

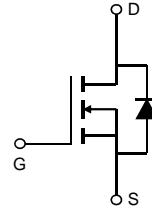
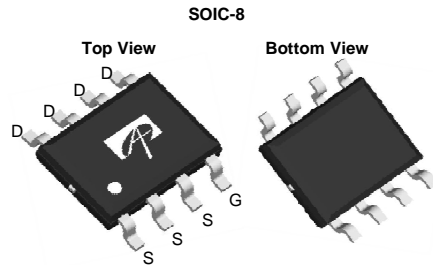
### General Description

The AO4406A uses advanced trench technology to provide excellent  $R_{DS(ON)}$  with low gate charge. This device is suitable for high side switch in SMPS and general purpose applications.

### Product Summary

|                                    |                  |
|------------------------------------|------------------|
| $V_{DS}$                           | 30V              |
| $I_D$ (at $V_{GS}=10V$ )           | 13A              |
| $R_{DS(ON)}$ (at $V_{GS}=10V$ )    | < 11.5m $\Omega$ |
| $R_{DS(ON)}$ (at $V_{GS} = 4.5V$ ) | < 15.5m $\Omega$ |

100% UIS Tested  
 100%  $R_g$  Tested



### 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                            | $V_{GS}$       | $\pm 20$               | V                |
| Continuous Drain Current                       | $I_D$          | $T_A=25^\circ\text{C}$ | 13               |
|  |                | $T_A=70^\circ\text{C}$ | 10.4             |
| Pulsed Drain Current <sup>C</sup>              | $I_{DM}$       | 100                    | A                |
| Avalanche Current <sup>C</sup>                 | $I_{AS}$       | 22                     | A                |
| Avalanche energy $L=0.1\text{mH}$ <sup>C</sup> | $E_{AS}$       | 24                     | mJ               |
| Power Dissipation <sup>B</sup>                 | $P_D$          | $T_A=25^\circ\text{C}$ | 3.1              |
|  |                | $T_A=70^\circ\text{C}$ | 2                |
| 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>    | $R_{\theta JA}$ | 31           | 40  | $^\circ\text{C}/\text{W}$ |
| Maximum Junction-to-Ambient <sup>A, D</sup> |                 | Steady-State | 59  | 75                        |
| Maximum Junction-to-Lead                    | $R_{\theta JL}$ | 16           | 24  | $^\circ\text{C}/\text{W}$ |

**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   | 30  |      |        | V     |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =30V, 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> =±20V   |     |      | ±100   | nA    |
| V <sub>GS(th)</sub>         | Gate Threshold Voltage                | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA                                   | 1.5 | 1.9  | 2.5    | V     |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =10V, V <sub>DS</sub> =5V  | 100 |      |        | A     |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =12A<br>T <sub>J</sub> =125°C                         |     | 9.5  | 11.5   | mΩ    |
|                             |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =10A   |     | 12.5 | 15.5   |       |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =12A   |     | 45   |        | S     |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V  |     | 0.75 | 1      | V     |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |  |     |      | 4      | A     |
| <b>DYNAMIC PARAMETERS</b>   |                                       |  |     |      |        |       |
| C <sub>iss</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =15V, f=1MHz  | 610 | 760  | 910    | pF    |
| C <sub>oss</sub>            | Output Capacitance                    |  | 88  | 125  | 160    | pF    |
| C <sub>riss</sub>           | Reverse Transfer Capacitance          |  | 40  | 70   | 100    | pF    |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz   | 0.8 | 1.6  | 2.4    | Ω     |
| <b>SWITCHING PARAMETERS</b> |                                       |  |     |      |        |       |
| Q <sub>g(10V)</sub>         | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, I <sub>D</sub> =12A                            | 11  | 14   | 17     | nC    |
| Q <sub>g(4.5V)</sub>        | Total Gate Charge                     |  | 5   | 6.6  | 8      | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    |  | 1.9 | 2.4  | 2.9    | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |  | 1.8 | 3    | 4.2    | nC    |
| Q <sub>gs</sub>             | Gate Source Charge                    | V <sub>GS</sub> =4.5V, V <sub>DS</sub> =15V, I <sub>D</sub> =12A                           | 1.9 | 2.4  | 2.9    | nC    |
| Q <sub>gd</sub>             | Gate Drain Charge                     |  | 1.8 | 3    | 4.2    | nC    |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =15V, R <sub>L</sub> =1.25Ω,<br>R <sub>GEN</sub> =3Ω |     | 4.4  |        | ns    |
| t <sub>r</sub>              | Turn-On Rise Time                     |  |     | 9    |        | ns    |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |  |     | 17   |        | ns    |
| t <sub>f</sub>              | Turn-Off Fall Time                    |  |     | 6    |        | ns    |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =12A, dI/dt=500A/μs   | 5.6 | 7    | 8      | ns    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =12A, dI/dt=500A/μs   | 6.4 | 8    | 9.6    | 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.

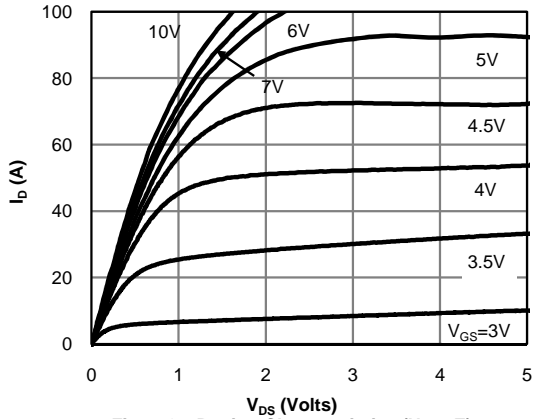
D. The R<sub>θJA</sub> is the sum of the thermal impedance from junction to lead R<sub>θJL</sub> and lead to ambient.

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

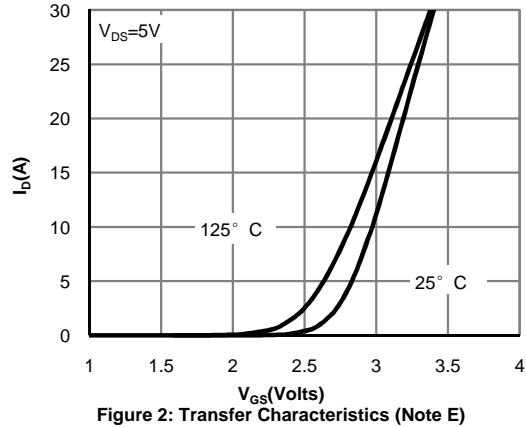
F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, assuming a maximum junction temperature of T<sub>J(MAX)</sub>=150° C. The SOA curve provides a single pulse rating.

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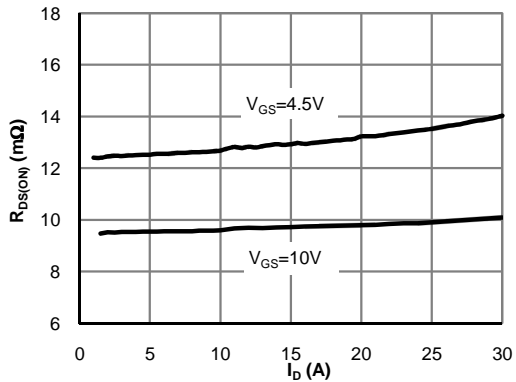
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



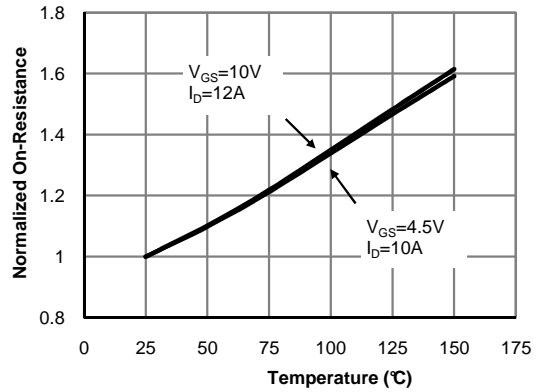
**Fig 1: On-Region Characteristics (Note E)**



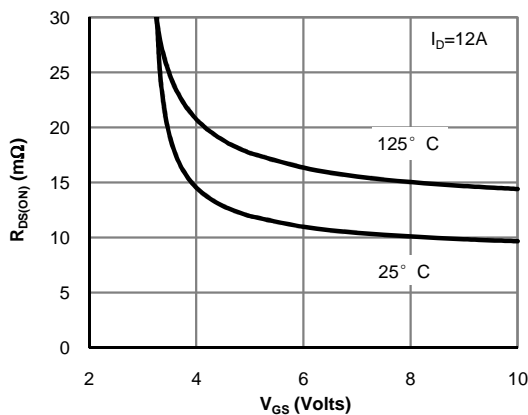
**Figure 2: Transfer Characteristics (Note E)**



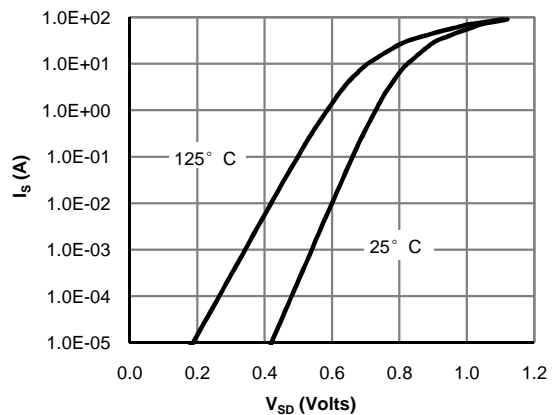
**Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)**



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

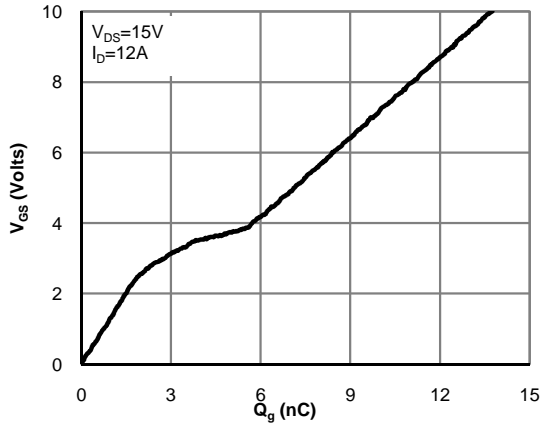


**Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)**

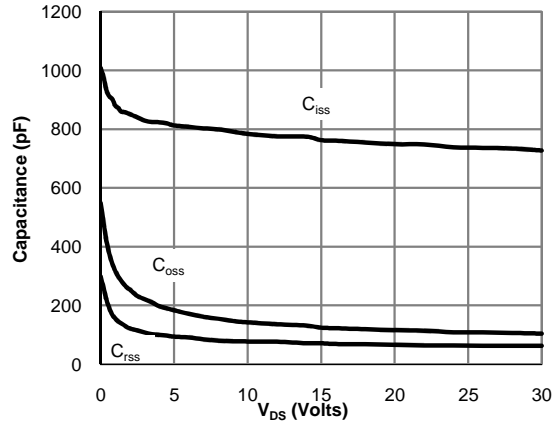


**Figure 6: Body-Diode Characteristics (Note E)**

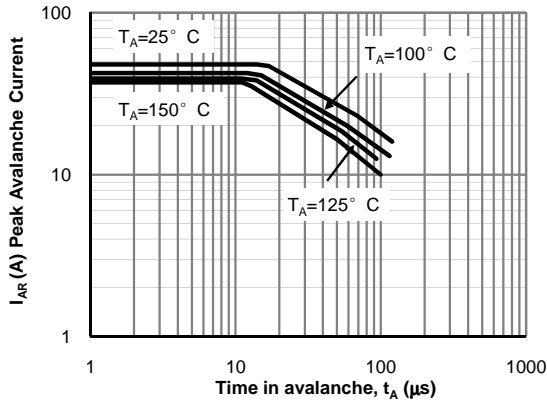
**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



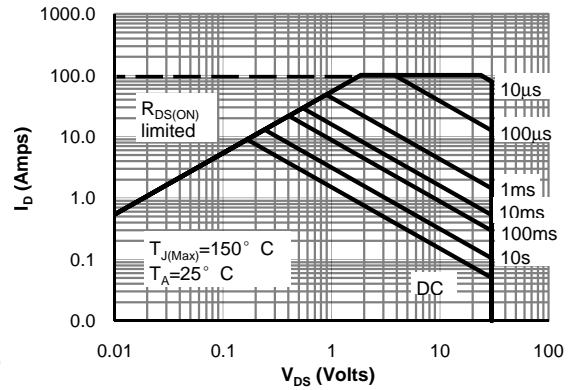
**Figure 7: Gate-Charge Characteristics**



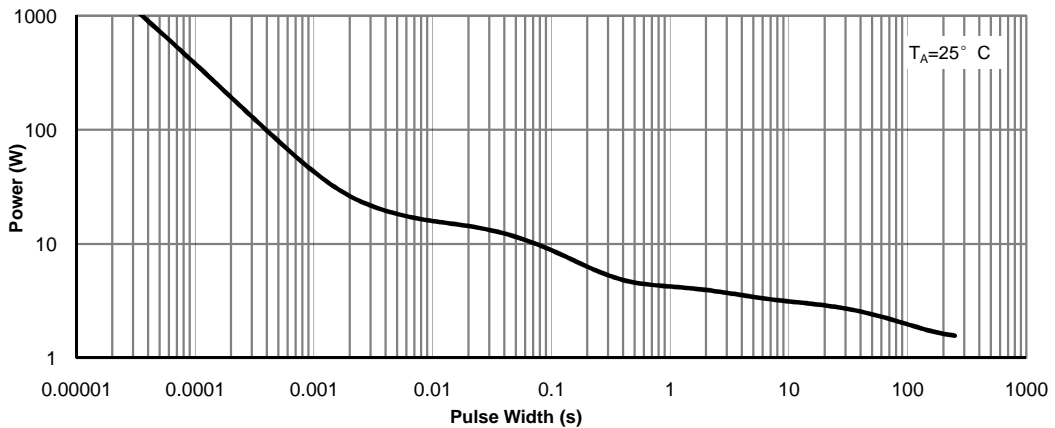
**Figure 8: Capacitance Characteristics**



**Figure 9: Single Pulse Avalanche capability (Note C)**

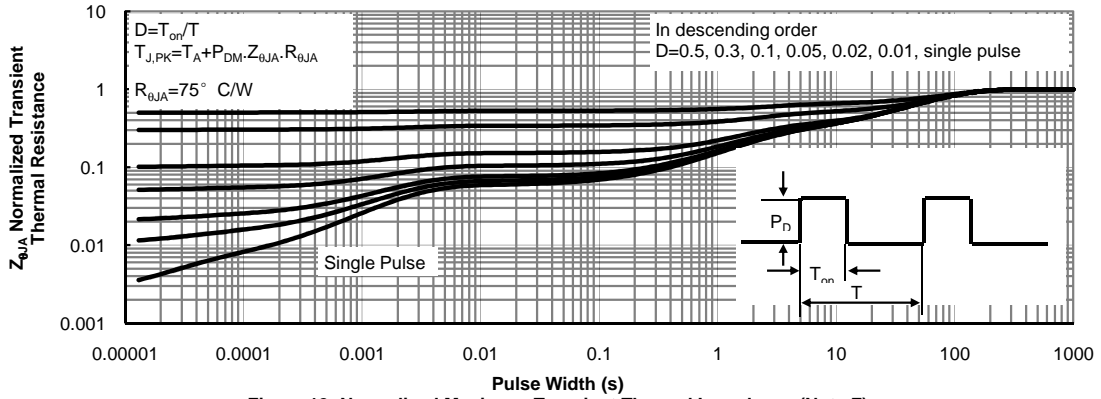


**Figure 10: Maximum Forward Biased Safe Operating Area (Note F)**



**Figure 11: Single Pulse Power Rating Junction-to-Ambient (Note F)**

**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**



**Figure 12: 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**

