ALPHA & OMEGA SEMICONDUCTOR, INC.

July 2001

# AO8701
# P-Channel Enhancement Mode Field Effect Transistor with Schottky Diode

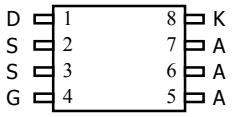
## General Description

The AO8701 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch.

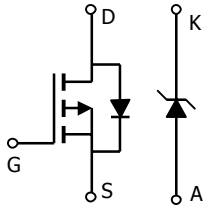
## Features

$V_{DS}$ (V) = -30V
$I_D$ = -4.2A
$R_{DS(ON)}$ < 50mΩ ($V_{GS}$ = 10V)
$R_{DS(ON)}$ < 65mΩ ($V_{GS}$ = 4.5V)
$R_{DS(ON)}$ < 120mΩ ($V_{GS}$ = 2.5V)

**SCHOTTKY**
$V_{DS}$ (V) = 30V, $I_F$ = 3A, $V_F$=0.5V@1A




**TSSOP-8**




**Absolute Maximum Ratings $T_A$=25°C unless otherwise noted**

| Parameter | | Symbol | MOSFET | Schottky | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -30 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | | V |
| Continuous Drain Current[A] | $T_A$=25°C | $I_D$ | -4.2 | | A |
| | $T_A$=70°C | | -3.5 | | |
| Pulsed Drain Current[B] | | $I_{DM}$ | -30 | | |
| Schottky reverse voltage | | $V_{KA}$ | | 30 | V |
| Continuous Forward Current[A] | $T_A$=25°C | $I_F$ | | 3 | A |
| | $T_A$=70°C | | | 2 | |
| Pulsed Forward Current[B] | | $I_{FM}$ | | 40 | |
| Power Dissipation | $T_A$=25°C | $P_D$ | 1.4 | 1.4 | W |
| | $T_A$=70°C | | 1 | 1 | |
| Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | -55 to 150 | °C |

| Parameter: Thermal Characteristics MOSFET | | Symbol | Typ | Max | Units |
|---|---|---|---|---|---|
| Maximum Junction-to-Ambient[A] | t ≤ 10s | $R_{\theta JA}$ | 73 | 90 | °C/W |
| Maximum Junction-to-Ambient[A] | Steady-State | | 96 | 125 | |
| Maximum Junction-to-Lead[C] | Steady-State | $R_{\theta JL}$ | 63 | 75 | |
| **Thermal Characteristics Schottky** | | | | | |
| Maximum Junction-to-Ambient[A] | t ≤ 10s | $R_{\theta JA}$ | 75 | 90 | °C/W |
| Maximum Junction-to-Ambient[A] | Steady-State | | 97 | 125 | |
| Maximum Junction-to-Lead[C] | Steady-State | $R_{\theta JL}$ | 63 | 75 | |

## Electrical Characteristics ($T_J$=25°C unless otherwise noted)

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **STATIC PARAMETERS** | | | | | | |
| $BV_{DSS}$ | Drain-Source Breakdown Voltage | $I_D$=-250µA, $V_{GS}$=0V | -30 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=-24V, $V_{GS}$=0V | | | -1 | µA |
| | | $T_J$=55°C | | | -5 | |
| $I_{GSS}$ | Gate-Body leakage current | $V_{DS}$=0V, $V_{GS}$=±12V | | | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$ $I_D$=-250µA | -0.7 | -1 | -1.3 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS}$=-4.5V, $V_{DS}$=-5V | -25 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS}$=-10V, $I_D$=-4.2A | | 43 | 50 | mΩ |
| | | $T_J$=125°C | | | 75 | |
| | | $V_{GS}$=-4.5V, $I_D$=-4A | | 54 | 65 | mΩ |
| | | $V_{GS}$=-2.5V, $I_D$=-1A | | 82 | 120 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$=-5V, $I_D$=-5A | 7 | 11 | | S |
| $V_{SD}$ | Diode Forward Voltage | $I_S$=-1A,$V_{GS}$=0V | | -0.75 | -1 | V |
| $I_S$ | Maximum Body-Diode Continuous Current | | | | -2.2 | A |
| **DYNAMIC PARAMETERS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V, $V_{DS}$=-15V, f=1MHz | | 954 | | pF |
| $C_{oss}$ | Output Capacitance | | | 115 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 77 | | pF |
| $R_g$ | Gate resistance | $V_{GS}$=0V, $V_{DS}$=0V, f=1MHz | | 6.1 | | Ω |
| **SWITCHING PARAMETERS** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{GS}$=-4.5V, $V_{DS}$=-15V, $I_D$=-4A | | 9.4 | | nC |
| $Q_{gs}$ | Gate Source Charge | | | 2 | | nC |
| $Q_{gd}$ | Gate Drain Charge | | | 3 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}$=-10V, $V_{DS}$=-15V, $R_L$=3.6Ω, $R_{GEN}$=6Ω | | 6.3 | | ns |
| $t_r$ | Turn-On Rise Time | | | 3.2 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 38.2 | | ns |
| $t_f$ | Turn-Off Fall Time | | | 12 | | ns |
| $t_{rr}$ | Body Diode Reverse Recovery Time | $I_F$=-4A, dI/dt=100A/µs | | 20.2 | | ns |
| $Q_{rr}$ | Body Diode Reverse Recovery Charge | $I_F$=-4A, dI/dt=100A/µs | | 11.2 | | nC |
| **SCHOTTKY PARAMETERS** | | | | | | |
| $V_F$ | Forward Voltage Drop | $I_F$=1.0A | | 0.45 | 0.5 | V |
| $I_{rm}$ | Maximum reverse leakage current | $V_R$=30V | | 0.007 | 0.05 | mA |
| | | $V_R$=30V, $T_J$=125°C | | 3.2 | 10 | |
| | | $V_R$=30V, $T_J$=150°C | | 12 | 20 | |
| $C_T$ | Junction Capacitance | $V_R$=15V | | 37 | | pF |

A: The value of $R_{\theta JA}$ is measured with the device mounted on 1in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The value in any a given application depends on the user's specific board design. The current rating is based on the t≤ 10s thermal resistance rating.

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

C. The $R_{\theta JA}$ is the sum of the thermal impedence 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 80µs pulses, duty cycle 0.5% max.

E. These tests are performed with the device mounted on 1 in$^2$ FR-4 board with 2oz. Copper, in a still air environment with $T_A$=25°C. The SOA curve provides a single pulse rating.

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

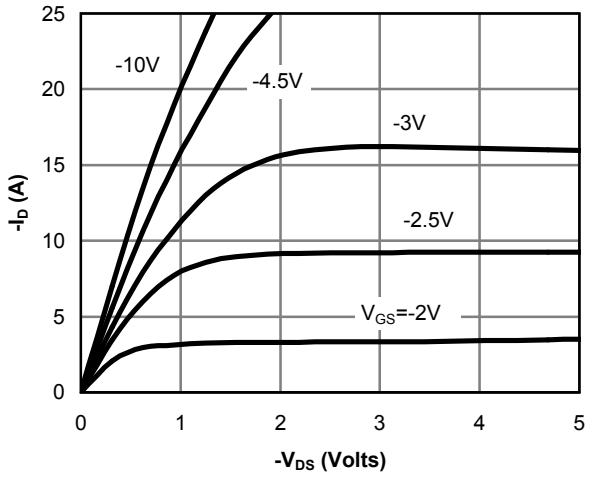



**Fig 1: On-Region Characteristics**

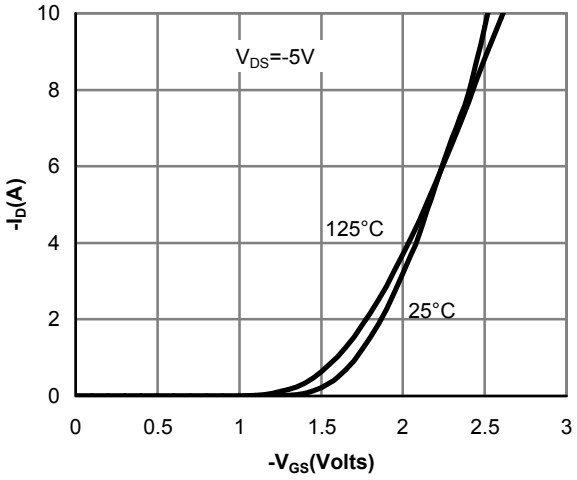



**Figure 2: Transfer Characteristics**

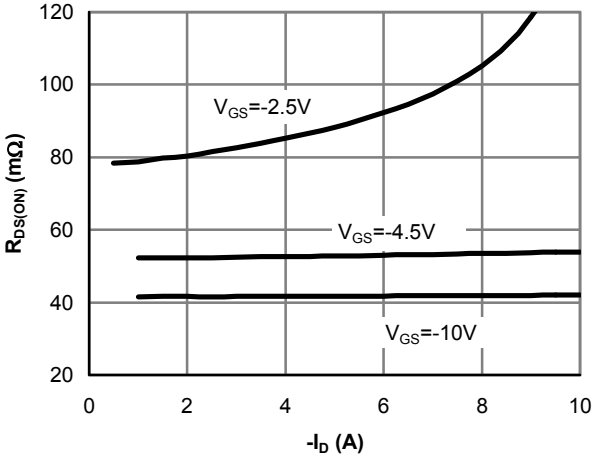



**Figure 3: On-Resistance vs. Drain Current and Gate Voltage**

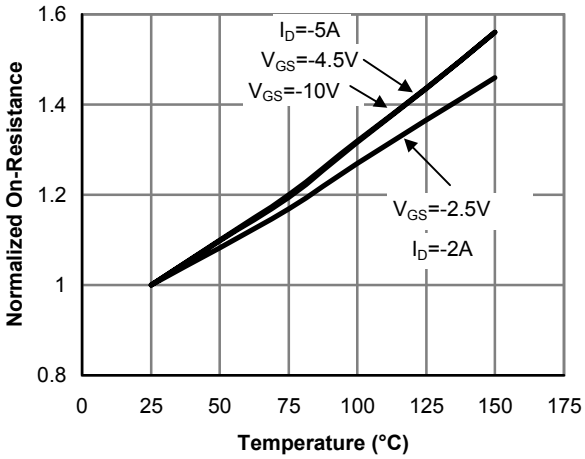



**Figure 4: On-Resistance vs. Junction Temperature**

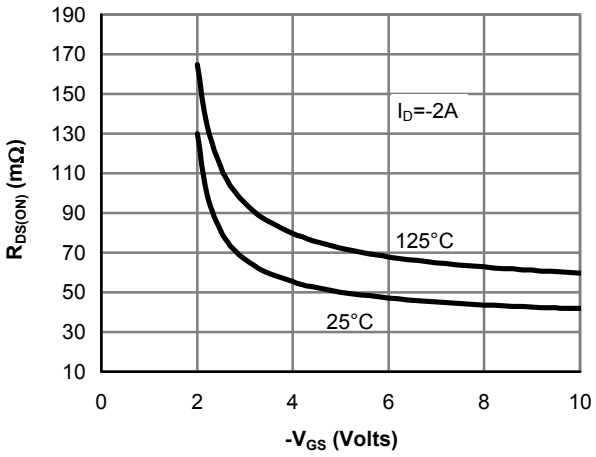



**Figure 5: On-Resistance vs. Gate-Source Voltage**

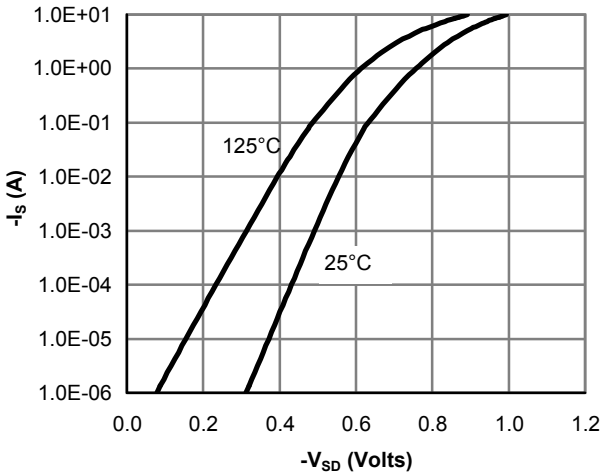



**Figure 6: Body-Diode Characteristics**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

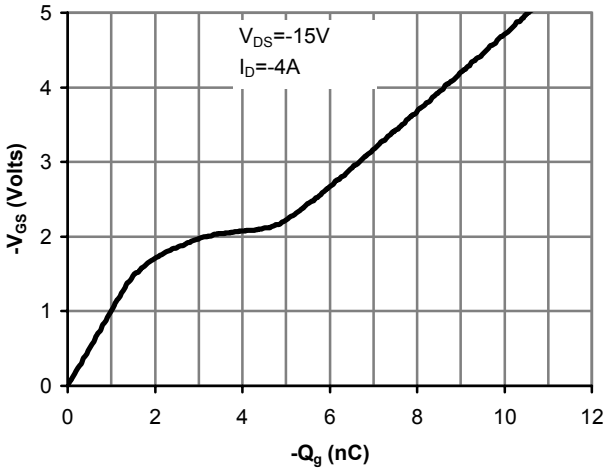



**Figure 7: Gate-Charge Characteristics**

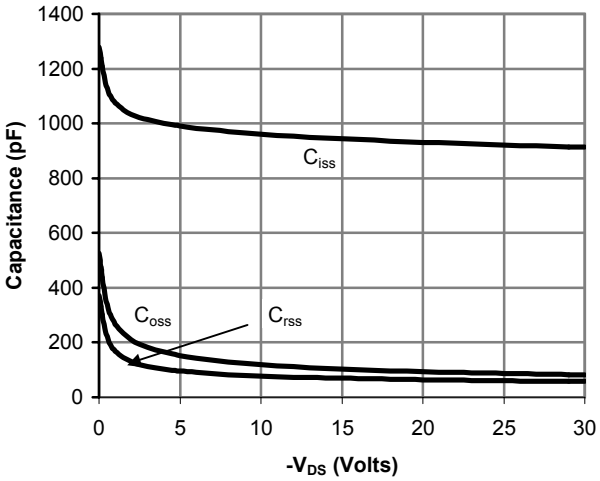



**Figure 8: Capacitance Characteristics**

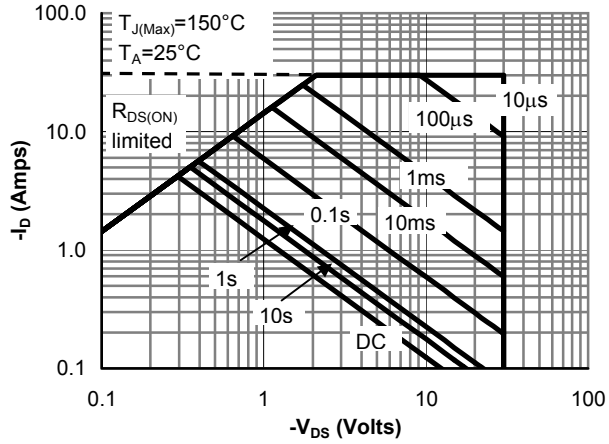



**Figure 9: Maximum Forward Biased Safe Operating Area (Note E)**

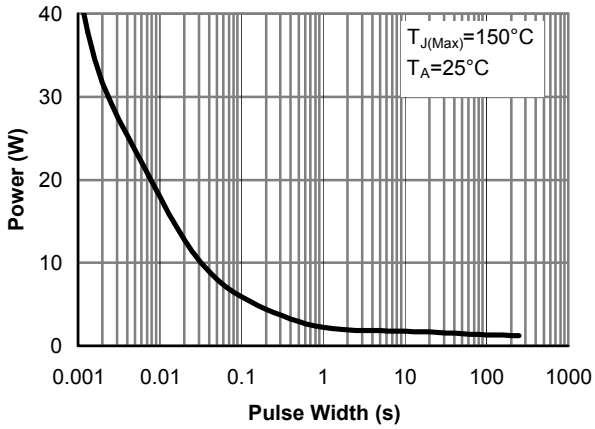



**Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)**

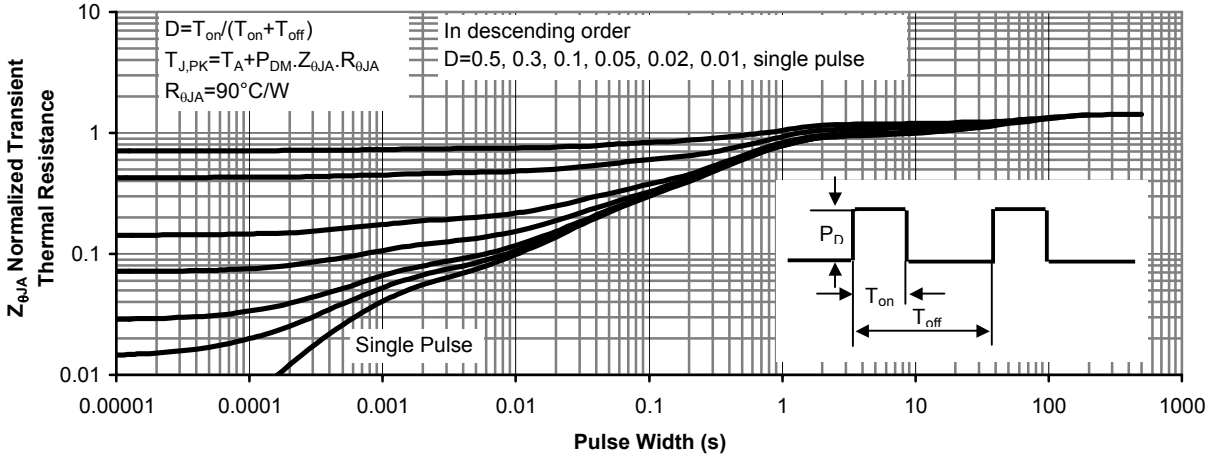



**Figure 11: Normalized Maximum Transient Thermal Impedance**

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS: SCHOTTKY

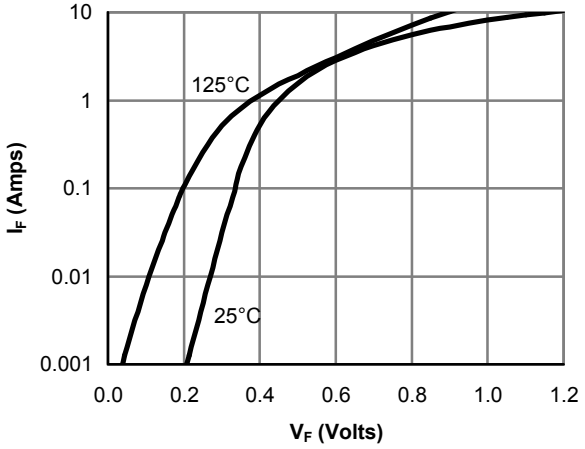



**Figure 12: Schottky Forward Characteristics**

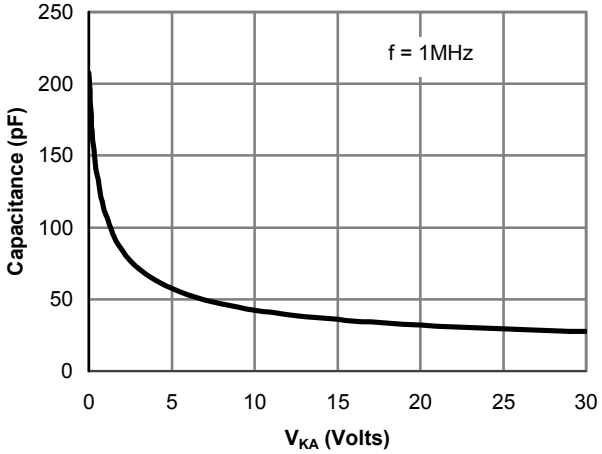



**Figure 13: Schottky Capacitance Characteristics**

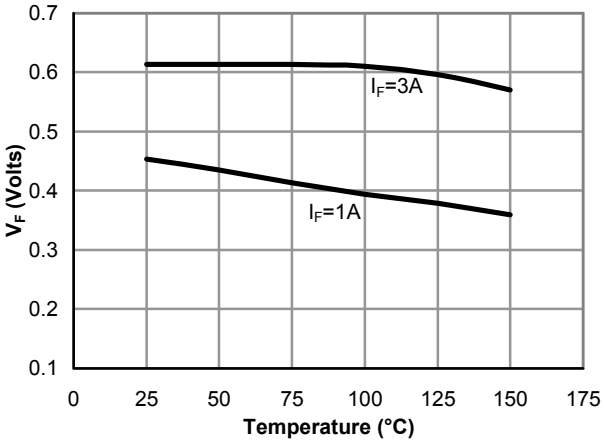



**Figure 14: Schottky Forward Drop vs. Junction Temperature**

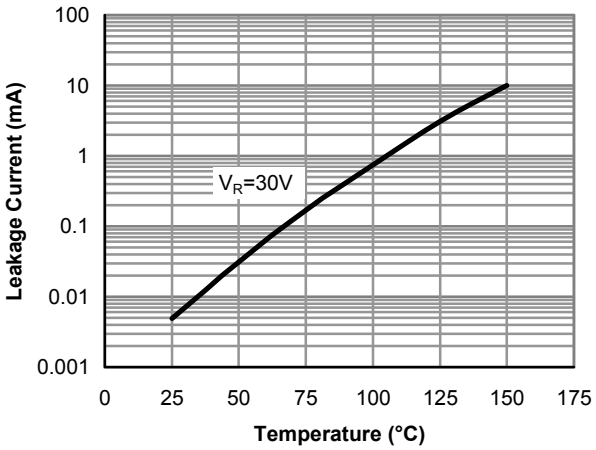



**Figure 15: Schottky Leakage current vs. Junction Temperature**

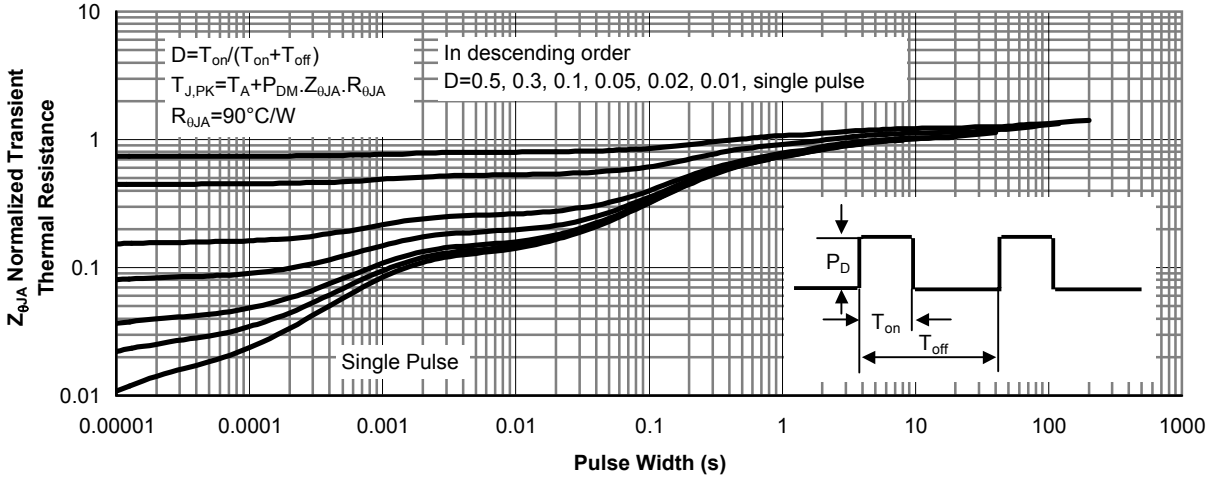



**Figure 15: Schottky Normalized Maximum Transient Thermal Impedance**

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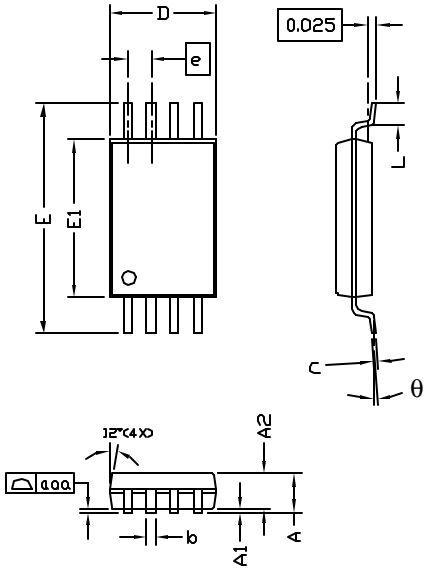
# TSSOP-8 Package Data



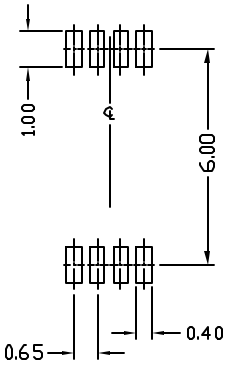

| SYMBOLS | DIMENSIONS IN MILLIMETERS | | | DIMENSIONS IN INCHES | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | — | — | 1.20 | — | — | 0.047 |
| A1 | 0.05 | — | 0.15 | 0.002 | — | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | — | 0.30 | 0.007 | — | 0.012 |
| c | 0.09 | — | 0.20 | 0.004 | — | 0.008 |
| D | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| E | 6.40 BSC | | | 0.252 BSC | | |
| E1 | 4.30 | 4.40 | 4.50 | 0.169 | 0.173 | 0.177 |
| e | 0.65 BSC | | | 0.0259 (REF) | | |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| y | — | — | 0.10 | — | — | 0.004 |
| θ | 0° | — | 8° | 0° | — | 8° |

NOTE:
1. LEAD FINISH: 150 MICROINCHES ( 3.8 um) MIN. THICKNESS OF Tin/Lead (SOLDER) PLATED ON LEAD
2. TOLERANCE ±0.100 mm (4 mil) UNLESS OTHERWISE SPECIFIED
3. COPLANARITY : 0.1000 mm
4. DIMENSION L IS MEASURED IN GAGE PLANE

PACKAGE MARKING DESCRIPTION


NOTE:
LG - AOS LOGO
PARTN - PART NUMBER CODE.
F - FAB LOCATION
A - ASSEMBLY LOCATION
W - WEEK CODE.
L N - ASSEMBLY LOT CODE

RECOMMENDED LAND PATTERN




UNIT: mm

TSSOP-8 PART NO. CODE

| PART NO. | CODE | PART NO. | CODE | PART NO. | CODE |
|---|---|---|---|---|---|
| AO8800 | 8800 | | | | |
| AO8701 | 8701 | | | | |
| | | | | | |
| | | | | | |
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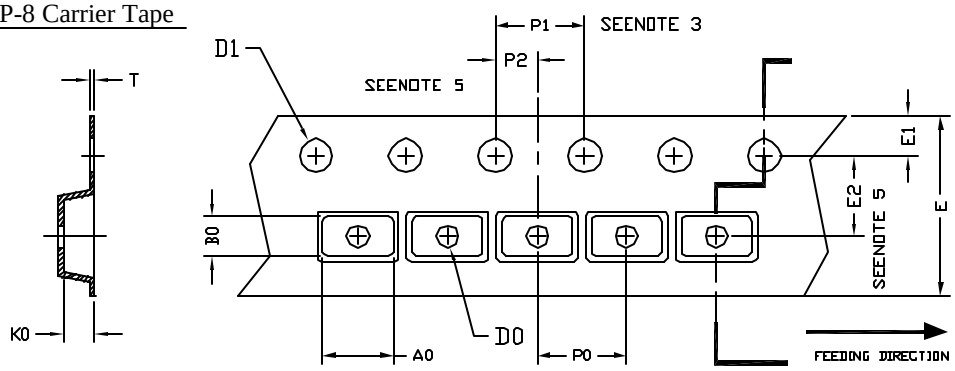
**ALPHA & OMEGA**
*SEMICONDUCTOR, INC.*

# TSSOP-8 Tape and Reel Data

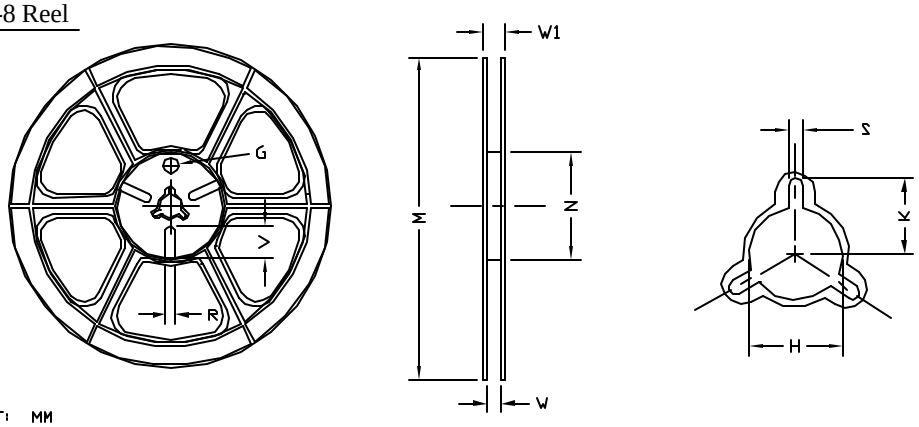
## TSSOP-8 Carrier Tape




UNIT: MM

| PACKAGE | A0 | B0 | K0 | D0 | D1 | E | E1 | E2 | P0 | P1 | P2 | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SO-8 (12 mm) | 6.80 ±0.10 | 3.40 ±0.10 | 1.60 ±0.10 | 1.50 ±0.10 | 1.50 MIN. | 12.00 ±0.30 | 1.75 ±0.10 | 5.50 ±0.05 | 8.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.10 | 0.30 ±0.05 |

## TSSOP-8 Reel




UNIT: MM

| TAPE SIZE | REEL SIZE | M | N | W | W1 | H | K | S | G | R | V |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 mm | ø330 | ø178.00 ±0.50 | ø60.00 ±0.50 | 13.00 +1.50 −0.00 | 16.00 ±1.00 | ø13.50 ±0.50 | 10.60 | 2.20 ±0.50 | --- | --- | --- |

## TSSOP-8 Tape

Leader / Trailer
& Orientation