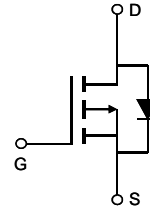


General Description

The AO3401 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications.

Product Summary

| | |
|-----------------------------------|----------------|
| V_{DS} | -30V |
| I_D (at $V_{GS}=-10V$) | -4.0A |
| $R_{DS(ON)}$ (at $V_{GS}=-10V$) | < 50m Ω |
| $R_{DS(ON)}$ (at $V_{GS}=-4.5V$) | < 60m Ω |
| $R_{DS(ON)}$ (at $V_{GS}=-2.5V$) | < 85m Ω |



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 | I_D | $T_A=25^\circ\text{C}$ | -4 |
| | | $T_A=70^\circ\text{C}$ | -3.2 |
| Pulsed Drain Current ^C | I_{DM} | -27 | A |
| Power Dissipation ^B | 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 ^A | $R_{\theta JA}$ | 70 | 90 | $^\circ\text{C}/\text{W}$ |
| Maximum Junction-to-Ambient ^{A,D} | | 100 | 125 | $^\circ\text{C}/\text{W}$ |
| Maximum Junction-to-Lead | $R_{\theta JL}$ | 63 | 80 | $^\circ\text{C}/\text{W}$ |

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 T _J =55°C | | | -1 -5 | μA |
| I _{GSS} | Gate-Body leakage current | V _{DS} =0V, V _{GS} = ±12V | | | ±100 | nA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} , I _D =-250μA | -0.5 | -0.9 | -1.3 | V |
| I _{D(ON)} | On state drain current | V _{GS} =-10V, V _{DS} =5V | -27 | | | A |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} =-10V, I _D =-4.0A T _J =125°C | | 41 | 50 | mΩ |
| | | V _{GS} =-4.5V, I _D =-3.7A | | 47 | 60 | |
| | | V _{GS} =-2.5V, I _D =-2A | | 60 | 85 | mΩ |
| g _{FS} | Forward Transconductance | V _{DS} =-5V, I _D =-4.0A | | 17 | | S |
| V _{SD} | Diode Forward Voltage | I _S =1A, V _{GS} =0V | | -0.7 | -1 | V |
| I _S | Maximum Body-Diode Continuous Current | | | | -2 | A |
| I _{SM} | Pulsed Body-Diode Current ^B | | | | -27 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C _{iss} | Input Capacitance | V _{GS} =0V, V _{DS} =-15V, f=1MHz | | 645 | | pF |
| C _{oss} | Output Capacitance | | | 80 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 55 | | pF |
| R _g | Gate resistance | V _{GS} =0V, V _{DS} =0V, f=1MHz | 4 | 7.8 | 12 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q _{g(10V)} | Total Gate Charge | V _{GS} =-10V, V _{DS} =-15V, I _D =-4.0A | | 14 | | nC |
| Q _{g(4.5V)} | Total Gate Charge | | | 7 | | nC |
| Q _{gs} | Gate Source Charge | | | 1.5 | | nC |
| Q _{gd} | Gate Drain Charge | | | 2.5 | | nC |
| t _{D(on)} | Turn-On DelayTime | V _{GS} =-10V, V _{DS} =-15V, R _L =3.75Ω, R _{GEN} =3Ω | | 6.5 | | ns |
| t _r | Turn-On Rise Time | | | 3.5 | | ns |
| t _{D(off)} | Turn-Off DelayTime | | | 41 | | ns |
| t _f | Turn-Off Fall Time | | | 9 | | ns |
| t _{rr} | Body Diode Reverse Recovery Time | I _F =-4.0A, dI/dt=100A/μs | | 11 | | ns |
| Q _{rr} | Body Diode Reverse Recovery Charge | I _F =-4.0A, dI/dt=100A/μs | | 3.5 | | nC |

A. The value of R_{θJA} 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 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_{θJA} is the sum of the thermal impedance from junction to lead R_{θJL} 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 impedance which is measured with the device mounted on 1in² FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T_{J(MAX)}=150° C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

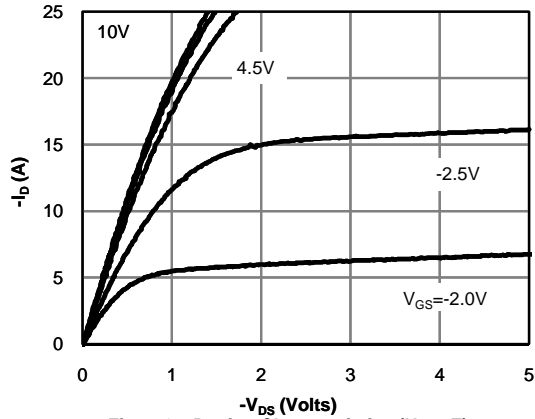


Fig 1: On-Region Characteristics (Note E)

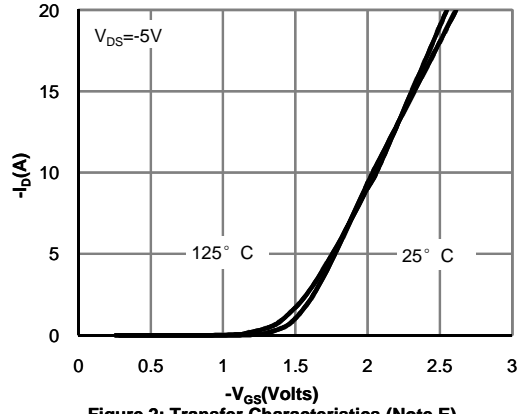


Figure 2: Transfer Characteristics (Note E)

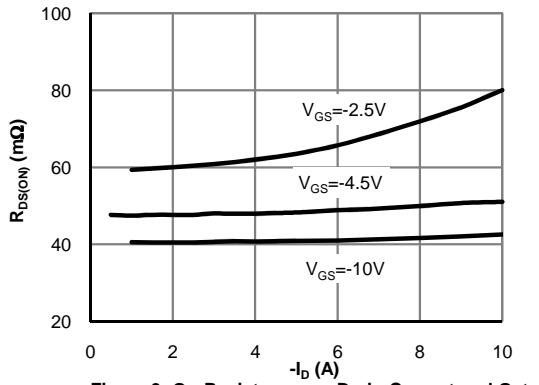


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

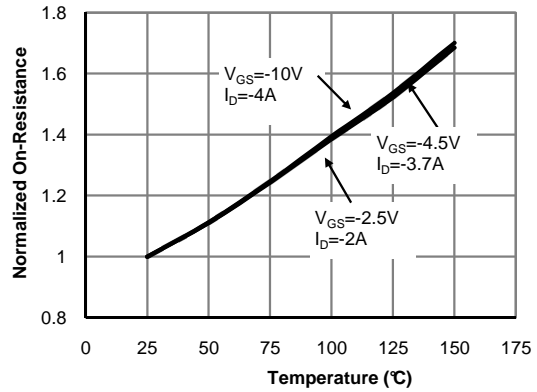


Figure 4: On-Resistance vs. Junction Temperature (Note E)

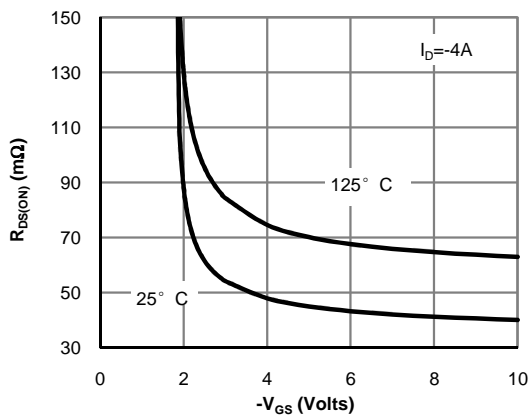


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

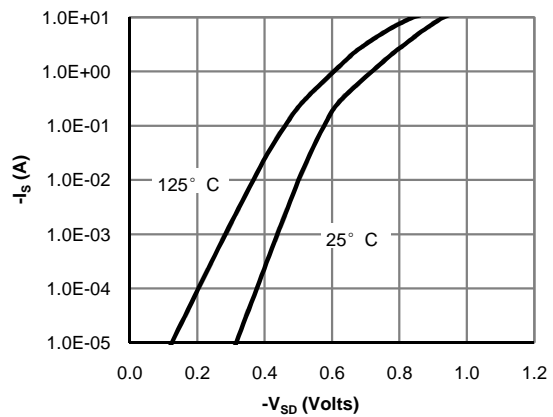


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

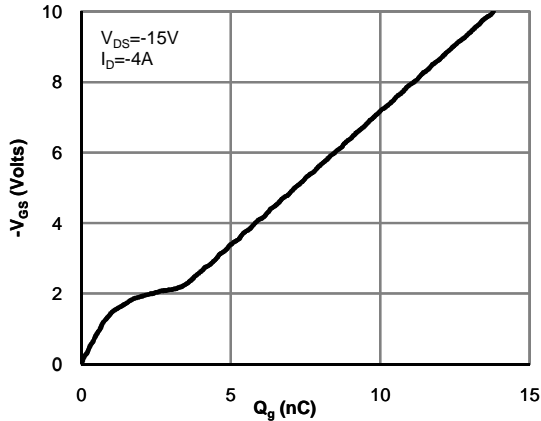


Figure 7: Gate-Charge Characteristics

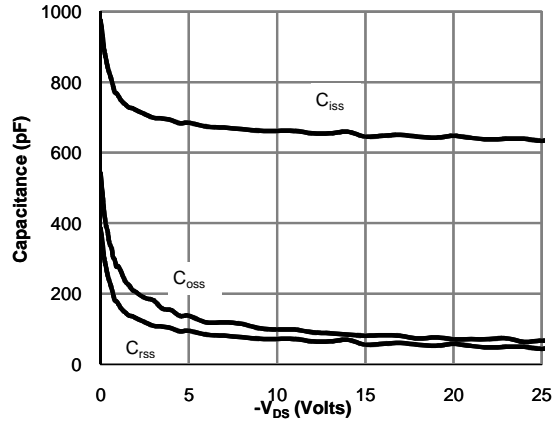


Figure 8: Capacitance Characteristics

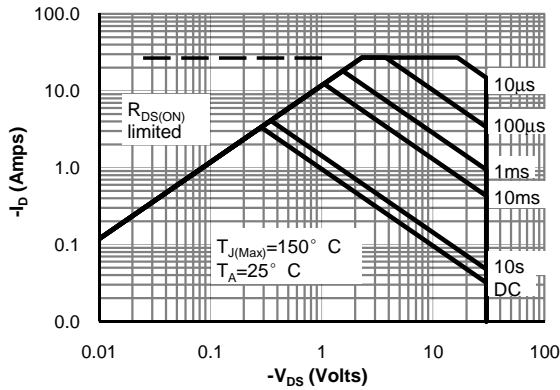


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

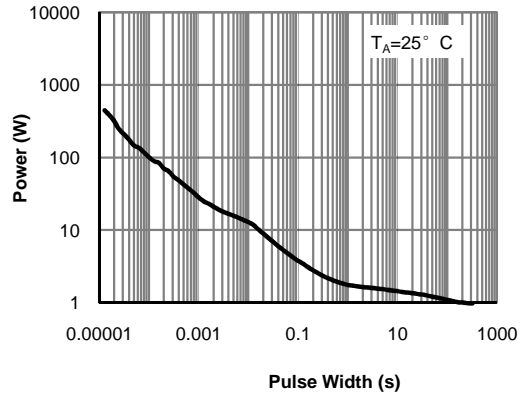


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

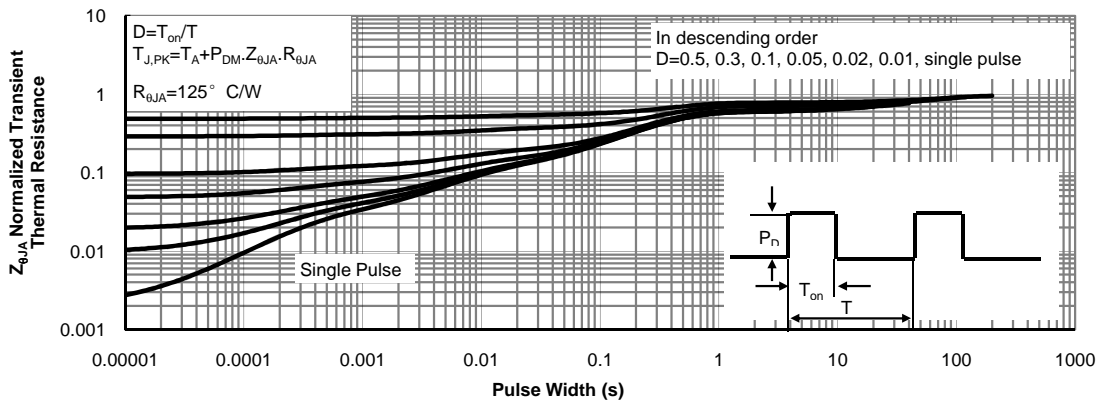
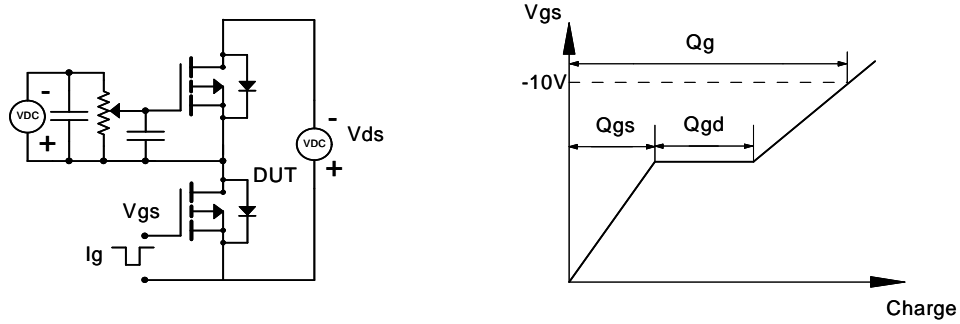
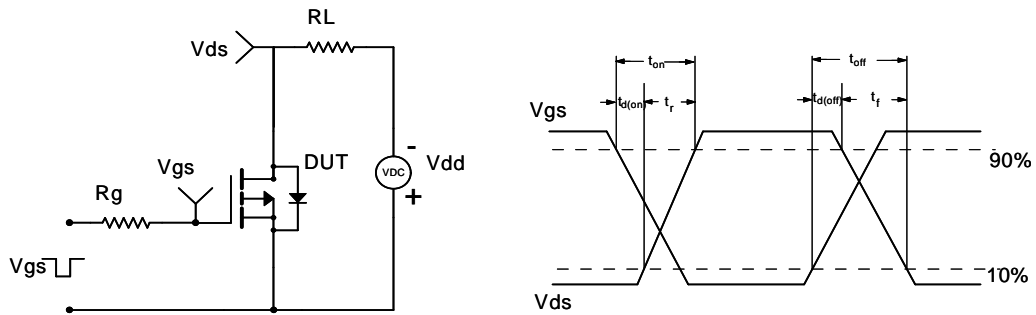


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

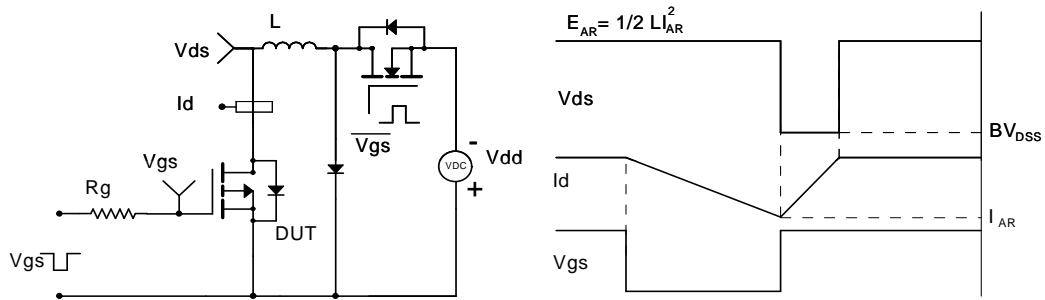
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

