



**General Description**

- Logic Level Driving 4.5V
- ESD Protection
- RoHS and Halogen Free Compliant

**Applications**

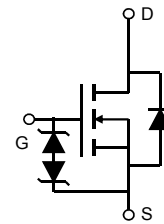
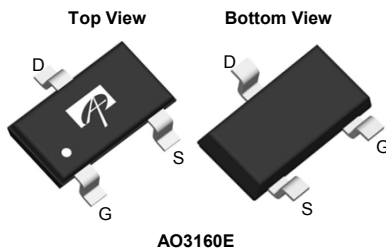
- Load Switch

**Product Summary**

|                                  |        |
|----------------------------------|--------|
| $V_{DS} @ T_{j,max}$             | 700V   |
| $I_D$ (at $V_{GS}=10V$ )         | 0.04A  |
| $R_{DS(ON)}$ (at $V_{GS}=10V$ )  | < 500Ω |
| $R_{DS(ON)}$ (at $V_{GS}=4.5V$ ) | < 600Ω |

Typical ESD protection

HBM Class 2



| Orderable Part Number | Package Type | Form        | Minimum Order Quantity |
|-----------------------|--------------|-------------|------------------------|
| AO3160E               | SOT23A       | Tape & Reel | 3000                   |

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

| Parameter  | Symbol         | Maximum                | Units            |
|--|----------------|------------------------|------------------|
| Drain-Source Voltage   | $V_{DS}$       | 600                    | V                |
| Gate-Source Voltage  | $V_{GS}$       | $\pm 20$               | V                |
| Continuous Drain Current <sup>A,F</sup>                                      | $I_D$          | $T_A=25^\circ\text{C}$ | 0.04             |
|  |                | $T_A=70^\circ\text{C}$ | 0.03             |
| Pulsed Drain Current <sup>B</sup>  | $I_{DM}$       | 0.12                   | A                |
| Peak diode recovery dv/dt  | dv/dt          | 5                      | V/ns             |
| Power Dissipation <sup>A</sup>   | $P_D$          | $T_A=25^\circ\text{C}$ | 1.39             |
|  |                | $T_A=70^\circ\text{C}$ | 0.89             |
| Junction and Storage Temperature Range                                       | $T_J, T_{STG}$ | -55 to 150             | $^\circ\text{C}$ |
| Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | $T_L$          | 300                    | $^\circ\text{C}$ |

**Thermal Characteristics**

| Parameter                                | Symbol          | Typical      | Maximum | Units              |
|--|-----------------|--------------|---------|--------------------|
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | 70           | 90      | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | Steady-State | 100     | 125                |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | 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, T <sub>J</sub> =25°C                          | 600                                    | -     | -    | V     |
|                                    |  | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V, T <sub>J</sub> =150°C                         | -                                      | 700   | -    |       |
| BV <sub>DSS</sub> /ΔT <sub>J</sub> | Breakdown Voltage Temperature Coefficient      | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V  | -                                      | 0.68  | -    | V/°C  |
| I <sub>DSS</sub>                   | Zero Gate Voltage Drain Current                | V <sub>DS</sub> =600V, V <sub>GS</sub> =0V  | -                                      | -     | 1    | μA    |
|                                    |  | V <sub>DS</sub> =480V, T <sub>J</sub> =125°C  | -                                      | -     | 10   |       |
| I <sub>GSS</sub>                   | Gate-Body leakage current                      | V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V  | -                                      | -     | ±10  | μA    |
| V <sub>GS(th)</sub>                | Gate Threshold Voltage                         | V <sub>DS</sub> =5V, I <sub>D</sub> =8μA  | 1.4                                    | 2     | 3.2  | V     |
| R <sub>DS(ON)</sub>                | Static Drain-Source On-Resistance              | V <sub>GS</sub> =10V, I <sub>D</sub> =0.016A  | -                                      | 176   | 500  | Ω     |
|                                    |  | V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.016A   | -                                      | 178   | 600  | Ω     |
| g <sub>FS</sub>                    | Forward Transconductance                       | V <sub>DS</sub> =40V, I <sub>D</sub> =0.016A  | -                                      | 0.125 | -    | S     |
| V <sub>SD</sub>                    | Diode Forward Voltage                          | I <sub>S</sub> =0.016A, V <sub>GS</sub> =0V   | -                                      | 0.76  | 1    | V     |
| I <sub>S</sub>                     | Maximum Body-Diode Continuous Current          |   | -                                      | -     | 0.04 | A     |
| I <sub>SM</sub>                    | Maximum Body-Diode Pulsed Current <sup>C</sup> |   | -                                      | -     | 0.12 | A     |
| <b>DYNAMIC PARAMETERS</b>          |  |   |  |       |      |       |
| C <sub>iss</sub>                   | Input Capacitance                              | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz   | -                                      | 9.5   | -    | pF    |
| C <sub>oss</sub>                   | Output Capacitance                             |   | -                                      | 1.7   | -    | pF    |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance                   | V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz   | -                                      | 0.6   | -    | pF    |
| R <sub>g</sub>                     | Gate resistance                                | f=1MHz  | -                                      | 20    | -    | Ω     |
| <b>SWITCHING PARAMETERS</b>        |  |   |  |       |      |       |
| Q <sub>g</sub>                     | Total Gate Charge                              | V <sub>GS</sub> =10V, V <sub>DS</sub> =400V, I <sub>D</sub> =0.01A                        | -                                      | 0.9   | -    | nC    |
| Q <sub>gs</sub>                    | Gate Source Charge                             |   | -                                      | 0.09  | -    | nC    |
| Q <sub>gd</sub>                    | Gate Drain Charge                              |   | -                                      | 0.49  | -    | nC    |
| T <sub>d(on)</sub>                 | Turn-On DelayTime                              | V <sub>GS</sub> =10V, V <sub>DS</sub> =300V, I <sub>D</sub> =0.01A,<br>R <sub>G</sub> =6Ω | -                                      | 4     | -    | ns    |
| T <sub>r</sub>                     | Turn-On Rise Time                              |   | -                                      | 5     | -    | ns    |
| T <sub>d(off)</sub>                | Turn-Off DelayTime                             |   | -                                      | 13    | -    | ns    |
| T <sub>f</sub>                     | Turn-Off Fall Time                             |   | -                                      | 55    | -    | ns    |
| T <sub>rr</sub>                    | Body Diode Reverse Recovery Time               |   | I <sub>F</sub> =0.016A, dI/dt=100A/μs, | -     | 105  | -     |
| Q <sub>rr</sub>                    | Body Diode Reverse Recovery Charge             | V <sub>DS</sub> =300V   | -                                      | 9.5   | -    | nC    |

A. The value of R<sub>qJA</sub> is measured with the device mounted on 1 in<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. Repetitive rating, pulse width limited by junction temperature.

C. The R<sub>qJA</sub> is the sum of the thermal impedance from junction to lead R<sub>qJL</sub> and lead to ambient.

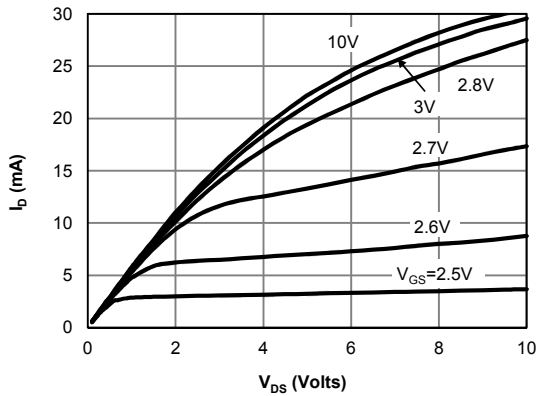
D. The static characteristics in Figures 1 to 6 are obtained using <300 ms pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>A</sub>=25° C. The SOA curve provides a single pulse rating.

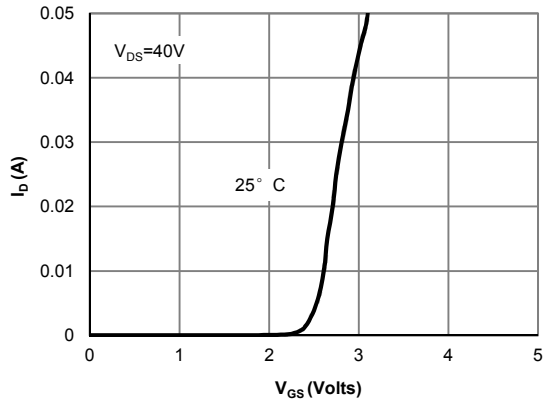
F. The current rating is based on the t ≤ 10s thermal resistance rating.

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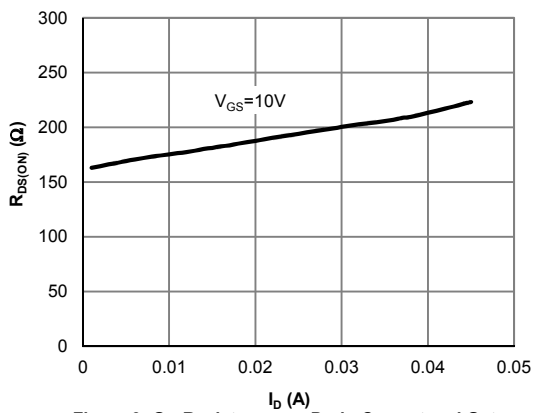
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



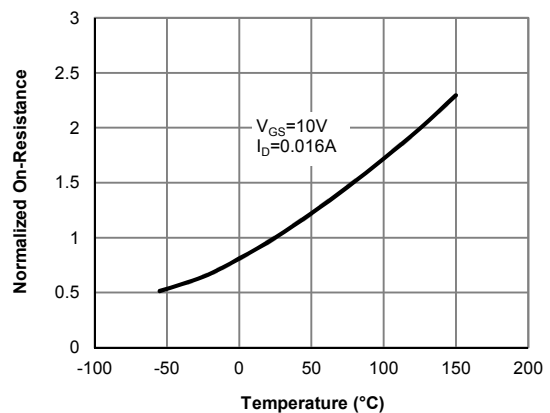
**Figure 1: On-Region Characteristics**



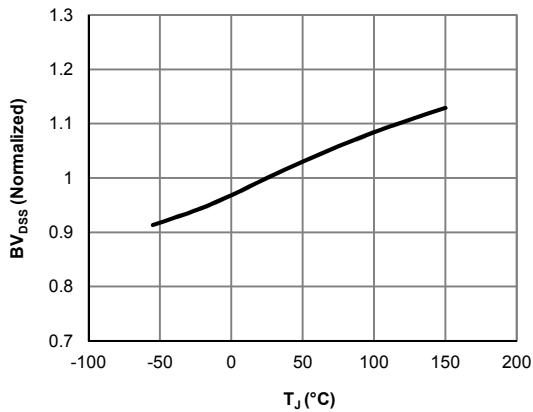
**Figure 2: Transfer Characteristics**



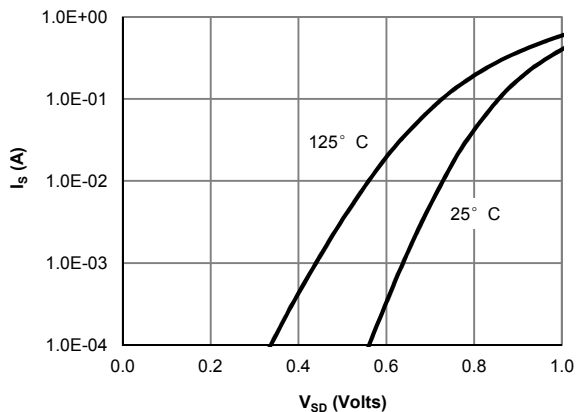
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**



**Figure 4: On-Resistance vs. Junction Temperature**

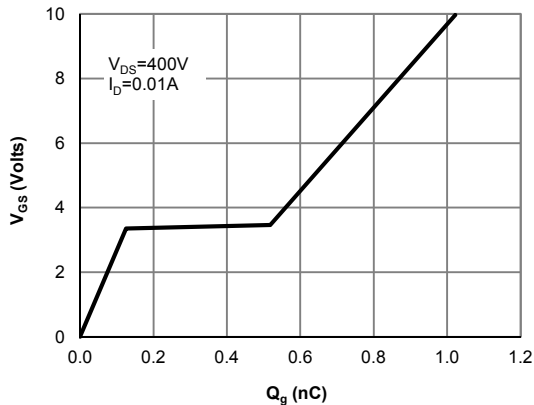


**Figure 5: Break Down vs. Junction Temperature**

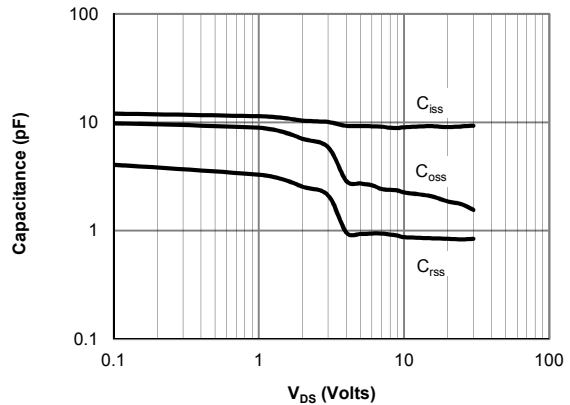


**Figure 6: Body-Diode Characteristics**

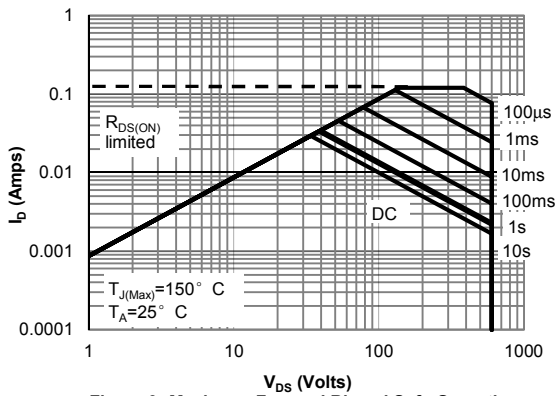
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



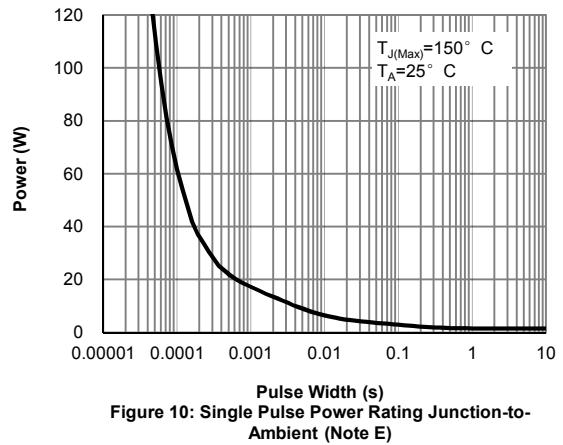
**Figure 7: Gate-Charge Characteristics**



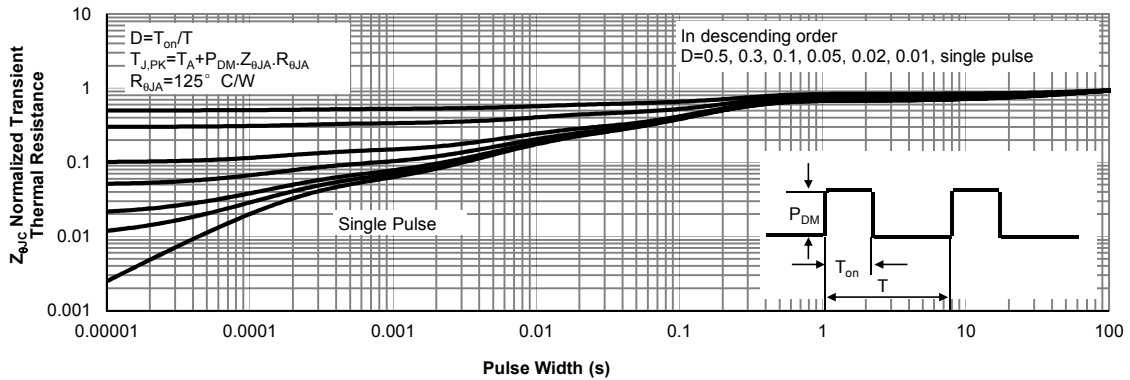
**Figure 8: Capacitance Characteristics**



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

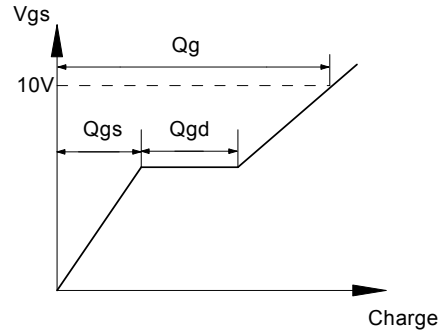
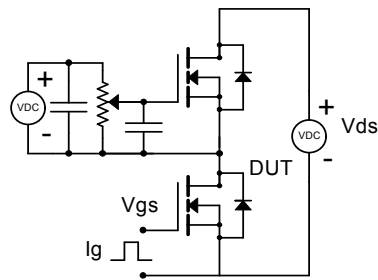


**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

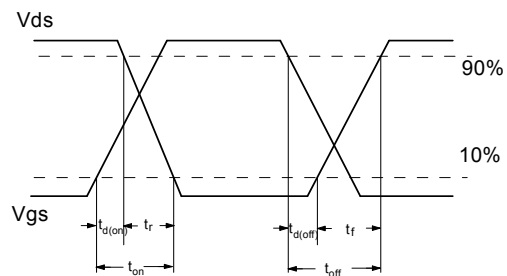
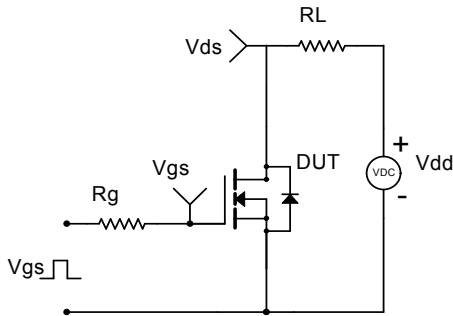


**Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)**

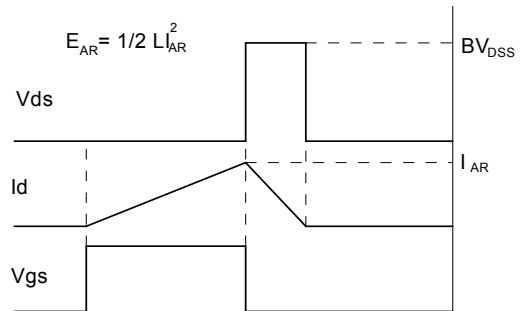
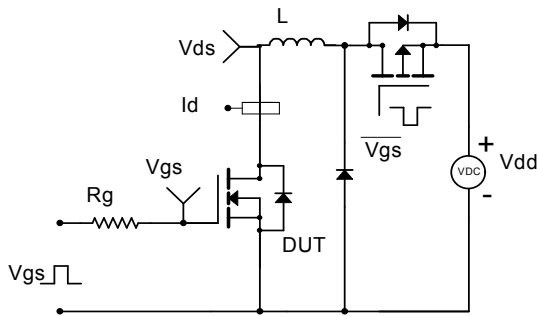
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

