



AO4611

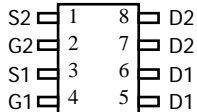
Complementary Enhancement Mode Field Effect Transistor

General Description

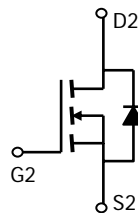
The AO4611 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. *Standard Product AO4611 is Pb-free (meets ROHS & Sony 259 specifications). AO4611L is a Green Product ordering option. AO4611 and AO4611L are electrically identical.*

Features

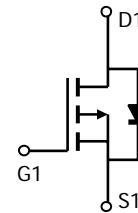
| | |
|----------------------------------|-------------------------------------|
| n-channel | p-channel |
| V_{DS} (V) = 60V | -60V |
| I_D = 6.3A (V_{GS} =10V) | -4.9A ($V_{GS} = -10V$) |
| $R_{DS(ON)}$ | $R_{DS(ON)}$ |
| < 25m Ω (V_{GS} =10V) | < 42m Ω ($V_{GS} = -10V$) |
| < 30m Ω (V_{GS} =4.5V) | < 52m Ω ($V_{GS} = -4.5V$) |



SOIC-8



n-channel



p-channel

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

| Parameter | Symbol | Max n-channel | Max p-channel | Units | |
|--|----------------|------------------------|---------------|------------------|---|
| Drain-Source Voltage | V_{DS} | 60 | -60 | V | |
| Gate-Source Voltage | V_{GS} | ± 20 | ± 20 | V | |
| Continuous Drain Current ^A | I_D | $T_A=25^\circ\text{C}$ | 6.3 | -4.9 | A |
| | | $T_A=70^\circ\text{C}$ | 5 | -3.9 | |
| Pulsed Drain Current ^B | I_{DM} | 40 | -30 | | |
| Power Dissipation | P_D | $T_A=25^\circ\text{C}$ | 2 | 2 | W |
| | | $T_A=70^\circ\text{C}$ | 1.28 | 1.28 | |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | -55 to 150 | $^\circ\text{C}$ | |

Thermal Characteristics: n-channel and p-channel

| Parameter | Symbol | Device | Typ | Max | Units |
|--|-----------------|--------|-----|------|--------------------|
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | n-ch | 48 | 62.5 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient ^A | | n-ch | 74 | 110 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | n-ch | 35 | 60 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | p-ch | 48 | 62.5 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Ambient ^A | | p-ch | 74 | 110 | $^\circ\text{C/W}$ |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | p-ch | 35 | 40 | $^\circ\text{C/W}$ |

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|---------------------------------------|--|-----|----------|----------|---------------|
| STATIC PARAMETERS | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$ | 60 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=48\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | 1 5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$ | | | 100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$ | 1 | 2.1 | 3 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}=10\text{V}$, $V_{DS}=5\text{V}$ | 40 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10\text{V}$, $I_D=6.3\text{A}$ $T_J=125^\circ\text{C}$ | | 20 34 | 25 42 | m Ω |
| | | $V_{GS}=4.5\text{V}$, $I_D=5.7\text{A}$ | | 22 | 30 | m Ω |
| g_{FS} | Forward Transconductance | $V_{DS}=5\text{V}$, $I_D=6.3\text{A}$ | | 27 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=1\text{A}$, $V_{GS}=0\text{V}$ | | 0.74 | 1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | 3 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=30\text{V}$, $f=1\text{MHz}$ | | 1920 | 2300 | pF |
| C_{oss} | Output Capacitance | | | 155 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 116 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 0.65 | 0.8 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_g(10\text{V})$ | Total Gate Charge | $V_{GS}=10\text{V}$, $V_{DS}=30\text{V}$, $I_D=6.3\text{A}$ | | 47.6 | 58 | nC |
| $Q_g(4.5\text{V})$ | Total Gate Charge | | | 24.2 | 30 | nC |
| Q_{gs} | Gate Source Charge | | | 6 | | nC |
| Q_{gd} | Gate Drain Charge | | | 14.4 | | nC |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}=10\text{V}$, $V_{DS}=30\text{V}$, $R_L=4.7\Omega$, $R_{GEN}=3\Omega$ | | 7.6 | | ns |
| t_r | Turn-On Rise Time | | | 5 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 28.9 | | ns |
| t_f | Turn-Off Fall Time | | | 5.5 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=6.3\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 33.2 | 40 | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=6.3\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 43 | | nC |

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in² 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 $t \leq 10\text{s}$ 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 are obtained using 80 μs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in² 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.

Rev4: August 2005

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CANNEL

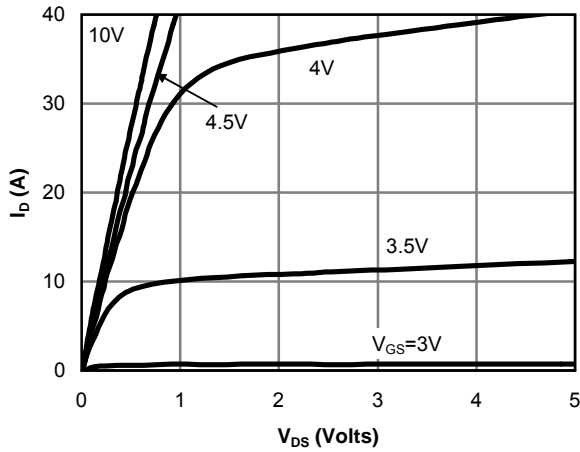


Fig 1: On-Region Characteristics

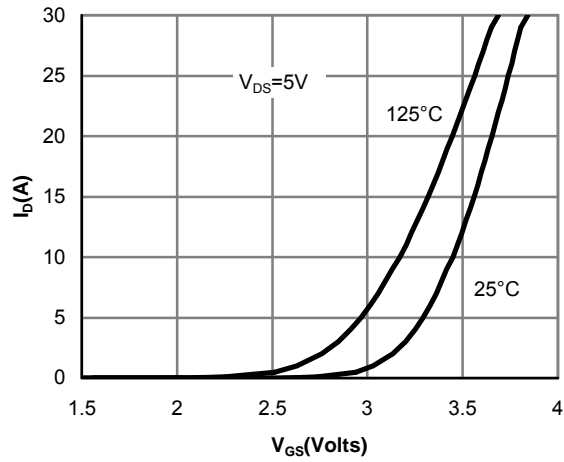


Figure 2: Transfer Characteristics

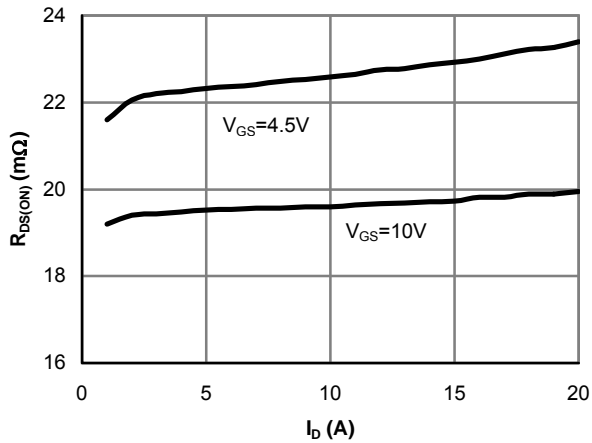


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

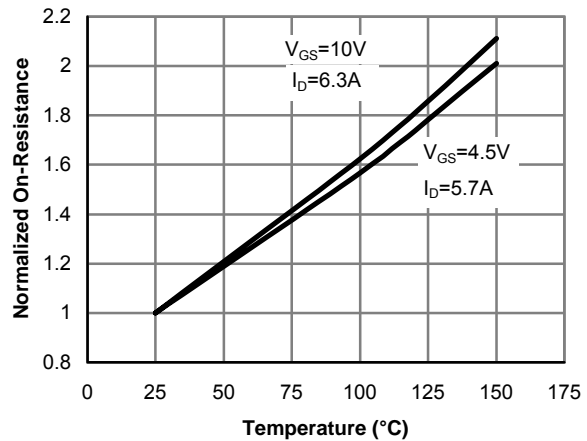


Figure 4: On-Resistance vs. Junction Temperature

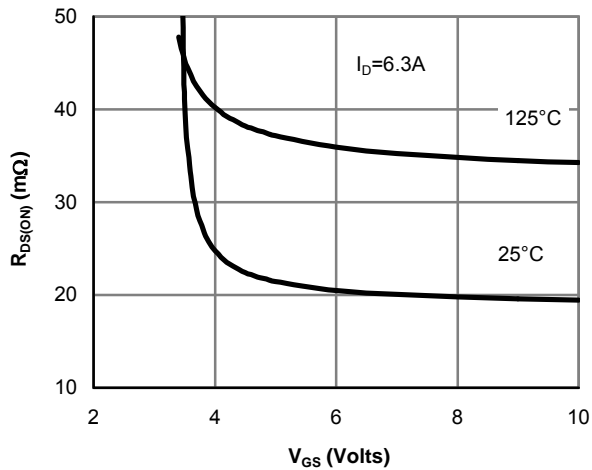


Figure 5: On-Resistance vs. Gate-Source Voltage

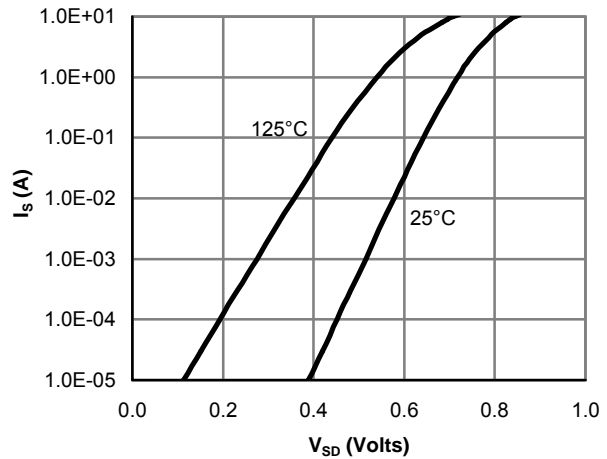


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: N-CHANNEL

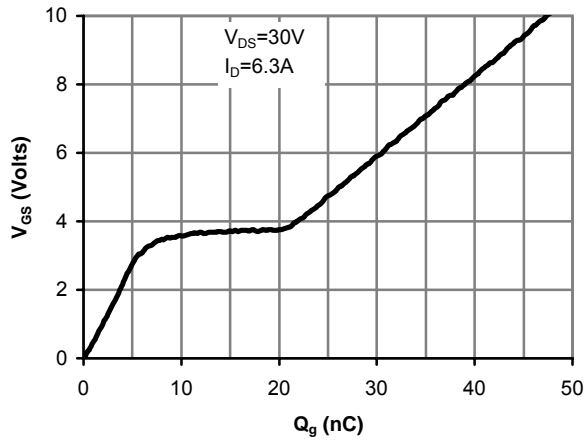


Figure 7: Gate-Charge Characteristics

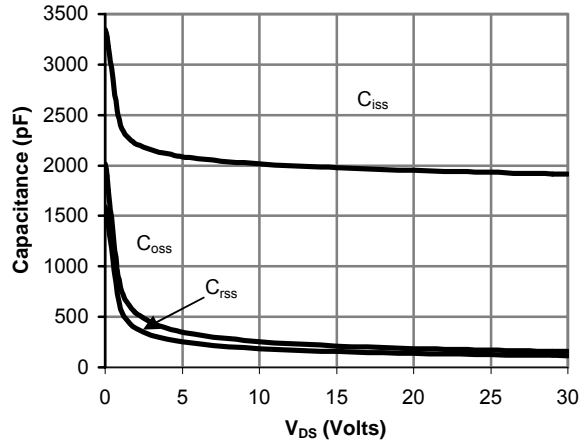


Figure 8: Capacitance Characteristics

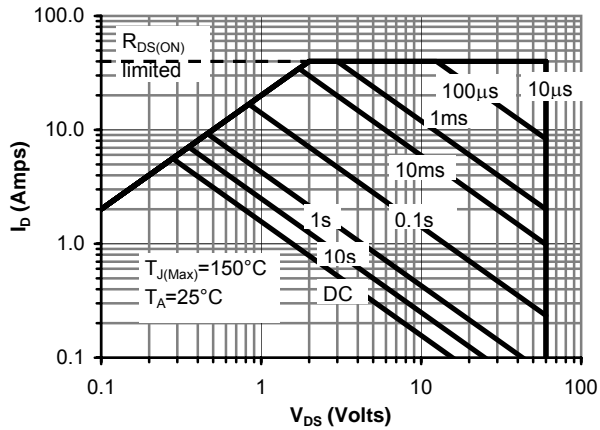


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

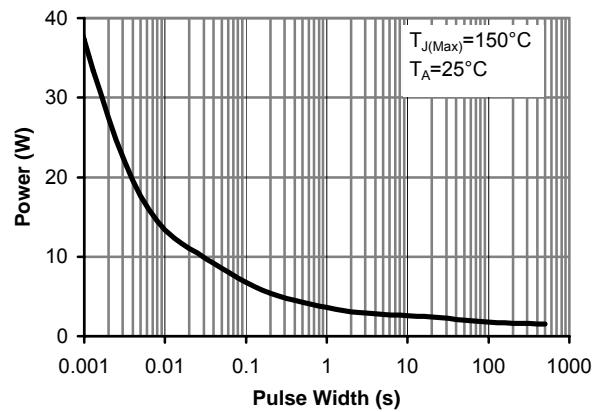


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

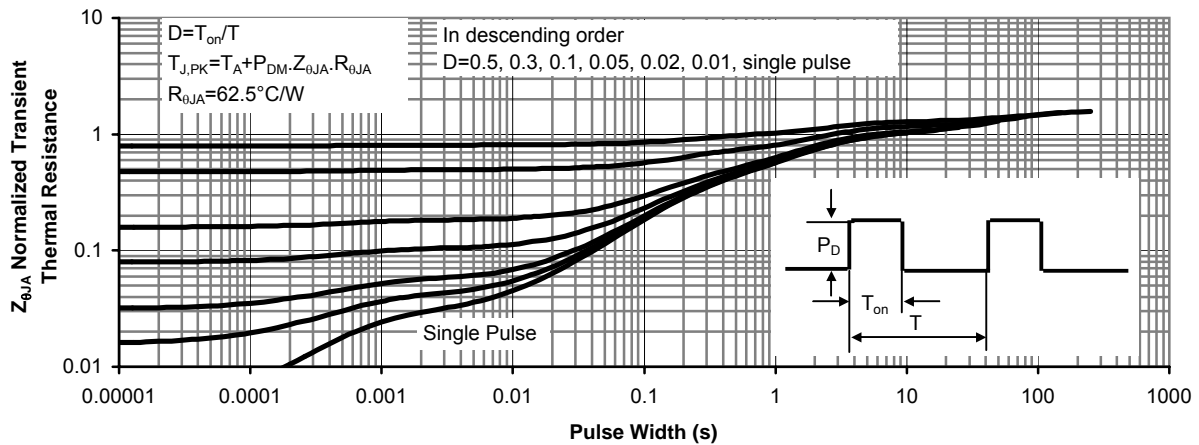


Figure 11: Normalized Maximum Transient Thermal Impedance

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------------------------|---------------------------------------|--|--|----------|-----------|---------------|
| STATIC PARAMETERS | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$ | -60 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=-48\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | -1 -5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS}=0\text{V}$, $V_{GS}=\pm 20\text{V}$ | | | ± 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 | $V_{GS}=-10\text{V}$, $V_{DS}=-5\text{V}$ | -30 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=-10\text{V}$, $I_D=-4.9\text{A}$ $T_J=125^\circ\text{C}$ | | 34 58 | 42 72 | m Ω |
| | | $V_{GS}=-4.5\text{V}$, $I_D=-4.4\text{A}$ | | 42 | 52 | m Ω |
| g_{FS} | Forward Transconductance | $V_{DS}=-5\text{V}$, $I_D=-4.9\text{A}$ | | 17.8 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=-1\text{A}$, $V_{GS}=0\text{V}$ | | -0.73 | -1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | -3 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=-30\text{V}$, $f=1\text{MHz}$ | | 2417 | 2900 | pF |
| C_{oss} | Output Capacitance | | | 179 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 120 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 1.9 | 2.3 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_g(10\text{V})$ | Total Gate Charge (10V) | $V_{GS}=-10\text{V}$, $V_{DS}=-30\text{V}$, $I_D=-4.9\text{A}$ | | 45.2 | 55 | nC |
| $Q_g(4.5\text{V})$ | Total Gate Charge (4.5V) | | | 22.8 | 28 | nC |
| Q_{gs} | Gate Source Charge | | | 5.8 | | nC |
| Q_{gd} | Gate Drain Charge | | | 9.6 | | nC |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}=-10\text{V}$, $V_{DS}=-30\text{V}$, $R_L=6.2\Omega$, $R_{GEN}=3\Omega$ | | 9.8 | | ns |
| t_r | Turn-On Rise Time | | | 6.1 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 44 | | ns |
| t_f | Turn-Off Fall Time | | | 12.7 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | | $I_F=-4.9\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 32 | 42 |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=-4.9\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 42 | | nC |

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1 in² 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 $t \leq 10\text{s}$ 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 μs pulses, duty cycle 0.5% max.

E: These tests are performed with the device mounted on 1 in² 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.

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

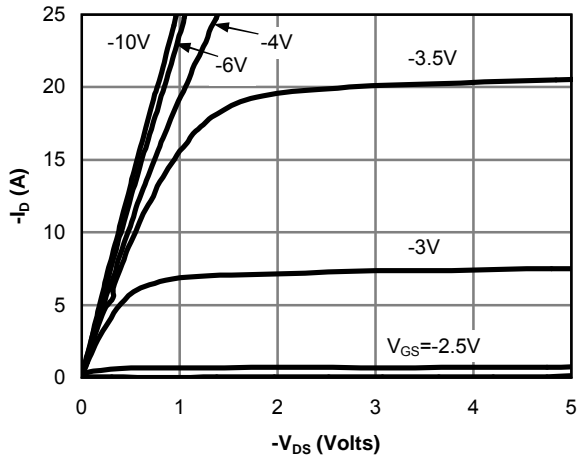


Fig 1: On-Region Characteristics

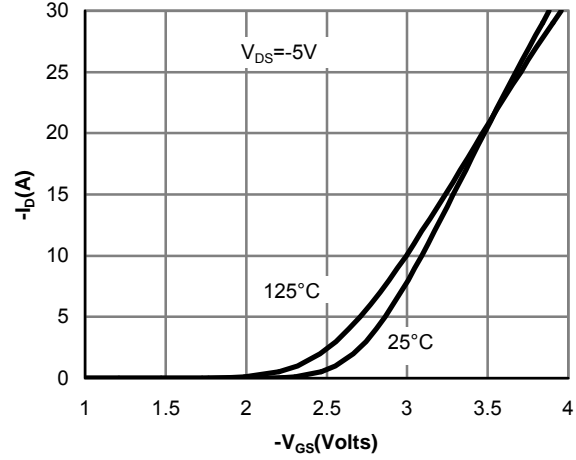


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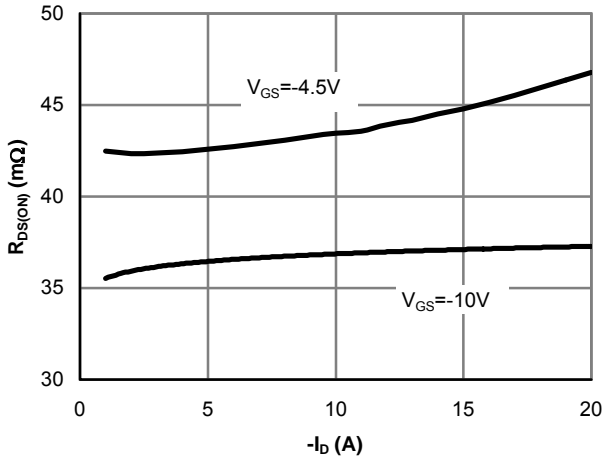


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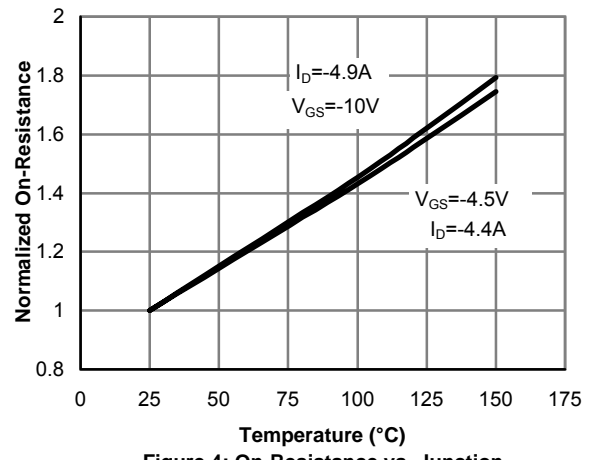


Figure 4: On-Resistance vs. Junction Temperature

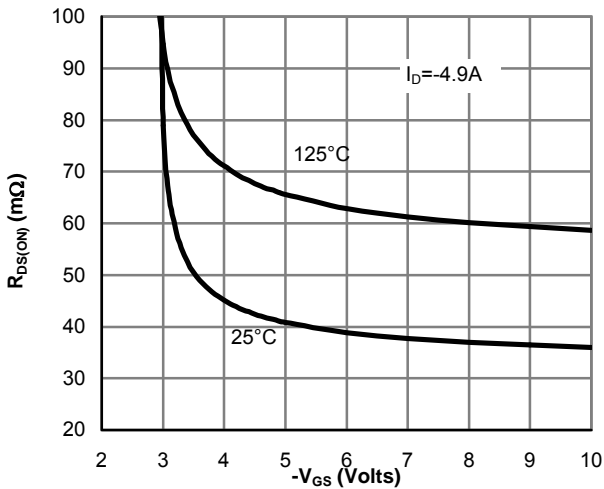


Figure 5: On-Resistance vs. Gate-Source Voltage

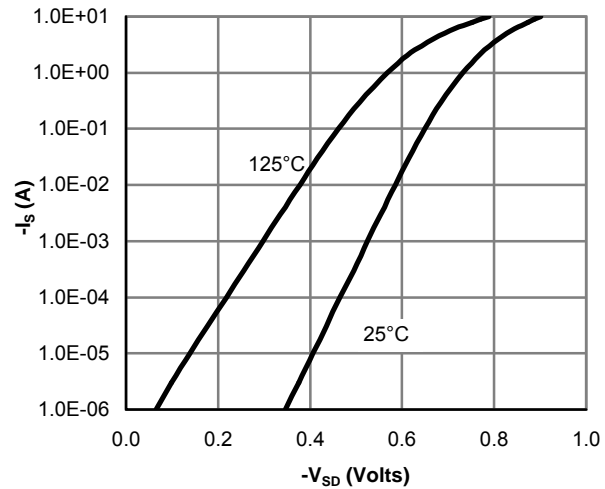


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: P-CHANNEL

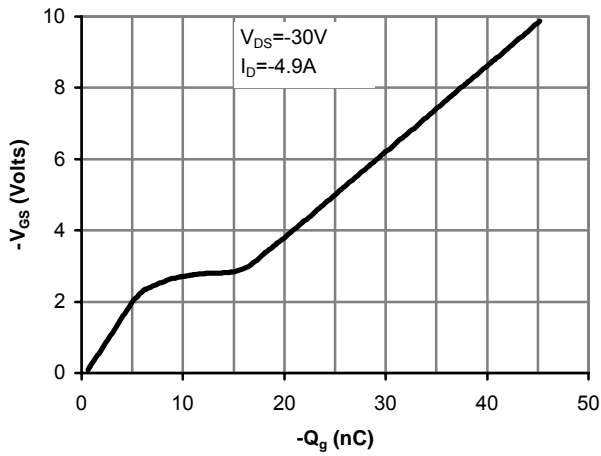


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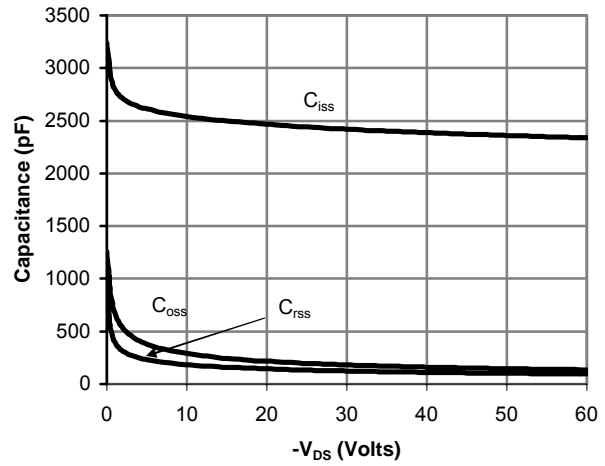


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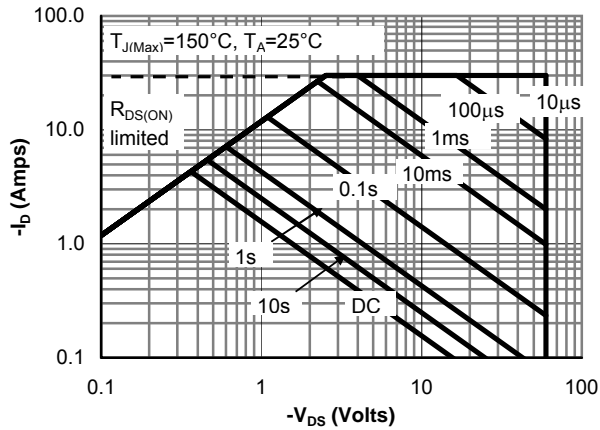


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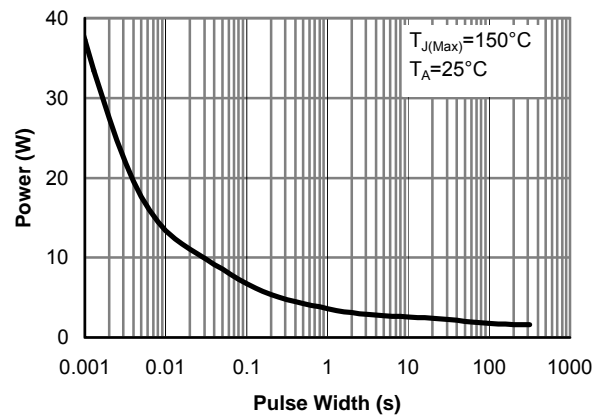


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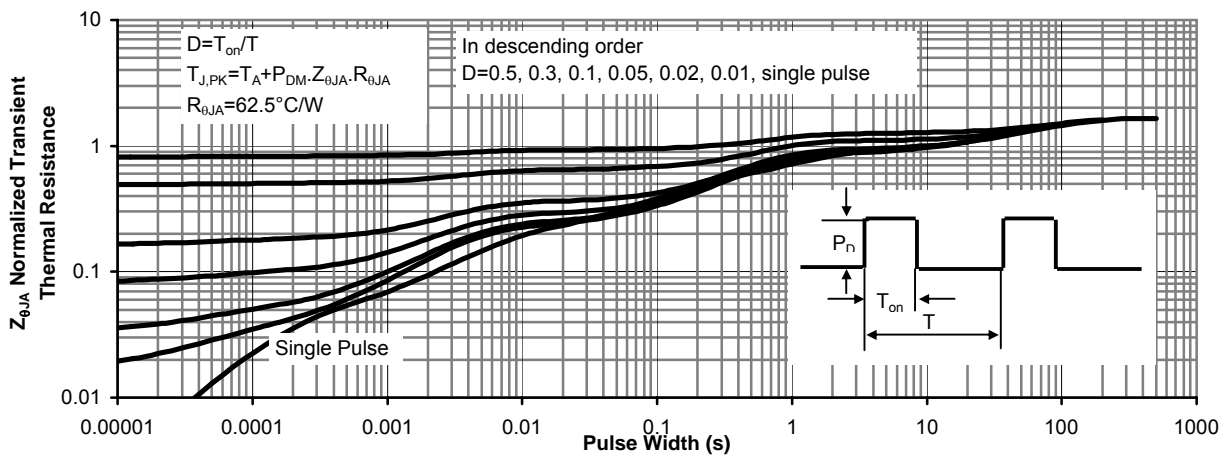


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