

General Description

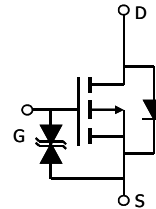
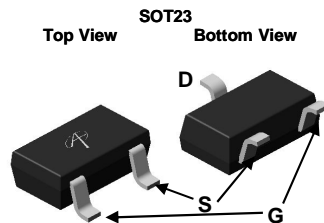
The AO3415 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 1.8V. This device is suitable for use as a load switch applications.

Product Summary

Parameter

| | |
|-----------------------------------|----------------|
| V_{DS} | -20V |
| I_D (at $V_{GS}=-4.5V$) | -4A |
| $R_{DS(ON)}$ (at $V_{GS}=-4.5V$) | < 43m Ω |
| $R_{DS(ON)}$ (at $V_{GS}=-2.5V$) | < 54m Ω |
| $R_{DS(ON)}$ (at $V_{GS}=-1.8V$) | < 73m Ω |

ESD Protected



Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

| Parameter | Symbol | Maximum | Units |
|--|----------------|------------------------|------------------|
| Drain-Source Voltage | V_{DS} | -20 | V |
| Gate-Source Voltage | V_{GS} | ± 8 | V |
| Continuous Drain Current | I_D | $T_A=25^\circ\text{C}$ | -4 |
| | | $T_A=70^\circ\text{C}$ | -3.5 |
| Pulsed Drain Current ^C | I_{DM} | -30 | A |
| Power Dissipation ^B | P_D | $T_A=25^\circ\text{C}$ | 1.5 |
| | | $T_A=70^\circ\text{C}$ | 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 | $R_{\theta JA}$ | 65 | 80 | $^\circ\text{C}/\text{W}$ |
| Maximum Junction-to-Ambient ^{A,D} | | Steady-State | 85 | 100 |
| Maximum Junction-to-Lead | $R_{\theta JL}$ | 43 | 52 | $^\circ\text{C}/\text{W}$ |

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 | -20 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current | V _{DS} =-20V, V _{GS} =0V T _J =55°C | | | -1 -5 | μA |
| I _{GSS} | Gate-Body leakage current | V _{DS} =0V, V _{GS} = ±8V | | | ±10 | μA |
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} =V _{GS} I _D =-250μA | -0.3 | -0.57 | -0.9 | V |
| I _{D(ON)} | On state drain current | V _{GS} =-4.5V, V _{DS} =-5V | -30 | | | A |
| R _{DS(ON)} | Static Drain-Source On-Resistance | V _{GS} =-4.5V, I _D =-4A T _J =125°C | | 37 | 43 | mΩ |
| | | | | 52 | 62 | |
| | | V _{GS} =-2.5V, I _D =-4A | | 45 | 54 | mΩ |
| | | V _{GS} =-1.8V, I _D =-2A | | 54 | 73 | mΩ |
| | | V _{GS} =-1.5V, I _D =-1A | | 65 | | mΩ |
| g _{FS} | Forward Transconductance | V _{DS} =-5V, I _D =-4A | | 20 | | S |
| V _{SD} | Diode Forward Voltage | I _S =-1A, V _{GS} =0V | | -0.64 | -1 | V |
| I _S | Maximum Body-Diode Continuous Current | | | | -2 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C _{iss} | Input Capacitance | V _{GS} =0V, V _{DS} =-10V, f=1MHz | 620 | 780 | 940 | pF |
| C _{oss} | Output Capacitance | | 80 | 115 | 150 | pF |
| C _{rss} | Reverse Transfer Capacitance | | 50 | 80 | 110 | pF |
| SWITCHING PARAMETERS | | | | | | |
| Q _g | Total Gate Charge | V _{GS} =-4.5V, V _{DS} =-10V, I _D =-4A | 7.4 | 9.3 | 11 | nC |
| Q _{gs} | Gate Source Charge | | 1.2 | 1.5 | 1.8 | nC |
| Q _{gd} | Gate Drain Charge | | 1 | 1.8 | 2.5 | nC |
| t _{D(on)} | Turn-On DelayTime | V _{GS} =-4.5V, V _{DS} =-10V, R _L =2.5Ω, R _{GEN} =3Ω | | 120 | | ns |
| t _r | Turn-On Rise Time | | | 240 | | ns |
| t _{D(off)} | Turn-Off DelayTime | | | 2.8 | | μs |
| t _f | Turn-Off Fall Time | | | 2 | | μs |
| t _{rr} | Body Diode Reverse Recovery Time | I _F =-4A, di/dt=500A/μs | 11 | 14 | 17 | ns |
| Q _{rr} | Body Diode Reverse Recovery Charge | I _F =-4A, di/dt=500A/μs | 24 | 30 | 36 | 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.

Rev 0: January 2009

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

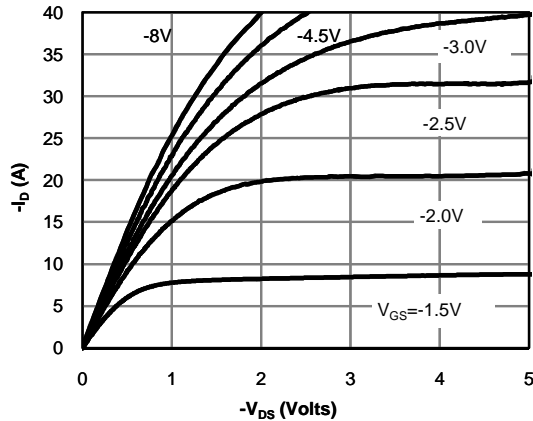


Figure 1: On-Region Characteristics (Note E)

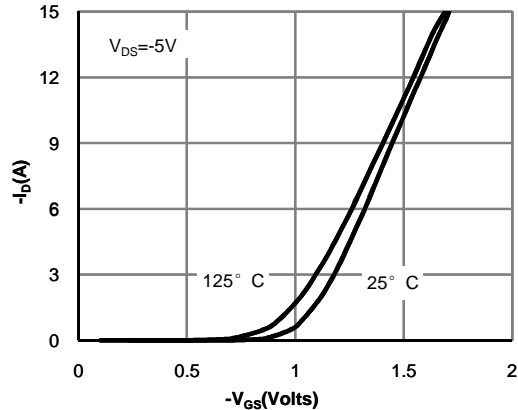


Figure 2: Transfer Characteristics (Note E)

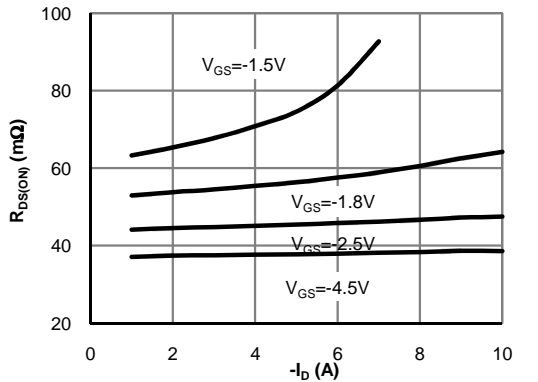


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

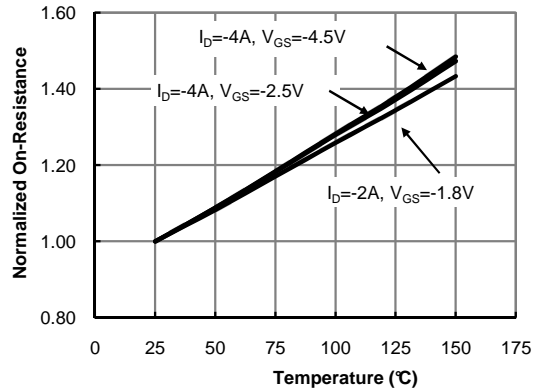


Figure 4: On-Resistance vs. Junction Temperature (Note E)

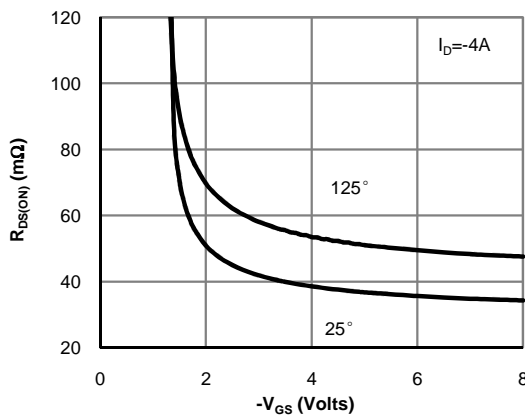


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

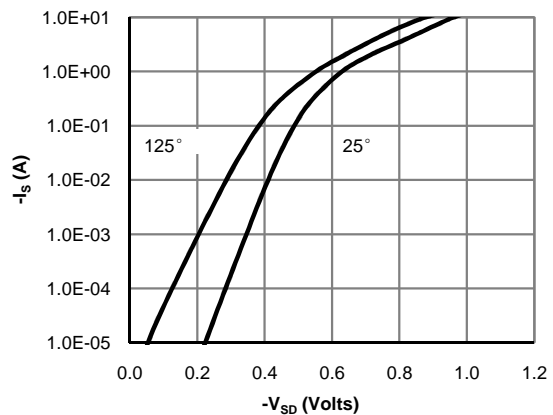


Figure 6: Body-Diode Characteristics (Note E)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

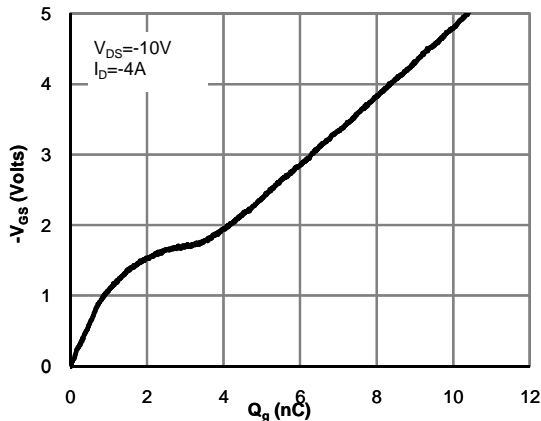


Figure 7: Gate-Charge Characteristics

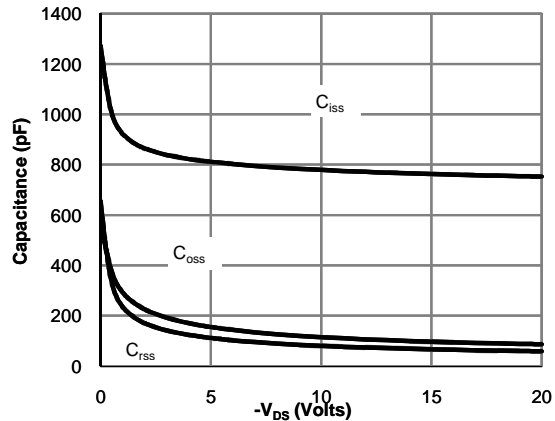


Figure 8: Capacitance Characteristics

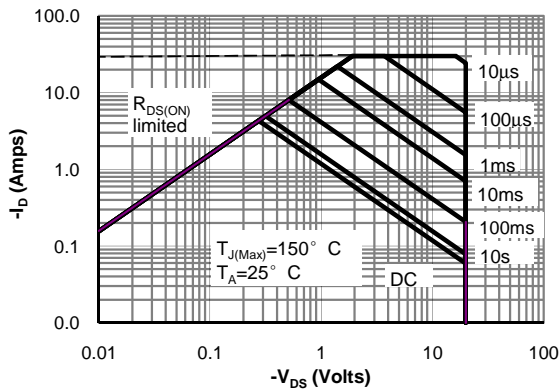


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

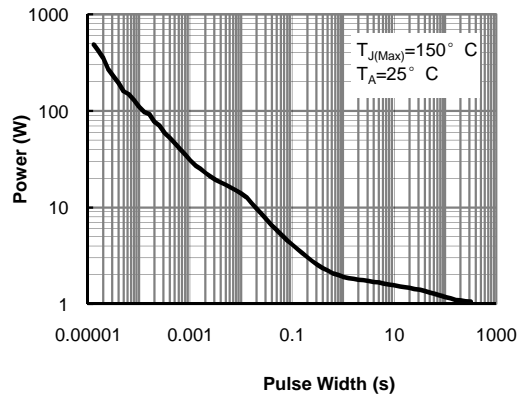


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)

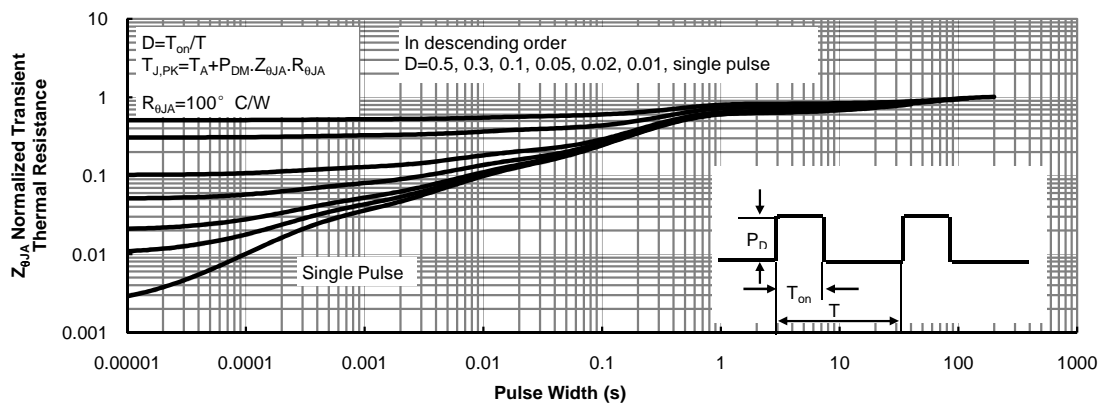
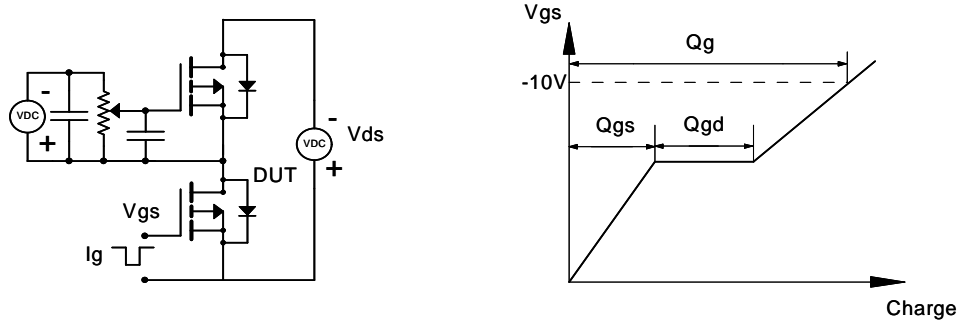
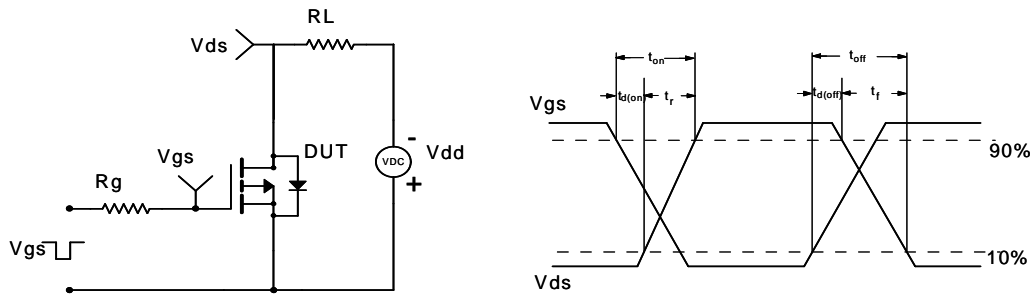


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

