



AO3401A
P-Channel Enhancement Mode Field Effect Transistor

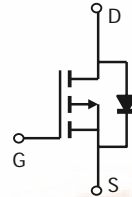
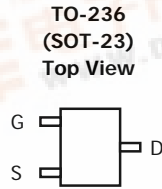
General Description

The AO3401A uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation gate voltages as low as 2.5V. This device is suitable for use as a load switch or other general applications. *Standard product AO3401A is Pb-free (meets ROHS & Sony 259 specifications).*

Features

- V_{DS} (V) = -30V
- I_D = -4.3A (V_{GS} = -10V)
- $R_{DS(ON)}$ < 46m Ω (V_{GS} = -10V)
- $R_{DS(ON)}$ < 55m Ω (V_{GS} = -4.5V)
- $R_{DS(ON)}$ < 80mW (V_{GS} = -2.5V)

Rg, Ciss, Coss, Crss Tested



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} | ± 12 | V |
| Continuous Drain Current ^{A,F} | I_D | $T_A=25^\circ\text{C}$ | -4.3 |
| | | $T_A=70^\circ\text{C}$ | -3.8 |
| Pulsed Drain Current ^B | I_{DM} | -25 | A |
| Power Dissipation ^A | P_D | $T_A=25^\circ\text{C}$ | 1.4 |
| | | $T_A=70^\circ\text{C}$ | 0.9 |
| 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 ^{AF} | $R_{\theta JA}$ | $t \leq 10\text{s}$ | 65 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient ^A | | Steady-State | 85 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | 43 | 80 | $^\circ\text{C/W}$ |



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 | $V_{DS}=-30\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | -1 -5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS}=0\text{V}$, $V_{GS}=\pm 12\text{V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}$, $I_D=-250\mu\text{A}$ | -0.6 | -1 | -1.3 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}=-4.5\text{V}$, $V_{DS}=-5\text{V}$ | -25 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=-10\text{V}$, $I_D=-4.3\text{A}$ $T_J=125^\circ\text{C}$ | | 36 | 44 | $\text{m}\Omega$ |
| | | $V_{GS}=-4.5\text{V}$, $I_D=-3.5\text{A}$ | | 44 | 55 | $\text{m}\Omega$ |
| | | $V_{GS}=-2.5\text{V}$, $I_D=-2.5\text{A}$ | | 62 | 80 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS}=-5\text{V}$, $I_D=-4.3\text{A}$ | | 13 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=-1\text{A}$, $V_{GS}=0\text{V}$ | | -0.75 | -1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | -2 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$ | | 933 | 1200 | pF |
| C_{oss} | Output Capacitance | | | 108 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 81 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 6 | 9 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q_g | Total Gate Charge | $V_{GS}=-4.5\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-4.3\text{A}$ | | 9.3 | 12.2 | nC |
| Q_{gs} | Gate Source Charge | | | 1.5 | | nC |
| Q_{gd} | Gate Drain Charge | | | 3.7 | | nC |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=3.5\Omega$, $R_{GEN}=6\Omega$ | | 5.2 | | ns |
| t_r | Turn-On Rise Time | | | 6.8 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 42 | | ns |
| t_f | Turn-Off Fall Time | | | 15 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=-4.3\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 21 | 28 | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=-4.3\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 14.3 | | 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 $T_A=25^\circ\text{C}$. The value in any given application depends on the user's specific board design.

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 are obtained using $<300\mu\text{s}$ pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1in^2 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.

F: The current rating is based on the $t \leq 10\text{s}$ thermal resistance rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

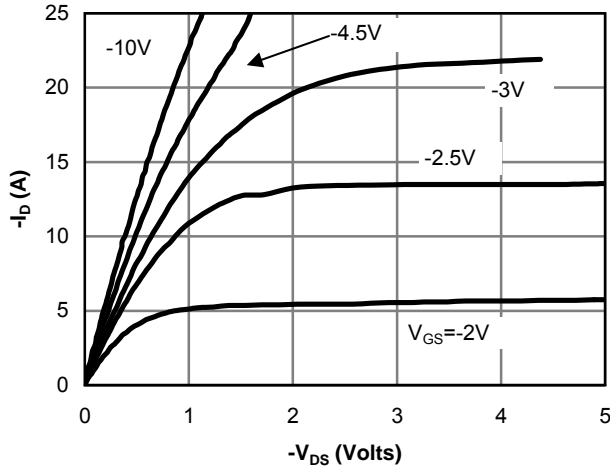


Figure 1: On-Region Characteristics

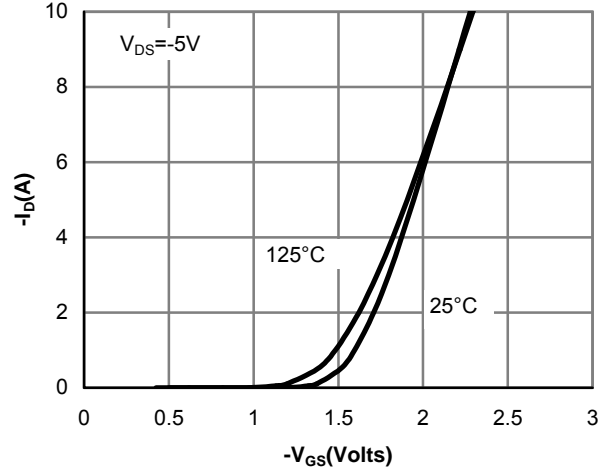


Figure 2: Transfer Characteristics

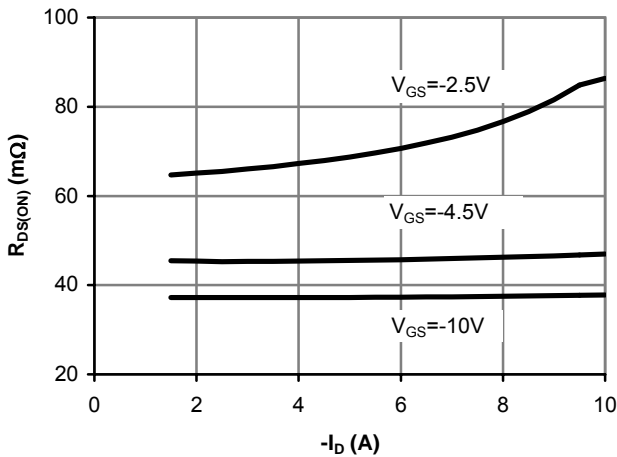


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

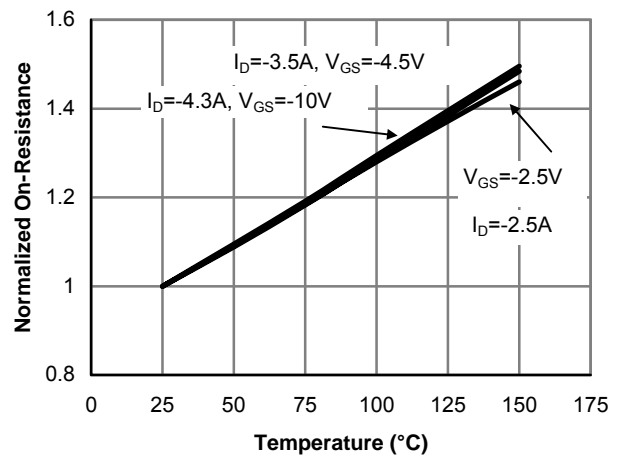


Figure 4: On-Resistance vs. Junction Temperature

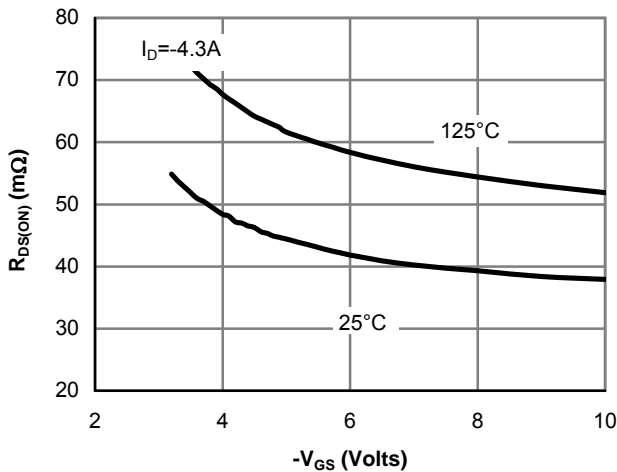


Figure 5: On-Resistance vs. Gate-Source Voltage

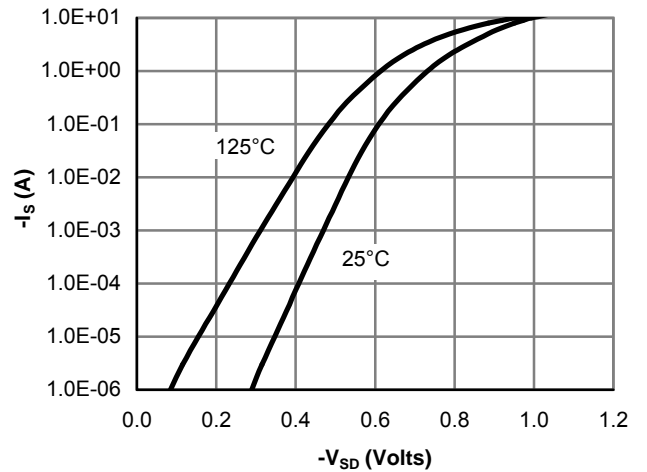


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

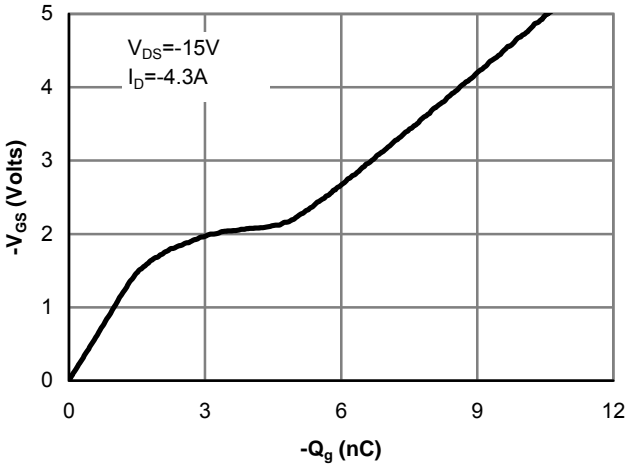


Figure 7: Gate-Charge Characteristics

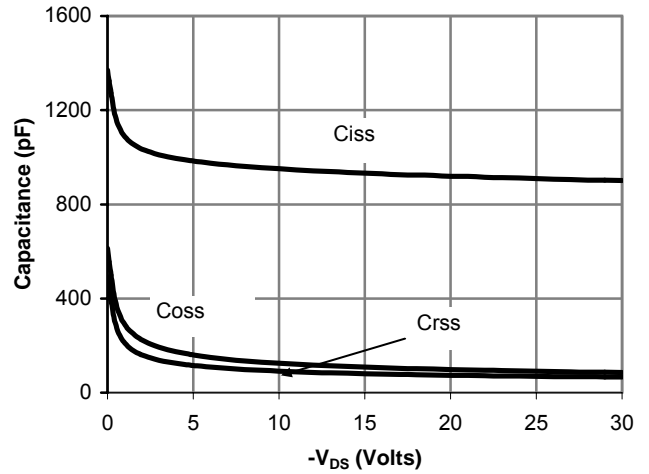


Figure 8: Capacitance Characteristics

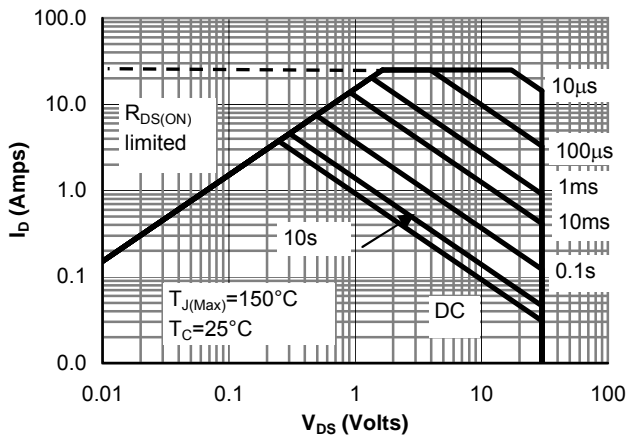


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

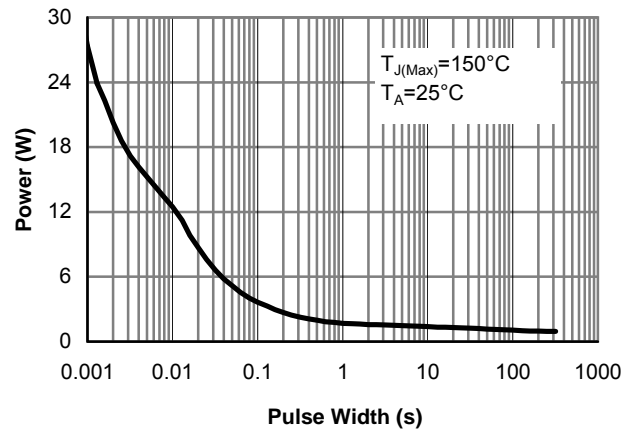


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

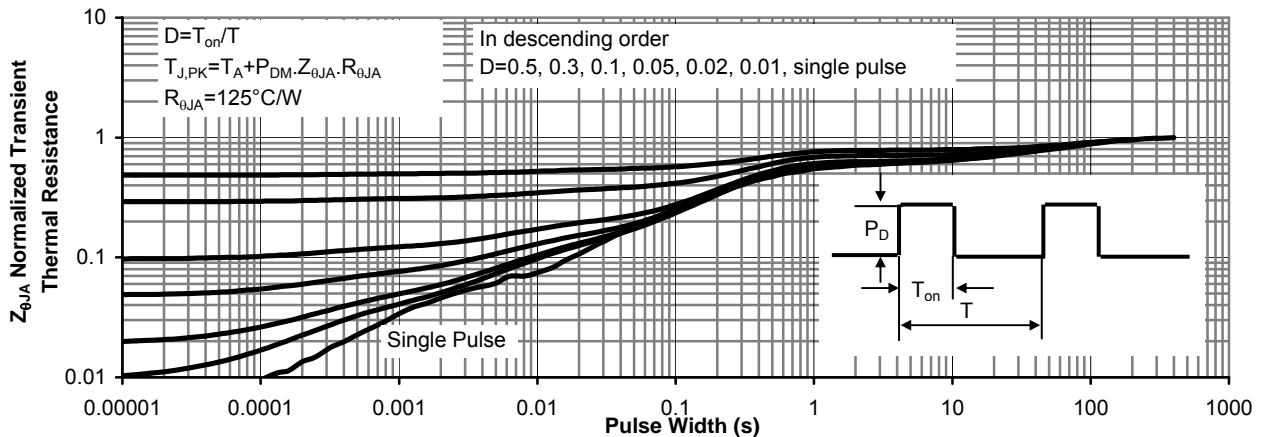


Figure 11: Normalized Maximum Transient Thermal Impedance