ALPHA & OMEGA SEMICONDUCTOR

# AO3404

## 30V N-Channel MOSFET

### General Description

The AO3404 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. This device may be used as a load switch or in PWM applications.

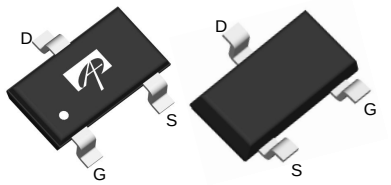
### Product Summary

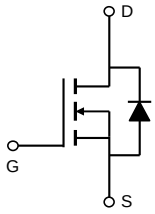
| | |
|---|---|
| $V_{DS}$ | 30V |
| $I_D$ (at $V_{GS}$=10V) | 5A |
| $R_{DS(ON)}$ (at $V_{GS}$=10V) | < 31mΩ |
| $R_{DS(ON)}$ (at $V_{GS}$ =4.5V) | < 43mΩ |

Green Product

**SOT23**

**Top View** **Bottom View**




**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 | $T_A$=25°C | $I_D$ | 5 | A |
| | $T_A$=70°C | | 4 | |
| Pulsed Drain Current [C] | | $I_{DM}$ | 20 | |
| Power Dissipation [B] | $T_A$=25°C | $P_D$ | 1.4 | W |
| | $T_A$=70°C | | 0.9 | |
| 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 | $R_{\theta JA}$ | 70 | 90 | °C/W |
| Maximum Junction-to-Ambient [A D] | Steady-State | | 100 | 125 | °C/W |
| Maximum Junction-to-Lead | Steady-State | $R_{\theta JL}$ | 63 | 80 | °C/W |

**Electrical Characteristics ($T_J$=25°C 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 | $V_{DS}$=30V, $V_{GS}$=0V | | | 1 | µA |
| | | $T_J$=55°C | | | 5 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$=±20V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=250µA | 1.2 | 1.8 | 2.4 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=10V, $V_{DS}$=5V | 20 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=10V, $I_D$=5A | | 25.5 | 31 | mΩ |
| | | $T_J$=125°C | | 41 | 50 | |
| | | $V_{GS}$=4.5V, $I_D$=4A | | 34 | 43 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=5V, $I_D$=5A | | 15 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=1A,$V_{GS}$=0V | | 0.76 | 1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | 1.5 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=15V, f=1MHz | | 255 | 310 | pF |
| $C_{oss}$ | Output Capacitance | | | 45 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 35 | 50 | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | 1.6 | 3.25 | 4.9 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_{g(10V)}$ | Total Gate Charge | $V_{GS}$=10V, $V_{DS}$=15V, $I_D$=5A | | 5.2 | 6.3 | nC |
| $Qg_{(4.5V)}$ | | | | 2.55 | 3.2 | |
| $Q_{gs}$ | Gate Source Charge | | | 0.85 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 1.3 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=10V, $V_{DS}$=15V, $R_L$=3Ω, $R_{GEN}$=3Ω | | 4.5 | | ns |
| $t_r$ | Turn-On Rise Time | | | 2.5 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 14.5 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 3.5 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=5A, dI/dt=100A/µs | | 8.5 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=5A, dI/dt=100A/µs | | 2.2 | | nC |

A. The value of $R_{\theta JA}$ is measured with the device mounted on 1in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$ =25°C. The value in any given application depends on the user's specific board design.

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

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 impedence 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 impedence which is measured with the device mounted on 1in$^2$ FR-4 board with 2oz. Copper, assuming a maximum junction temperature of $T_{J(MAX)}$=150°C. The SOA curve provides a single pulse ratin g.

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## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

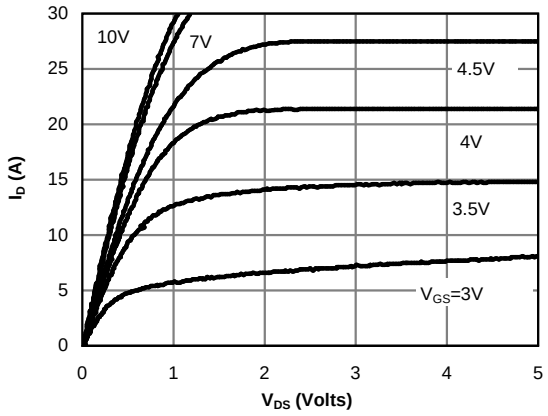



Fig 1: On-Region Characteristics (Note E)

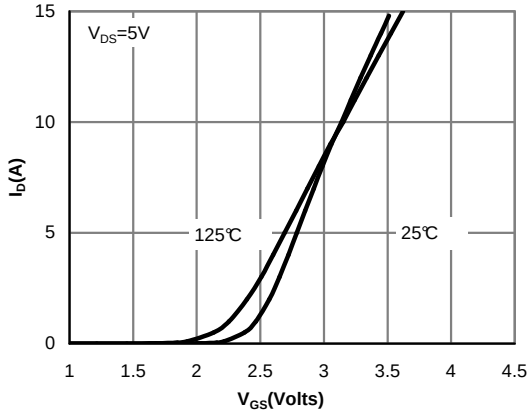



Figure 2: Transfer Characteristics (Note E)

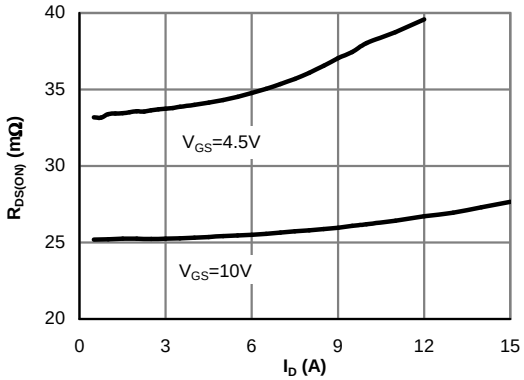



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

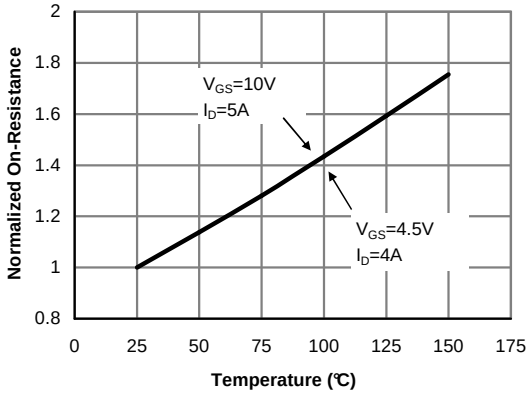



Figure 4: On-Resistance vs. Junction Temperature (Note E)

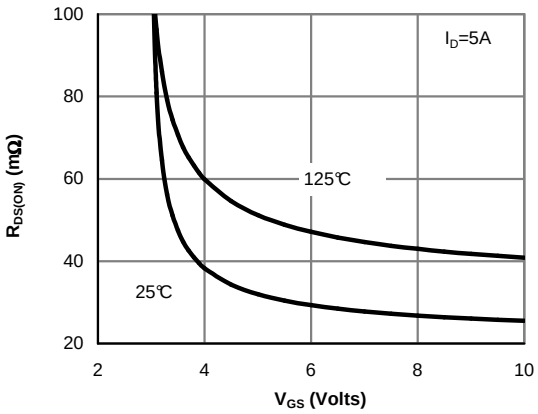



Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

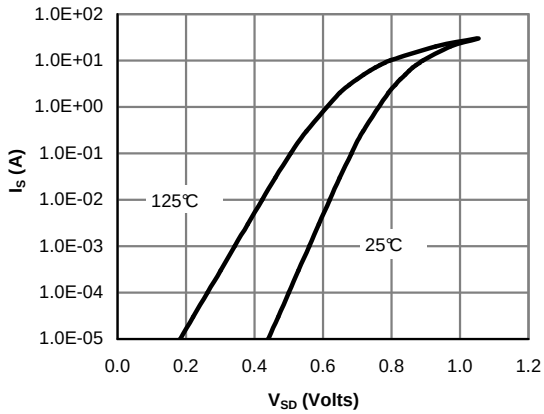



Figure 6: Body-Diode Characteristics (Note E)

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

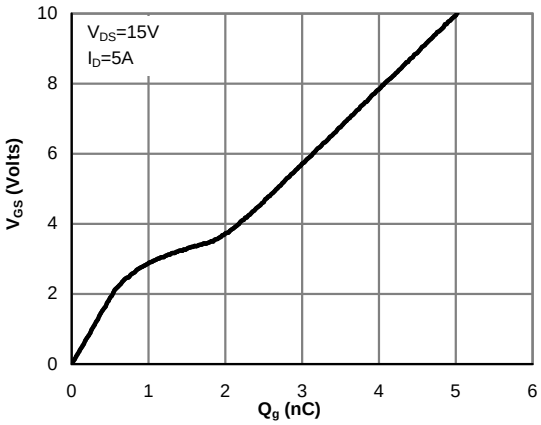



Figure 7: Gate-Charge Characteristics

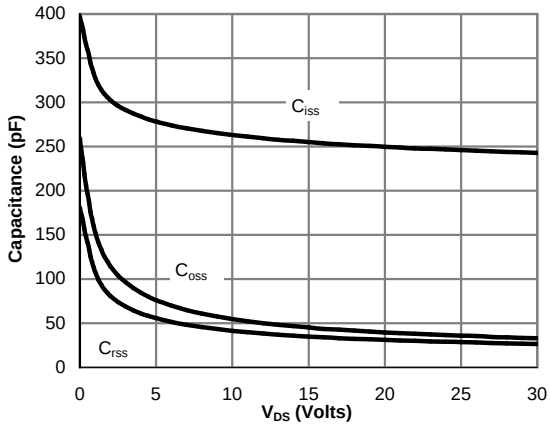



Figure 8: Capacitance Characteristics

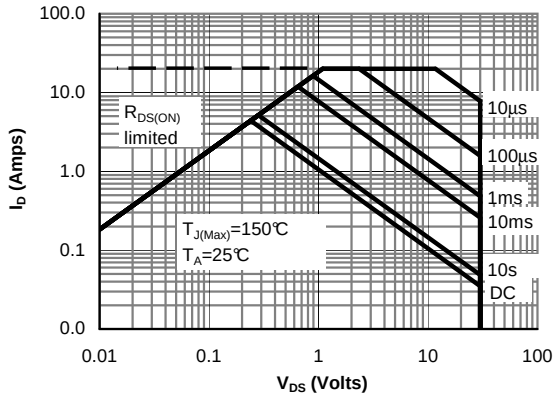



Figure 10: Maximum Forward Biased Safe Operating Area (Note F)

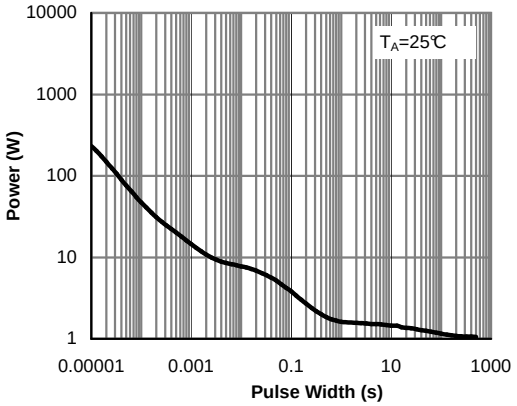



Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)

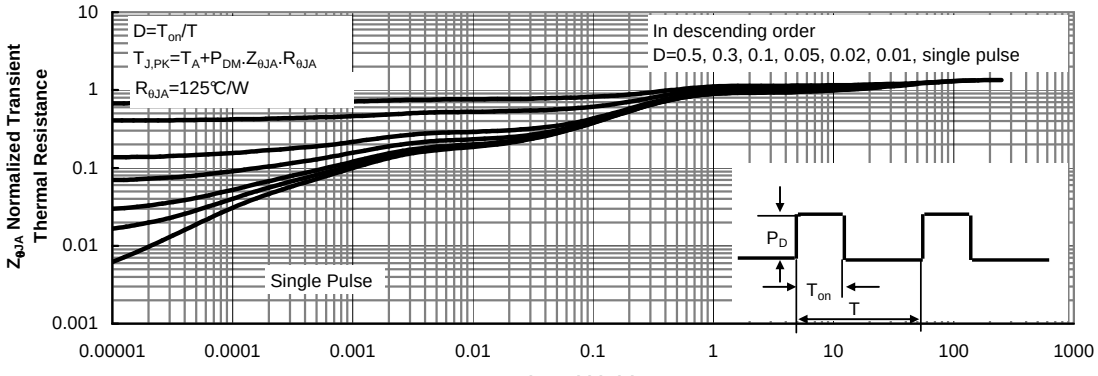
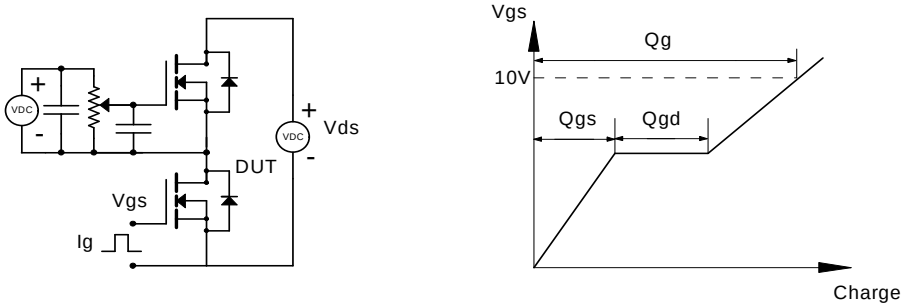
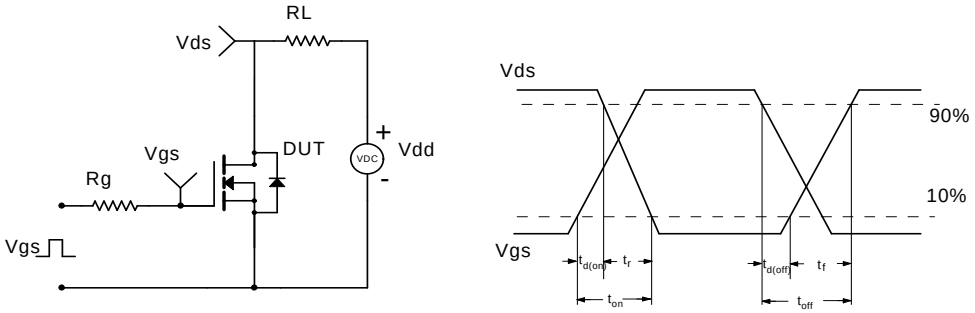



Figure 12: Normalized Maximum Transient Thermal Impedance (Note F)

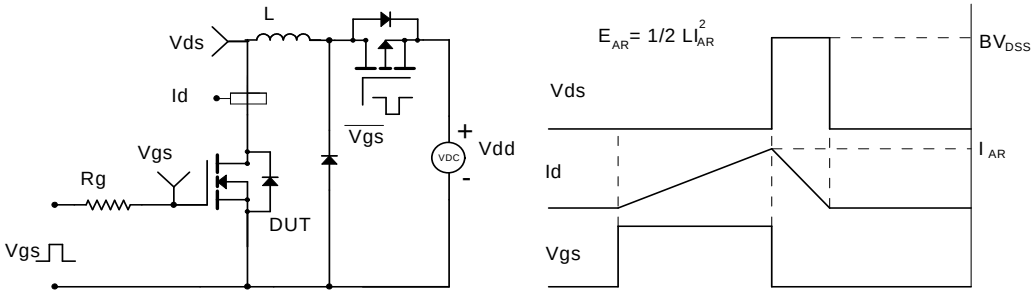
## Gate Charge Test Circuit & Waveform



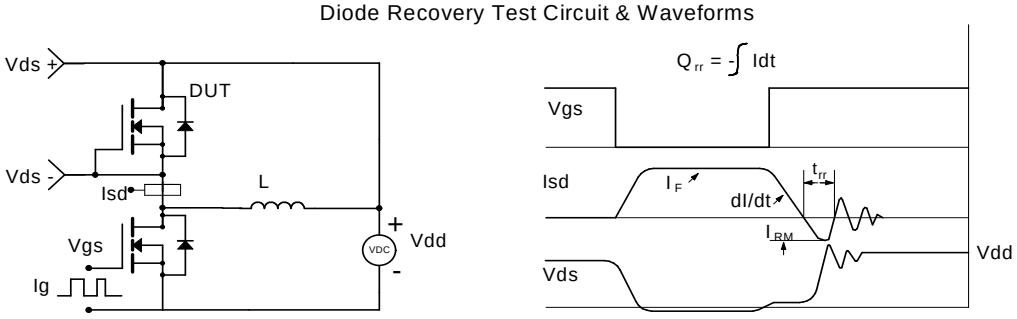

## Resistive Switching Test Circuit & Waveforms




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



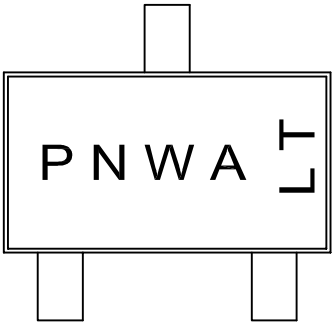

## Diode Recovery Test Circuit & Waveforms



ALPHA & OMEGA SEMICONDUCTOR

| Document No. | PD-00005 |
|---|---|
| Version | G |
| Title | AO3404 Marking Description |

# SOT-23 PACKAGE MARKING DESCRIPTION




Green product

NOTE:
P - Package and product type
N - Last digital of product number
W - Week code
A - Assembly location code
L&T - Assembly lot code

| PART NO. | DESCRIPTION | CODE (PN) |
|---|---|---|
| AO3404 | Green product | A4 |
| AO3404L | Green product | A4 |