



ALPHA & OMEGA
SEMICONDUCTOR

AO4824

Asymmetric Dual N-Channel Enhancement Mode Field Effect Transistor



General Description

The AO4824 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. Standard Product AO4824 is Pb-free (meets ROHS & Sony 259 specifications). AO4824L is a Green Product ordering option. AO4824 and AO4824L are electrically identical.

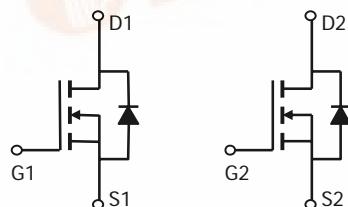
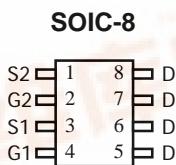
Features

Q1

V_{DS} (V) = 30V
 I_D = 8.5A
 $R_{DS(ON)}$ < 17mΩ
 $R_{DS(ON)}$ < 27mΩ

Q2

$V_{DS}(V)$ = 30V
 I_D = 9.8A (V_{GS} = 10V)
 $<13m\Omega$ (V_{GS} = 10V)
 $<15m\Omega$ (V_{GS} = 4.5V)



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}	± 20	± 12	V
Continuous Drain Current ^A	I_D	8.5	9.8	A
$T_A=70^\circ C$		6.8	7.8	
Pulsed Drain Current ^B	I_{DM}	30	40	
Power Dissipation	P_D	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	°C

Parameter: Thermal Characteristics MOSFET Q1	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient ^A		74	110	
Maximum Junction-to-Lead ^C		35	40	

Parameter: Thermal Characteristics MOSFET Q2	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient ^A	$R_{\theta JA}$	48	62.5	°C/W
Maximum Junction-to-Ambient ^A		74	110	
Maximum Junction-to-Lead ^C		35	40	

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS			30			V
I_{DSS}	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$		0.003	1	
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=24\text{V}, V_{GS}=0\text{V}$	$T_J=55^\circ\text{C}$		5	μA
I_{GSS}					100	nA
$V_{GS(\text{th})}$	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 20\text{V}$	1	1.8	3	V
$I_{D(\text{ON})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	30			A
$R_{DS(\text{ON})}$	On state drain current	$V_{GS}=10\text{V}, V_{DS}=5\text{V}$		13.8	17	
	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=8.5\text{A}$	$T_J=125^\circ\text{C}$	20	25	$\text{m}\Omega$
				21	27	$\text{m}\Omega$
g_{FS}		$V_{GS}=4.5\text{V}, I_D=6\text{A}$		23		S
V_{SD}	Forward Transconductance	$V_{DS}=5\text{V}, I_D=8.5\text{A}$		0.76	1	V
I_S	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$			3	A
	Maximum Body-Diode Continuous Current					
DYNAMIC PARAMETERS				1040	1250	pF
C_{oss}	Input Capacitance			180		pF
C_{rss}	Output Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$		110		pF
R_g	Reverse Transfer Capacitance			0.7	0.85	Ω
	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$				
SWITCHING PARAMETERS				19.2	23	nC
$Q_g(4.5\text{V})$	Total Gate Charge			9.36	11.2	nC
Q_{gs}	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, I_D=8.5\text{A}$		2.6		nC
Q_{gd}	Gate Source Charge			4.2		nC
$t_{D(\text{on})}$	Gate Drain Charge			5.2	7.5	ns
t_r	Turn-On Delay Time			4.4	6.5	ns
$t_{D(\text{off})}$	Turn-On Rise Time	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=1.8\Omega,$		17.3	25	ns
t_f	Turn-Off Delay Time	$R_{\text{GEN}}=3\Omega$		3.3	5	ns
t_{rr}	Turn-Off Fall Time			16.7	21	ns
Q_{rr}	Body Diode Reverse Recovery Time	$I_F=8.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$		6.7	10	nC
	Body Diode Reverse Recovery Charge	$I_F=8.5\text{A}, dI/dt=100\text{A}/\mu\text{s}$				

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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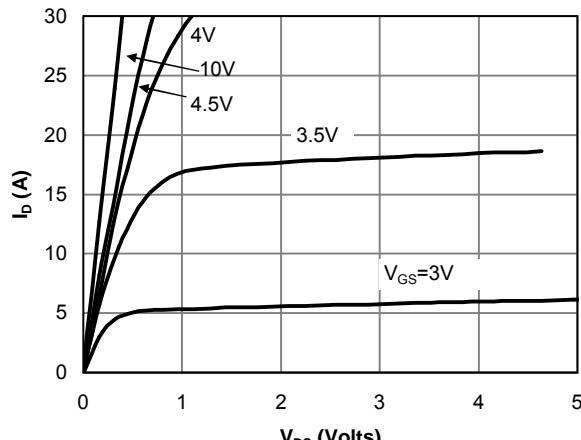
Q1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Fig 1: On-Region Characteristics

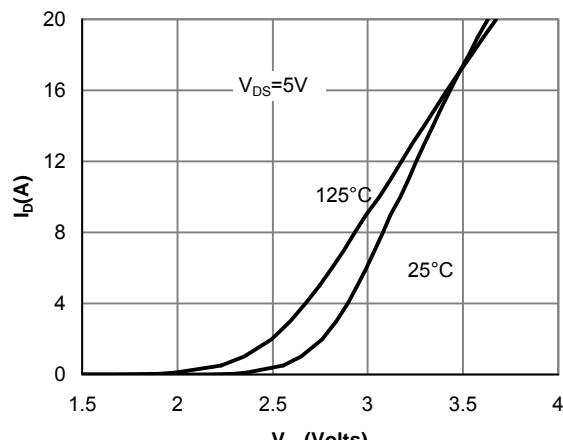


Figure 2: Transfer Characteristics

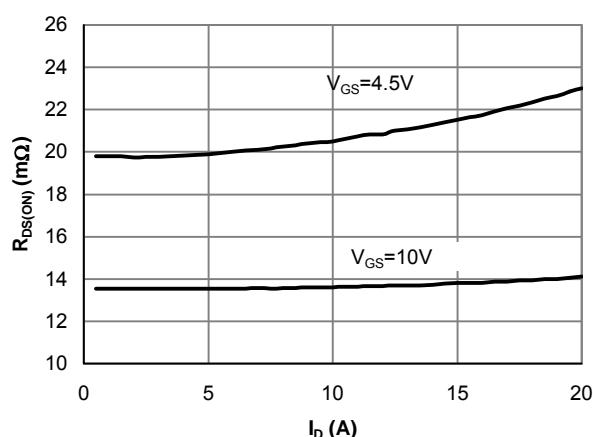


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

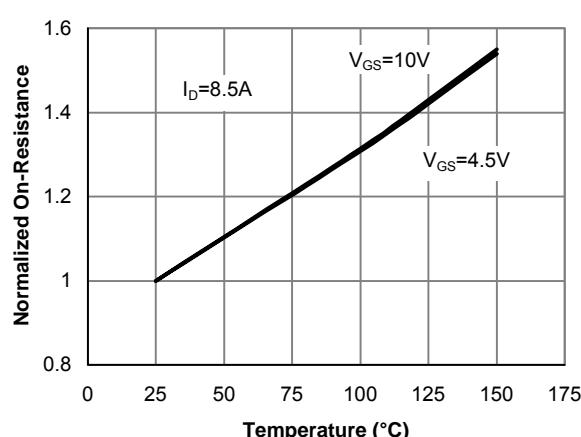


Figure 4: On-Resistance vs. Junction Temperature

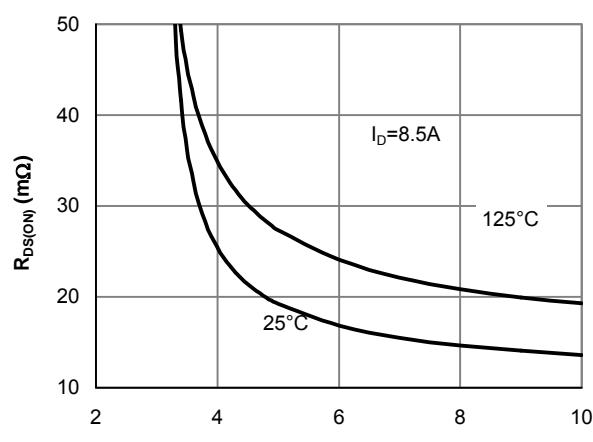


Figure 5: On-Resistance vs. Gate-Source Voltage

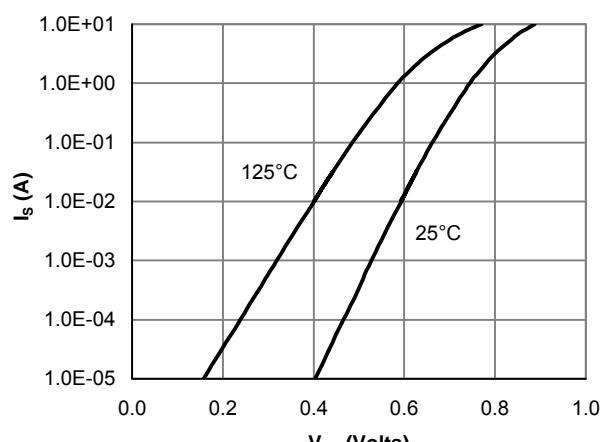


Figure 6: Body-Diode Characteristics

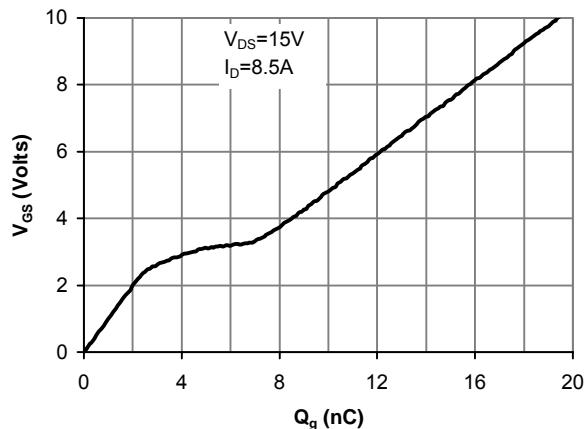
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Figure 7: Gate-Charge Characteristics

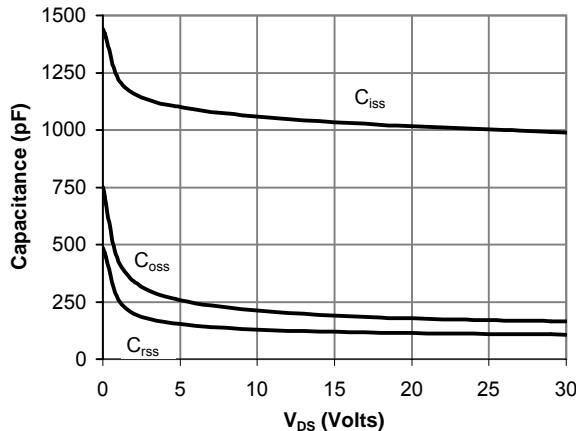


Figure 8: Capacitance Characteristics

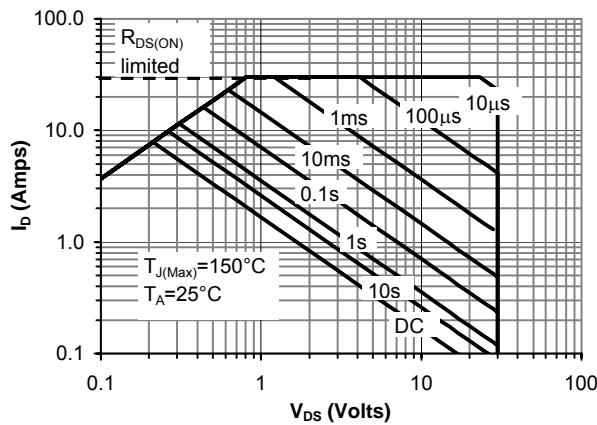


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

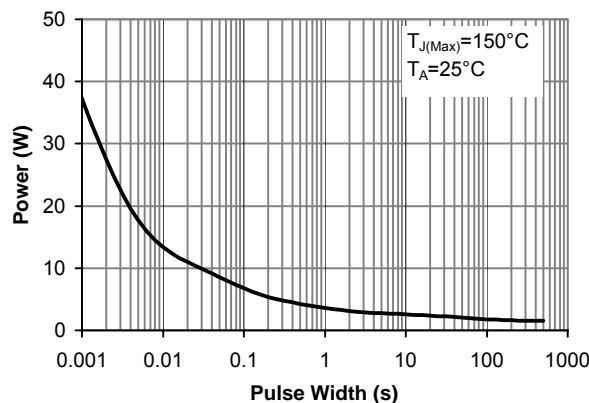


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

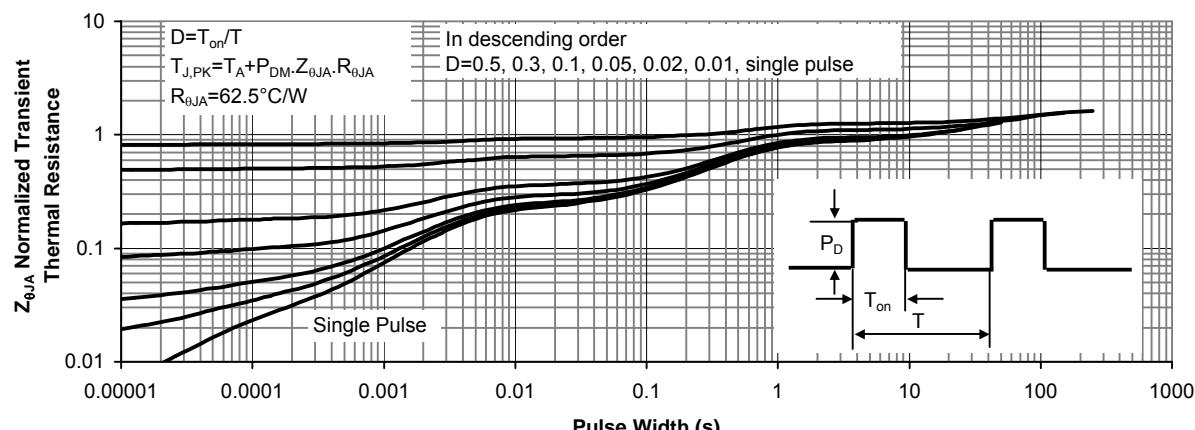


Figure 11: Normalized Maximum Transient Thermal Impedance

Q2 Electrical Characteristics ($T_J=25^\circ\text{C}$ 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	$V_{DS}=24\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$		0.004	1	μA
I_{GSS}	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 12\text{V}$			5	nA
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	0.6	1.1	2	V
$I_{D(\text{ON})}$	On state drain current	$V_{GS}=4.5\text{V}, V_{DS}=5\text{V}$	40			A
$R_{DS(\text{ON})}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=9.8\text{A}$ $T_J=125^\circ\text{C}$		10.5	13	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=9\text{A}$		13.4	17	$\text{m}\Omega$
g_{FS}	Forward Transconductance	$V_{DS}=5\text{V}, I_D=9.8\text{A}$	30	37		S
V_{SD}	Diode Forward Voltage	$I_S=1\text{A}$		0.73	1	V
I_S	Maximum Body-Diode Continuous Current				3	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$		3656	4250	pF
C_{oss}	Output Capacitance			256		pF
C_{rss}	Reverse Transfer Capacitance			168		pF
R_g	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$		0.86	1.05	Ω
SWITCHING PARAMETERS						
Q_g	Total Gate Charge	$V_{GS}=4.5\text{V}, V_{DS}=15\text{V}, I_D=9.8\text{A}$		30.5	36	nC
Q_{gs}	Gate Source Charge			4.5		nC
Q_{gd}	Gate Drain Charge			8.5		nC
$t_{D(\text{on})}$	Turn-On Delay Time	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=1.6\Omega, R_{\text{GEN}}=3\Omega$		5.5	8.2	ns
t_r	Turn-On Rise Time			3.1	5	ns
$t_{D(\text{off})}$	Turn-Off Delay Time			52.4	75	ns
t_f	Turn-Off Fall Time			5.7	8.5	ns
t_{rr}	Body Diode Reverse Recovery time	$I_F=9.8\text{A}, dI/dt=100\text{A}/\mu\text{s}$		21.5	26	ns
Q_{rr}	Body Diode Reverse Recovery charge	$I_F=9.8\text{A}, dI/dt=100\text{A}/\mu\text{s}$		11	15	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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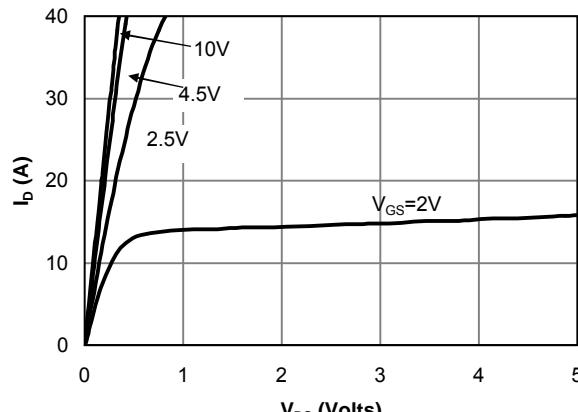
Q2 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

Fig 1: On-Region Characteristics

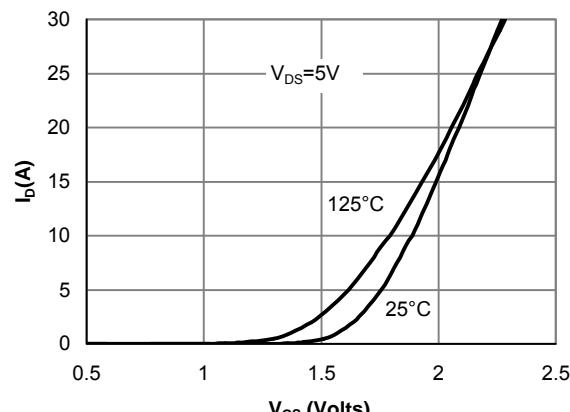


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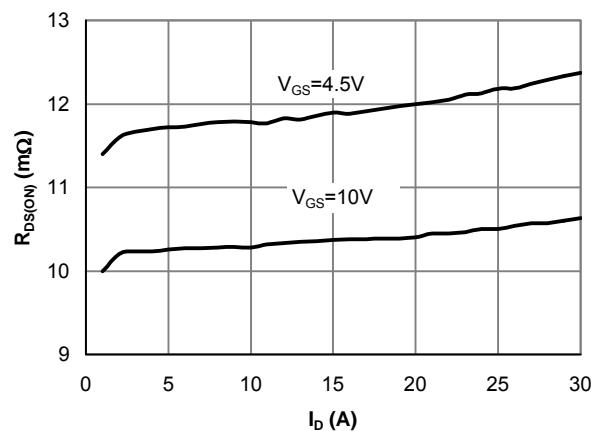


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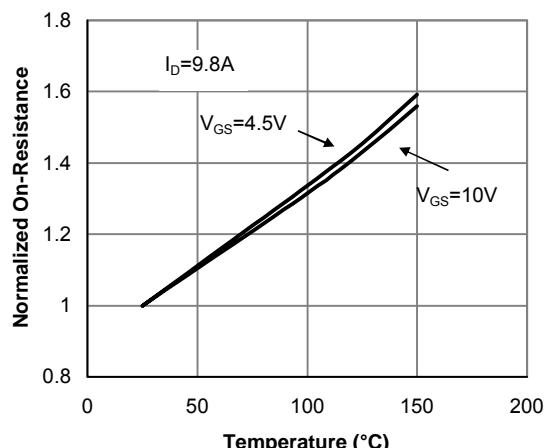


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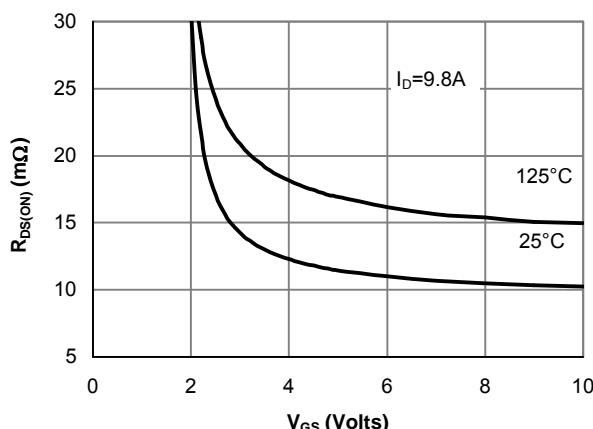


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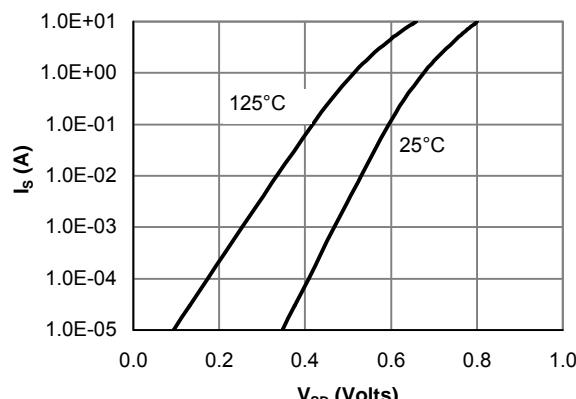


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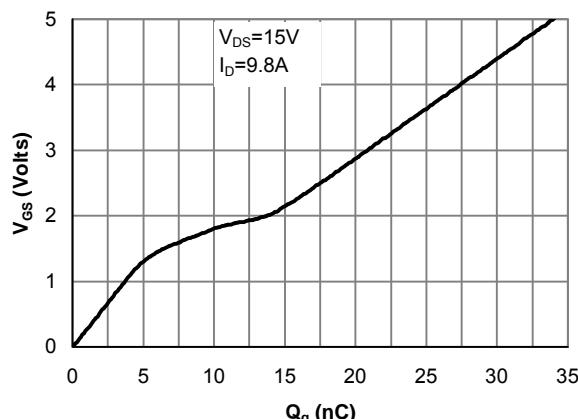
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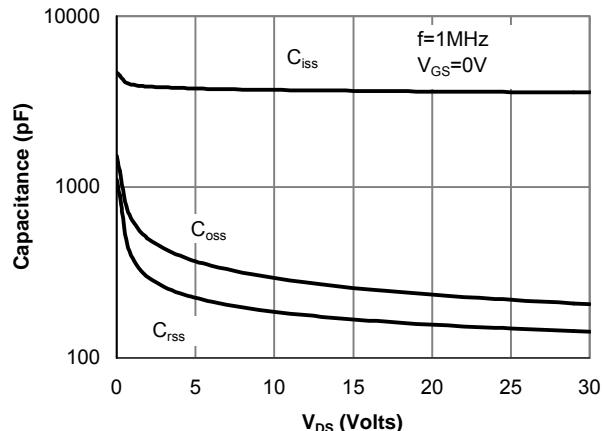


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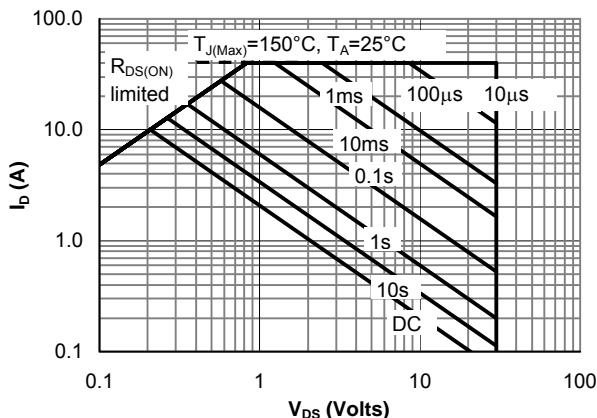


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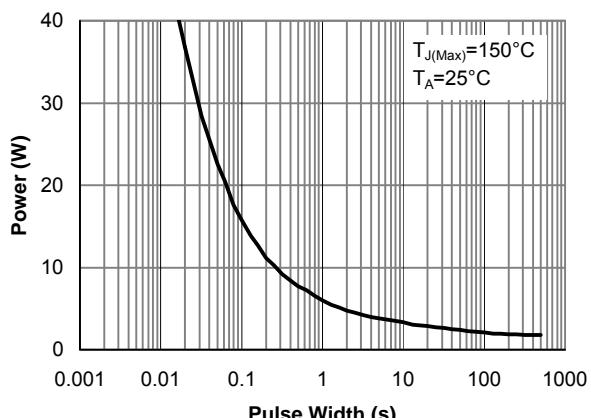


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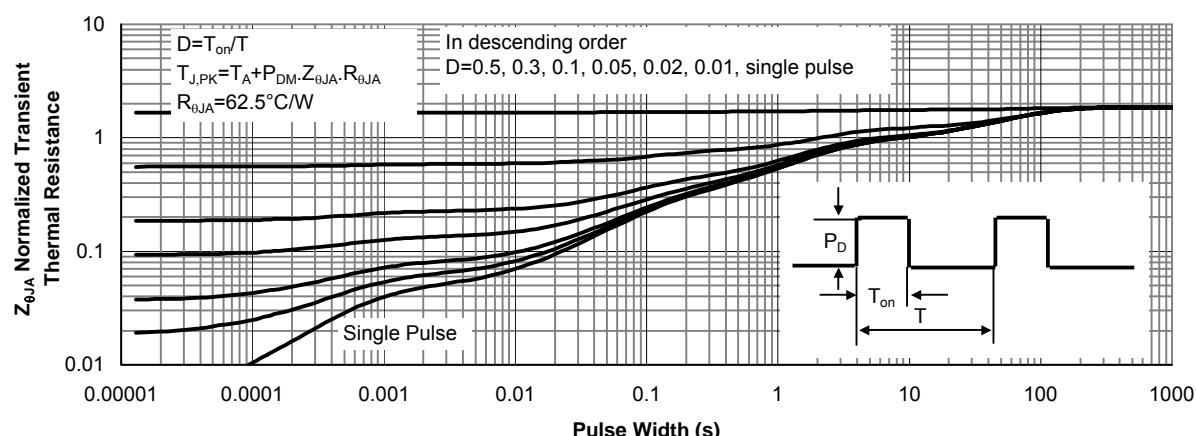


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