



**ALPHA & OMEGA**  
SEMICONDUCTOR

**AO4304**

**30V N-Channel MOSFET**

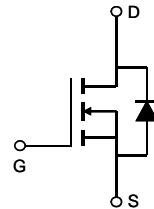
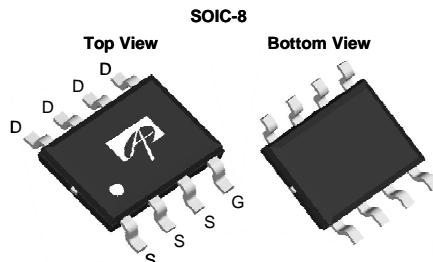
### General Description

The AO4304 combines advanced trench MOSFET technology with a low resistance package to provide extremely low  $R_{DS(ON)}$ . This device is ideal for load switch and battery protection applications.

### Product Summary

$V_{DS}$	30V
$I_D$ (at $V_{GS}=10V$ )	18A
$R_{DS(ON)}$ (at $V_{GS}=10V$ )	< 6.0mΩ
$R_{DS(ON)}$ (at $V_{GS} = 4.5V$ )	< 7.6mΩ

100% UIS Tested  
100%  $R_g$  Tested



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

Parameter	Symbol	Maximum	Units
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current <sup>A</sup>	$I_D$	18	A
Current $T_A=70^\circ C$		14	
Pulsed Drain Current <sup>C</sup>	$I_{DM}$	200	
Avalanche Current <sup>C</sup>	$I_{AS}, I_{AR}$	35	A
Avalanche energy $L=0.1mH$ <sup>C</sup>	$E_{AS}, E_{AR}$	61	mJ
Power Dissipation <sup>B</sup>	$P_D$	3.6	W
$T_A=70^\circ C$		2.3	
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	°C

### Thermal Characteristics

Parameter	Symbol	Typ	Max	Units
Maximum Junction-to-Ambient <sup>A</sup> $t \leq 10s$	$R_{\theta JA}$	27	35	°C/W
Maximum Junction-to-Ambient <sup>A,D</sup> Steady-State		52	65	°C/W
Maximum Junction-to-Lead	$R_{\theta JL}$	12	15	°C/W

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>STATIC PARAMETERS</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	30			V
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{DS}=30\text{V}, V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$			1 5	$\mu\text{A}$
$I_{\text{GSS}}$	Gate-Body leakage current	$V_{DS}=0\text{V}, V_{GS}=\pm 20\text{V}$			100	nA
$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.4	1.9	2.4	V
$I_{\text{D(ON)}}$	On state drain current	$V_{GS}=10\text{V}, V_{DS}=5\text{V}$	200			A
$R_{\text{DS(ON)}}$	Static Drain-Source On-Resistance	$V_{GS}=10\text{V}, I_D=15\text{A}$ $T_J=125^\circ\text{C}$		4.1	6	$\text{m}\Omega$
		$V_{GS}=4.5\text{V}, I_D=10\text{A}$		6.5	9.5	
$g_{\text{FS}}$	Forward Transconductance	$V_{DS}=5\text{V}, I_D=15\text{A}$		5	7.6	$\text{m}\Omega$
$V_{\text{SD}}$	Diode Forward Voltage	$I_S=1\text{A}, V_{GS}=0\text{V}$		0.7	1	V
$I_S$	Maximum Body-Diode Continuous Current				5	A
<b>DYNAMIC PARAMETERS</b>						
$C_{\text{iss}}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=15\text{V}, f=1\text{MHz}$	1275	1598	1920	pF
$C_{\text{oss}}$	Output Capacitance		215	308	400	pF
$C_{\text{rss}}$	Reverse Transfer Capacitance		90	154	215	pF
$R_g$	Gate resistance	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$	0.7	1.5	2.3	$\Omega$
<b>SWITCHING PARAMETERS</b>						
$Q_g(10\text{V})$	Total Gate Charge	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, I_D=15\text{A}$	19	24	29	nC
$Q_g(4.5\text{V})$	Total Gate Charge		8.5	11.1	14	nC
$Q_{\text{gs}}$	Gate Source Charge		4	5.2	6.5	nC
$Q_{\text{gd}}$	Gate Drain Charge		3	5.6	8	nC
$t_{\text{D(on)}}$	Turn-On Delay Time	$V_{GS}=10\text{V}, V_{DS}=15\text{V}, R_L=1\Omega, R_{\text{GEN}}=3\Omega$		7.3		ns
$t_r$	Turn-On Rise Time			3		ns
$t_{\text{D(off)}}$	Turn-Off Delay Time			25		ns
$t_f$	Turn-Off Fall Time			5.3		ns
$t_{\text{rr}}$	Body Diode Reverse Recovery Time	$I_F=15\text{A}, dI/dt=500\text{A}/\mu\text{s}$	7	9.5	12	ns
$Q_{\text{rr}}$	Body Diode Reverse Recovery Charge	$I_F=15\text{A}, dI/dt=500\text{A}/\mu\text{s}$	14	17.5	21	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 given application depends on the user's specific board design.

B. The power dissipation  $P_D$  is based on  $T_{J(\text{MAX})}=150^\circ\text{C}$ , using  $\leq 10\text{s}$  junction-to-ambient thermal resistance.

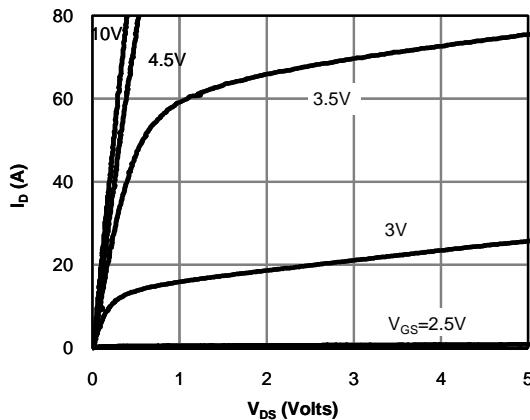
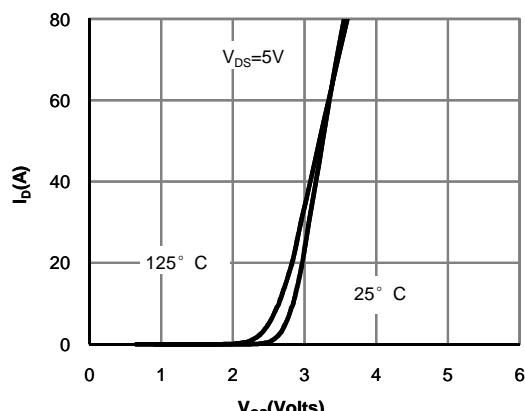
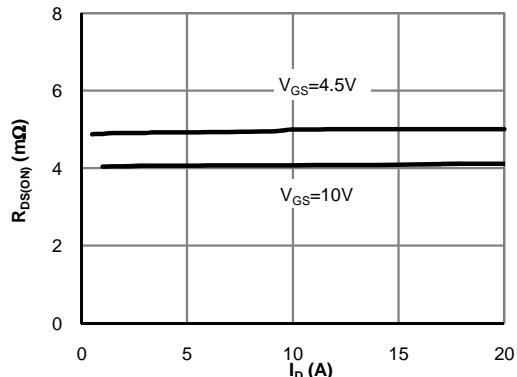
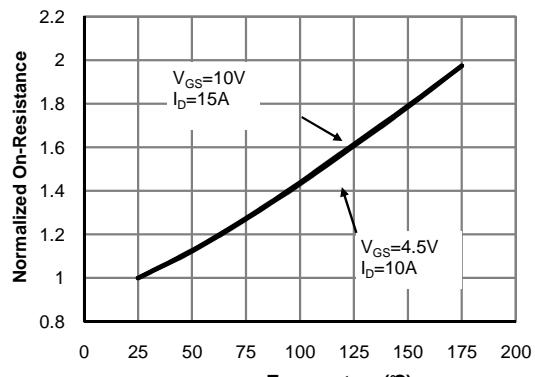
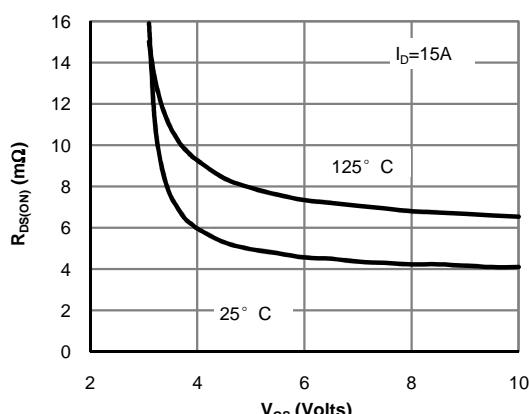
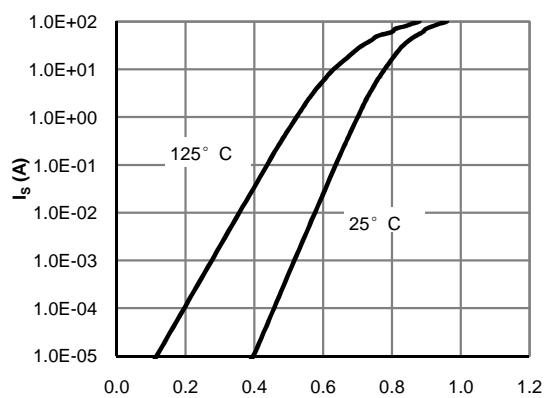
C. Repetitive rating, pulse width limited by junction temperature  $T_{J(\text{MAX})}=150^\circ\text{C}$ . Ratings are based on low frequency and duty cycles to keep initial  $T_J=25^\circ\text{C}$ .

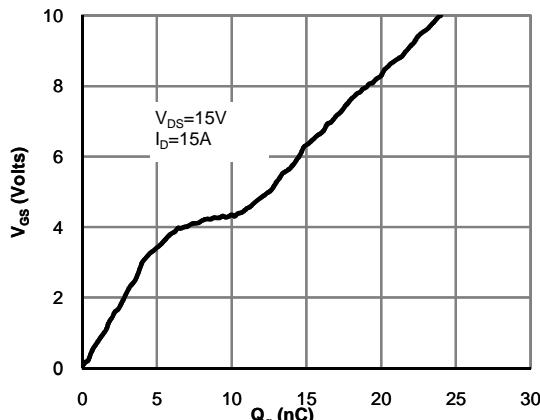
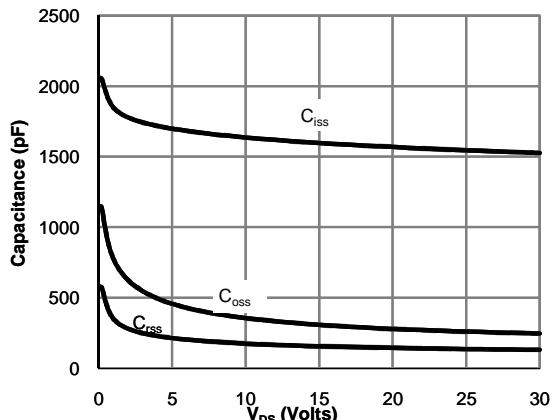
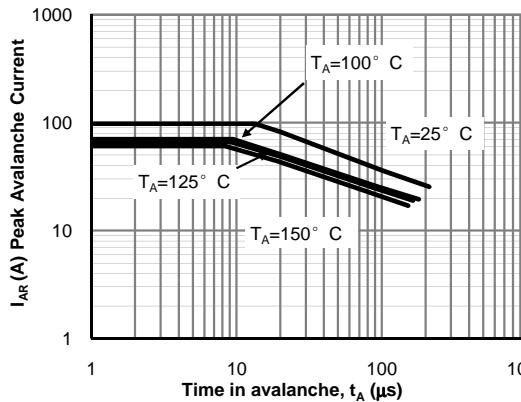
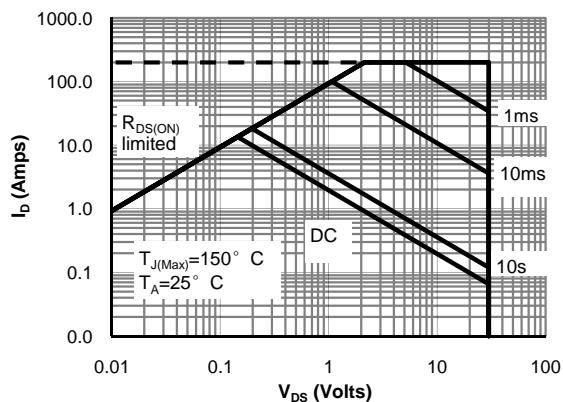
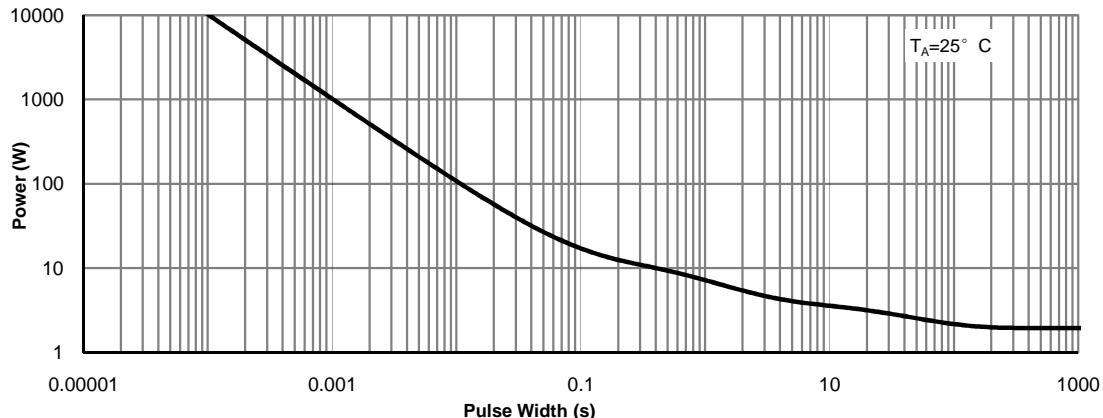
D. The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of  $T_{J(\text{MAX})}=150^\circ\text{C}$ . The SOA curve provides a single pulse rating.

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**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Fig 1: On-Region Characteristics (Note E)**

**Figure 2: Transfer Characteristics (Note E)**

**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**

**Figure 4: On-Resistance vs. Junction Temperature (Note E)**

**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

**Figure 6: Body-Diode Characteristics (Note E)**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 7: Gate-Charge Characteristics**

**Figure 8: Capacitance Characteristics**

**Figure 9: Single Pulse Avalanche capability  
(Note C)**

**Figure 10: Maximum Forward Biased  
Safe Operating Area (Note F)**

**Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)**

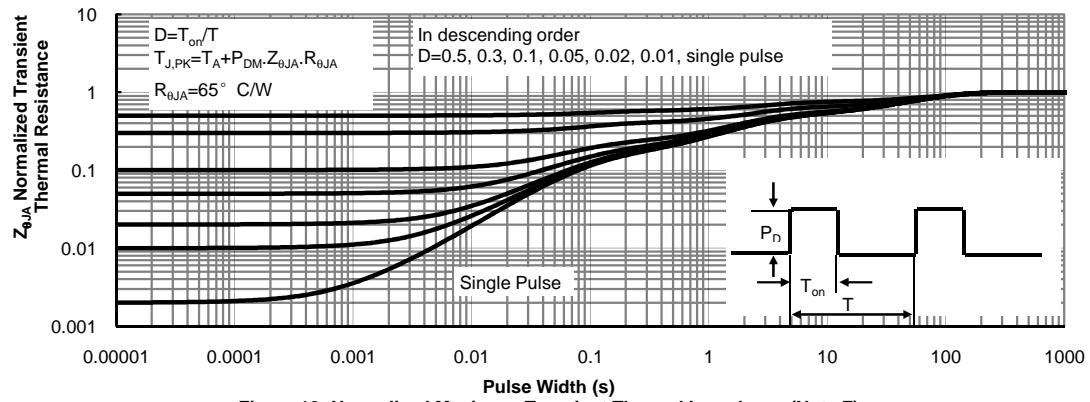
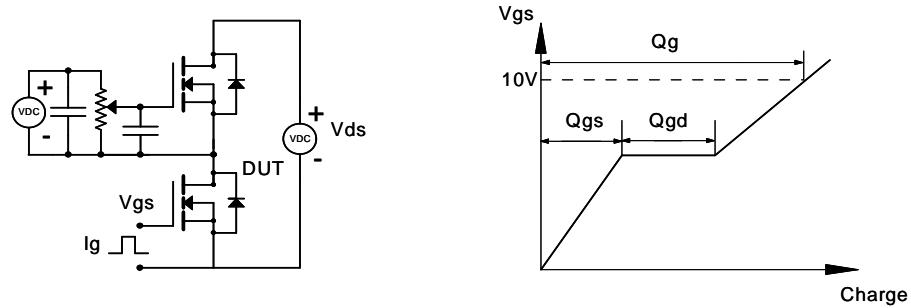
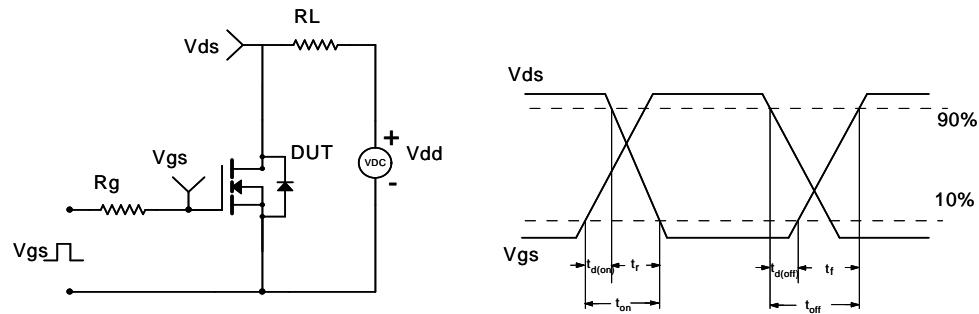
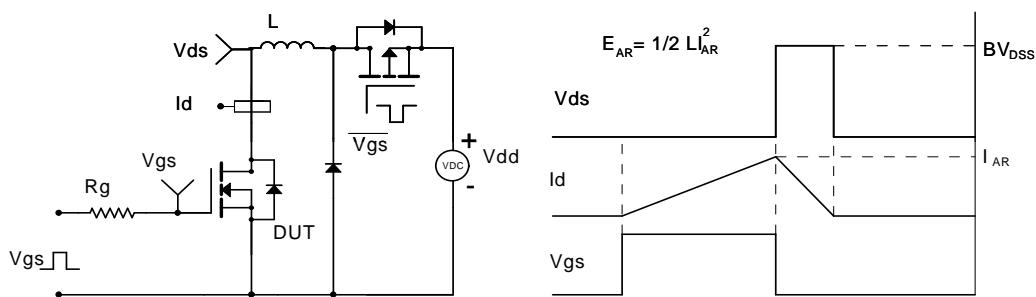
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Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)

**Gate Charge Test Circuit & Waveform**

**Resistive Switching Test Circuit & Waveforms**

**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**

**Diode Recovery Test Circuit & Waveforms**
