



ALPHA & OMEGA
SEMICONDUCTOR

AO4407

P-Channel Enhancement Mode Field Effect Transistor

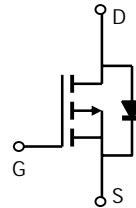
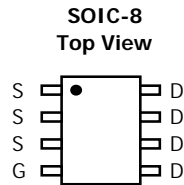


General Description

The AO4407 uses advanced trench technology to provide excellent $R_{DS(ON)}$, and ultra-low low gate charge with a 25V gate rating. This device is suitable for use as a load switch or in PWM applications. Standard Product AO4407 is Pb-free (meets ROHS & Sony 259 specifications). AO4407L is a Green Product ordering option. AO4407 and AO4407L are electrically identical.

Features

- V_{DS} (V) = -30V
- I_D = -12 A (V_{GS} = -20V)
- $R_{DS(ON)} < 13m\Omega$ (V_{GS} = -20V)
- $R_{DS(ON)} < 14m\Omega$ (V_{GS} = -10V)



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ 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 | $T_A=25^\circ\text{C}$ $T_A=70^\circ\text{C}$ | I_D | -12 |
| | | | -10 |
| Pulsed Drain Current ^B | I_{DM} | -60 | A |
| Power Dissipation ^A | $T_A=25^\circ\text{C}$ $T_A=70^\circ\text{C}$ | P_D | 3 |
| | | | 2.1 |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ |

Thermal Characteristics

| Parameter | Symbol | Typ | Max | Units |
|--|-----------------|-----|-----|--------------------|
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | 28 | 40 | $^\circ\text{C/W}$ |
| $t \leq 10\text{s}$ | | | | |
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | 54 | 75 | $^\circ\text{C/W}$ |
| Steady-State | | | | |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | 21 | 30 | $^\circ\text{C/W}$ |

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|---------------------------------------|---|------|----------|-----------|------------------|
| STATIC PARAMETERS | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$ | -30 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=-24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | -1 -5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS}=0\text{V}$, $V_{GS}=\pm 25\text{V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$ | -1.7 | -2.5 | -3 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$ | 60 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=-10\text{V}$, $I_D=-10\text{A}$ $T_J=125^\circ\text{C}$ | | 11 15 | 14 19 | $\text{m}\Omega$ |
| | | $V_{GS}=-20\text{V}$, $I_D=-10\text{A}$ | | 10 | 13 | $\text{m}\Omega$ |
| | | $V_{GS}=-4.5\text{V}$, $I_D=-10\text{A}$ | | 24 | | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS}=-5\text{V}$, $I_D=-10\text{A}$ | | 26 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=-1\text{A}$, $V_{GS}=0\text{V}$ | | -0.72 | -1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | -4.2 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$ | | 2076 | 2500 | pF |
| C_{oss} | Output Capacitance | | | 503 | | pF |
| C_{rSS} | Reverse Transfer Capacitance | | | 302 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 2 | 3 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q_g | Total Gate Charge | $V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-12\text{A}$ | | 37.2 | 45 | nC |
| Q_{gs} | Gate Source Charge | | | 7 | | nC |
| Q_{gd} | Gate Drain Charge | | | 10.4 | | nC |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=1.25\Omega$, $R_{GEN}=3\Omega$ | | 12.4 | | ns |
| t_r | Turn-On Rise Time | | | 8.2 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 25.6 | | ns |
| t_f | Turn-Off Fall Time | | | 12 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=-12\text{A}$, $di/dt=100\text{A}/\mu\text{s}$ | | 33 | 40 | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=-12\text{A}$, $di/dt=100\text{A}/\mu\text{s}$ | | 23 | | 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 $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design. The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The $R_{\theta JA}$ is the sum of the thermal impedance 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 in² FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^\circ\text{C}$. The SOA curve provides a single pulse rating. Rev 1 : Sept 2005

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

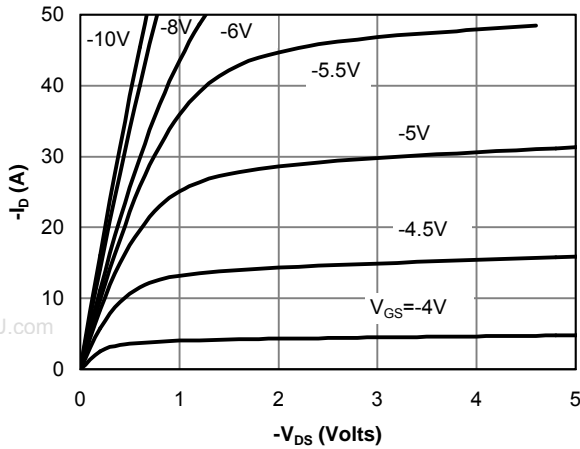


Fig 1: On-Region Characteristics

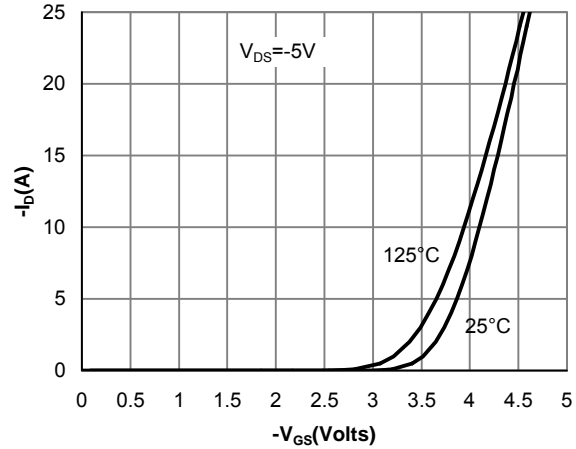


Figure 2: Transfer Characteristics

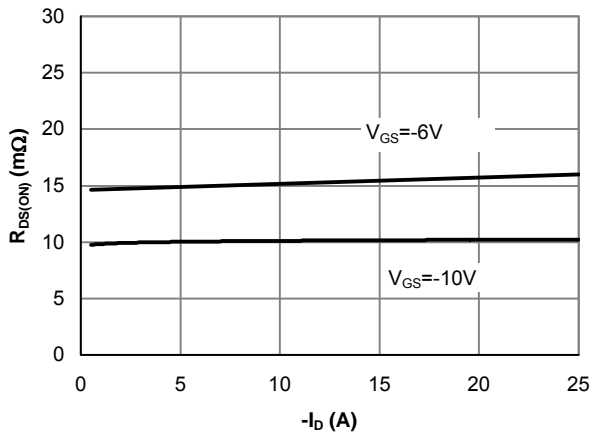


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

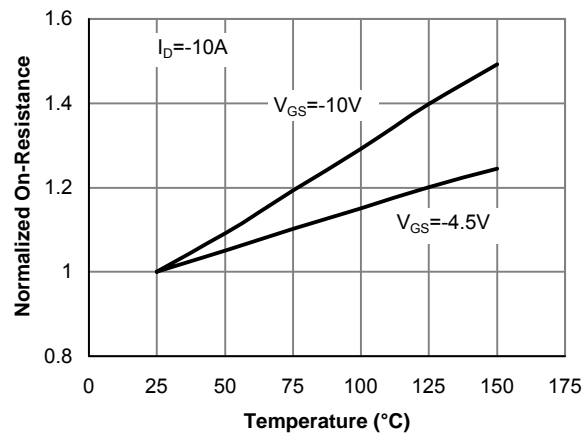


Figure 4: On-Resistance vs. Junction Temperature

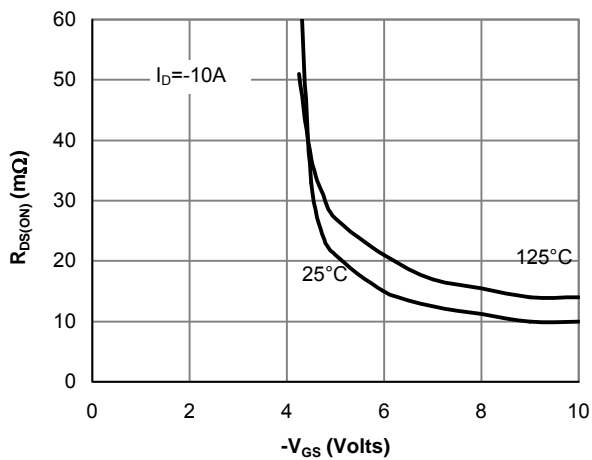


Figure 5: On-Resistance vs. Gate-Source Voltage

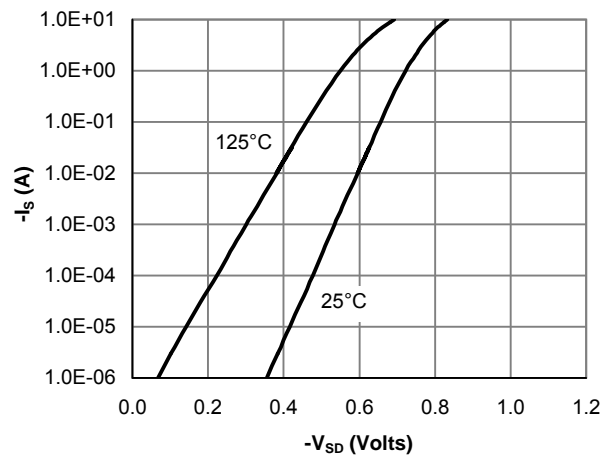


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

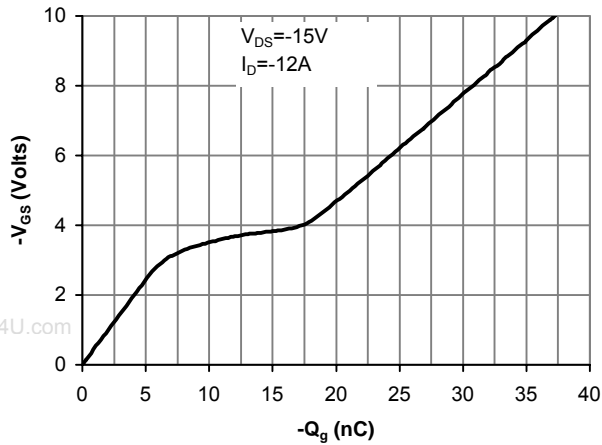


Figure 7: Gate-Charge Characteristics

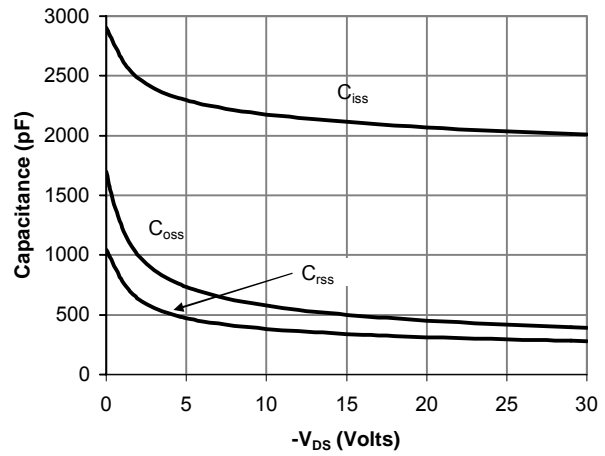


Figure 8: Capacitance Characteristics

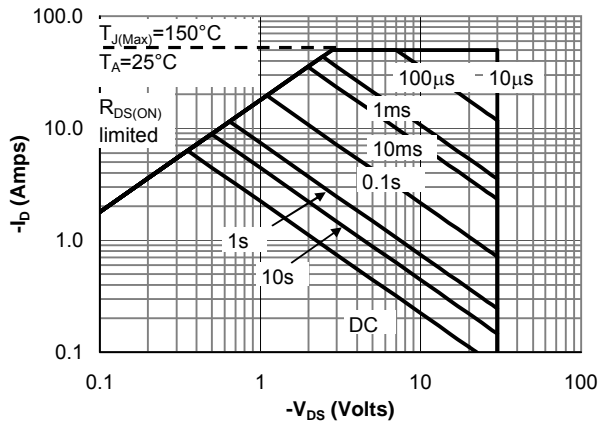


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

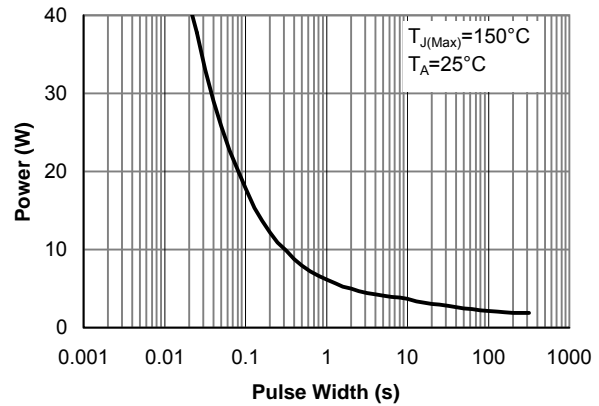


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

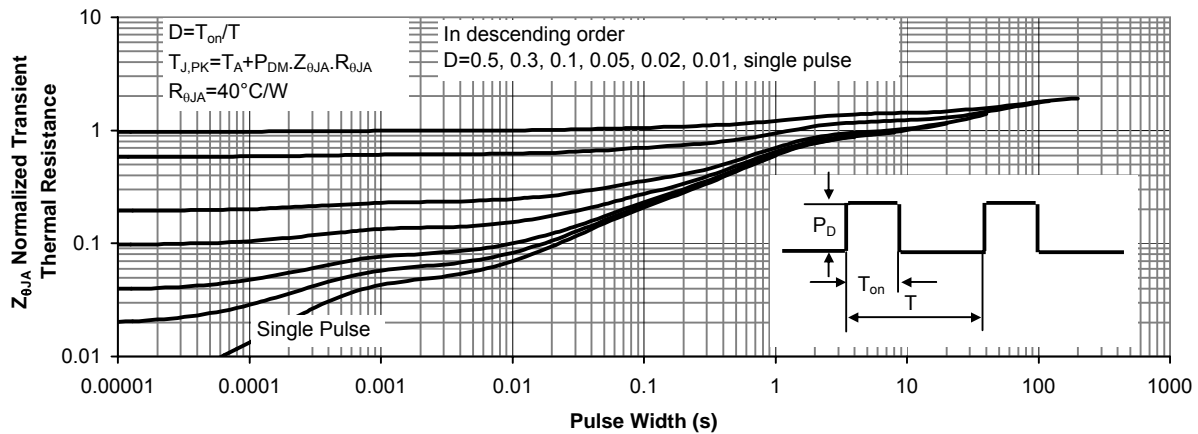


Figure 11: Normalized Maximum Transient Thermal Impedance