



**AO4614**

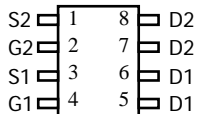
**Complementary Enhancement Mode Field Effect Transistor**

**General Description**

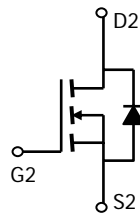
The AO4614 uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used in H-bridge, Inverters and other applications. *Standard Product AO4614 is Pb-free (meets ROHS & Sony 259 specifications). AO4614L is a Green Product ordering option. AO4614 and AO4614L are electrically identical.*

**Features**

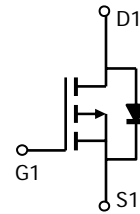
|                                  |                                     |
|----------------------------------|-------------------------------------|
| n-channel                        | p-channel                           |
| $V_{DS} (V) = 40V$               | -40V                                |
| $I_D = 6A (V_{GS}=10V)$          | -5A ( $V_{GS} = -10V$ )             |
| $R_{DS(ON)}$                     | $R_{DS(ON)}$                        |
| < 31m $\Omega$ ( $V_{GS}=10V$ )  | < 45m $\Omega$ ( $V_{GS} = -10V$ )  |
| < 45m $\Omega$ ( $V_{GS}=4.5V$ ) | < 63m $\Omega$ ( $V_{GS} = -4.5V$ ) |



**SOIC-8**



**n-channel**



**p-channel**

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

| Parameter                              | Symbol         | Max n-channel    | Max p-channel | Units      |
|--|----------------|------------------|---------------|------------|
| Drain-Source Voltage                   | $V_{DS}$       | 40               | -40           | V          |
| Gate-Source Voltage                    | $V_{GS}$       | $\pm 20$         | $\pm 20$      | V          |
| Continuous Drain Current <sup>A</sup>  | $I_D$          | $T_A=25^\circ C$ | 6             | -5         |
|  |                | $T_A=70^\circ C$ | 5             | -4         |
| Pulsed Drain Current <sup>B</sup>      | $I_{DM}$       | 20               | -20           | A          |
| Power Dissipation                      | $P_D$          | $T_A=25^\circ C$ | 2             | 2          |
|  |                | $T_A=70^\circ C$ | 1.28          | 1.28       |
| Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 to 150       | -55 to 150    | $^\circ C$ |

**Thermal Characteristics: n-channel and p-channel**

| Parameter                                | Symbol          | Device | Typ | Max  | Units        |
|--|-----------------|--------|-----|------|--------------|
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | n-ch   | 48  | 62.5 | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | n-ch   | 74  | 110  | $^\circ C/W$ |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | n-ch   | 35  | 50   | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | p-ch   | 48  | 62.5 | $^\circ C/W$ |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | p-ch   | 74  | 110  | $^\circ C/W$ |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | p-ch   | 35  | 50   | $^\circ C/W$ |

N Channel 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> =10mA, V <sub>GS</sub> =0V   | 40  |            |          | V     |    |
| I <sub>DSS</sub>            | Zero Gate Voltage Drain Current       | V <sub>DS</sub> =32V, 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   | 2.3        | 3        | V     |    |
| I <sub>D(ON)</sub>          | On state drain current                | V <sub>GS</sub> =10V, V <sub>DS</sub> =5V   | 20  |            |          | A     |    |
| R <sub>DS(ON)</sub>         | Static Drain-Source On-Resistance     | V <sub>GS</sub> =10V, I <sub>D</sub> =6A<br>T <sub>J</sub> =125°C                         |     | 23.2<br>36 | 31<br>48 | mΩ    |    |
|                             |                                       | V <sub>GS</sub> =4.5V, I <sub>D</sub> =5A   |     | 32.6       | 45       | mΩ    |    |
| g <sub>FS</sub>             | Forward Transconductance              | V <sub>DS</sub> =5V, I <sub>D</sub> =6A   |     | 22         |          | S     |    |
| V <sub>SD</sub>             | Diode Forward Voltage                 | I <sub>S</sub> =1A, V <sub>GS</sub> =0V   |     | 0.77       | 1        | V     |    |
| I <sub>S</sub>              | Maximum Body-Diode Continuous Current |   |     |            | 3        | A     |    |
| <b>DYNAMIC PARAMETERS</b>   |                                       |   |     |            |          |       |    |
| C <sub>ISS</sub>            | Input Capacitance                     | V <sub>GS</sub> =0V, V <sub>DS</sub> =20V, f=1MHz   |     | 404        |          | pF    |    |
| C <sub>OSS</sub>            | Output Capacitance                    |   |     |            | 95       |       | pF |
| C <sub>RSS</sub>            | Reverse Transfer Capacitance          |   |     |            | 37       |       | pF |
| R <sub>g</sub>              | Gate resistance                       | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz  |     | 2.7        |          | Ω     |    |
| <b>SWITCHING PARAMETERS</b> |                                       |   |     |            |          |       |    |
| Q <sub>g(10V)</sub>         | Total Gate Charge                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, I <sub>D</sub> =6A                            |     | 8.3        |          | nC    |    |
| Q <sub>g(4.5V)</sub>        | Total Gate Charge                     |   |     |            | 4.2      |       | nC |
| Q <sub>gs</sub>             | Gate Source Charge                    |   |     |            | 1.3      |       | nC |
| Q <sub>gd</sub>             | Gate Drain Charge                     |   |     |            | 2.3      |       | nC |
| t <sub>D(on)</sub>          | Turn-On DelayTime                     | V <sub>GS</sub> =10V, V <sub>DS</sub> =20V, R <sub>L</sub> =3.3Ω,<br>R <sub>GEN</sub> =3Ω |     | 4.2        |          | ns    |    |
| t <sub>r</sub>              | Turn-On Rise Time                     |   |     |            | 3.3      |       | ns |
| t <sub>D(off)</sub>         | Turn-Off DelayTime                    |   |     |            | 15.6     |       | ns |
| t <sub>f</sub>              | Turn-Off Fall Time                    |   |     |            | 3        |       | ns |
| t <sub>rr</sub>             | Body Diode Reverse Recovery Time      | I <sub>F</sub> =6A, dI/dt=100A/μs   |     | 20.5       |          | ns    |    |
| Q <sub>rr</sub>             | Body Diode Reverse Recovery Charge    | I <sub>F</sub> =6A, dI/dt=100A/μs   |     | 14.5       |          | 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. The current rating is based on the t<sub>s</sub> ≤ 10s thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

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

D: The static characteristics in Figures 1 to 6 are obtained using 80μs 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.

Rev 3 : Sept 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CANNEL

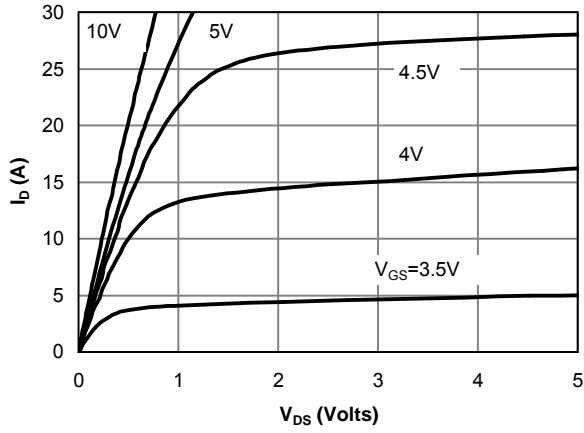


Fig 1: On-Region Characteristics

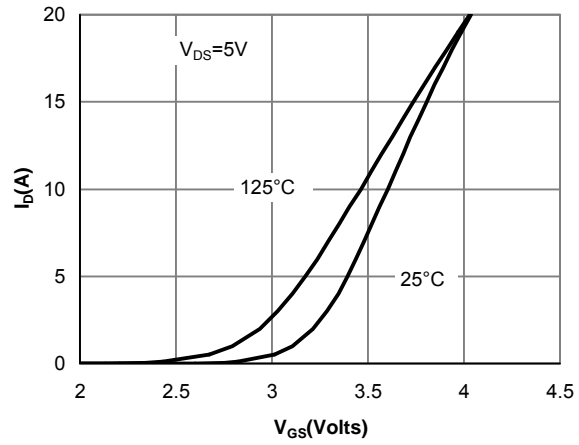


Figure 2: Transfer Characteristics

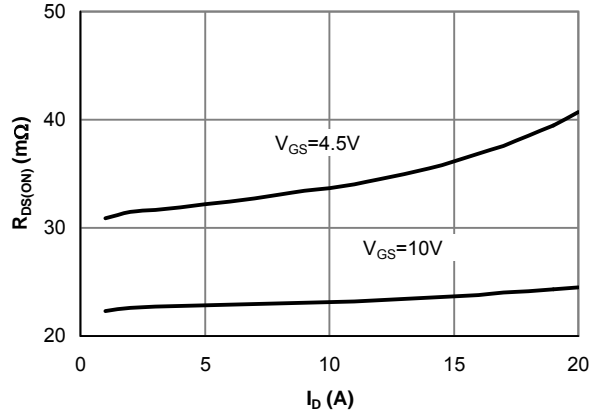


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

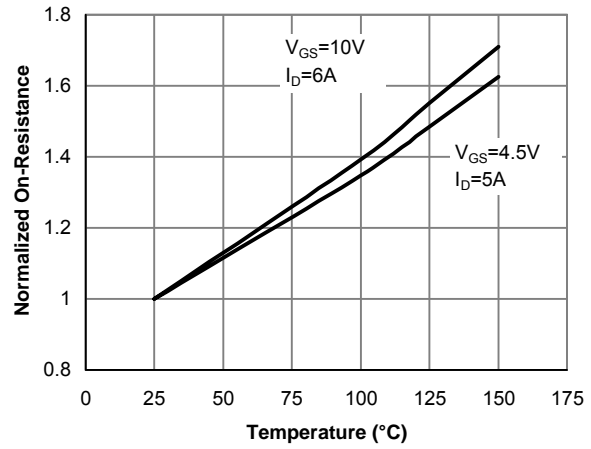


Figure 4: On-Resistance vs. Junction Temperature

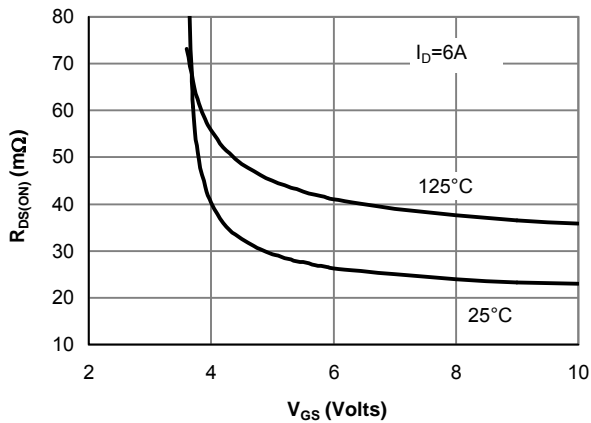


Figure 5: On-Resistance vs. Gate-Source Voltage

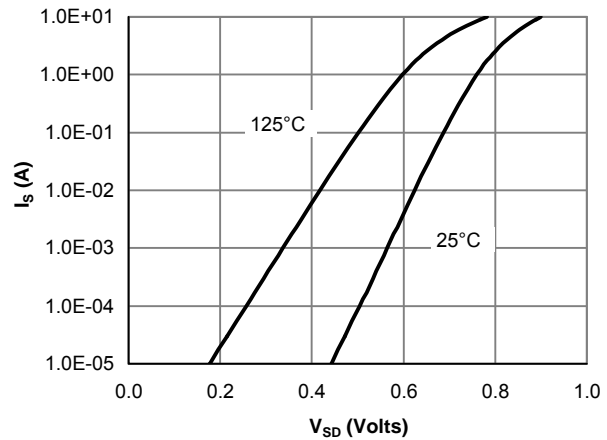


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

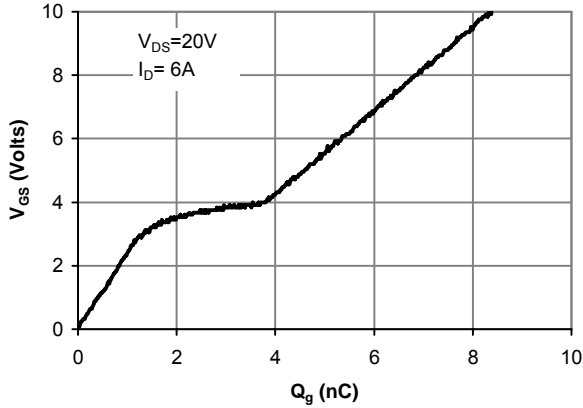


Figure 7: Gate-Charge Characteristics

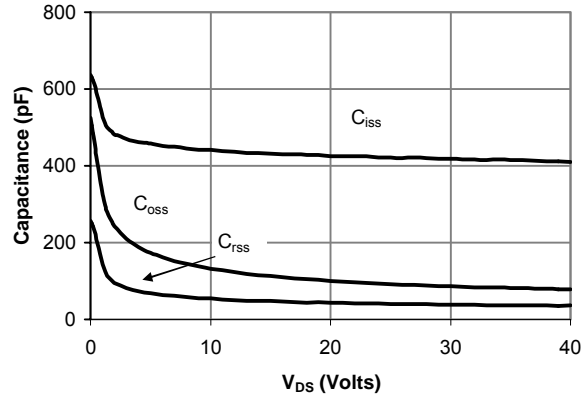


Figure 8: Capacitance Characteristics

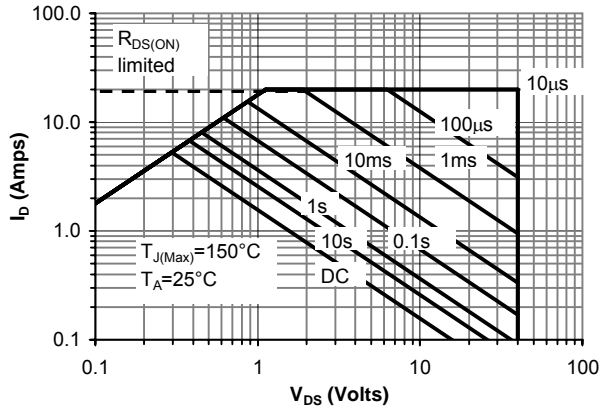


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

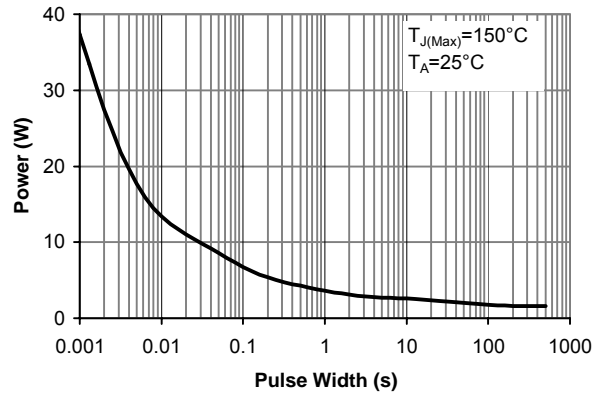


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

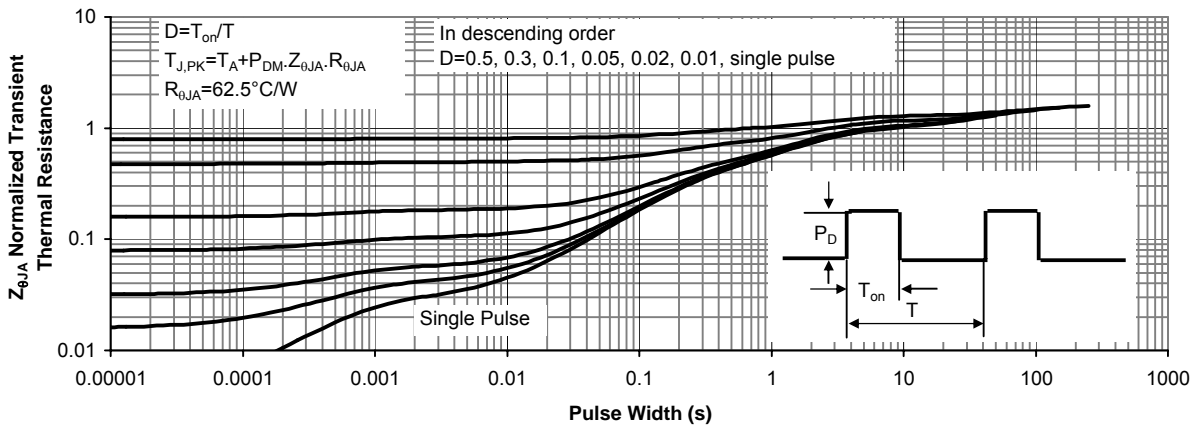


Figure 11: Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics ( $T_J=25^\circ\text{C}$  unless otherwise noted)

| Symbol                      | Parameter                             | Conditions   | Min  | Typ   | Max       | Units         |
|-----------------------------|---------------------------------------|--|--|-------|-----------|---------------|
| <b>STATIC PARAMETERS</b>    |                                       |  |  |       |           |               |
| $BV_{DSS}$                  | Drain-Source Breakdown Voltage        | $I_D=-10\text{mA}$ , $V_{GS}=0\text{V}$  | -40  |       |           | V             |
| $I_{DSS}$                   | Zero Gate Voltage Drain Current       | $V_{DS}=-32\text{V}$ , $V_{GS}=0\text{V}$<br>$T_J=55^\circ\text{C}$                |  |       | -1        | $\mu\text{A}$ |
|                             |                                       |  |  |       | -5        |               |
| $I_{GSS}$                   | Gate-Body leakage current             | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$                                       |  |       | $\pm 100$ | nA            |
| $V_{GS(th)}$                | Gate Threshold Voltage                | $V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$  | -1   | -1.9  | -3        | V             |
| $I_{D(ON)}$                 | On state drain current                | $V_{GS}=-10\text{V}$ , $V_{DS}=-5\text{V}$   | -20  |       |           | A             |
| $R_{DS(ON)}$                | Static Drain-Source On-Resistance     | $V_{GS}=-10\text{V}$ , $I_D=-5\text{A}$<br>$T_J=125^\circ\text{C}$                 |  | 34.7  | 45        | m $\Omega$    |
|                             |                                       |  |  | 52    | 65        |               |
|                             |                                       | $V_{GS}=-4.5\text{V}$ , $I_D=-2\text{A}$   |  | 50.6  | 63        | m $\Omega$    |
| $g_{FS}$                    | Forward Transconductance              | $V_{DS}=-5\text{V}$ , $I_D=-4.8\text{A}$   |  | 12    |           | S             |
| $V_{SD}$                    | Diode Forward Voltage                 | $I_S=-1\text{A}$ , $V_{GS}=0\text{V}$  |  | -0.75 | -1        | V             |
| $I_S$                       | Maximum Body-Diode Continuous Current |  |  |       | -3.2      | A             |
| <b>DYNAMIC PARAMETERS</b>   |                                       |  |  |       |           |               |
| $C_{ISS}$                   | Input Capacitance                     | $V_{GS}=0\text{V}$ , $V_{DS}=-20\text{V}$ , $f=1\text{MHz}$                        |  | 657   |           | pF            |
| $C_{OSS}$                   | Output Capacitance                    |  |  | 143   |           | pF            |
| $C_{RSS}$                   | Reverse Transfer Capacitance          |  |  | 63    |           | pF            |
| $R_g$                       | Gate resistance                       | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$                          |  | 6.5   |           | $\Omega$      |
| <b>SWITCHING PARAMETERS</b> |                                       |  |  |       |           |               |
| $Q_g(10\text{V})$           | Total Gate Charge (10V)               | $V_{GS}=-10\text{V}$ , $V_{DS}=-20\text{V}$ , $I_D=-5\text{A}$                     |  | 13.6  |           | nC            |
| $Q_g(4.5\text{V})$          | Total Gate Charge (4.5V)              |  |  | 6.8   |           | nC            |
| $Q_{gs}$                    | Gate Source Charge                    |  |  | 1.8   |           | nC            |
| $Q_{gd}$                    | Gate Drain Charge                     |  |  | 3.9   |           | nC            |
| $t_{D(on)}$                 | Turn-On DelayTime                     | $V_{GS}=-10\text{V}$ , $V_{DS}=-20\text{V}$ , $R_L=4\Omega$ ,<br>$R_{GEN}=3\Omega$ |  | 7.5   |           | ns            |
| $t_r$                       | Turn-On Rise Time                     |  |  | 6.7   |           | ns            |
| $t_{D(off)}$                | Turn-Off DelayTime                    |  |  | 26    |           | ns            |
| $t_f$                       | Turn-Off Fall Time                    |  |  | 11.2  |           | ns            |
| $t_{rr}$                    | Body Diode Reverse Recovery Time      |  | $I_F=-5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$ |       | 22.3      |               |
| $Q_{rr}$                    | Body Diode Reverse Recovery Charge    | $I_F=-5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                 |  | 15.2  |           | nC            |

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^\circ\text{C}$ . The value in any given application depends on the user's specific board design. The current rating is based on the  $\leq 10\text{s}$  thermal resistance rating.

B: Repetitive rating, pulse width limited by junction temperature.

C: The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

D: The static characteristics in Figures 1 to 6,12,14 are obtained using 80 $\mu\text{s}$  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  $T_A=25^\circ\text{C}$ . The SOA curve provides a single pulse rating.

Rev 3 : Sept 2005

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

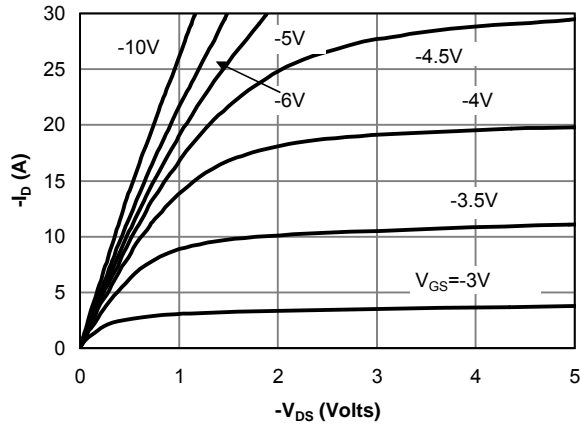


Fig 1: On-Region Characteristics

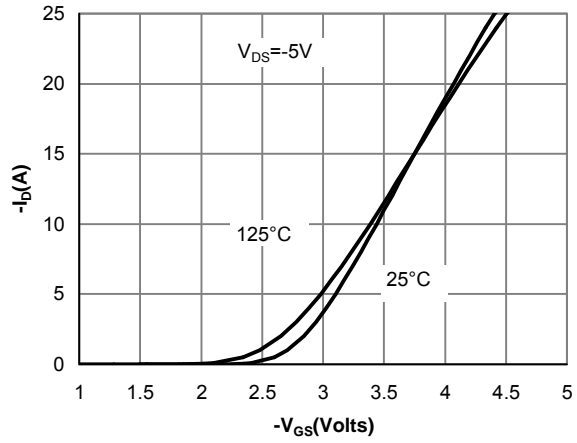


Figure 2: Transfer Characteristics

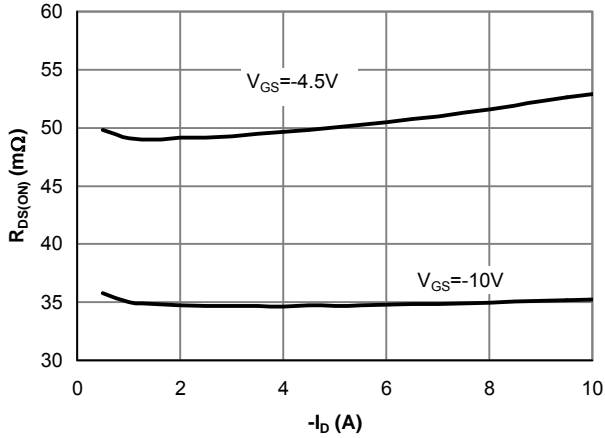


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

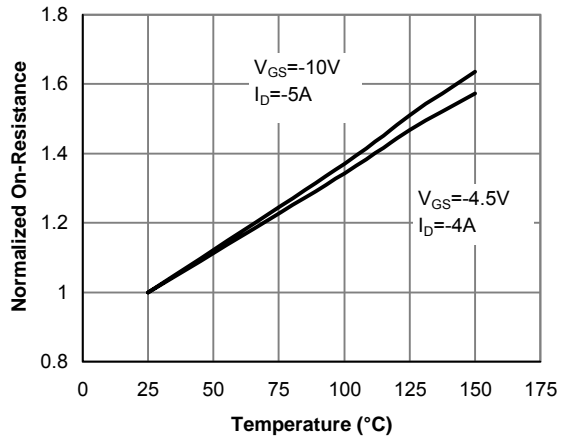


Figure 4: On-Resistance vs. Junction Temperature

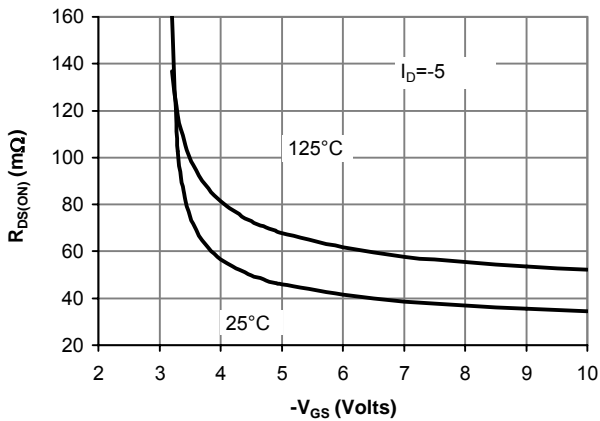


Figure 5: On-Resistance vs. Gate-Source Voltage

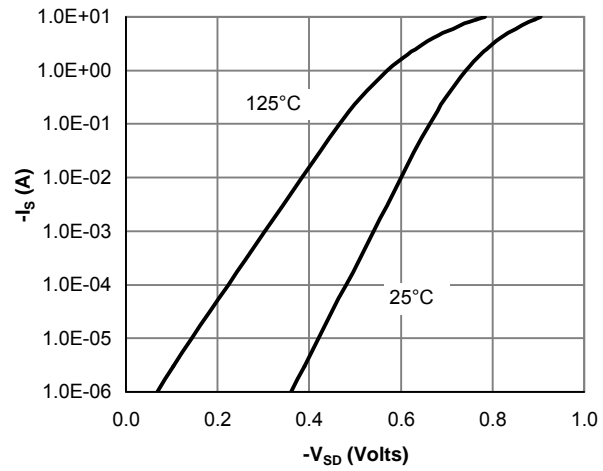


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

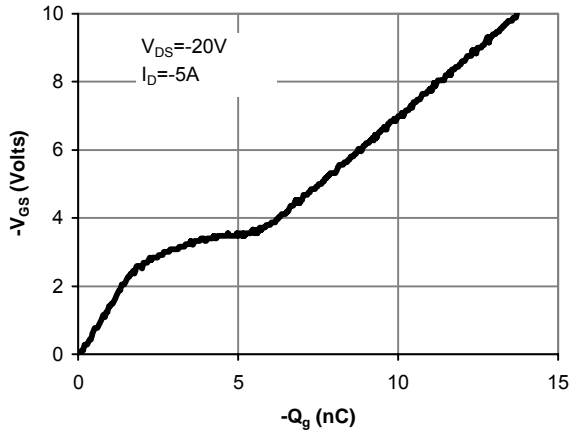


Figure 7: Gate-Charge Characteristics

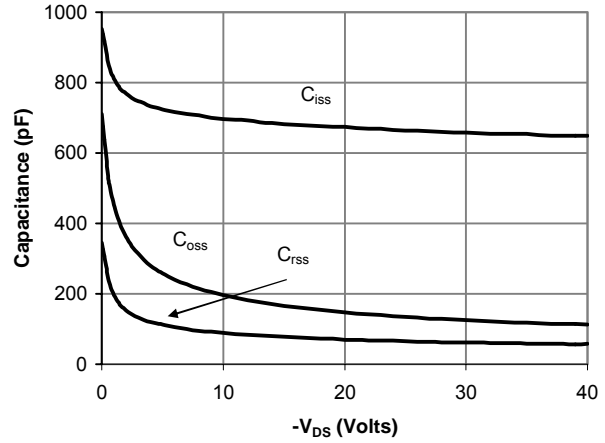


Figure 8: Capacitance Characteristics

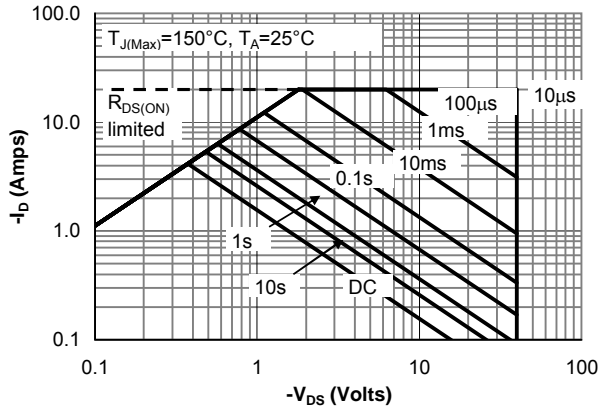


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

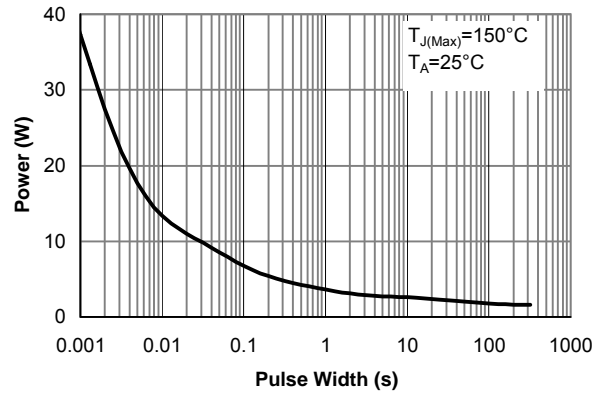


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

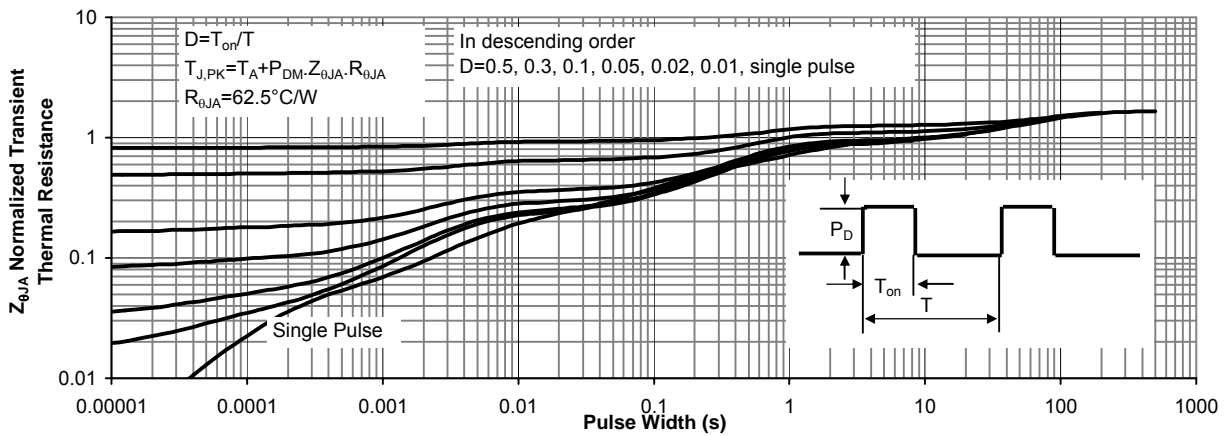


Figure 11: Normalized Maximum Transient Thermal Impedance