

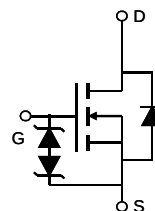
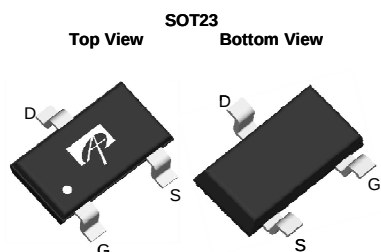
### General Description

The AO3416 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 or in PWM applications. It is ESD protected.

### Product Summary

|                                    |                |
|------------------------------------|----------------|
| $V_{DS}$                           | 20V            |
| $I_D$ (at $V_{GS}=4.5V$ )          | 6.5A           |
| $R_{DS(ON)}$ (at $V_{GS}=4.5V$ )   | < 22m $\Omega$ |
| $R_{DS(ON)}$ (at $V_{GS} = 2.5V$ ) | < 26m $\Omega$ |
| $R_{DS(ON)}$ (at $V_{GS} = 1.8V$ ) | < 34m $\Omega$ |

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                    | $V_{GS}$       | $\pm 8$    | V                |
| Continuous Drain Current               | $I_D$          | 6.5        | A                |
|                                        |                | 5.2        |                  |
| Pulsed Drain Current <sup>C</sup>      | $I_{DM}$       | 30         |                  |
| Power Dissipation <sup>B</sup>         | $P_D$          | 1.4        | W                |
|                                        |                | 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 <sup>A</sup>   | $R_{\theta JA}$ | 70  | 90  | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>A D</sup> |                 | 100 | 125 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead                   | $R_{\theta JL}$ | 63  | 80  | $^\circ\text{C/W}$ |

**Electrical Characteristics (T<sub>j</sub>=25°C unless otherwise noted)**

| Symbol                      | Parameter                             | Conditions                                                                                  | Min | Typ      | Max      | Units |
|-----------------------------|---------------------------------------|---------------------------------------------------------------------------------------------|-----|----------|----------|-------|
| <b>STATIC PARAMETERS</b>    |                                       |                                                                                             |     |          |          |       |
| BV <sub>DSS</sub>           | Drain-Source Breakdown Voltage        | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V                                                  | 20  |          |          | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =20V, V <sub>GS</sub> =0V<br>T <sub>j</sub> =55°C                           |     |          | 1<br>5   | μA    |
| I <sub>GSS</sub>            | Gate-Body leakage current             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±8V                                                  |     |          | ±10      | μA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                    | 0.4 | 0.7      | 1.1      | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =5V                                                  | 30  |          |          | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =6.5A<br>T <sub>j</sub> =125°C                        |     | 16<br>22 | 22<br>30 | mΩ    |
|                             |                                       | V <sub>GS</sub> =2.5V, I <sub>D</sub> =5.5A                                                 |     | 18       | 26       | mΩ    |
|                             |                                       | V <sub>GS</sub> =1.8V, I <sub>D</sub> =5A                                                   |     | 21       | 34       | mΩ    |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =6.5A                                                   |     | 50       |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V                                                     |     | 0.62     | 1        | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |                                                                                             |     |          | 2        | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                             |     |          |          |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =10V, f=1MHz                                           |     | 1295     | 1650     | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |                                                                                             |     | 160      |          | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |                                                                                             |     | 87       |          | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz                                            |     | 1.8      |          | KΩ    |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                             |     |          |          |       |
| Q <sub>g</sub>              | Total Gate Charge                     | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V, I <sub>D</sub> =6.5A                           |     | 10       |          | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |                                                                                             |     | 4.2      |          | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |                                                                                             |     | 2.6      |          | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =10V, R <sub>L</sub> =1.54Ω,<br>R <sub>GEN</sub> =3Ω |     | 280      |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |                                                                                             |     | 328      |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |                                                                                             |     | 3.76     |          | us    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |                                                                                             |     | 2.24     |          | us    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =6.5A, dI/dt=100A/μs                                                         |     | 31       | 41       | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =6.5A, dI/dt=100A/μs                                                         |     | 6.8      |          | nC    |

A. The value of R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The value in any given application depends on the user's specific board design.

B. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150° C, using ≤ 10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150° C. Ratings are based on low frequency and duty cycles to keep initial T<sub>j</sub>=25° C.

D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> 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 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

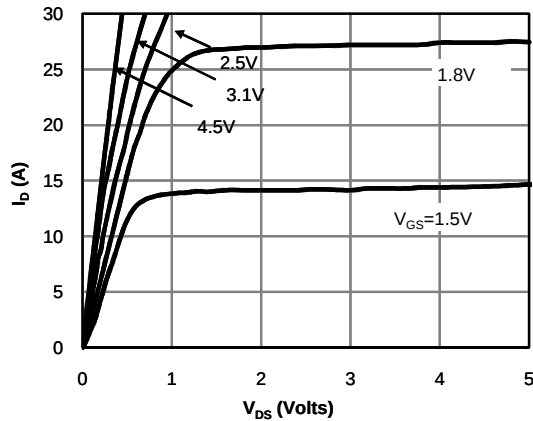


Fig 1: On-Region Characteristics (Note E)

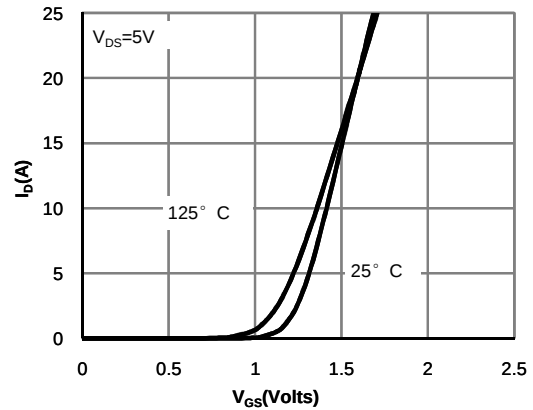


Figure 2: Transfer Characteristics (Note E)

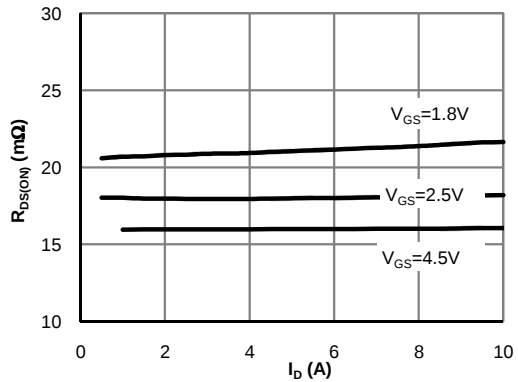


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

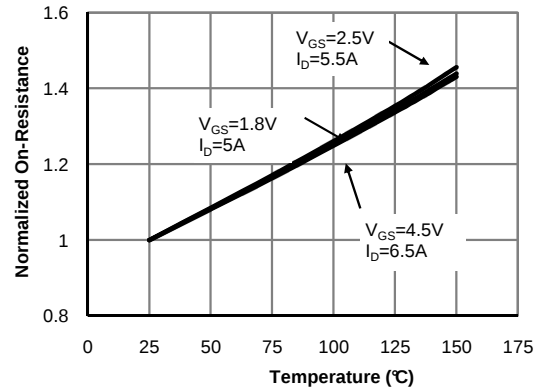


Figure 4: On-Resistance vs. Junction Temperature (Note E)

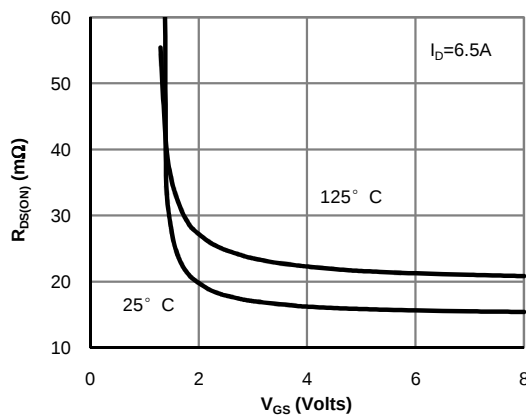


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

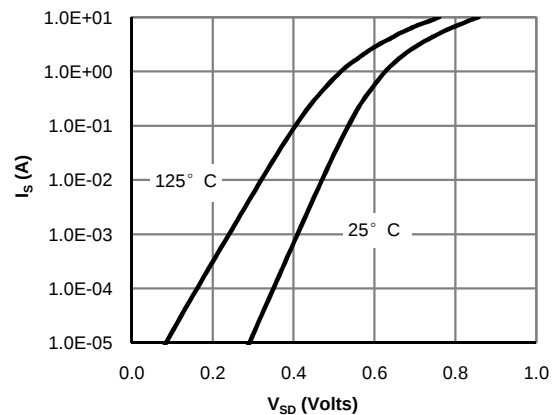
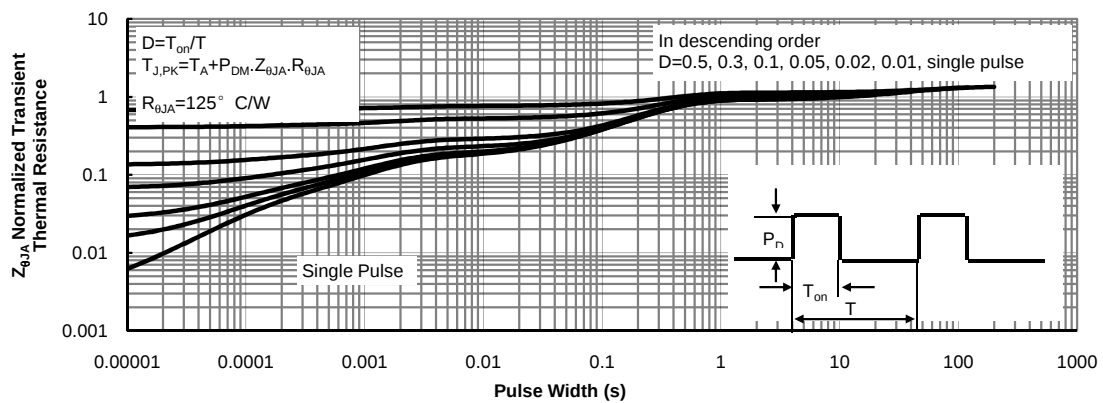
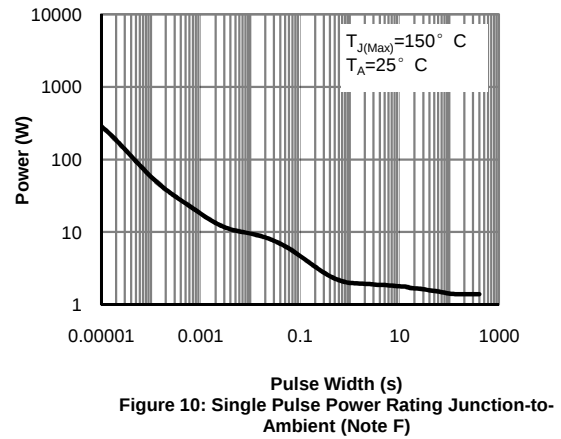
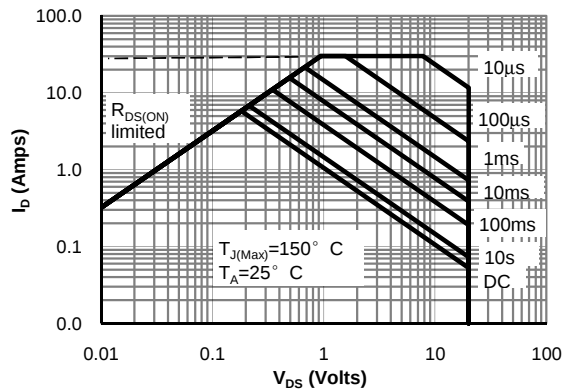
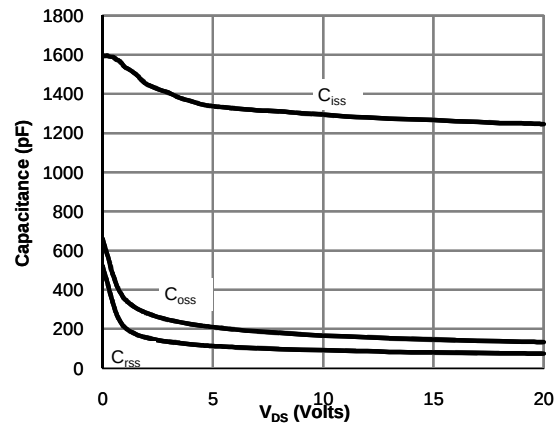
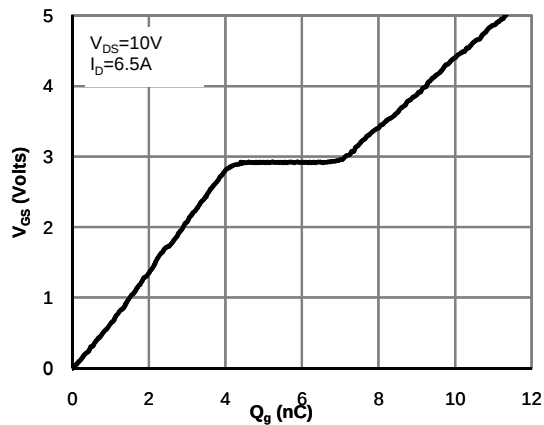


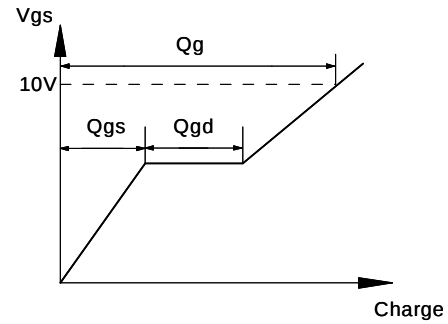
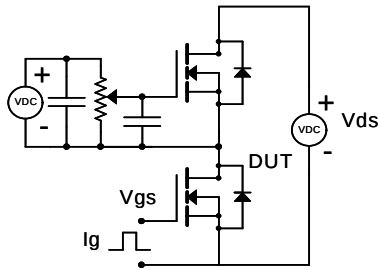
Figure 6: Body-Diode Characteristics (Note E)



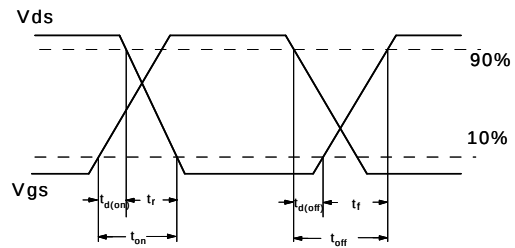
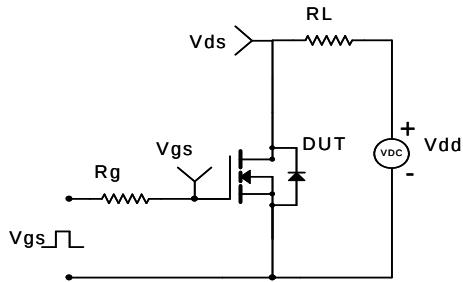
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS



### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



### Diode Recovery Test Circuit & Waveforms

