

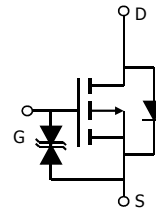
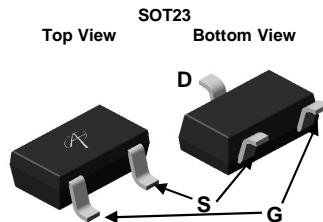
**General Description**

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**

|                                    |                |
|------------------------------------|----------------|
| $V_{DS}$                           | -20V           |
| $I_D$ (at $V_{GS}=-4.5V$ )         | -4A            |
| $R_{DS(ON)}$ (at $V_{GS}= -4.5V$ ) | < 41m $\Omega$ |
| $R_{DS(ON)}$ (at $V_{GS}= -2.5V$ ) | < 53m $\Omega$ |
| $R_{DS(ON)}$ (at $V_{GS}= -1.8V$ ) | < 65m $\Omega$ |

ESD protected



**Absolute Maximum Ratings**  $T_A=25^{\circ}C$  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               | $I_D$          | $T_A=25^{\circ}C$ | -4          |
|  |                | $T_A=70^{\circ}C$ | -3.5        |
| Pulsed Drain Current <sup>C</sup>      | $I_{DM}$       | -30               | A           |
| Power Dissipation <sup>B</sup>         | $P_D$          | $T_A=25^{\circ}C$ | 1.5         |
|  |                | $T_A=70^{\circ}C$ | 1           |
| Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 to 150        | $^{\circ}C$ |

**Thermal Characteristics**

| Parameter                                  | Symbol          | Typ          | Max | Units         |
|--|-----------------|--------------|-----|---------------|
| Maximum Junction-to-Ambient <sup>A</sup>   | $R_{\theta JA}$ | 65           | 80  | $^{\circ}C/W$ |
| Maximum Junction-to-Ambient <sup>A,D</sup> |                 | Steady-State | 85  | 100           |
| Maximum Junction-to-Lead                   | $R_{\theta JL}$ | 43           | 52  | $^{\circ}C/W$ |

**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                                    | -0.3 | -0.57    | -0.9     | 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> =-4A<br>T <sub>J</sub> =125°C                         |      | 34<br>49 | 41<br>59 | mΩ    |
|                             |                                       | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-4A  |      | 42       | 53       |       |
|                             |                                       | V <sub>GS</sub> =-1.8V, I <sub>D</sub> =-2A  |      | 52       | 65       |       |
|                             |                                       | V <sub>GS</sub> =-1.5V, I <sub>D</sub> =-1A  |      | 61       |          |       |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =-5V, I <sub>D</sub> =-4A  |      | 20       |          | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =-1A, V <sub>GS</sub> =0V   |      | -0.64    | -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   | 600  | 751      | 905      | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |  | 80   | 115      | 150      | pF    |
| C <sub>rss</sub>            | Reverse Transfer Capacitance          |  | 48   | 80       | 115      | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz   | 6    | 13       | 20       | Ω     |
| <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> =-4A                           | 7.4  | 9.3      | 11       | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |  | 0.8  | 1        | 1.2      | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |  | 1.3  | 2.2      | 3.1      | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-10V, R <sub>L</sub> =2.5Ω,<br>R <sub>GEN</sub> =3Ω |      | 13       |          | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |  |      | 9        |          | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |  |      | 19       |          | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |  |      | 29       |          | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =-4A, dI/dt=500A/μs   | 20   | 26       | 32       | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =-4A, dI/dt=500A/μs   | 40   | 51       | 62       | 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.

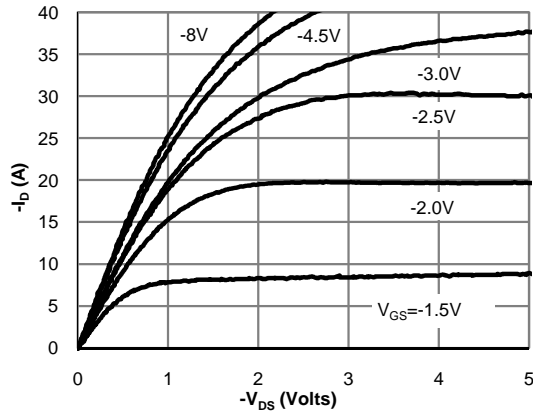
D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300μs pulses, duty cycle 0.5% max.

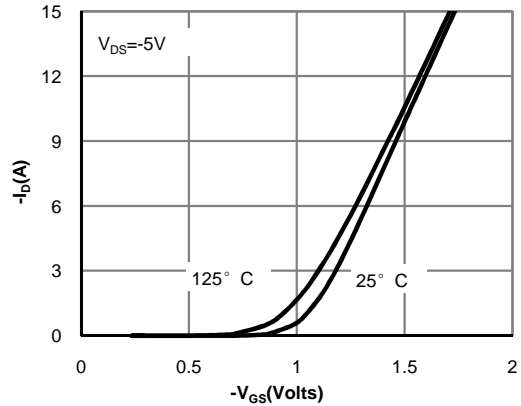
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

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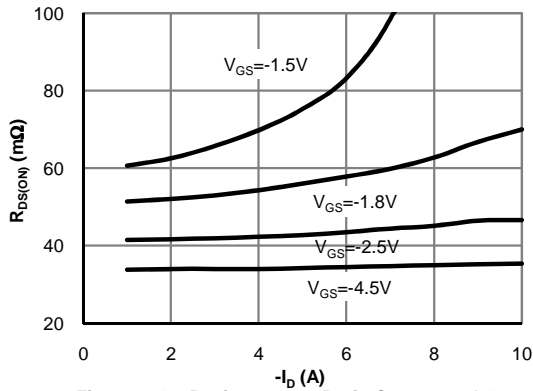
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



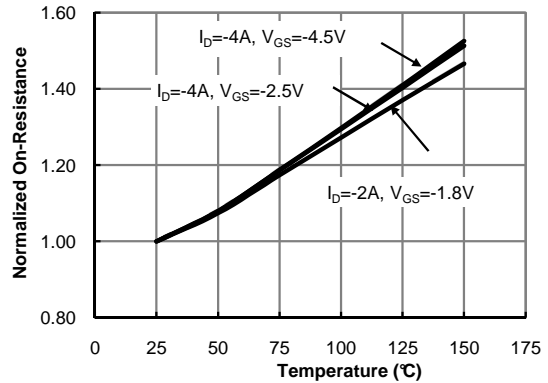
**Fig 1: On-Region Characteristics (Note E)**



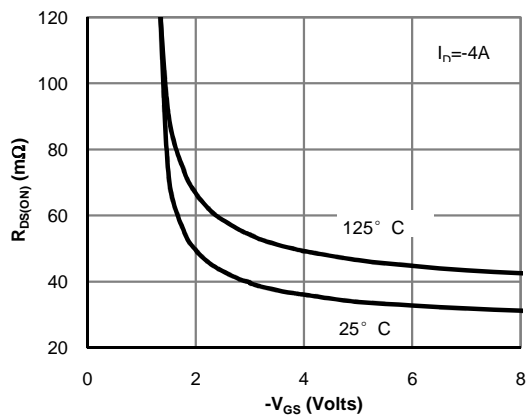
**Figure 2: Transfer Characteristics (Note E)**



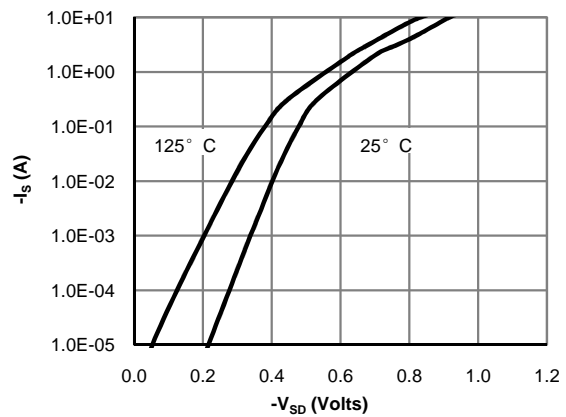
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



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

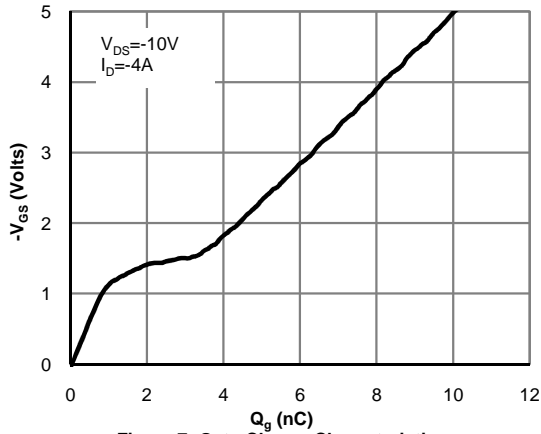


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

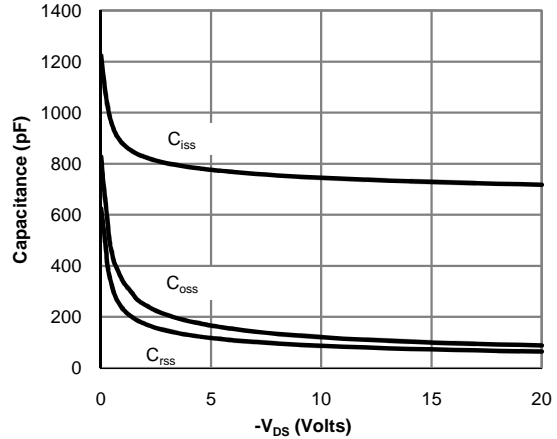


**Figure 6: Body-Diode Characteristics (Note E)**

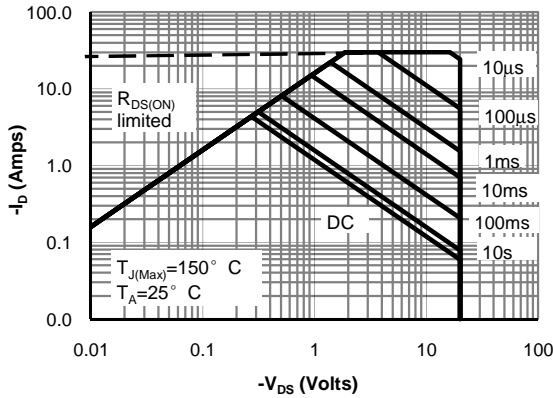
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



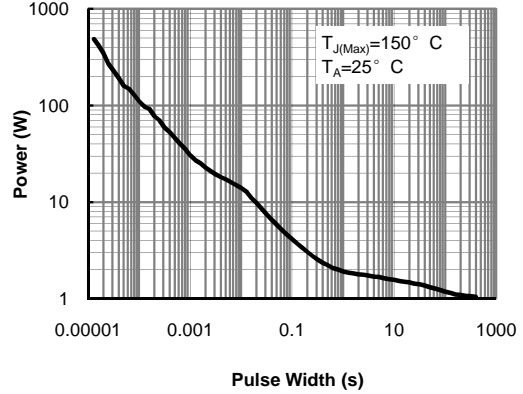
**Figure 7: Gate-Charge Characteristics**



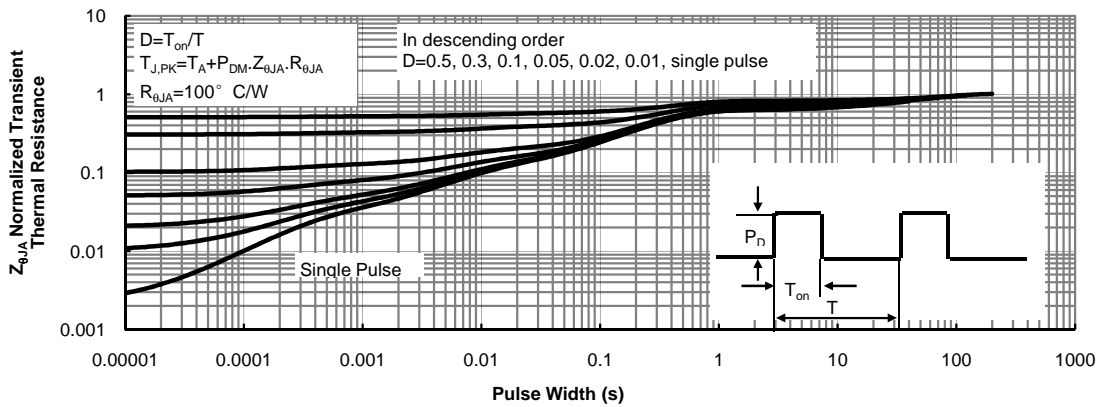
**Figure 8: Capacitance Characteristics**



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

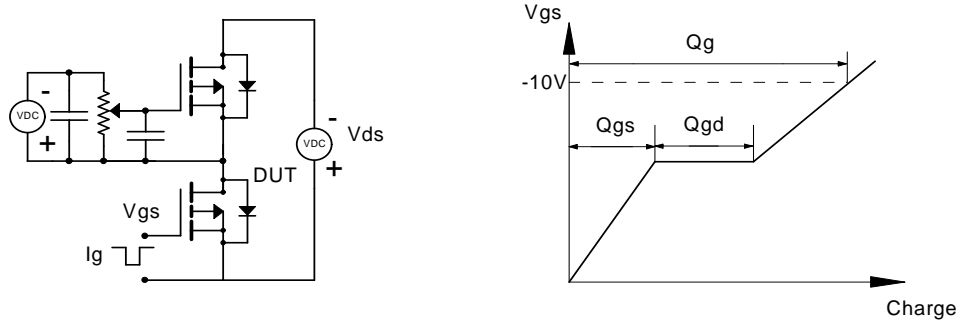


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)**

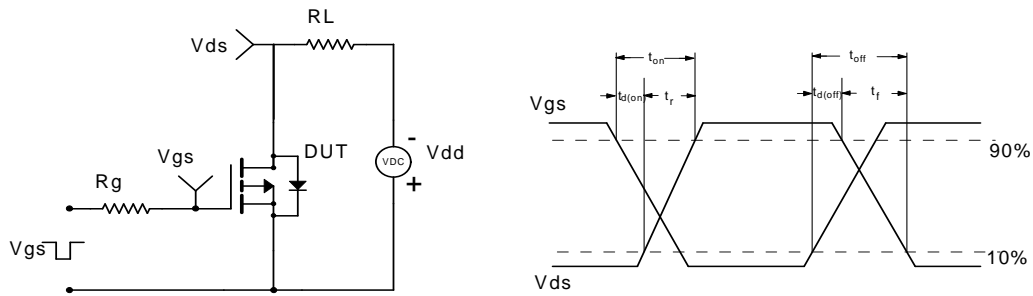


**Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)**

**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Diode Recovery Test Circuit & Waveforms**

