ALPHA & OMEGA SEMICONDUCTOR

AO4924
Asymmetric Dual N-Channel MOSFET
SRFET ™

General Description

The AO4924 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.
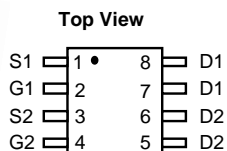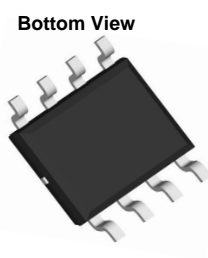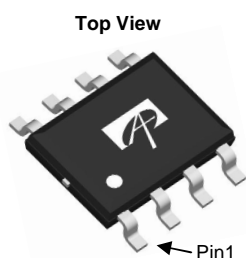
Product Summary

FET1	FET2	
V_{DS} (V) = 30V	V_{DS}(V) = 30V	
I_D = 9A	I_D=7.3A	(V_{GS} = 10V)
$R_{DS(ON)}$ < 15.8mΩ	<24mΩ	(V_{GS} = 10V)
$R_{DS(ON)}$ < 19.5mΩ	<29mΩ	(V_{GS} = 4.5V)

100% UIS Tested
100% Rg Tested

Green Product

SOIC-8

Top View

Bottom View

Top View

S1	1 •	8	D1
G1	2	7	D1
S2	3	6	D2
G2	4	5	D2

← Pin1

SRFET™
Soft **R**ecovery MOS**FET**:
Integrated Schottky Diode
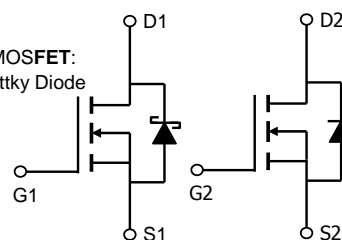
Absolute Maximum Ratings T_A=25℃ unless otherwise noted

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℃		9.0	7.3	A
	T_A=70℃	I_{DSM}	7.2	5.9	
Pulsed Drain Current [B]		I_{DM}	40	40	
Avalanche Current [B]		I_{AR}	16	12	A
Repetitive avalanche energy L=0.3mH [B]		E_{AR}	38	22	mJ
Power Dissipation	T_A=25℃	P_{DSM}	2.0	2.0	W
	T_A=70℃		1.3	1.3	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	-55 to 150	℃

Thermal Characteristics FET1

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

Thermal Characteristics FET2

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

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FET1 Electrical Characteristics (T$_J$=25℃ unless otherwise noted)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
STATIC PARAMETERS							
BV$_{DSS}$	Drain-Source Breakdown Voltage	I$_D$=1mA, 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℃		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	15.8	mΩ
			T$_J$=125℃		20.0	25.0	
		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$_{θJA}$ is measured with the device in a still air environment with T$_A$=25℃. The power dissipation P$_{DSM}$ and current rating I$_{DSM}$ are based on T$_{(J(MAX)}$=150℃, using t ≤ 10s junction-to-ambient thermal resistance.

B: Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=150℃.

C. The R$_{θJA}$ is the sum of the thermal impedence from junction to lead R$_{θJL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300 μs 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℃. The SOA curve provides a single pulse rating.

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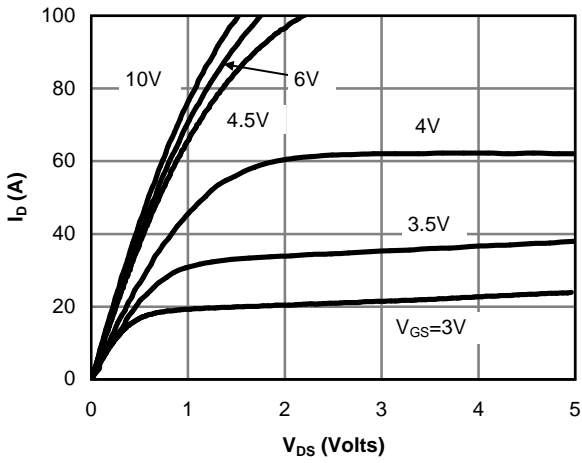**FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**
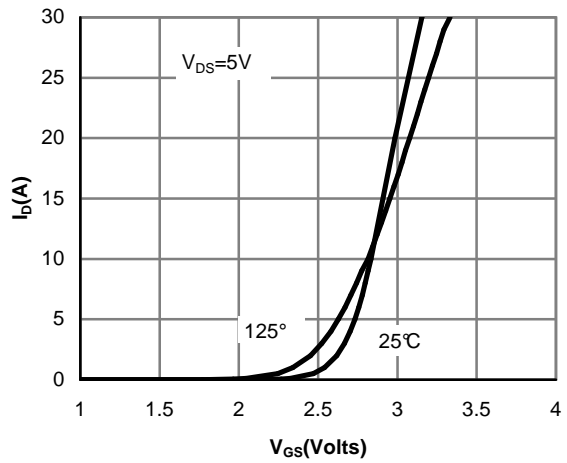

Figure 1: On-Region Characteristics

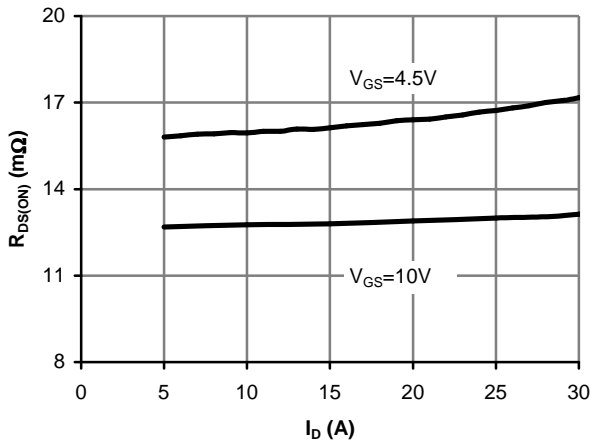**Figure 2: Transfer Characteristics**

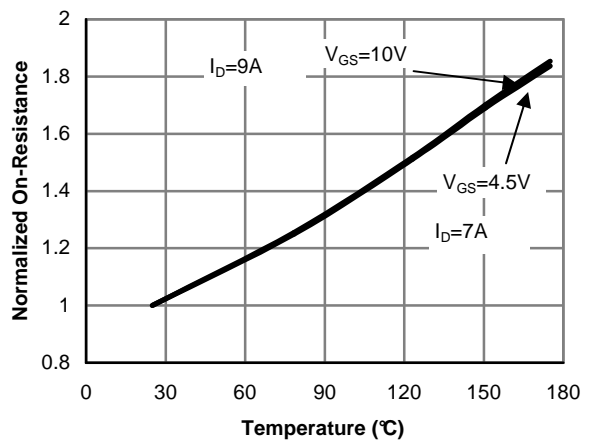**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

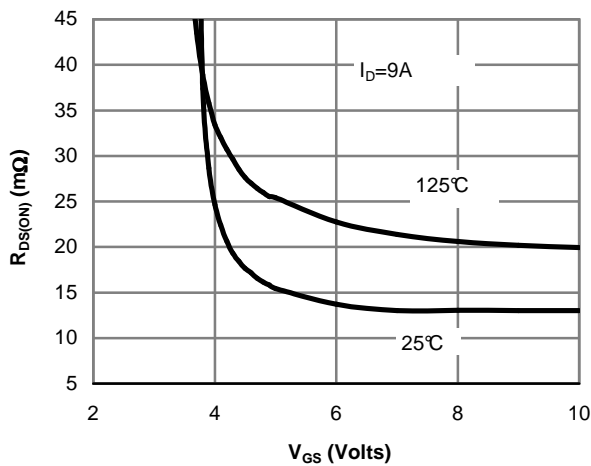
Figure 4: On-Resistance vs. Junction Temperature

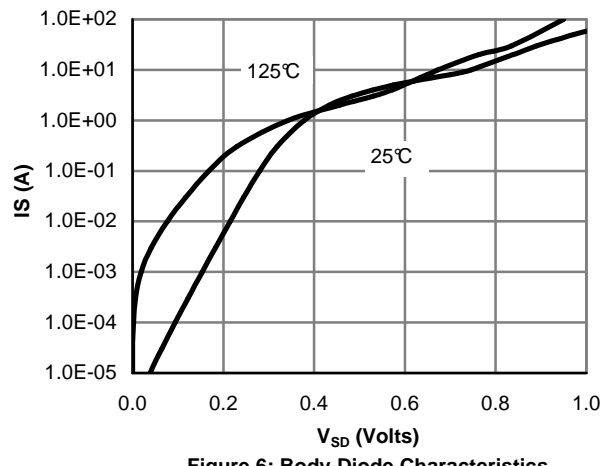**Figure 5: On-Resistance vs. Gate-Source Voltage**

Figure 6: Body-Diode Characteristics

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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)

In descending order
D=0.5, 0.3, 0.1, 0.05, 0.02, 0.01, single pulse

$D=T_{on}/T$
$T_{J,PK}=T_A+P_{DM}\cdot Z_{\theta JA}\cdot R_{\theta JA}$
$R_{\theta JA}=90°C/W$

Single Pulse

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

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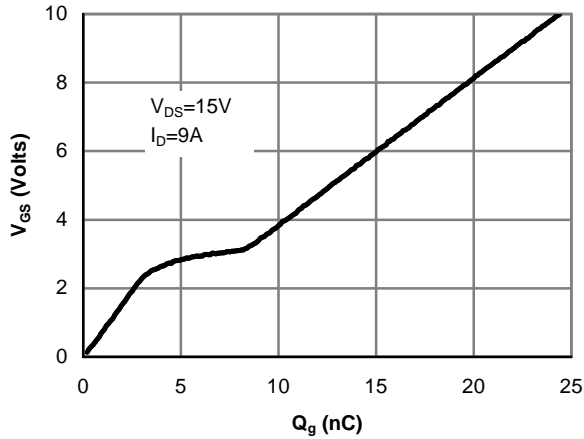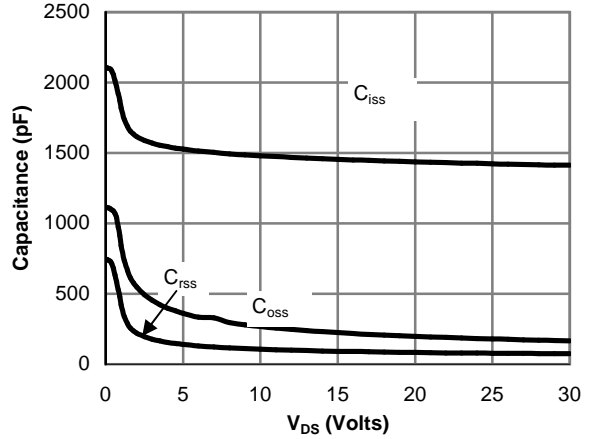
FET1 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
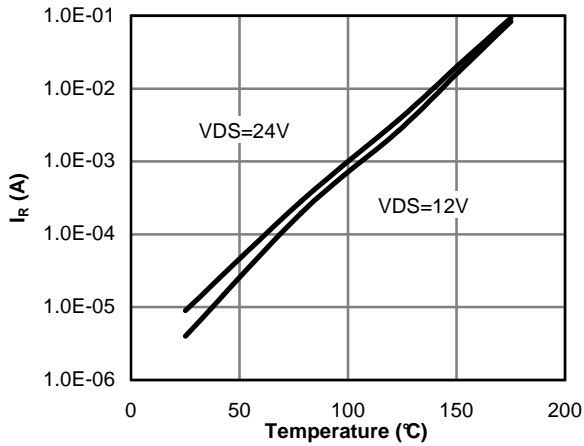
Figure 12: Diode Reverse Leakage Current vs. Junction Temperature
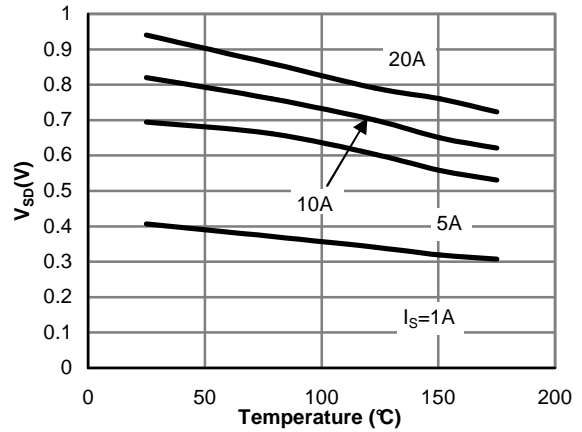
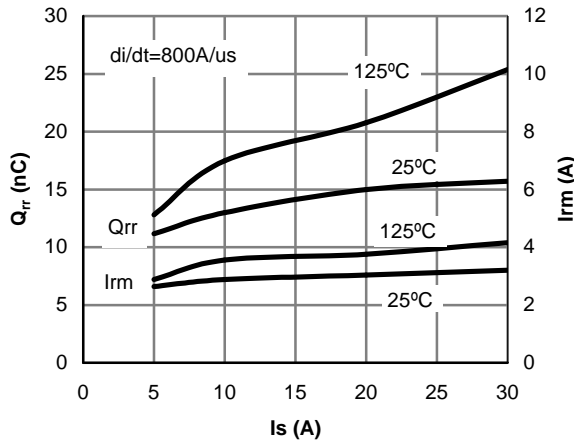Figure 13: Diode Forward voltage vs. Junction Temperature

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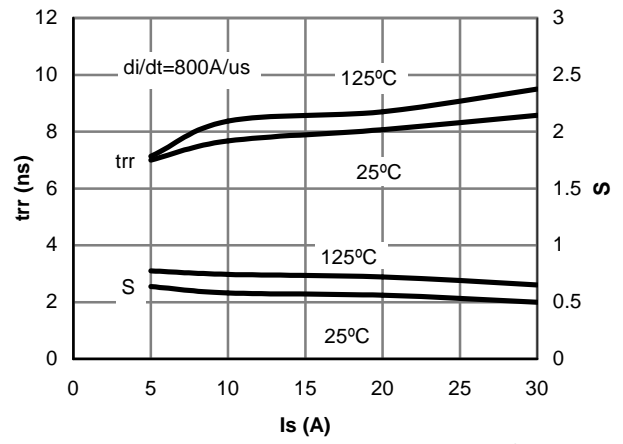

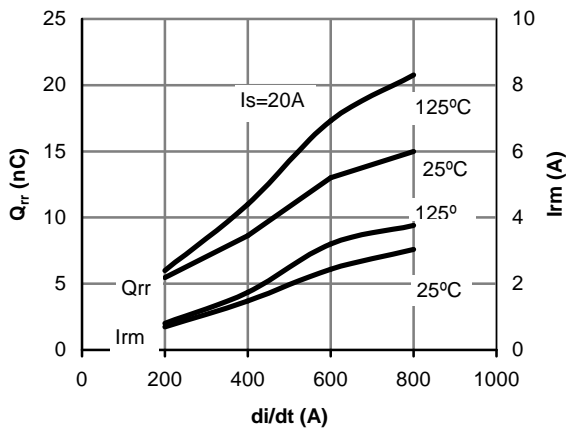Figure 15: Diode Reverse Recovery Time and Soft Coefficient vs. Conduction Current

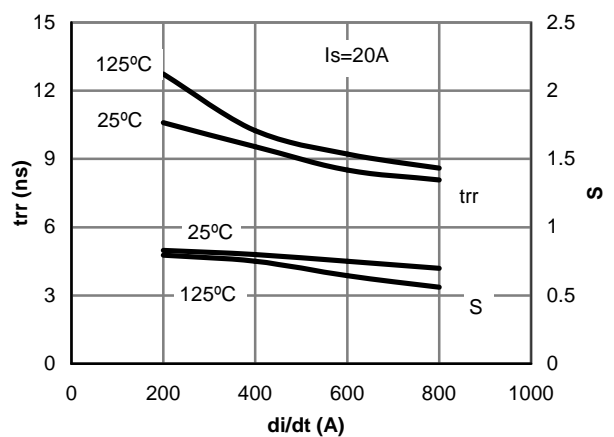Figure 16: Diode Reverse Recovery Charge and Peak Current vs. di/dt

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

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FET2 Electrical Characteristics (T$_J$=25℃ 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℃			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℃		28	34	
		V$_{GS}$=4.5V, I$_D$=6A			23.5	29	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	12	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$_L$=2Ω, 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	20	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=7.3A, dI/dt=100A/µs			8	12	nC

A: The value of R$_{θJA}$ is measured with the device mounted on 1in^2 FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25℃. 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$_{θJA}$ is the sum of the thermal impedence from junction to lead R$_{θJL}$ and lead to ambient.

D. The static characteristics in Figures 1 to 6 are obtained using <300 µs 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℃. The SOA curve provides a single pulse rating.

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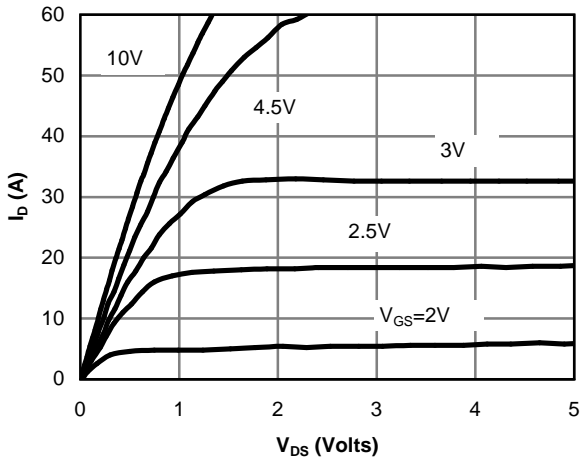**FET2 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**
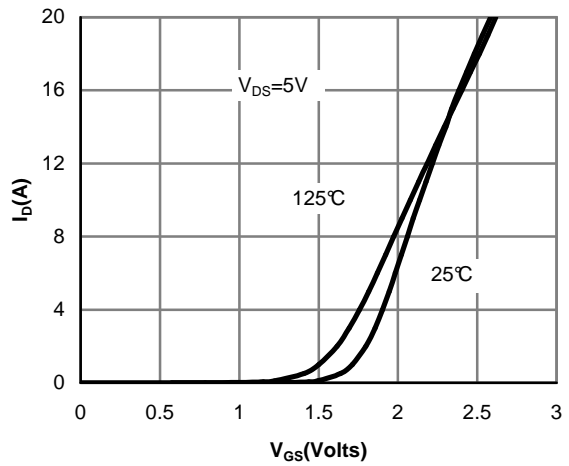
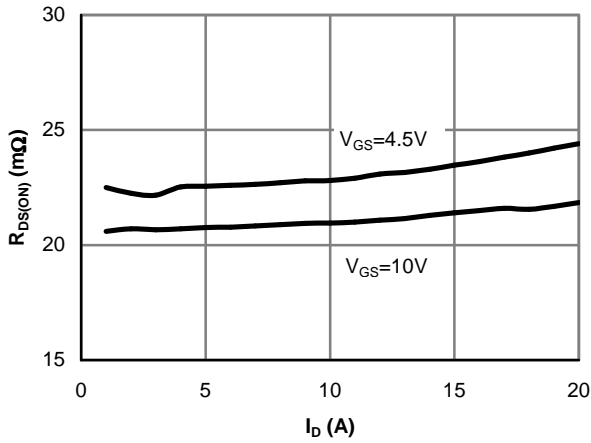Fig 1: On-Region Characteristics

Figure 2: Transfer Characteristics

Figure 3: On-Resistance vs. Drain Current and Gate Voltage
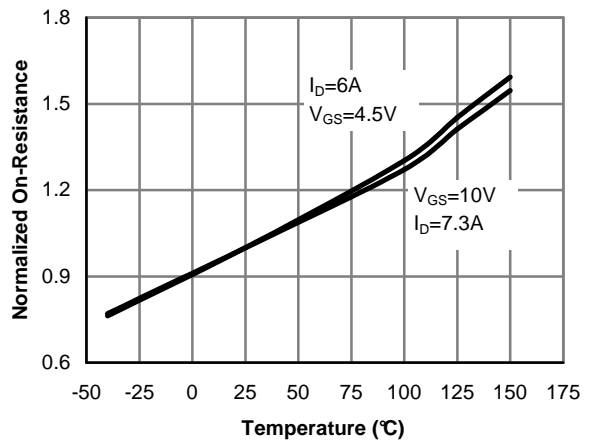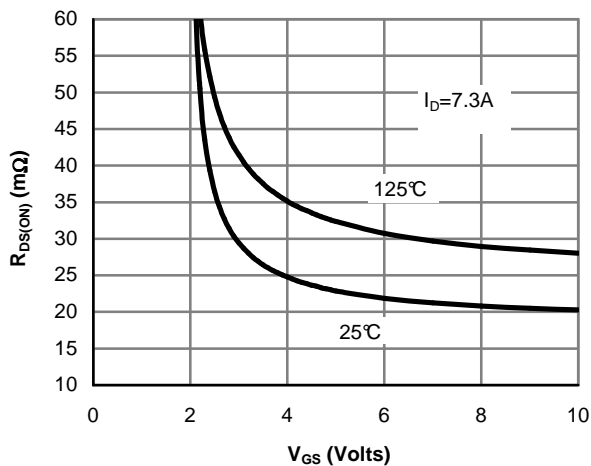
Figure 4: On-Resistance vs. Junction Temperature

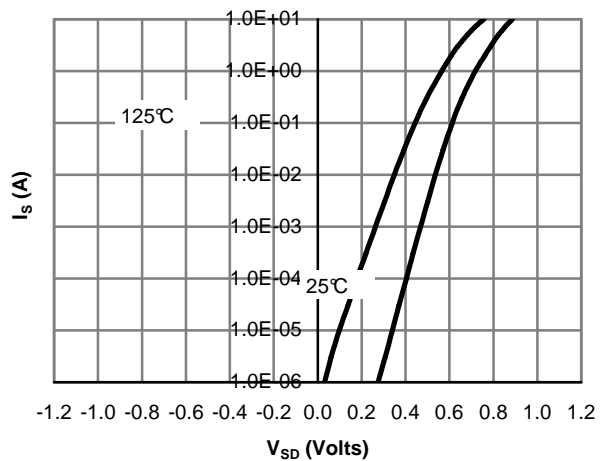Figure 5: On-Resistance vs. Gate-Source Voltage

Figure 6: Body-Diode Characteristics

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FET2 TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
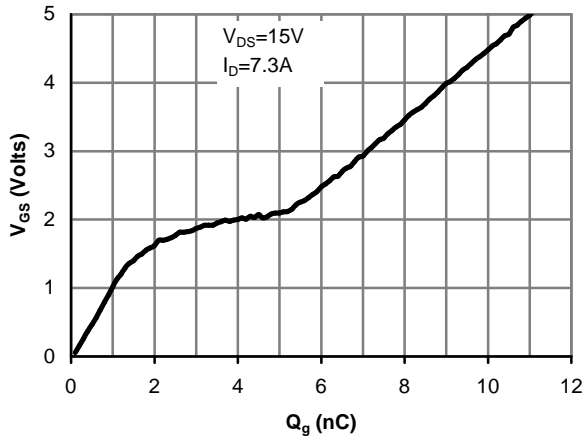
Figure 7: Gate-Charge Characteristics
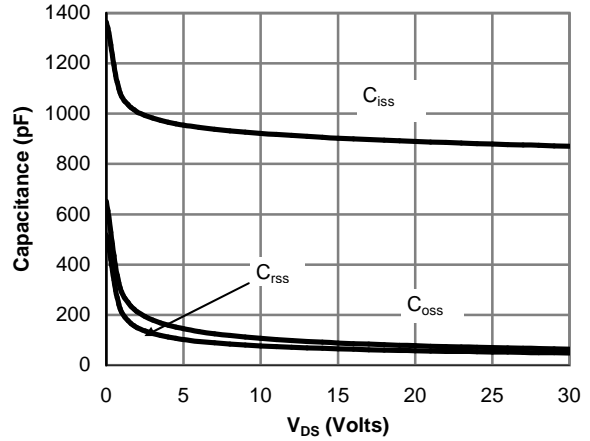
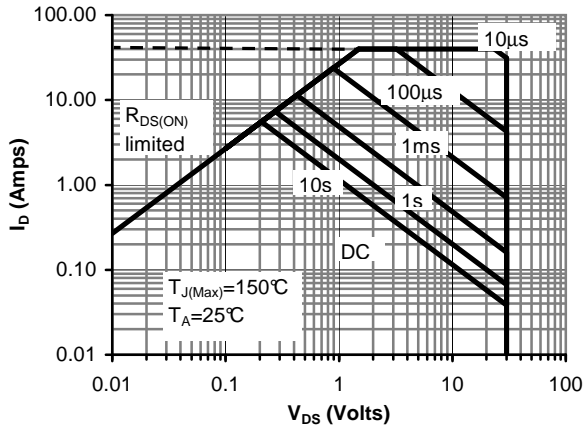Figure 8: Capacitance Characteristics

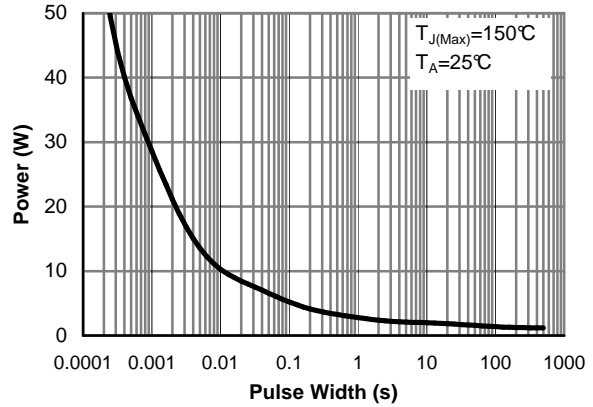

Figure 9: Maximum Forward Biased Safe
Operating Area (Note E)

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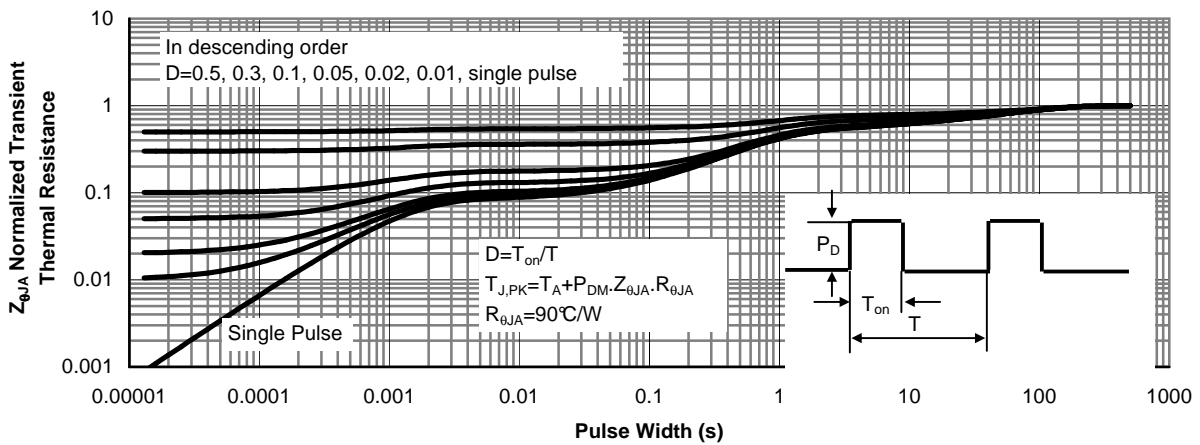Ambient (Note E)

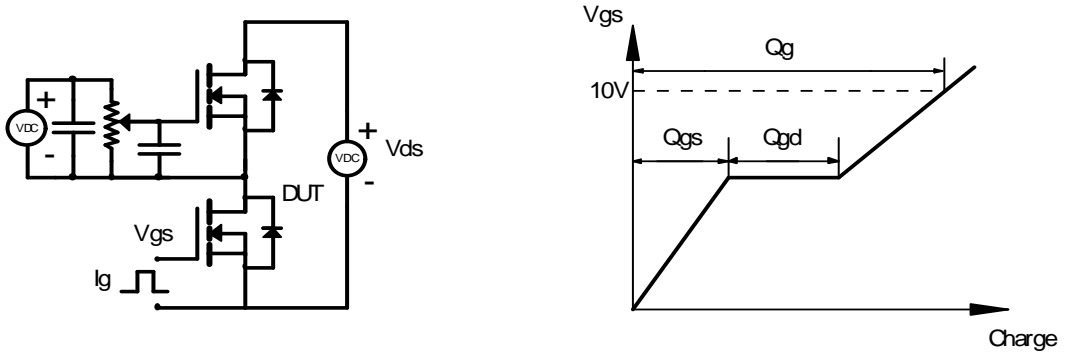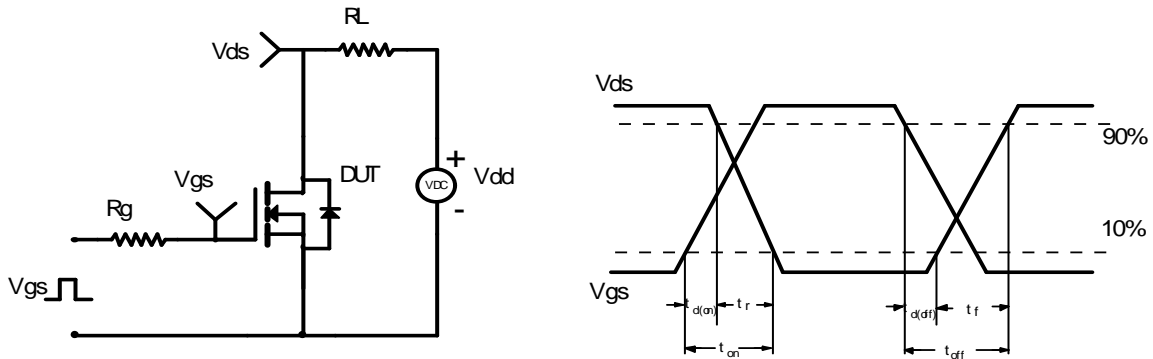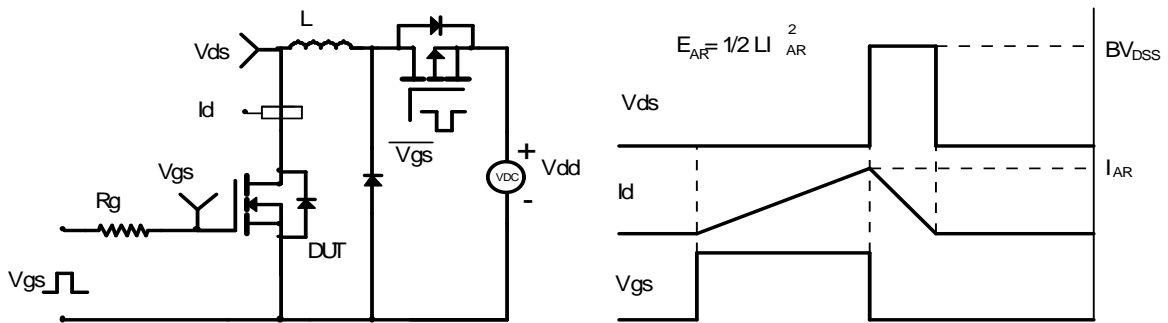Figure 11: Normalized Maximum Transient Thermal Impedance

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AO4924

Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

$E_{AR} = 1/2 \, LI_{AR}^2$

Diode Recovery Test Circuit & Waveforms

$Q_{rr} = -\int Idt$

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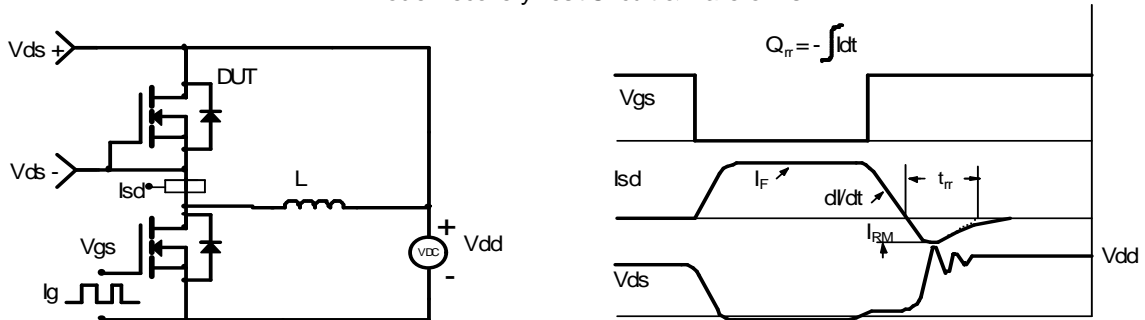
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