



AO4616

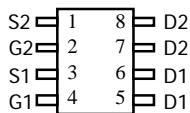
Complementary Enhancement Mode Field Effect Transistor

General Description

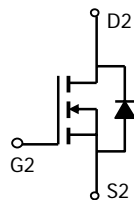
The AO4616 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used in inverter and other applications. *Standard Product AO4616 is Pb-free (meets ROHS & Sony 259 specifications). AO4616L is a Green Product ordering option. AO4616 and AO4616L are electrically identical.*

Features

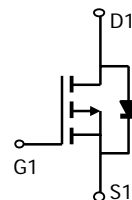
n-channel	p-channel
$V_{DS} (V) = 30V$	-30V
$I_D = 8.1A (V_{GS}=10V)$	-7.1A ($V_{GS} = -10V$)
$R_{DS(ON)}$	$R_{DS(ON)}$
< 20m Ω ($V_{GS}=10V$)	< 25m Ω ($V_{GS} = -10V$)
< 28m Ω ($V_{GS}=4.5V$)	< 40m Ω ($V_{GS} = -4.5V$)



SOIC-8



n-channel



p-channel

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	$T_A=25^\circ C$	8.1	-7.1
		$T_A=70^\circ C$	6.5	-5.6
Pulsed Drain Current ^B	I_{DM}	30	-30	A
Power Dissipation	P_D	$T_A=25^\circ C$	2	2
		$T_A=70^\circ C$	1.28	1.28
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	-55 to 150	$^\circ C$

Thermal Characteristics: n-channel and p-channel

Parameter	Symbol	Device	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	n-ch	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient ^A		n-ch	74	110	$^\circ C/W$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	n-ch	35	60	$^\circ C/W$
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	p-ch	48	62.5	$^\circ C/W$
Maximum Junction-to-Ambient ^A		p-ch	74	110	$^\circ C/W$
Maximum Junction-to-Lead ^C	$R_{\theta JL}$	p-ch	35	40	$^\circ C/W$

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	$V_{DS}=24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	μA
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	$V_{GS}=10\text{V}$, $I_D=8.1\text{A}$ $T_J=125^\circ\text{C}$		16.4 20	20 25	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}$, $I_D=6\text{A}$		23.4	28	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}$, $I_D=8.1\text{A}$		23		S
V_{SD}	Body-Diode Forward Voltage	$I_S=1\text{A}$		0.75	1	V
I_S	Maximum Body-Diode Continuous Current				3	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=15\text{V}$, $f=1\text{MHz}$		1040	1250	pF
C_{oss}	Output Capacitance			180		pF
C_{riss}	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		Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}$, $V_{DS}=15\text{V}$, $I_D=8.1\text{A}$		19.2		nC
$Q_g(4.5\text{V})$	Total Gate Charge			9.36		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		ns
t_r	Turn-On Rise Time			4.4		ns
$t_{D(off)}$	Turn-Off DelayTime			17.3		ns
t_f	Turn-Off Fall Time			3.3		ns
t_{rr}	Body-Diode Reverse Recovery Time	$I_F=8.1\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		16.7	21	ns
Q_{rr}	Body-Diode Reverse Recovery Charge	$I_F=8.1\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		6.7	10	nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² 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. 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 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² 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.

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N-CH TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

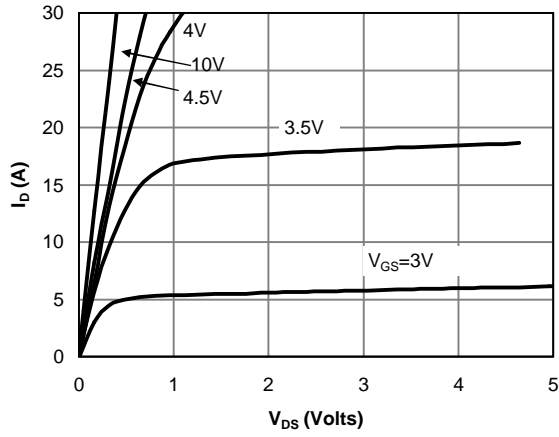


Fig 1: On-Region Characteristics

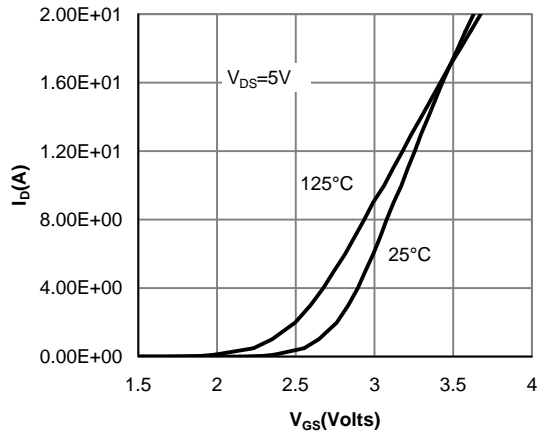


Figure 2: Transfer Characteristics

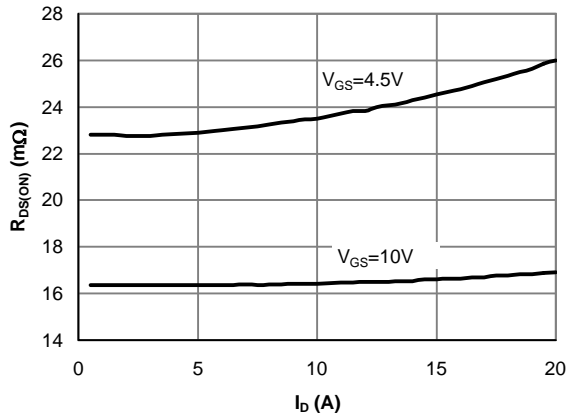


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

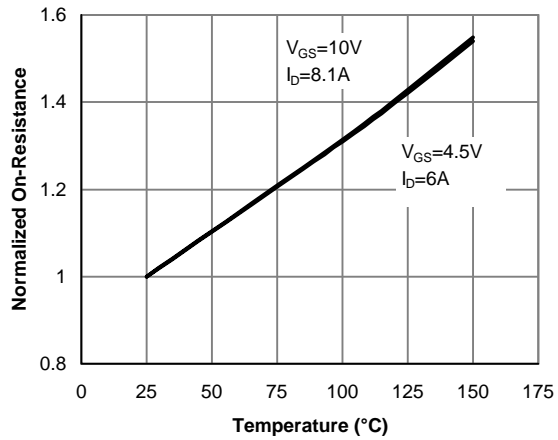


Figure 4: On-Resistance vs. Junction Temperature

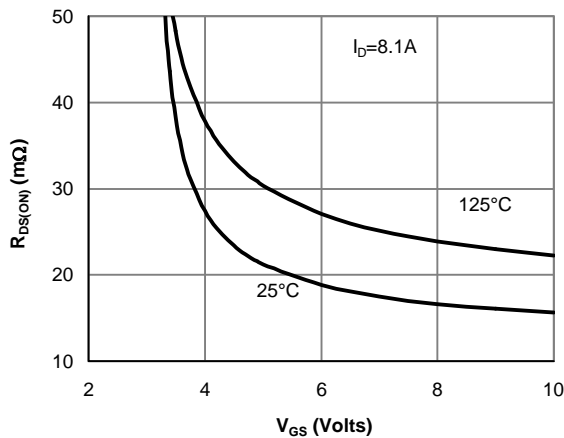


Figure 5: On-Resistance vs. Gate-Source Voltage

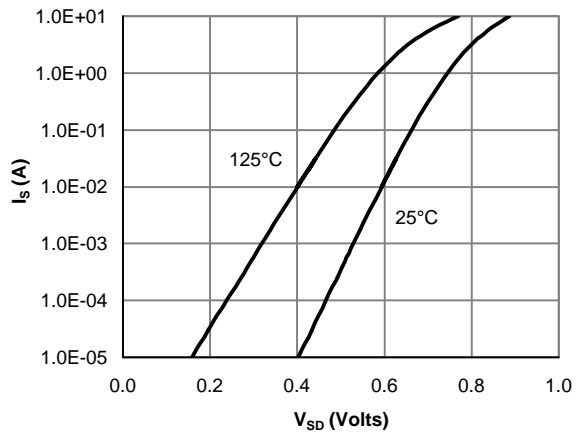


Figure 6: Body-Diode Characteristics

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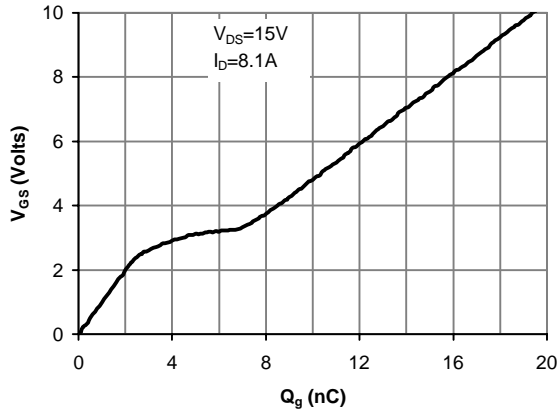


Figure 7: Gate-Charge Characteristics

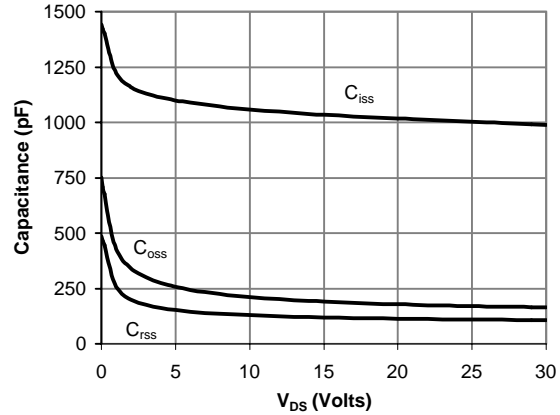


Figure 8: Capacitance Characteristics

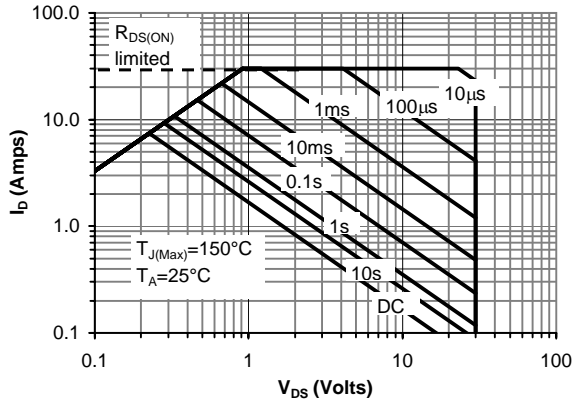


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

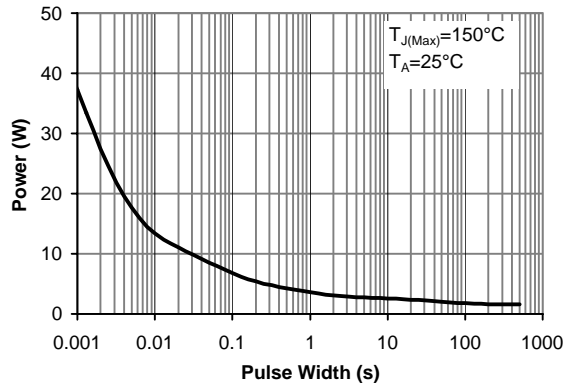


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

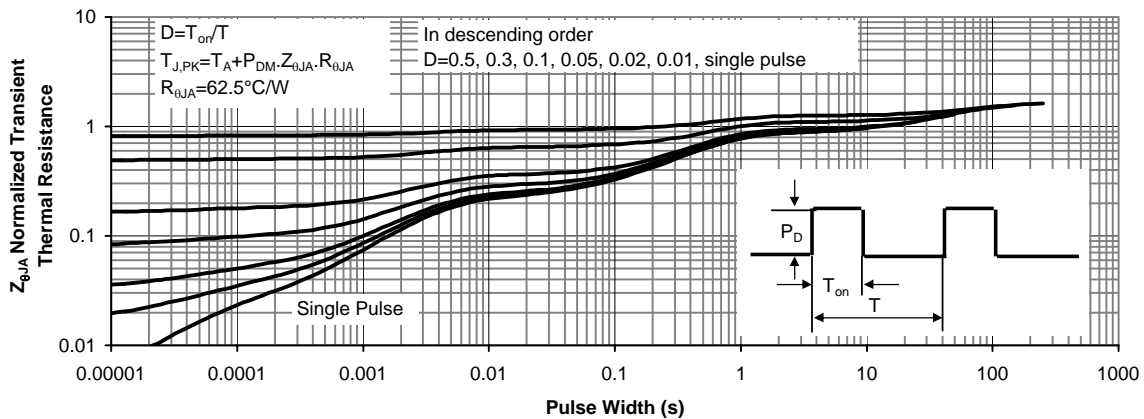


Figure 11: Normalized Maximum Transient Thermal Impedance

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	$V_{DS}=-24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			-1 -5	μA
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	$V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$	-1.4	-2	-2.7	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	$V_{GS}=-10\text{V}$, $I_D=-7.1\text{A}$ $T_J=125^\circ\text{C}$		20	25	m Ω
		$V_{GS}=-4.5\text{V}$, $I_D=-5.6\text{A}$		27	33	
g_{FS}	Forward Transconductance	$V_{DS}=-5\text{V}$, $I_D=-7.1\text{A}$		19.6		S
V_{SD}	Diode Forward Voltage	$I_S=-1\text{A}$, $V_{GS}=0\text{V}$		-0.7	-1	V
I_S	Maximum Body-Diode Continuous Current				-4.2	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$		1573		pF
C_{oss}	Output Capacitance			319		pF
C_{rss}	Reverse Transfer Capacitance			211		pF
R_g	Gate resistance	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$		6.7		Ω
SWITCHING PARAMETERS						
$Q_g(10\text{V})$	Total Gate Charge (10V)	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-7.1\text{A}$		30.9		nC
$Q_g(4.5\text{V})$	Total Gate Charge (4.5V)			16.1		nC
Q_{gs}	Gate Source Charge			8		nC
Q_{gd}	Gate Drain Charge			4.4		nC
$t_{D(on)}$	Turn-On DelayTime	$V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=2.2\Omega$, $R_{GEN}=3\Omega$		9.5		ns
t_r	Turn-On Rise Time			8		ns
$t_{D(off)}$	Turn-Off DelayTime			44.2		ns
t_f	Turn-Off Fall Time			22.2		ns
t_{rr}	Body Diode Reverse Recovery Time	$I_F=-7.1\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		25.5		ns
Q_{rr}	Body Diode Reverse Recovery Charge	$I_F=-7.1\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$		14.7		nC

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² 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. 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 6,12,14 are obtained using 80 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² 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.

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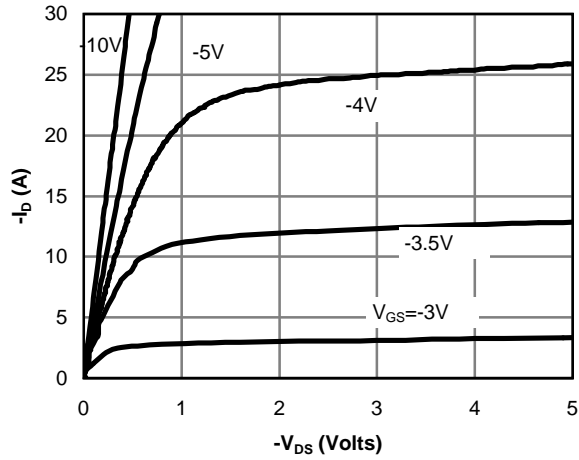


Fig 16: On-Region Characteristics

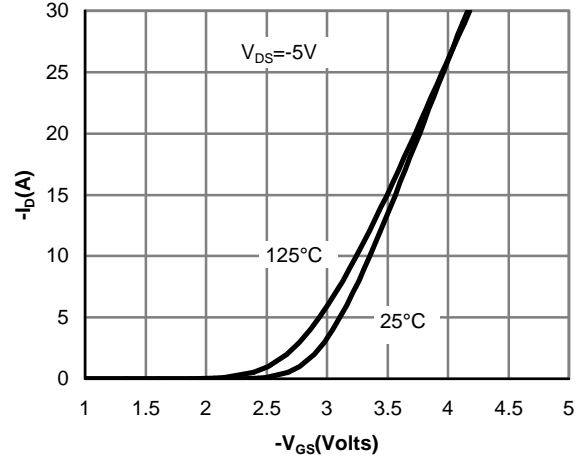


Figure 17: Transfer Characteristics

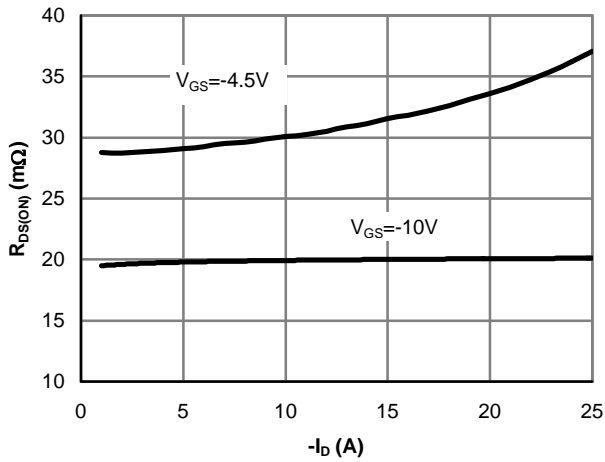


Figure 18: On-Resistance vs. Drain Current and Gate Voltage

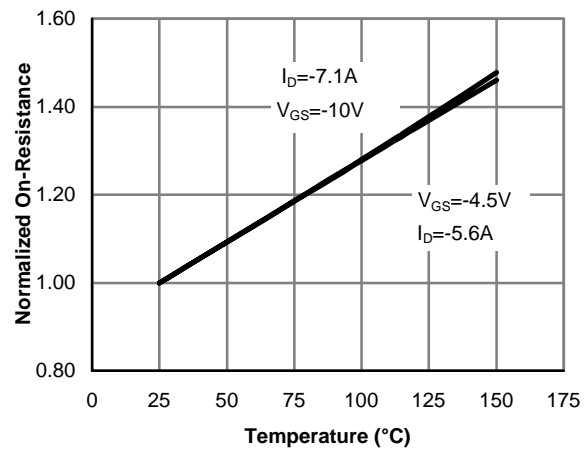


Figure 19: On-Resistance vs. Junction Temperature

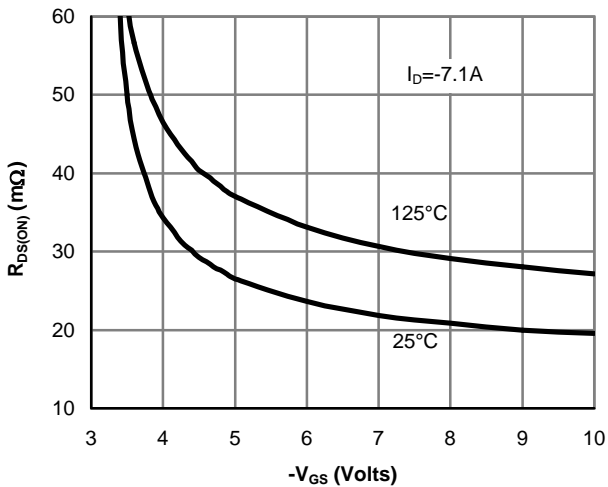


Figure 20: On-Resistance vs. Gate-Source Voltage

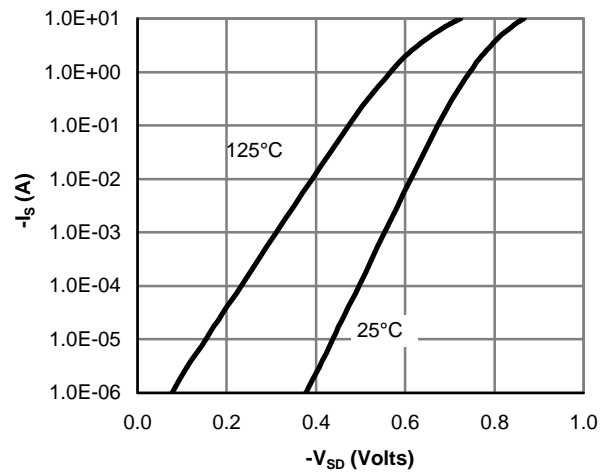


Figure 21: Body-Diode Characteristics

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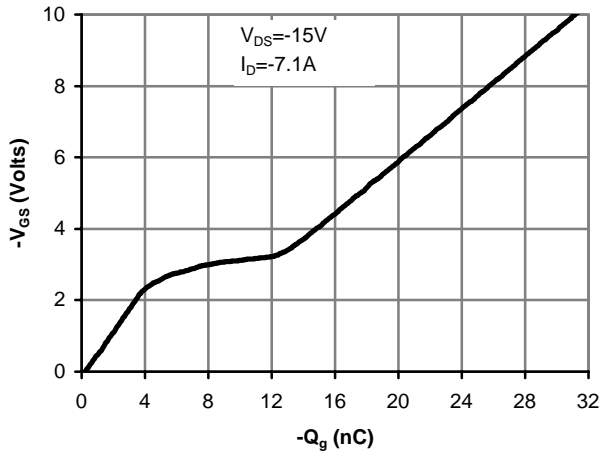


Figure 22: Gate-Charge Characteristics

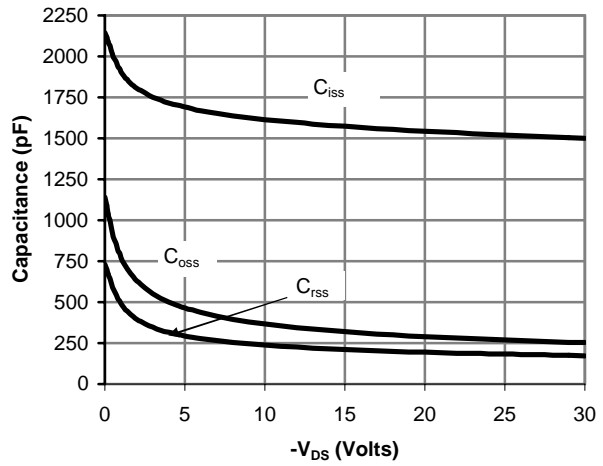


Figure 23: Capacitance Characteristics

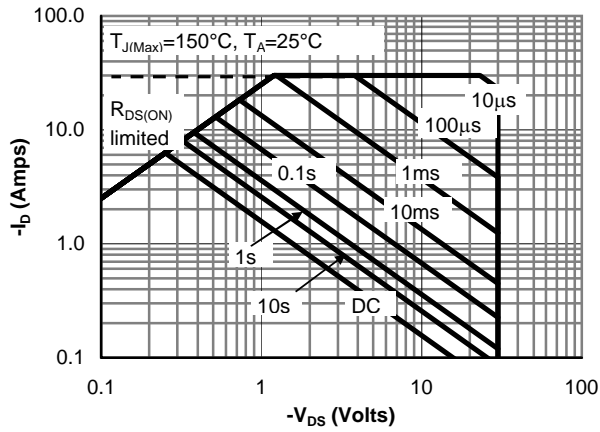


Figure 24: Maximum Forward Biased Safe Operating Area (Note E)

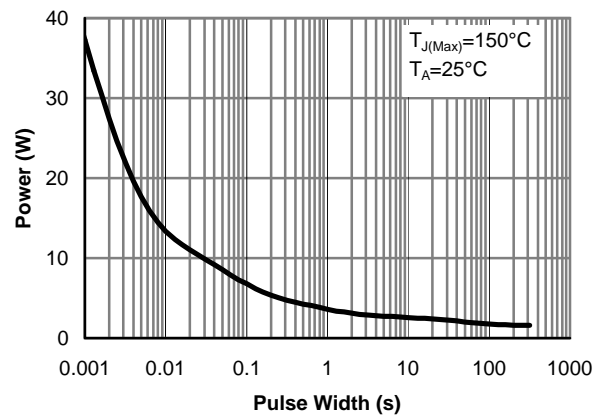


Figure 25: Single Pulse Power Rating Junction-to-Ambient (Note E)

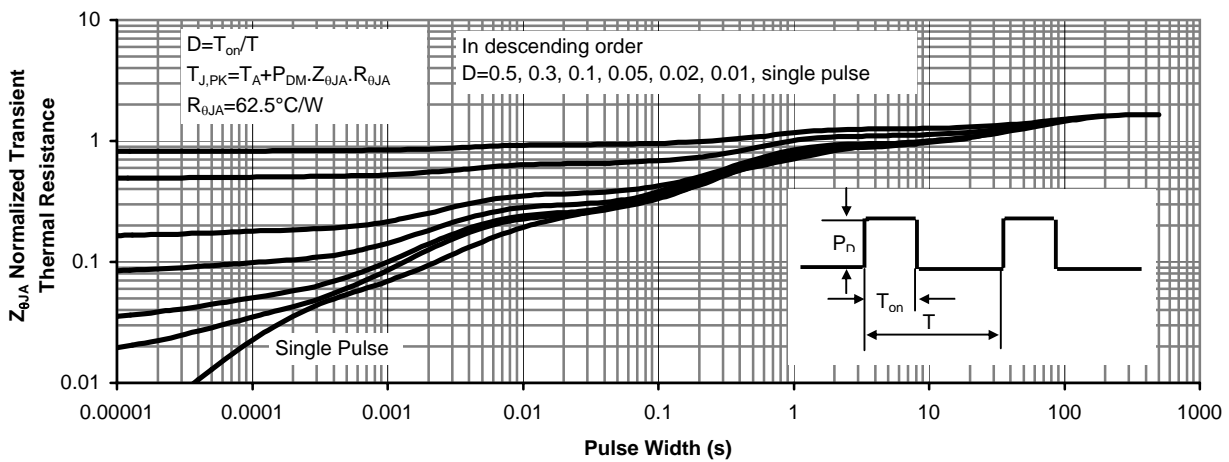


Figure 26: Normalized Maximum Transient Thermal Impedance