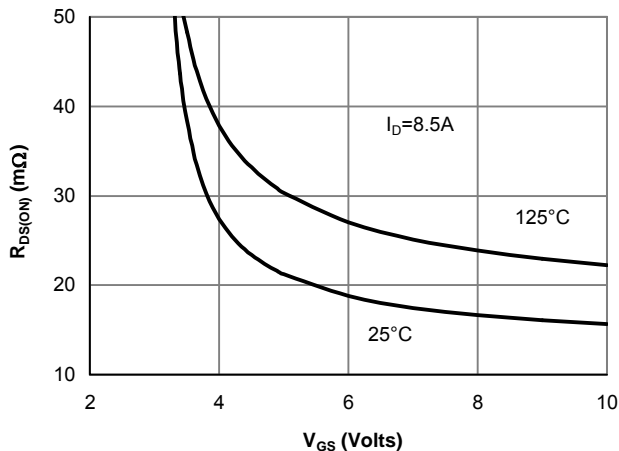


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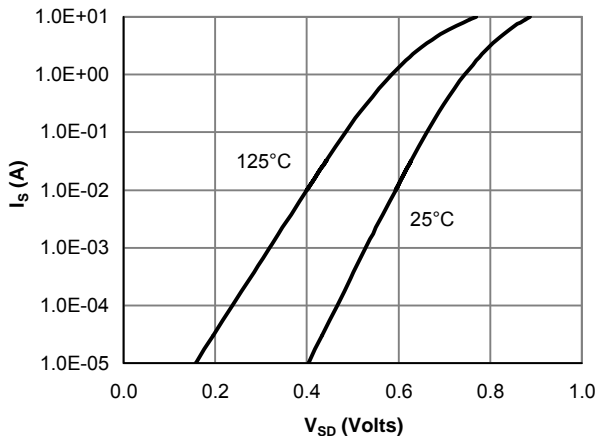


Figure 6: Body-Diode Characteristics

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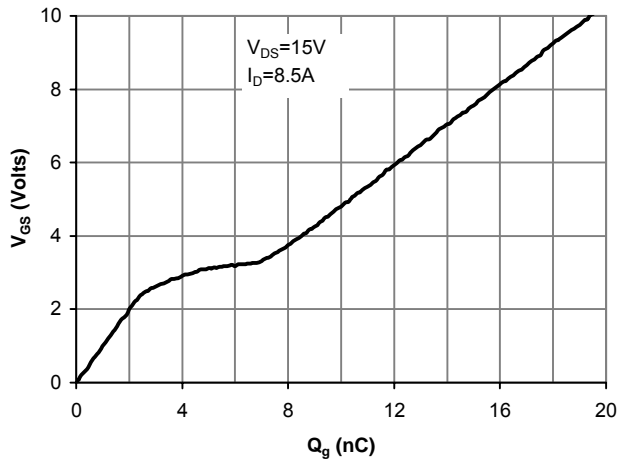


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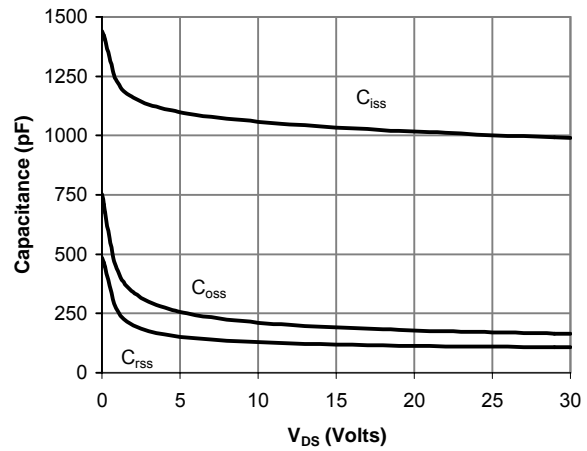


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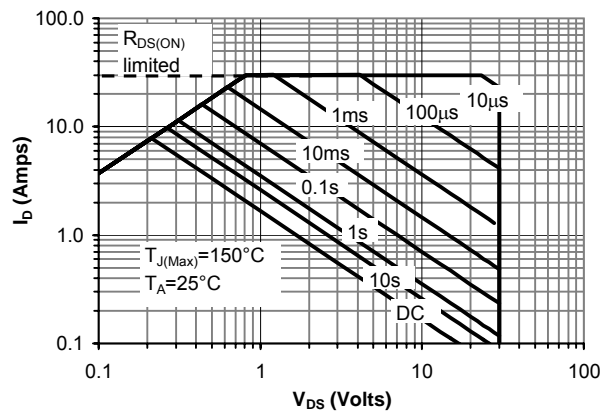


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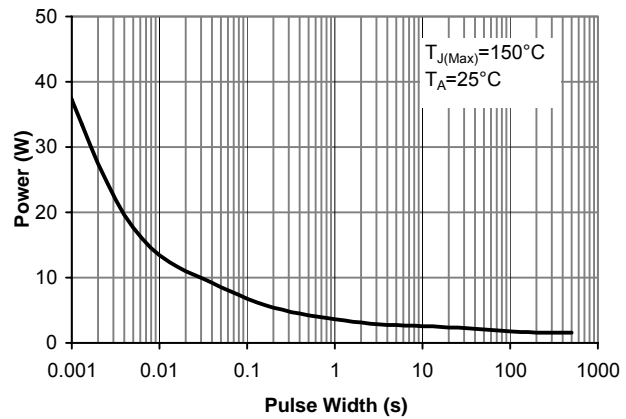


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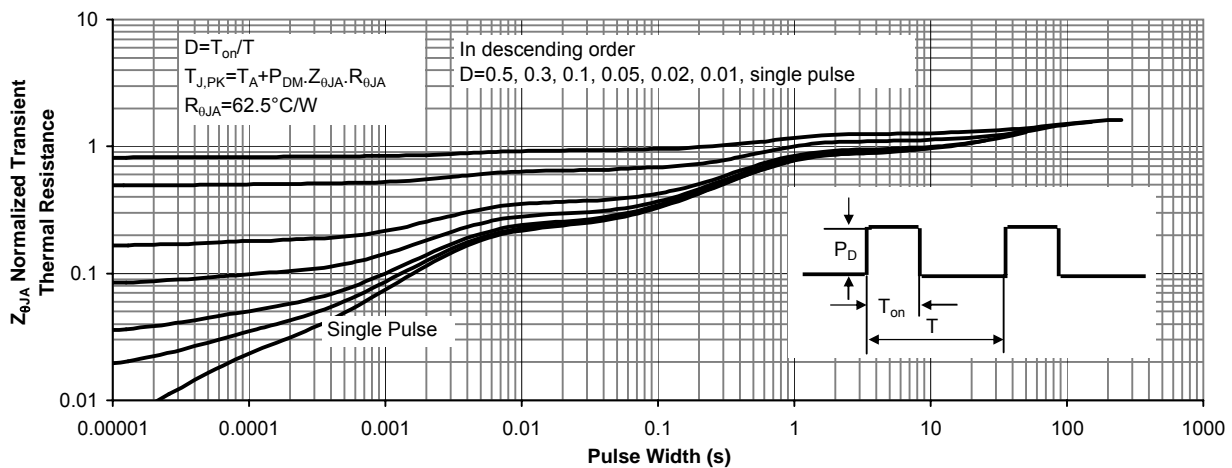


Figure 11: Normalized Maximum Transient Thermal Impedance