



AO4606

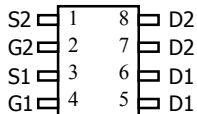
Complementary Enhancement Mode Field Effect Transistor

General Description

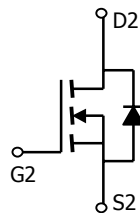
The AO4606 uses advanced trench technology MOSFETs to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

Features

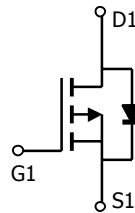
| | |
|-----------------------------|-------------------------------|
| n-channel | p-channel |
| $V_{DS} (V) = 30V$ | -30V |
| $I_D = 6.9A$ | -6A |
| $R_{DS(ON)}$ | $R_{DS(ON)}$ |
| $< 28m\Omega (V_{GS}=10V)$ | $< 35m\Omega (V_{GS} = 10V)$ |
| $< 42m\Omega (V_{GS}=4.5V)$ | $< 58m\Omega (V_{GS} = 4.5V)$ |



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} | 30 | -30 | V | |
| Gate-Source Voltage | V_{GS} | ± 20 | ± 20 | V | |
| Continuous Drain Current ^A | I_D | $T_A=25^\circ C$ | 6.9 | -6 | A |
| | | $T_A=70^\circ C$ | 5.8 | -5 | |
| Pulsed Drain Current ^B | I_{DM} | 30 | -30 | | |
| Power Dissipation | P_D | $T_A=25^\circ C$ | 2 | 2 | W |
| | | $T_A=70^\circ C$ | 1.44 | 1.44 | |
| 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 ^A | $R_{\theta JA}$ | n-ch | 48 | 62.5 | $^\circ C/W$ |
| Maximum Junction-to-Ambient ^A | | n-ch | 74 | 110 | $^\circ C/W$ |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | n-ch | 35 | 60 | $^\circ C/W$ |
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | p-ch | 48 | 62.5 | $^\circ C/W$ |
| Maximum Junction-to-Ambient ^A | | p-ch | 74 | 110 | $^\circ C/W$ |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | p-ch | 35 | 40 | $^\circ C/W$ |

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 | $I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$ | 30 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | 1 | μA |
| | | | | | 5 | |
| 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 | $V_{GS}=4.5\text{V}$, $V_{DS}=5\text{V}$ | 20 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}=10\text{V}$, $I_D=6.9\text{A}$ $T_J=125^\circ\text{C}$ | | 22.5 | 28 | m Ω |
| | | | | 31.3 | 38 | |
| | | | $V_{GS}=4.5\text{V}$, $I_D=5.0\text{A}$ | | 34.5 | |
| g_{FS} | Forward Transconductance | $V_{DS}=5\text{V}$, $I_D=6.9\text{A}$ | 10 | 15.4 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=1\text{A}$ | | 0.76 | 1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | 3 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=15\text{V}$, $f=1\text{MHz}$ | | 680 | | pF |
| C_{oss} | Output Capacitance | | | 102 | | pF |
| C_{riss} | Reverse Transfer Capacitance | | | 77 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 3 | | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_g(10\text{V})$ | Total Gate Charge | $V_{GS}=10\text{V}$, $V_{DS}=15\text{V}$, $I_D=6.9\text{A}$ | | 13.84 | | nC |
| $Q_g(4.5\text{V})$ | Total Gate Charge | | | 6.74 | | nC |
| Q_{gs} | Gate Source Charge | | | 1.82 | | nC |
| Q_{gd} | Gate Drain Charge | | | 3.2 | | nC |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}=10\text{V}$, $V_{DS}=15\text{V}$, $R_L=2.2\Omega$, $R_{GEN}=3\Omega$ | | 4.6 | | ns |
| t_r | Turn-On Rise Time | | | 4.1 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 20.6 | | ns |
| t_f | Turn-Off Fall Time | | | 5.2 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=6.9\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 16.5 | | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=6.9\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 7.8 | | 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 a 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.

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 | $I_D=-250\mu\text{A}$, $V_{GS}=0\text{V}$ | -30 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=-24\text{V}$, $V_{GS}=0\text{V}$ $T_J=55^\circ\text{C}$ | | | -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 | -2 | -2.4 | 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 | $V_{GS}=-10\text{V}$, $I_D=-6\text{A}$ $T_J=125^\circ\text{C}$ | | 28 37 | 35 45 | $\text{m}\Omega$ |
| | | $V_{GS}=-4.5\text{V}$, $I_D=-5\text{A}$ | | 44 | 58 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS}=-5\text{V}$, $I_D=-6\text{A}$ | | 13 | | S |
| V_{SD} | Diode Forward Voltage | $I_S=-1\text{A}$, $V_{GS}=0\text{V}$ | | -0.76 | -1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | -4.2 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=-15\text{V}$, $f=1\text{MHz}$ | | 920 | | pF |
| C_{oss} | Output Capacitance | | | 190 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 122 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 3.6 | | Ω |
| SWITCHING PARAMETERS | | | | | | |
| $Q_g(10\text{V})$ | Total Gate Charge (10V) | $V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $I_D=-6\text{A}$ | | 18.5 | | nC |
| $Q_g(4.5\text{V})$ | Total Gate Charge (4.5V) | | | 9.6 | | nC |
| Q_{gs} | Gate Source Charge | | | 2.7 | | nC |
| Q_{gd} | Gate Drain Charge | | | 4.5 | | nC |
| $t_{D(on)}$ | Turn-On Delay Time | $V_{GS}=-10\text{V}$, $V_{DS}=-15\text{V}$, $R_L=2.7\Omega$, $R_{GEN}=3\Omega$ | | 7.7 | | ns |
| t_r | Turn-On Rise Time | | | 5.7 | | ns |
| $t_{D(off)}$ | Turn-Off Delay Time | | | 20.2 | | ns |
| t_f | Turn-Off Fall Time | | | 9.5 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=-6\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 20 | | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=-6\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 8.8 | | 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 a 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.

N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

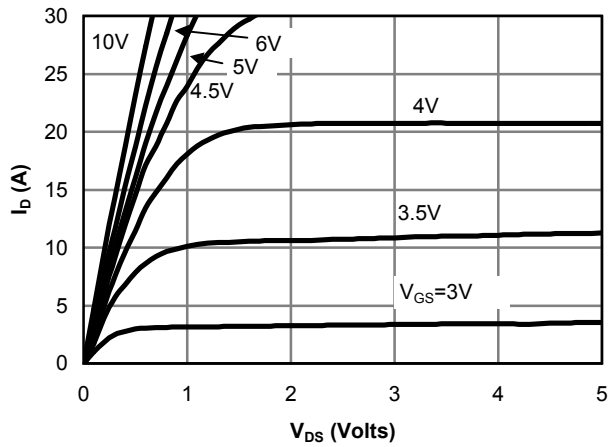


Fig 1: On-Region Characteristics

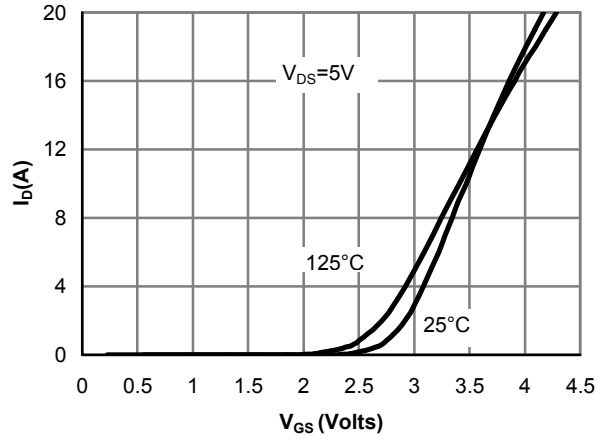


Figure 2: Transfer Characteristics

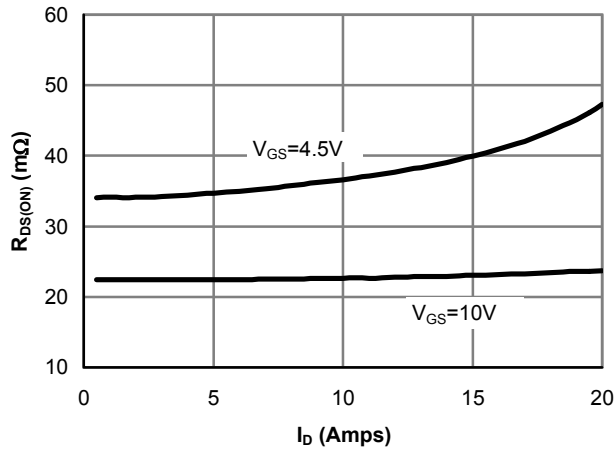


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

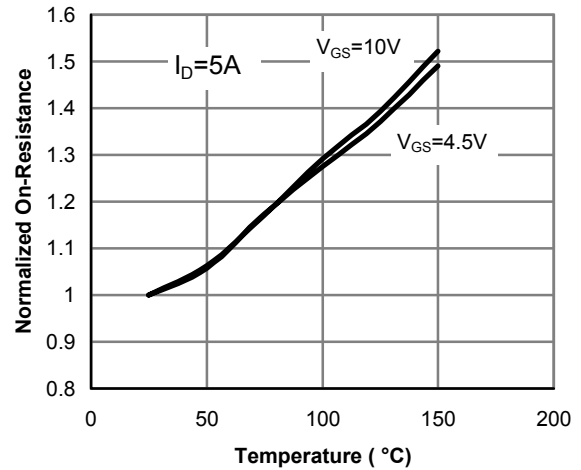


Figure 4: On-Resistance vs. Junction Temperature

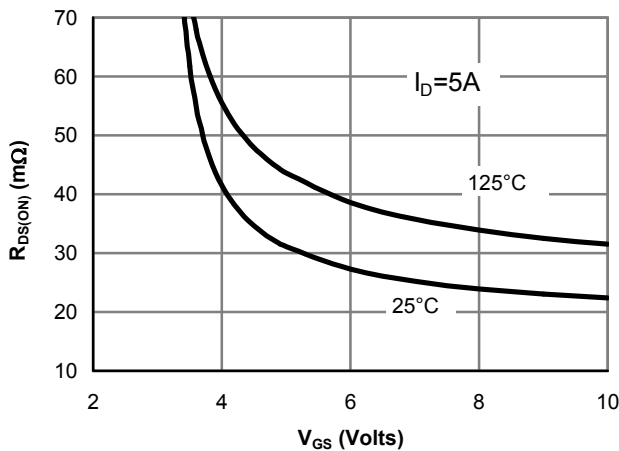


Figure 5: On-Resistance vs. Gate-Source Voltage

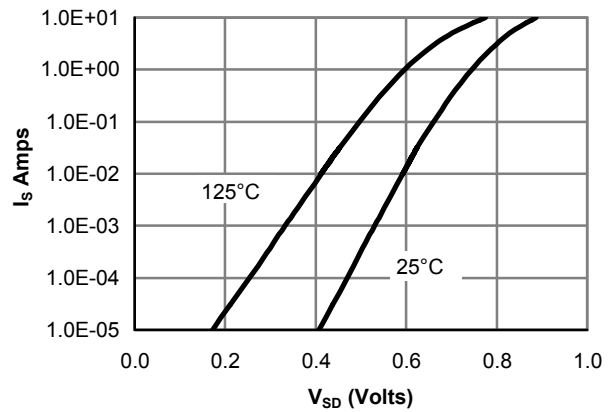


Figure 6: Body diode characteristics

N-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

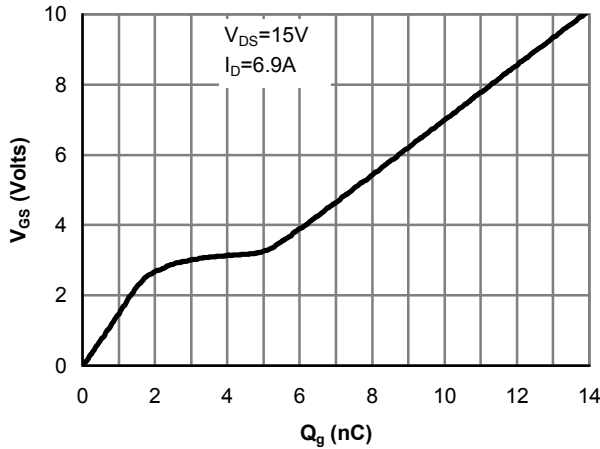


Figure 7: Gate-Charge characteristics

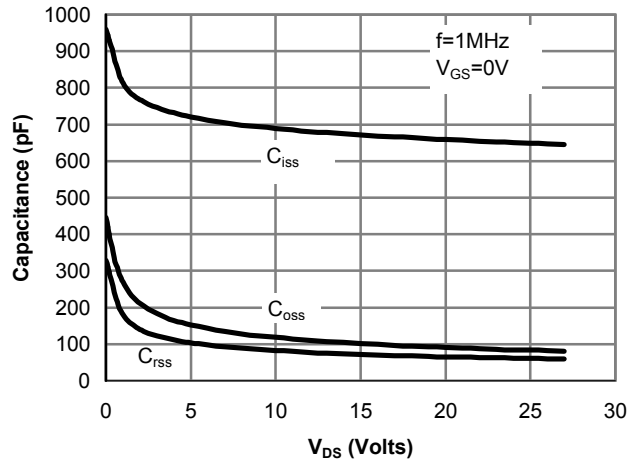


Figure 8: Capacitance Characteristics

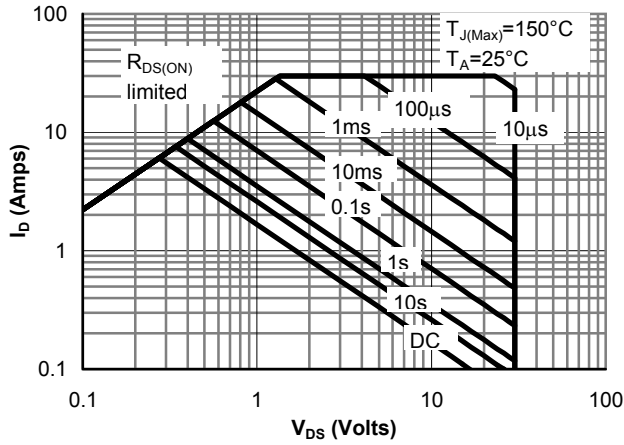


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

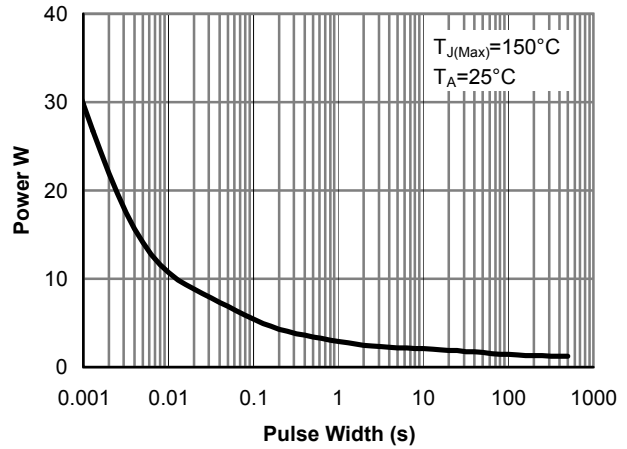


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

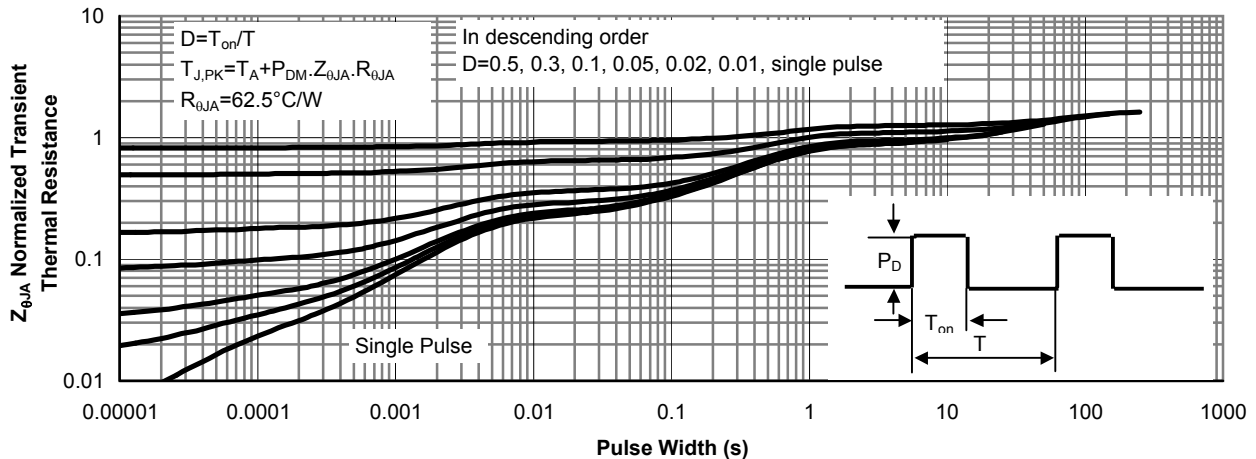


Figure 11: Normalized Maximum Transient Thermal Impedance

P-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

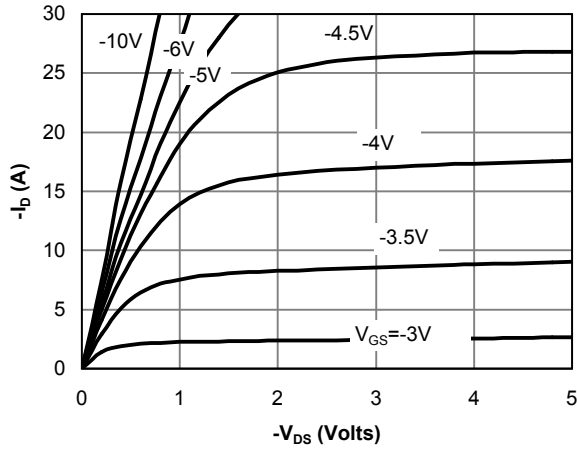


Fig 1: On-Region Characteristics

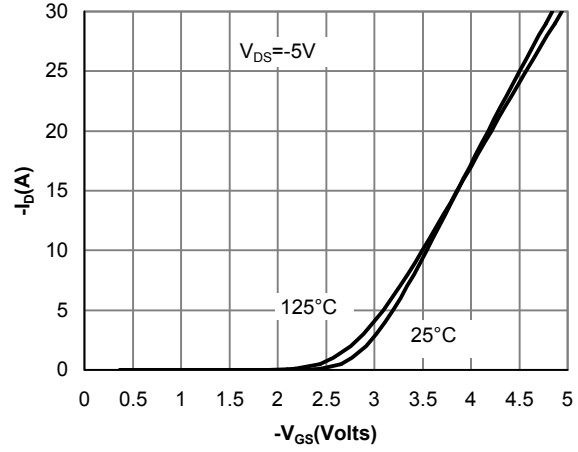


Figure 2: Transfer Characteristics

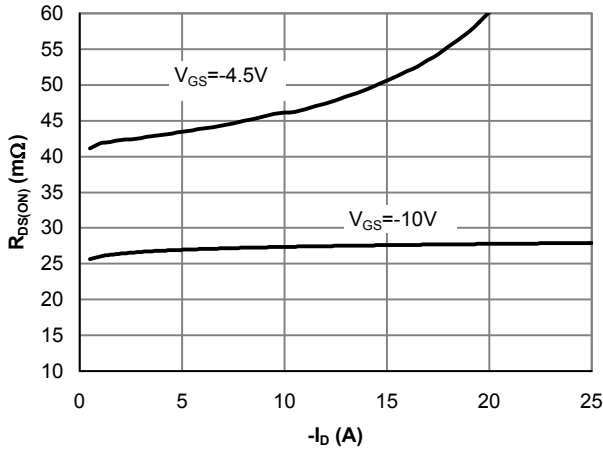


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

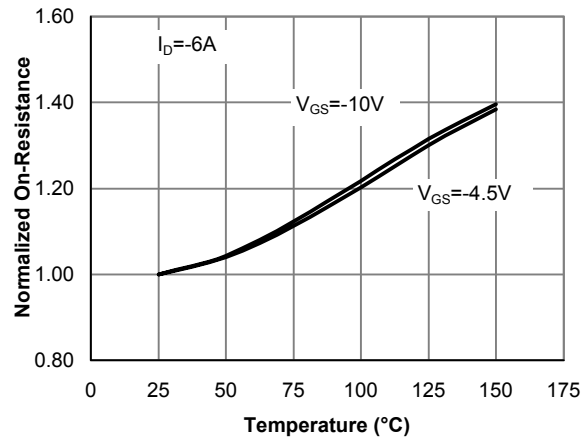


Figure 4: On-Resistance vs. Junction Temperature

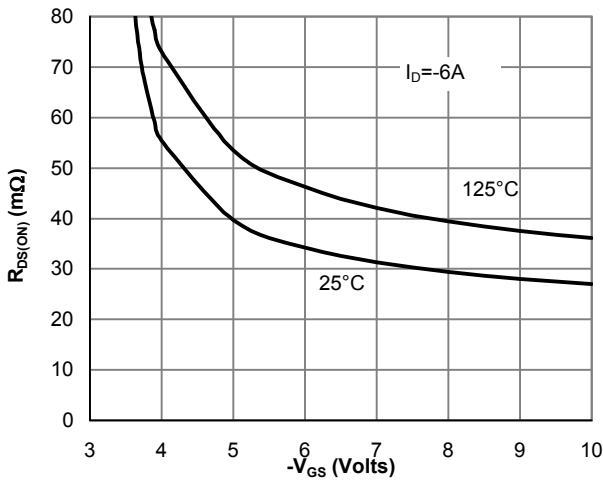


Figure 5: On-Resistance vs. Gate-Source Voltage

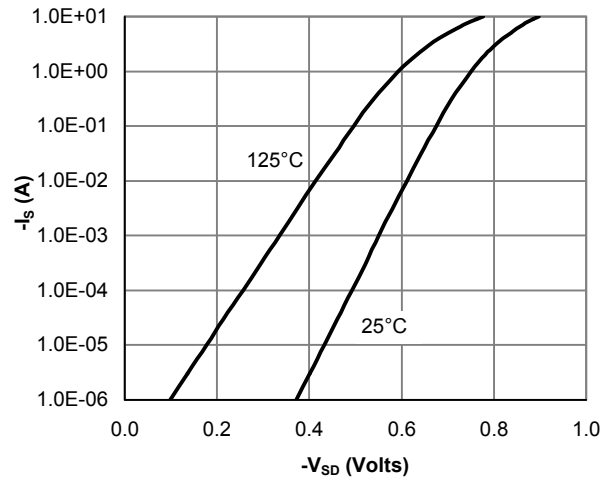


Figure 6: Body-Diode Characteristics

P-CHANNEL TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

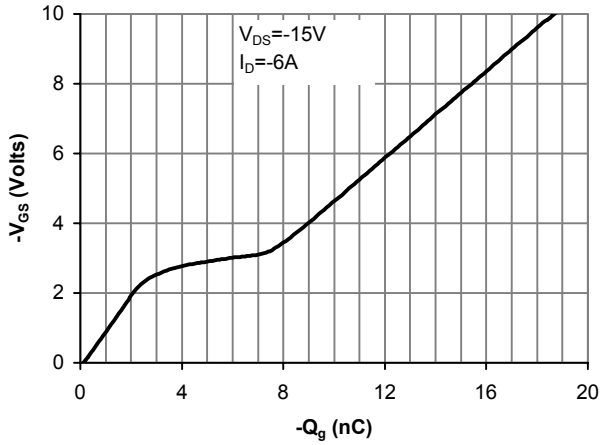


Figure 7: Gate-Charge Characteristics

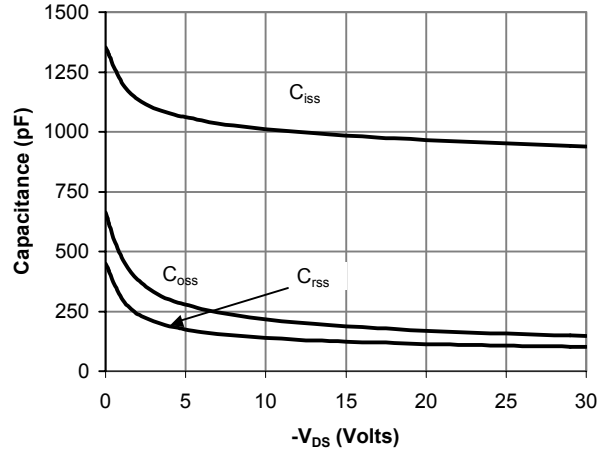


Figure 8: Capacitance Characteristics

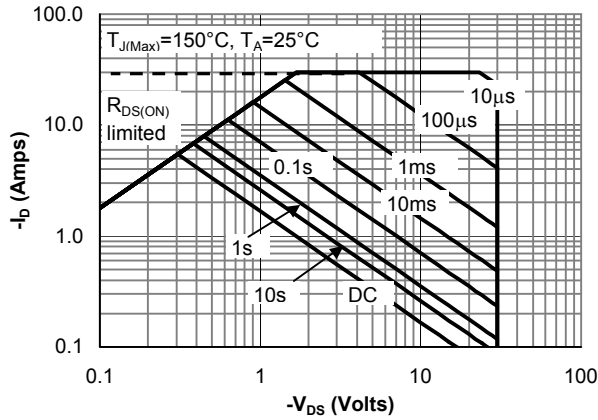


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

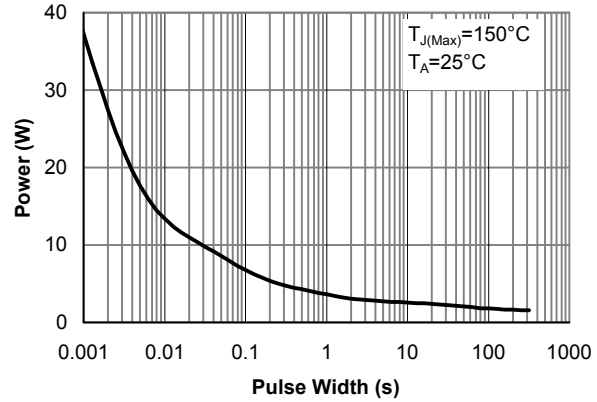


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

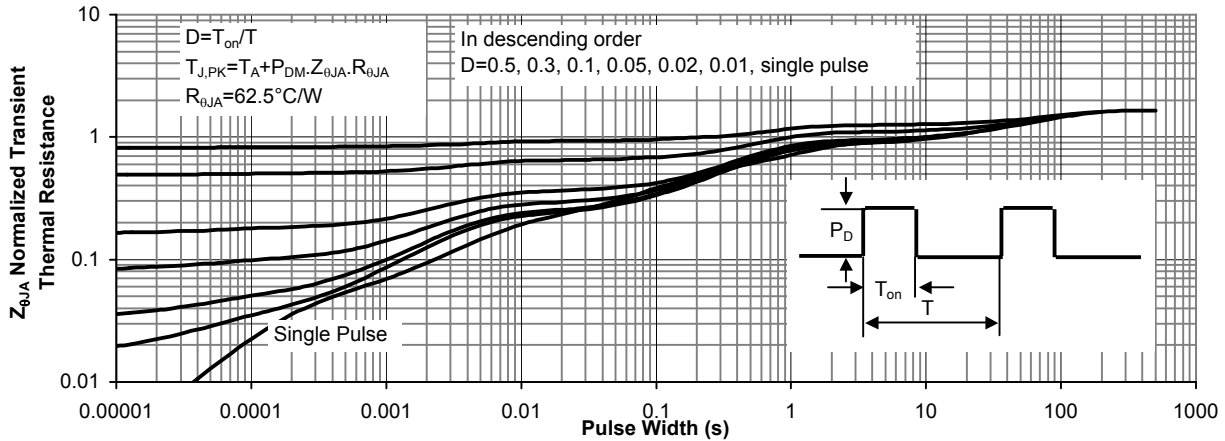
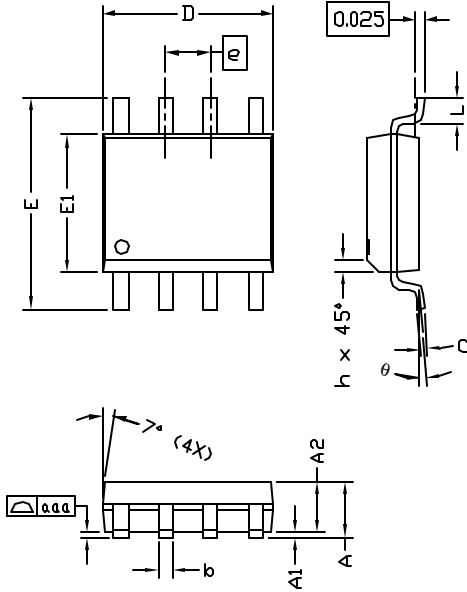


Figure 11: Normalized Maximum Transient Thermal Impedance



ALPHA & OMEGA
SEMICONDUCTOR, INC.

SO-8 Package Data



| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---------|---------------------------|------|------|----------------------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.45 | 1.50 | 1.55 | 0.057 | 0.059 | 0.061 |
| A1 | 0.00 | — | 0.10 | 0.000 | — | 0.004 |
| A2 | — | 1.45 | — | — | 0.057 | — |
| b | 0.33 | — | 0.51 | 0.013 | — | 0.020 |
| c | 0.19 | — | 0.25 | 0.007 | — | 0.010 |
| D | 4.80 | — | 5.00 | 0.189 | — | 0.197 |
| E1 | 3.80 | — | 4.00 | 0.150 | — | 0.157 |
| e | 1.27 BSC | | | 0.050 BSC | | |
| E | 5.80 | — | 6.20 | 0.228 | — | 0.244 |
| h | 0.25 | — | 0.50 | 0.010 | — | 0.020 |
| L | 0.40 | — | 1.27 | 0.016 | — | 0.050 |
| aaa | — | — | 0.10 | — | — | 0.004 |
| θ | 0° | — | 8° | 0° | — | 8° |

NOTE:

- LEAD FINISH: 150 MICROINCHES (3.8 um) MIN. THICKNESS OF Tin/Lead (SOLDER) PLATED ON LEAD
- TOLERANCE ±0.10 mm (4 mil) UNLESS OTHERWISE SPECIFIED
- COPLANARITY : 0.10 mm
- DIMENSION L IS MEASURED IN GAGE PLANE

PACKAGE MARKING DESCRIPTION



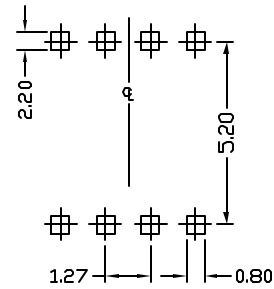
NOTE:

- LOGO - AOS LOGO
- 4606 - PART NUMBER CODE.
- F - FAB LOCATION
- A - ASSEMBLY LOCATION
- Y - YEAR CODE
- W - WEEK CODE.
- L C - ASSEMBLY LOT CODE

SO-8 PART NO. CODE

| PART NO. | CODE |
|----------|------|
| AO4606 | 4606 |
| | |

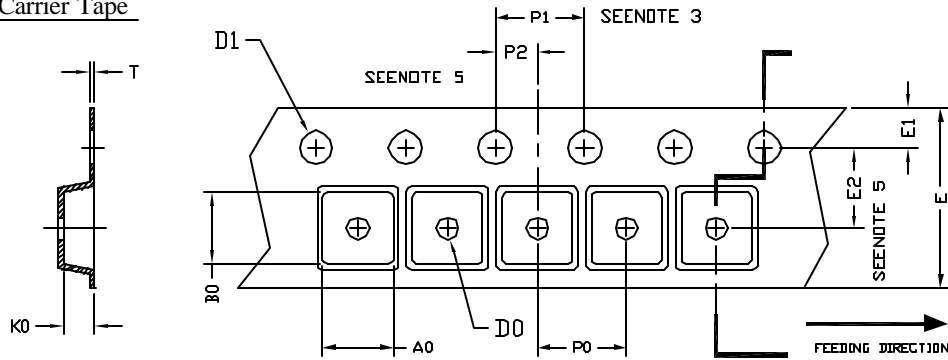
RECOMMENDED LAND PATTERN



UNIT: mm



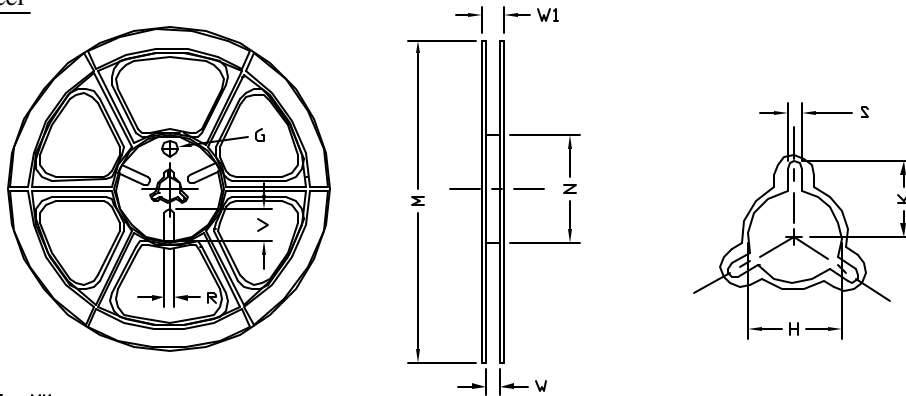
SO-8 Carrier Tape



UNIT: MM

| PACKAGE | A0 | B0 | K0 | D0 | D1 | E | E1 | E2 | P0 | P1 | P2 | T |
|-----------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|
| SO-8 (12 mm) | 6.40 ±0.10 | 5.20 ±0.10 | 2.10 ±0.10 | 1.60 ±0.10 | 1.30 ±0.10 | 12.00 ±0.30 | 1.75 ±0.10 | 5.50 ±0.05 | 8.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.05 | 0.25 ±0.05 |

SO-8 Reel



UNIT: MM

| TAPE SIZE | REEL SIZE | M | N | W | W1 | H | K | S | G | R | V |
|-----------|-----------|------------------|-----------------|----------------|----------------|--------------------------|-------|---------------|-----|-----|-----|
| 12 mm | φ330 | φ330.00 ±0.50 | φ97.00 ±0.10 | 13.00 ±0.30 | 17.40 ±1.00 | φ13.00 +0.50 -0.20 | 10.60 | 2.00 ±0.50 | --- | --- | --- |

SO-8 Tape

Leader / Trailer
& Orientation

