ALPHA & OMEGA SEMICONDUCTOR
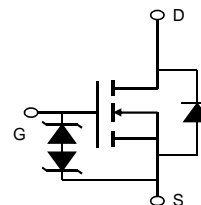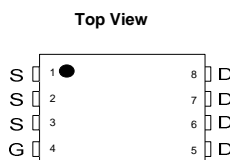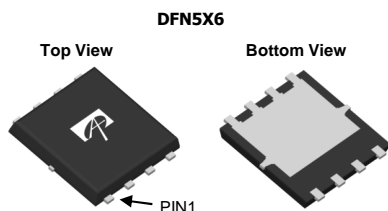
AON6404A
30V N-Channel MOSFET

General Description

The AON6404A 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)	85A
$R_{DS(ON)}$ (at V_{GS}=10V)	< 2.3mΩ
$R_{DS(ON)}$ (at V_{GS}=4.5V)	< 3.0mΩ

ESD protected
100% UIS Tested
100% R_g Tested

Green Product

DFN5X6

Top View

Bottom View

Top View

PIN1

```
S  1 •      8  D
S  2        7  D
S  3        6  D
G  4        5  D
```

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	30	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [G]	T_C=25°C	I_D	85	A
	T_C=100°C		67	
Pulsed Drain Current [C]		I_{DM}	280	
Continuous Drain Current	T_A=25°C	I_{DSM}	25	A
	T_A=70°C		19	
Avalanche Current [C]		I_{AS}, I_{AR}	60	A
Avalanche energy L=0.1mH [C]		E_{AS}, E_{AR}	180	mJ
Power Dissipation [B]	T_C=25°C	P_D	83	W
	T_C=100°C		33	
Power Dissipation [A]	T_A=25°C	P_{DSM}	2.3	W
	T_A=70°C		1.4	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	t ≤ 10s	$R_{\theta JA}$	14	17	°C/W
Maximum Junction-to-Ambient [A D]	Steady-State		40	55	°C/W
Maximum Junction-to-Case	Steady-State	$R_{\theta JC}$	0.85	1.5	°C/W

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	36		V
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$=30V, V$_{GS}$=0V				1	µA
			T$_J$=55℃			5	
I$_{GSS}$	Gate-Body leakage current	V$_{DS}$=0V, V$_{GS}$= ±16V				10	uA
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$ I$_D$=250µA		1.3	1.85	2.4	V
I$_{D(ON)}$	On state drain current	V$_{GS}$=10V, V$_{DS}$=5V		280			A
R$_{DS(ON)}$	Static Drain-Source On-Resistance	V$_{GS}$=10V, I$_D$=20A			1.9	2.3	mΩ
			T$_J$=125℃		2.8	3.4	
		V$_{GS}$=4.5V, I$_D$=20A			2.4	3	mΩ
g$_{FS}$	Forward Transconductance	V$_{DS}$=5V, I$_D$=20A			130		S
V$_{SD}$	Diode Forward Voltage	I$_S$=1A,V$_{GS}$=0V			0.67	1	V
I$_S$	Maximum Body-Diode Continuous Current[G]					85	A
DYNAMIC PARAMETERS							
C$_{iss}$	Input Capacitance	V$_{GS}$=0V, V$_{DS}$=15V, f=1MHz		3450	4335	5210	pF
C$_{oss}$	Output Capacitance			500	720	950	pF
C$_{rss}$	Reverse Transfer Capacitance			260	435	610	pF
R$_g$	Gate resistance	V$_{GS}$=0V, V$_{DS}$=0V, f=1MHz		1	2	3	Ω
SWITCHING PARAMETERS							
Q$_g$(10V)	Total Gate Charge	V$_{GS}$=10V, V$_{DS}$=15V, I$_D$=20A		55	71	86	nC
Q$_g$(4.5V)	Total Gate Charge			25	33	40	nC
Q$_{gs}$	Gate Source Charge				10		nC
Q$_{gd}$	Gate Drain Charge				16		nC
t$_{D(on)}$	Turn-On DelayTime	V$_{GS}$=10V, V$_{DS}$=15V, R$_L$=0.75Ω, R$_{GEN}$=3Ω			10		ns
t$_r$	Turn-On Rise Time				6.5		ns
t$_{D(off)}$	Turn-Off DelayTime				75.5		ns
t$_f$	Turn-Off Fall Time				17.5		ns
t$_{rr}$	Body Diode Reverse Recovery Time	I$_F$=20A, dI/dt=500A/µs			29	35	ns
Q$_{rr}$	Body Diode Reverse Recovery Charge	I$_F$=20A, dI/dt=500A/µs			13.5		nC

A. The value of R$_{\theta JA}$ is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25° C. The Power dissipation P$_{DSM}$ is based on R$_{\theta JA}$ and the maximum allowed junction temperature of 150° C. The value in any given application depends on the user's specific board design, and the maximum temperature of 150° C may be used if the PCB allows it.
B. The power dissipation P$_D$ is based on T$_{J(MAX)}$=150° C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
C. Repetitive rating, pulse width limited by junction temperature T$_{J(MAX)}$=150° C. Ratings are based on low frequency and duty cycles to keep initial T$_J$=25° C.
D. The R$_{\theta JA}$ is the sum of the thermal impedance from junction to case R$_{\theta JC}$ and case 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-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T$_{J(MAX)}$=150° C. The SOA curve provides a single pulse rating.
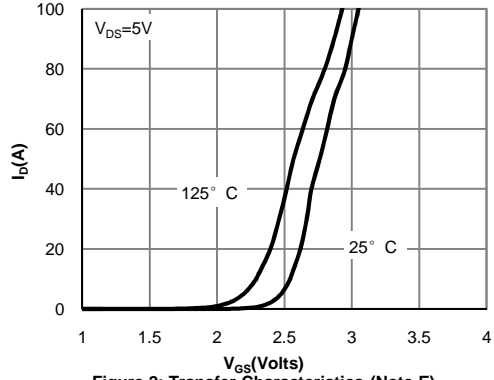G. The maximum current rating is package limited.
H. These tests are performed with the device mounted on 1 in² FR-4 board with 2oz. Copper, in a still air environment with T$_A$=25° C.
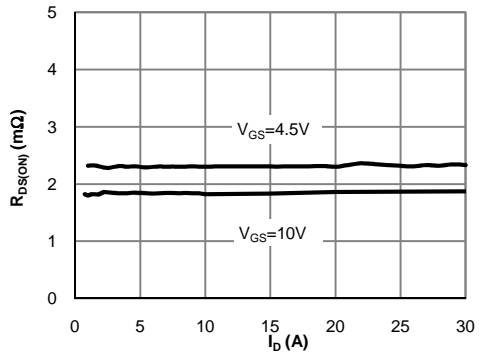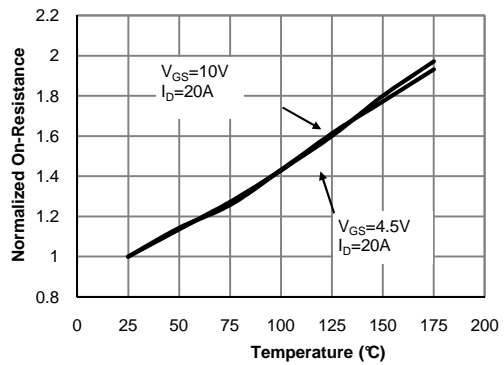
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
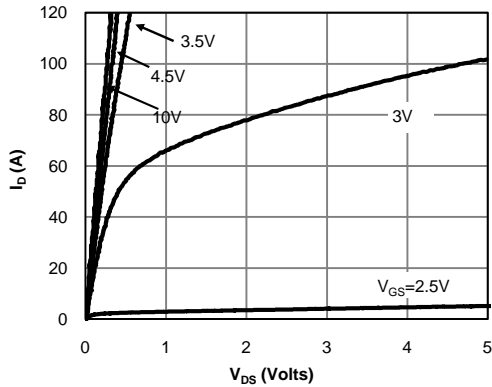
Fig 1: On-Region Characteristics (Note E)
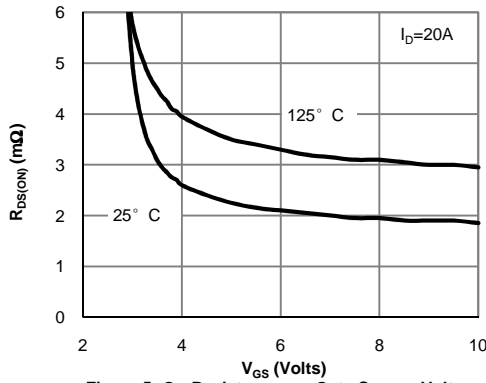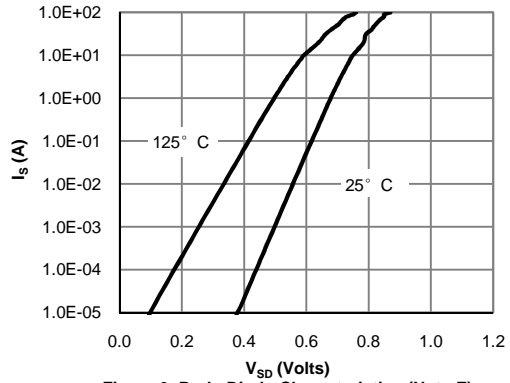

Figure 2: Transfer Characteristics (Note E)

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

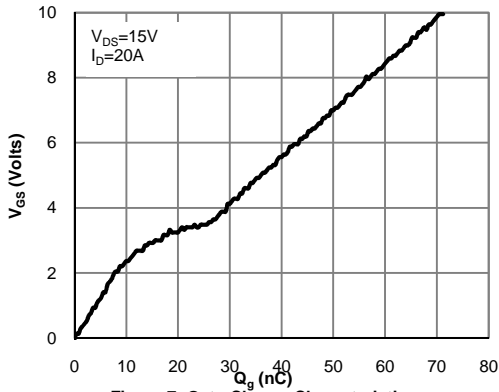

Figure 4: On-Resistance vs. Junction Temperature (Note E)

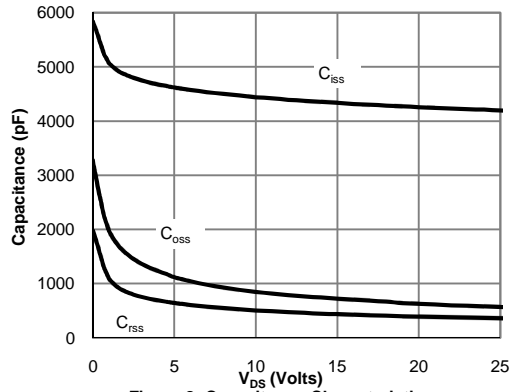Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)
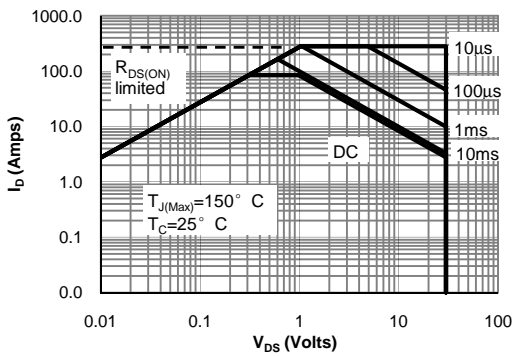

Figure 6: Body-Diode Characteristics (Note E)
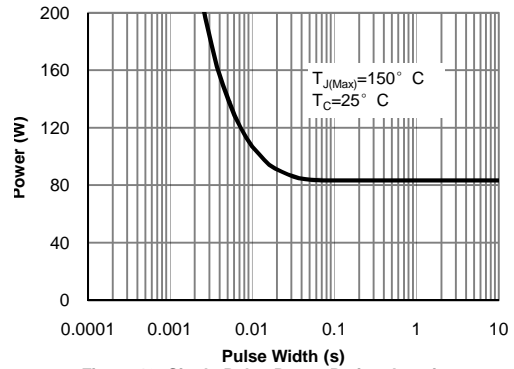
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
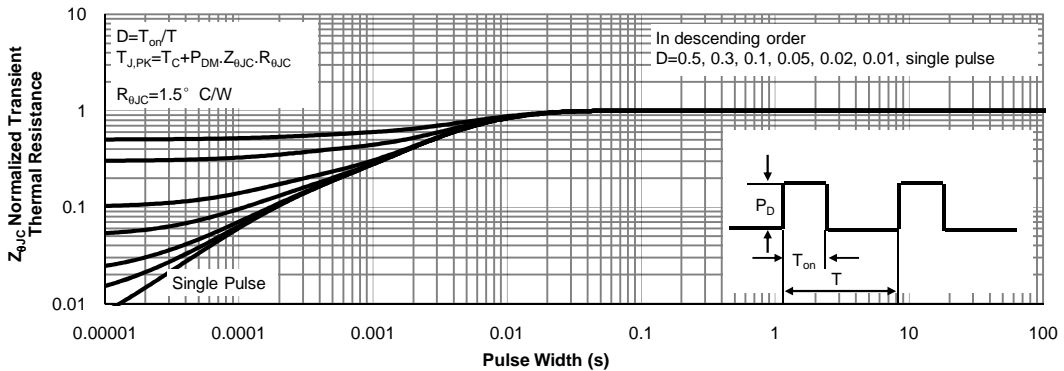

Figure 7: Gate-Charge Characteristics

V_{DS}=15V
I_D=20A

Figure 8: Capacitance Characteristics

C_{iss}
C_{oss}
C_{rss}

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

$R_{DS(ON)}$ limited
10µs
100µs
1ms
10ms
DC
$T_{J(Max)}$=150° C
T_C=25° C

Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

$T_{J(Max)}$=150° C
T_C=25° C

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

D=T_{on}/T
$T_{J,PK}$=T_C+P_{DM}·$Z_{\theta JC}$·$R_{\theta JC}$
$R_{\theta JC}$=1.5° C/W

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

P_D
T_{on}
T

Single Pulse

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS
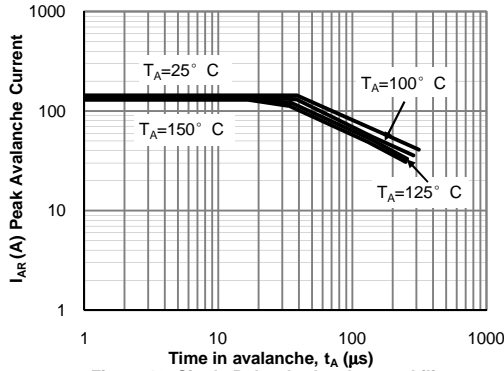
Figure 12: Single Pulse Avalanche capability (Note C)
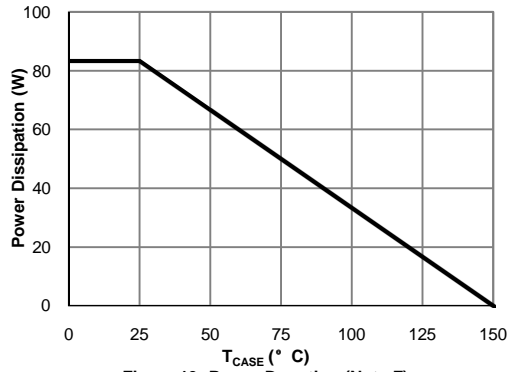
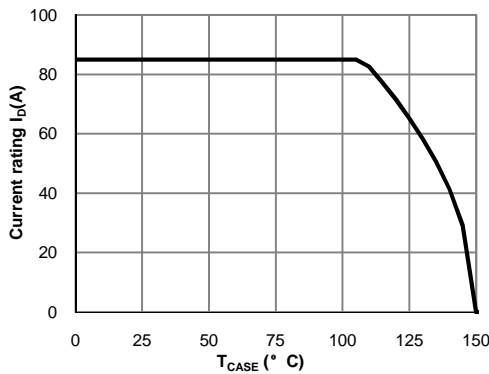
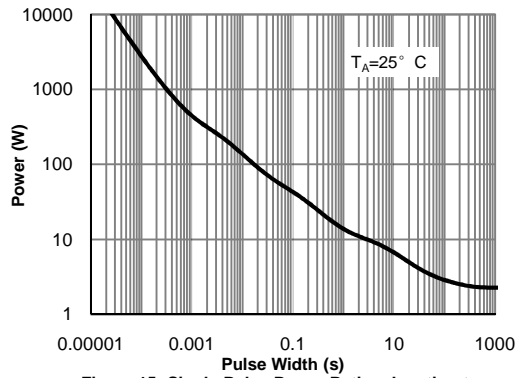**Figure 13: Power De-rating (Note F)**

Figure 14: Current De-rating (Note F)

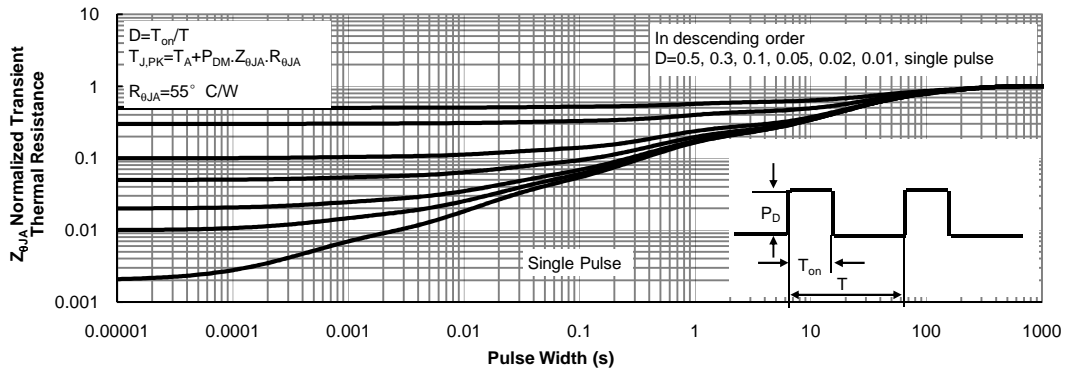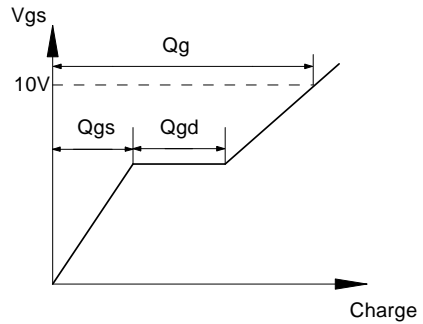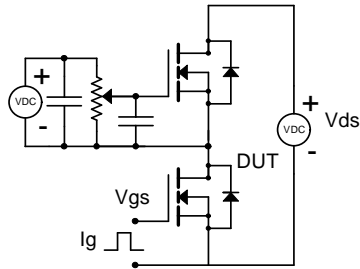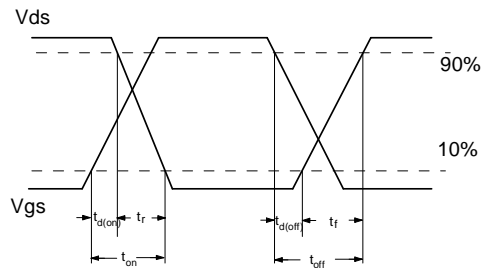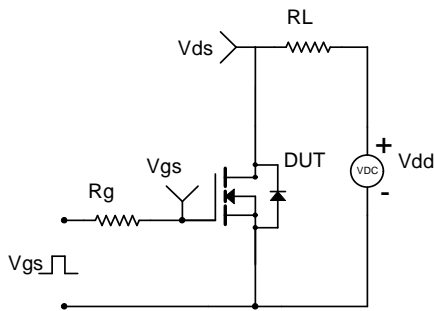**Figure 15: Single Pulse Power Rating Junction-to-Ambient (Note H)**

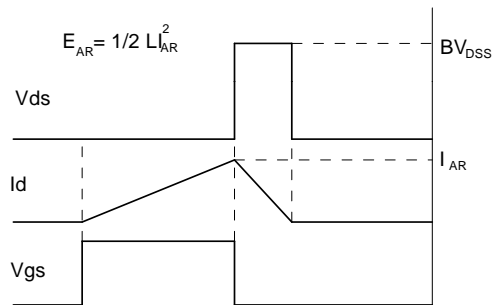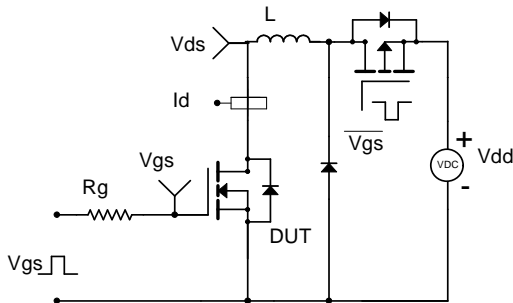**Figure 16: Normalized Maximum Transient Thermal Impedance (Note H)**

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

$$Q_{rr} = -\int Idt$$