ALPHA & OMEGA SEMICONDUCTOR

# AO4415

## 30V P-Channel MOSFET

### General Description

The AO4415 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge. This device is suitable for use as a load switch or in PWM applications.

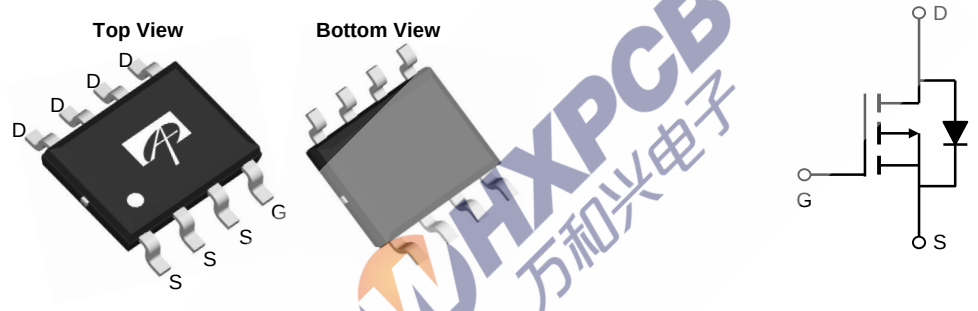
### Product Summary

$V_{DS}$ (V) = -30V
$I_D$ = -8 A ($V_{GS}$ = -20V)
$R_{DS(ON)}$ < 26mΩ ($V_{GS}$ = -20V)
$R_{DS(ON)}$ < 35mΩ ($V_{GS}$ = -10V)

100% UIS Tested
100% Rg Tested

Green Product

SOIC-8




**Absolute Maximum Ratings $T_A$=25℃ unless otherwise noted**

| Parameter | | Symbol | Maximum | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±25 | V |
| Continuous Drain Current [A] | $T_A$=25℃ | $I_D$ | -8 | A |
| | $T_A$=70℃ | | -6.6 | |
| Pulsed Drain Current [B] | | $I_{DM}$ | -40 | |
| Power Dissipation [A] | $T_A$=25℃ | $P_D$ | 3 | W |
| | $T_A$=70℃ | | 2.1 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | ℃ |

**Thermal Characteristics**

| Parameter | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient [A] | t ≤ 10s | $R_{\theta JA}$ | 24 | 40 | ℃/W |
| Maximum Junction-to-Ambient [A] | Steady-State | | 54 | 75 | ℃/W |
| Maximum Junction-to-Lead [C] | Steady-State | $R_{\theta JL}$ | 21 | 30 | ℃/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 | | | 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, $V_{GS}$=±25V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=-250µA | -1.7 | -2.8 | -3.5 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=-10V, $V_{DS}$=-5V | 40 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-20V, $I_D$=-8A | | 21.5 | 26 | mΩ |
| | | $T_J$=125℃ | | 29 | 35 | |
| | | $V_{GS}$=-10V, $I_D$=-8A | | 28.5 | 35 | mΩ |
| | | $V_{GS}$=-6V, $I_D$=-5A | | 41 | | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=-5V, $I_D$=-8A | | 11.5 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=-1A,$V_{GS}$=0V | | -0.76 | -1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | -4.2 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=-15V, f=1MHz | | 893 | 1100 | pF |
| $C_{oss}$ | Output Capacitance | | | 204 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 151 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 4 | 6 | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$(10V) | Total Gate Charge (10V) | $V_{GS}$=-10V, $V_{DS}$=-15V, $I_D$=-8A | | 16.6 | 21 | nC |
| $Q_{gs}$ | Gate Source Charge | | | 3.2 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 5.2 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=-10V, $V_{DS}$=-15V, $R_L$=1.8Ω, $R_{GEN}$=3Ω | | 10.5 | | ns |
| $t_r$ | Turn-On Rise Time | | | 7.3 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 15.1 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 8.6 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=-8A, dI/dt=100A/µs | | 21 | 26 | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=-8A, dI/dt=100A/µs | | 10.7 | | nC |

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1$in^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25℃. The value in any a 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 $R_{\theta JA}$ is the sum of the thermal impedence 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 $in^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25℃. The SOA curve provides a single pulse rating.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

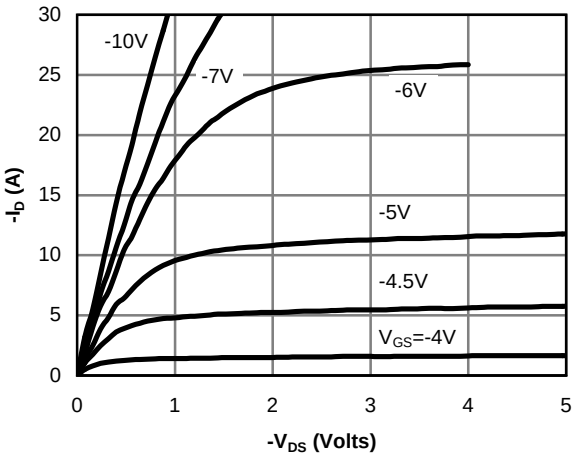



**Fig 1: On-Region Characteristics**

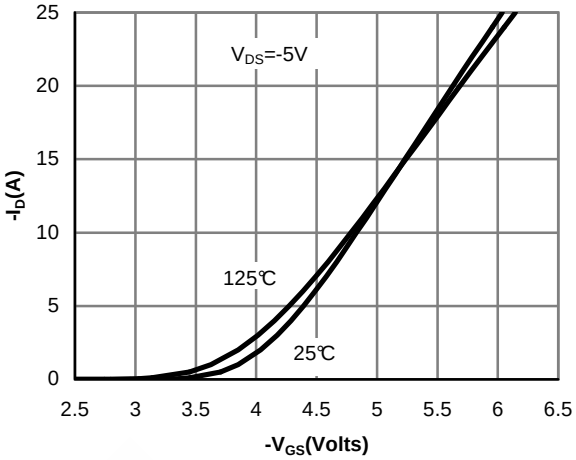



**Figure 2: Transfer Characteristics**

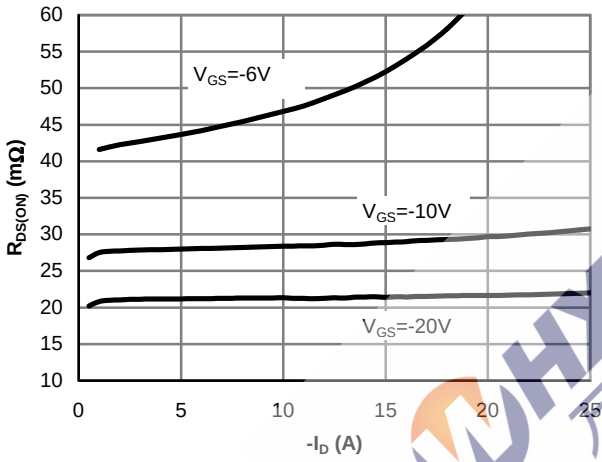



**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

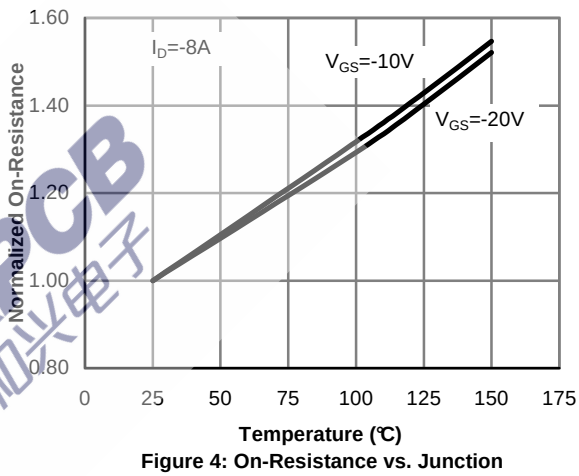



**Figure 4: On-Resistance vs. Junction Temperature**

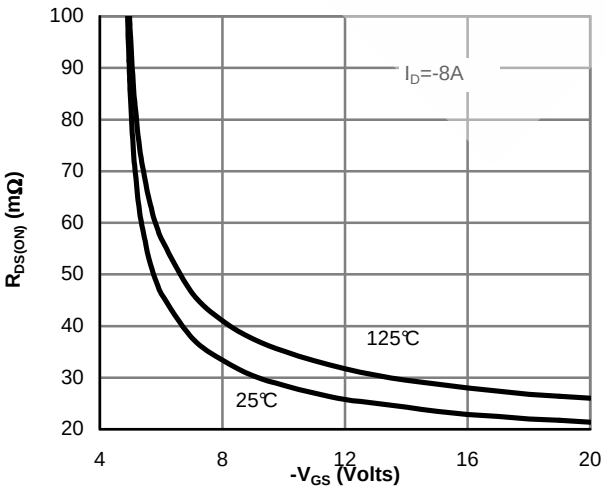



**Figure 5: On-Resistance vs. Gate-Source Voltage**

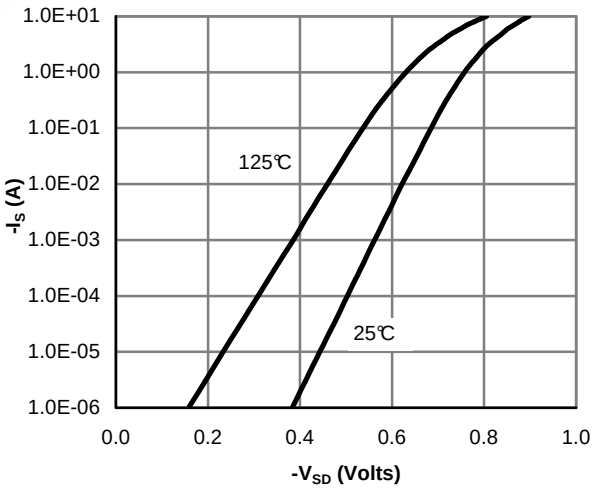



**Figure 6: Body-Diode Characteristics**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

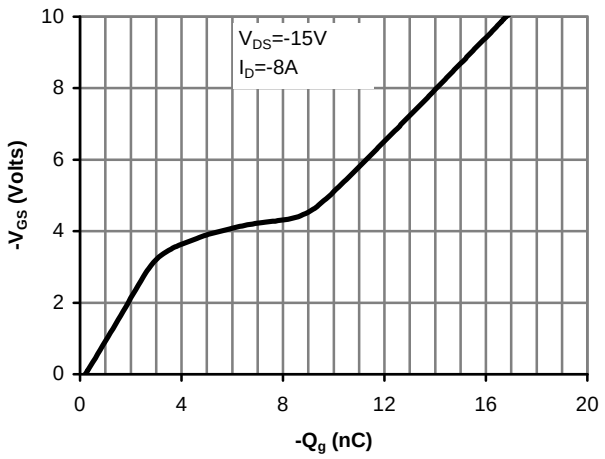



**Figure 7: Gate-Charge Characteristics**

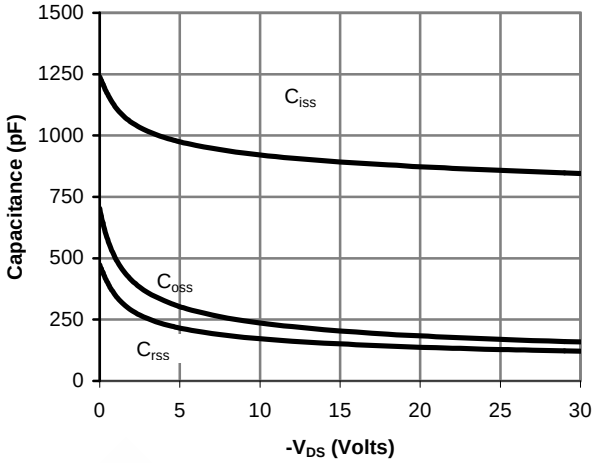



**Figure 8: Capacitance Characteristics**

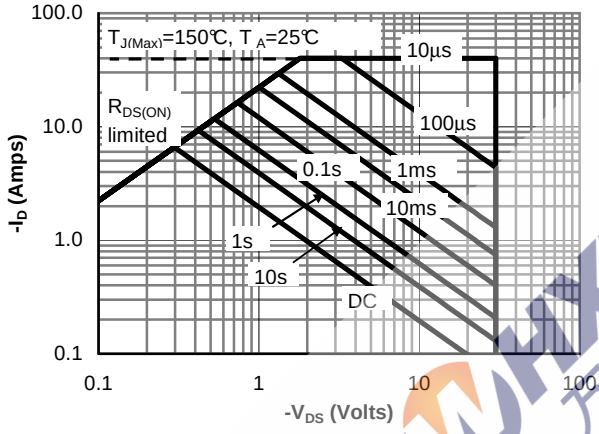



**Figure 9: Maximum Forward Biased Safe Operating Area (Note E)**

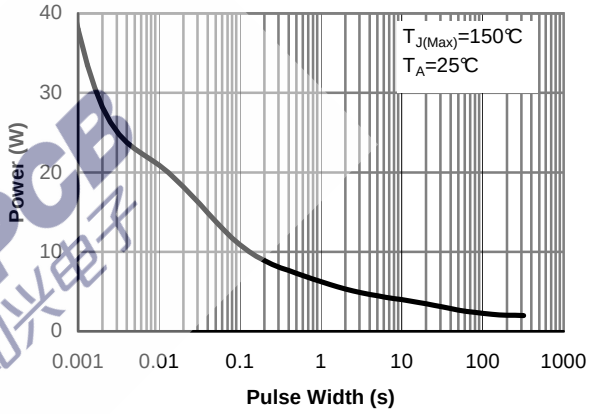



**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

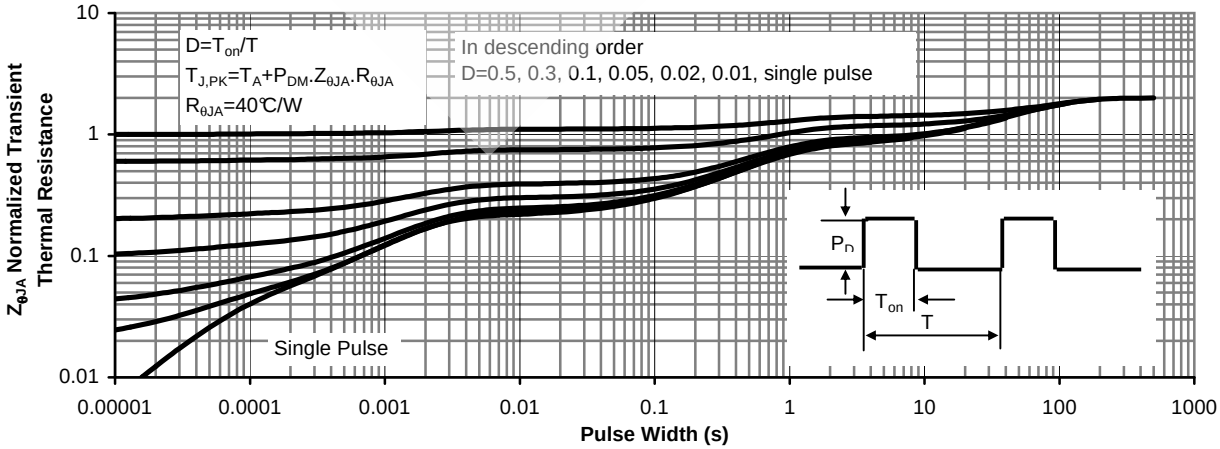



**Figure 11: Normalized Maximum Transient Thermal Impedance**