



**ALPHA & OMEGA**  
SEMICONDUCTOR, LTD.

Rev 3: Nov 2004

# **AO4916, AO4916L ( Green Product )** **Dual N-Channel Enhancement Mode Field Effect Transistor** **with Schottky Diode**

## **General Description**

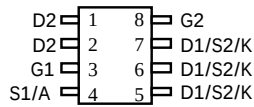
The AO4916 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. The two MOSFETs make a compact and efficient switch and synchronous rectifier combination for use in DC-DC converters. A Schottky diode is co-packaged in parallel with the synchronous MOSFET to boost efficiency further. AO4916L ( Green Product ) is offered in a lead-free package.

## **Features**

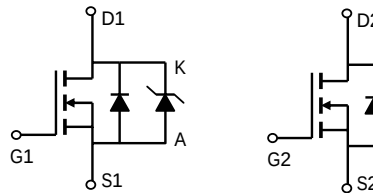
$V_{DS} (V) = 30V$   
 $I_D = 8.5A$   
 $R_{DS(ON)} < 17m\Omega (V_{GS} = 10V)$   
 $R_{DS(ON)} < 27m\Omega (V_{GS} = 4.5V)$

## **SCHOTTKY**

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



**SOIC-8**



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

| Parameter                               | Symbol           | MOSFET     | Schottky   | Units      |
|-----------------------------------------|------------------|------------|------------|------------|
| Drain-Source Voltage                    | $V_{DS}$         | 30         |            | V          |
| Gate-Source Voltage                     | $V_{GS}$         | $\pm 20$   |            | V          |
| Continuous Drain Current <sup>A</sup>   | $T_A=25^\circ C$ | 8.5        |            | A          |
|                                         | $T_A=70^\circ C$ | 6.6        |            |            |
| Pulsed Drain Current <sup>B</sup>       | $I_{DM}$         | 40         |            |            |
| Schottky reverse voltage                | $V_{KA}$         |            | 30         | V          |
| Continuous Forward Current <sup>A</sup> | $T_A=25^\circ C$ |            | 3          | A          |
|                                         | $T_A=70^\circ C$ |            | 2          |            |
| Pulsed Forward Current <sup>B</sup>     | $I_{FM}$         |            | 40         |            |
| Power Dissipation                       | $T_A=25^\circ C$ | 2          | 2          | W          |
|                                         | $T_A=70^\circ C$ | 1.28       | 1.28       |            |
| Junction and Storage Temperature Range  | $T_J, T_{STG}$   | -55 to 150 | -55 to 150 | $^\circ C$ |

| Parameter: Thermal Characteristics MOSFET |              | Symbol           | Typ  | Max  | Units |
|-------------------------------------------|--------------|------------------|------|------|-------|
| Maximum Junction-to-Ambient <sup>A</sup>  | t ≤ 10s      | R <sub>θJA</sub> | 48   | 62.5 | °C/W  |
| Maximum Junction-to-Ambient <sup>A</sup>  | Steady-State |                  | 74   | 110  |       |
| Maximum Junction-to-Lead <sup>C</sup>     | Steady-State | R <sub>θJL</sub> | 35   | 40   |       |
| Thermal Characteristics Schottky          |              |                  |      |      |       |
| Maximum Junction-to-Ambient <sup>A</sup>  | t ≤ 10s      | R <sub>θJA</sub> | 47.5 | 62.5 | °C/W  |
| Maximum Junction-to-Ambient <sup>A</sup>  | Steady-State |                  | 71   | 110  |       |
| Maximum Junction-to-Lead <sup>C</sup>     | Steady-State | R <sub>θJL</sub> | 32   | 40   |       |

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        | $I_D=250\mu\text{A}$ , $V_{GS}=0\text{V}$                                          | 30   |       |      | V                |
| $I_{DSS}$                   | Zero Gate Voltage Drain Current       | $V_{DS}=24\text{V}$ , $V_{GS}=0\text{V}$<br>$T_J=55^{\circ}\text{C}$               |      | 0.005 | 1    | $\mu\text{A}$    |
| $I_{GSS}$                   | 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    | 1.8   | 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     | $V_{GS}=10\text{V}$ , $I_D=8.5\text{A}$<br>$T_J=125^{\circ}\text{C}$               |      | 14    | 17   | $\text{m}\Omega$ |
|                             |                                       |                                                                                    |      | 20    | 25   | $\text{m}\Omega$ |
|                             |                                       | $V_{GS}=4.5\text{V}$ , $I_D=6\text{A}$                                             |      | 21    | 27   | $\text{m}\Omega$ |
| $g_{FS}$                    | Forward Transconductance              | $V_{DS}=5\text{V}$ , $I_D=8.5\text{A}$                                             |      | 23    |      | 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 |                                                                                    |      |       | 3    | A                |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                    |      |       |      |                  |
| $C_{iss}$                   | Input Capacitance                     | $V_{GS}=0\text{V}$ , $V_{DS}=15\text{V}$ , $f=1\text{MHz}$                         |      | 1040  | 1250 | pF               |
| $C_{oss}$                   | Output Capacitance                    |                                                                                    |      | 180   |      | pF               |
| $C_{rss}$                   | Reverse Transfer Capacitance          |                                                                                    |      | 110   |      | pF               |
| $R_g$                       | Gate resistance                       | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$                          | 0.35 | 0.7   | 0.85 | $\Omega$         |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                    |      |       |      |                  |
| $Q_g(10\text{V})$           | Total Gate Charge                     | $V_{GS}=10\text{V}$ , $V_{DS}=15\text{V}$ , $I_D=8.5\text{A}$                      |      | 19.2  | 24   | nC               |
| $Q_g(4.5\text{V})$          | Total Gate Charge                     |                                                                                    |      | 9.36  | 12   | nC               |
| $Q_{gs}$                    | Gate Source Charge                    |                                                                                    |      | 2.6   |      | nC               |
| $Q_{gd}$                    | Gate Drain Charge                     |                                                                                    |      | 4.2   |      | nC               |
| $t_{D(on)}$                 | Turn-On DelayTime                     | $V_{GS}=10\text{V}$ , $V_{DS}=15\text{V}$ , $R_L=1.8\Omega$ ,<br>$R_{GEN}=3\Omega$ |      | 5.2   | 7.5  | ns               |
| $t_r$                       | Turn-On Rise Time                     |                                                                                    |      | 4.4   | 6.5  | ns               |
| $t_{D(off)}$                | Turn-Off DelayTime                    |                                                                                    |      | 17.3  | 25   | ns               |
| $t_f$                       | Turn-Off Fall Time                    |                                                                                    |      | 3.3   | 5    | ns               |
| $t_{rr}$                    | Body Diode Reverse Recovery Time      | $I_F=8.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                |      | 16.7  | 21   | ns               |
| $Q_{rr}$                    | Body Diode Reverse Recovery Charge    | $I_F=8.5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                |      | 9.3   | 11   | nC               |
| <b>SCHOTTKY PARAMETERS</b>  |                                       |                                                                                    |      |       |      |                  |
| $V_F$                       | Forward Voltage Drop                  | $I_F=1.0\text{A}$                                                                  |      | 0.45  | 0.5  | V                |
| $I_{rm}$                    | Maximum reverse leakage current       | $V_R=30\text{V}$                                                                   |      | 0.007 | 0.05 | mA               |
|                             |                                       | $V_R=30\text{V}$ , $T_J=125^{\circ}\text{C}$                                       |      | 3.2   | 10   |                  |
|                             |                                       | $V_R=30\text{V}$ , $T_J=150^{\circ}\text{C}$                                       |      | 12    | 20   |                  |
| $C_T$                       | Junction Capacitance                  | $V_R=15\text{V}$                                                                   |      | 37    |      | pF               |

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 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  $\mu\text{s}$  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.

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

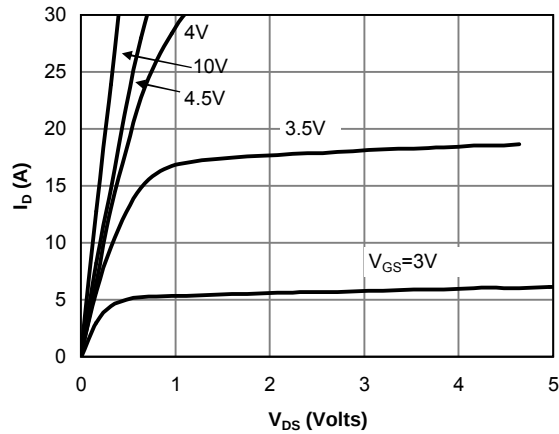


Fig 1: On-Region Characteristics

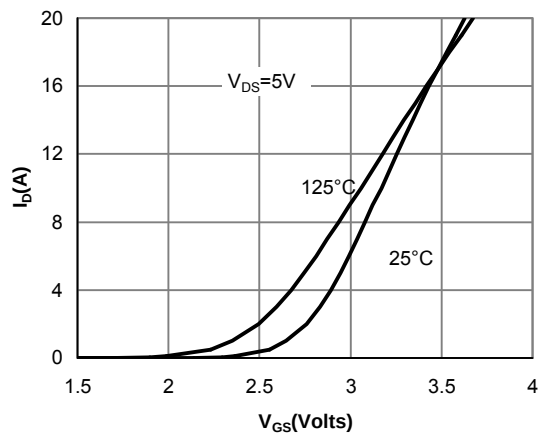


Figure 2: Transfer Characteristics

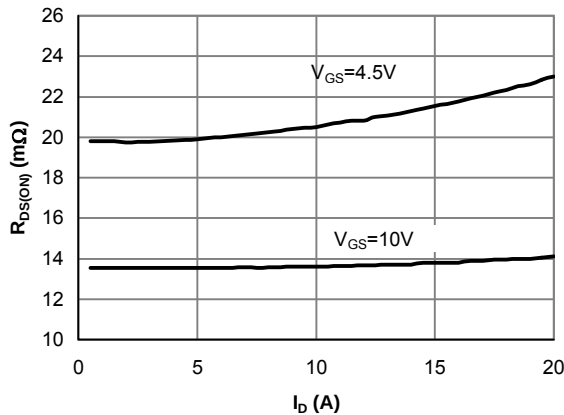


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

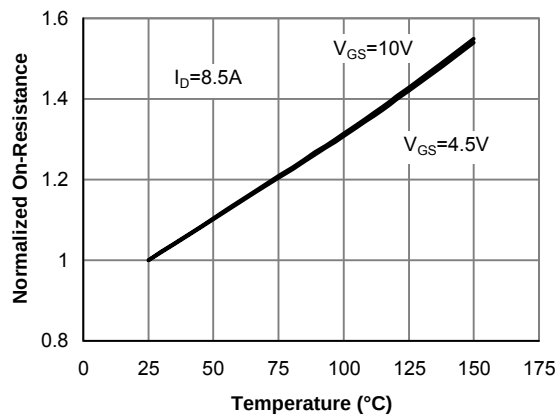


Figure 4: On-Resistance vs. Junction Temperature

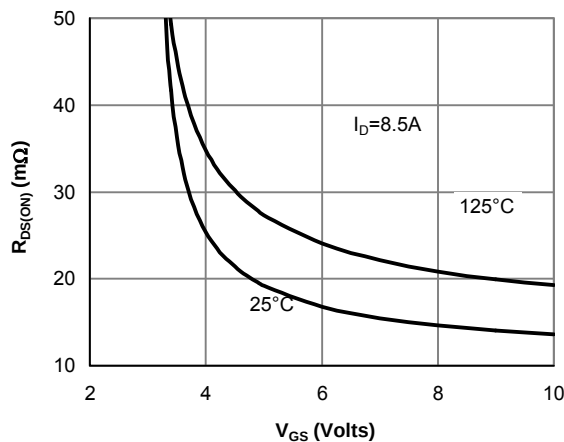


Figure 5: On-Resistance vs. Gate-Source Voltage

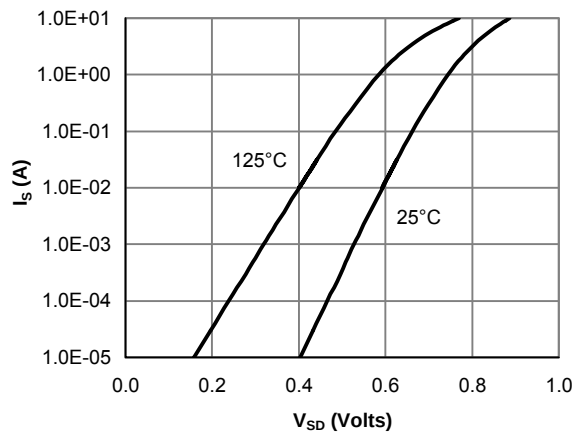


Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

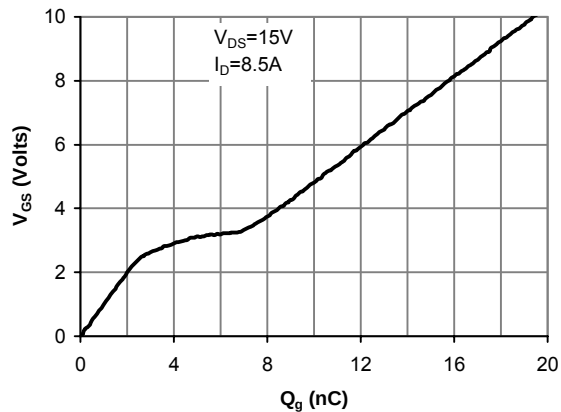


Figure 7: Gate-Charge Characteristics

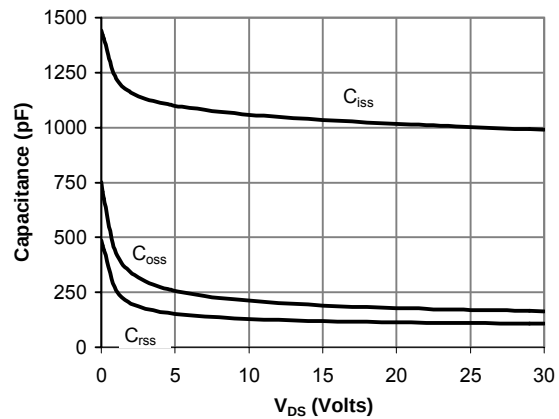


Figure 8: Capacitance Characteristics

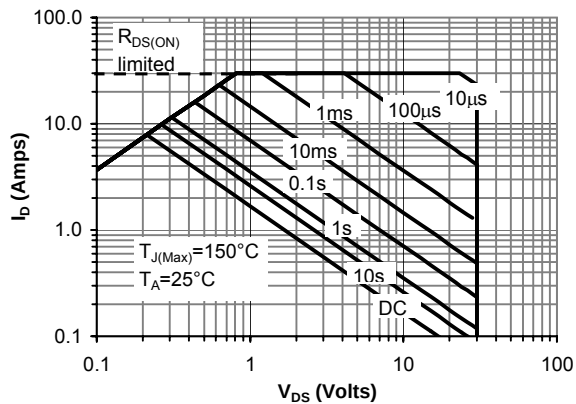


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

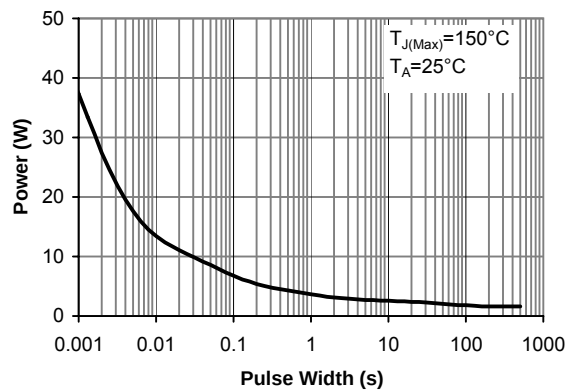


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

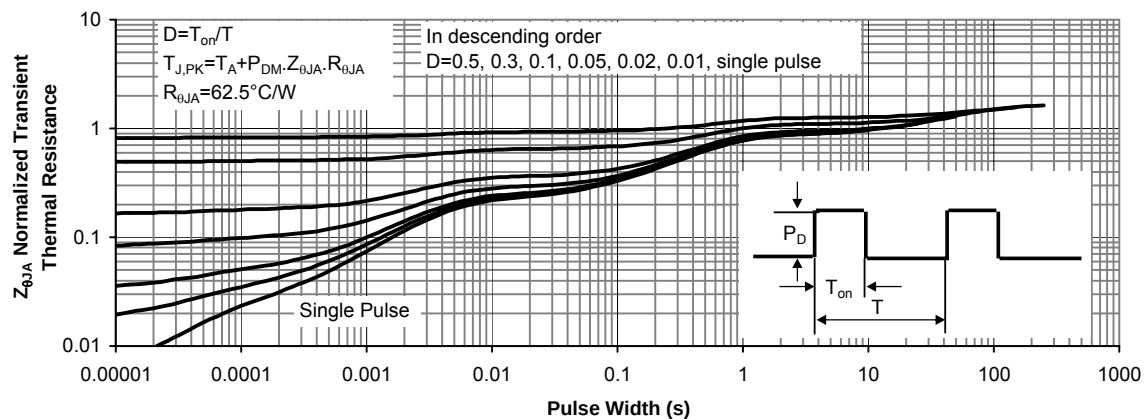


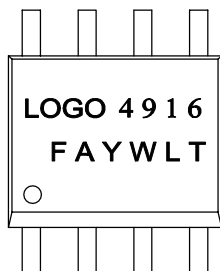
Figure 11: Normalized Maximum Transient Thermal Impedance



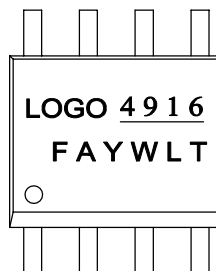
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|              |                            |
|--------------|----------------------------|
| Document No. | PD-00071                   |
| Version      | rev C                      |
| Title        | AO4916 Marking Description |

#### SO-8 PACKAGE MARKING DESCRIPTION



Standard product



Green product

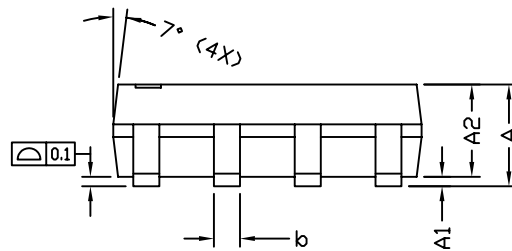
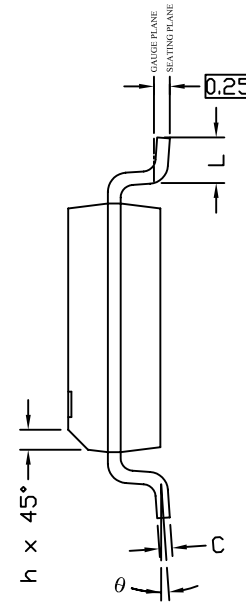
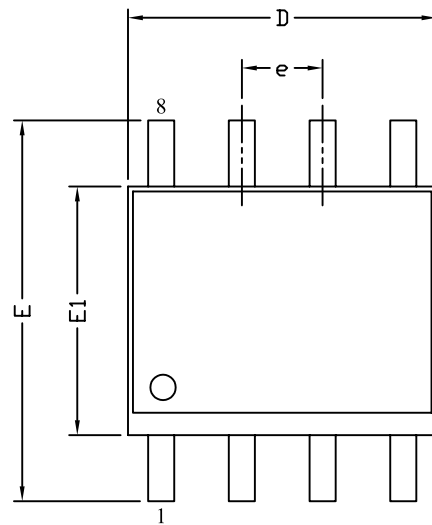
**NOTE:**

LOGO - AOS LOGO  
4916 - PART NUMBER CODE.  
F&A - FOUNDRY AND ASSEMBLY LOCATION  
Y - YEAR CODE  
W - WEEK CODE.  
L T - ASSEMBLY LOT CODE

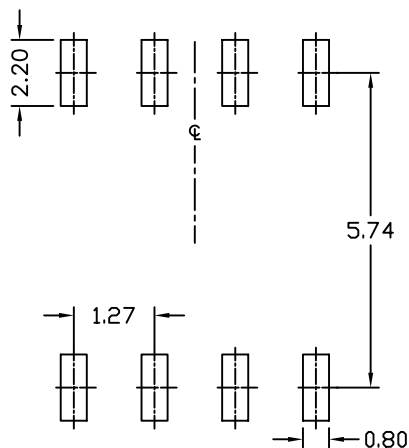
| PART NO. | DESCRIPTION      | CODE        |
|----------|------------------|-------------|
| AO4916   | Standard product | 4916        |
| AO4916L  | Green product    | <u>4916</u> |



## SO-8L PACKAGE OUTLINE



## RECOMMENDED LAND PATTERN



| SYMBOLS | DIMENSIONS IN MILLIMETERS |      |      | DIMENSIONS IN INCHES |       |       |
|---------|---------------------------|------|------|----------------------|-------|-------|
|         | MIN                       | NOM  | MAX  | MIN                  | NOM   | MAX   |
| A       | 1.35                      | 1.65 | 1.75 | 0.053                | 0.065 | 0.069 |
| A1      | 0.10                      | —    | 0.25 | 0.004                | —     | 0.010 |
| A2      | 1.25                      | 1.50 | 1.65 | 0.049                | 0.059 | 0.065 |
| b       | 0.31                      | —    | 0.51 | 0.012                | —     | 0.020 |
| c       | 0.17                      | —    | 0.25 | 0.007                | —     | 0.010 |
| D       | 4.80                      | 4.90 | 5.00 | 0.189                | 0.193 | 0.197 |
| E1      | 3.80                      | 3.90 | 4.00 | 0.150                | 0.154 | 0.157 |
| e       | 1.27 BSC                  |      |      | 0.050 BSC            |       |       |
| E       | 5.80                      | 6.00 | 6.20 | 0.228                | 0.236 | 0.244 |
| h       | 0.25                      | —    | 0.50 | 0.010                | —     | 0.020 |
| L       | 0.40                      | —    | 1.27 | 0.016                | —     | 0.050 |
| θ       | 0°                        | —    | 8°   | 0°                   | —     | 8°    |

UNIT: mm

### NOTE

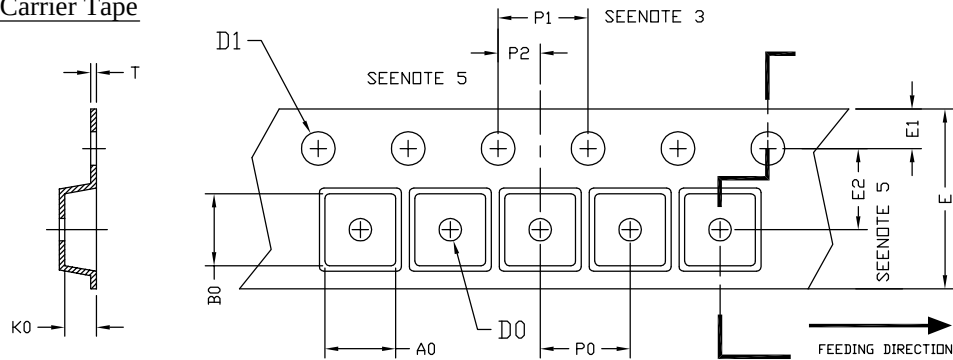
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONS ARE INCLUSIVE OF PLATING.
3. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
4. DIMENSION L IS MEASURED IN GAUGE PLANE.
5. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.



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## SO-8 Tape and Reel Data

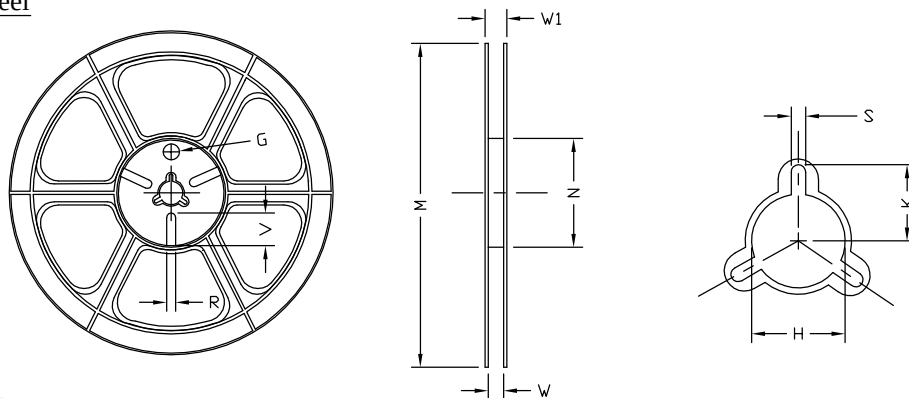
### SO-8 Carrier Tape



UNIT: MM

| PACKAGE         | A0            | B0            | K0            | D0            | D1            | E              | E1            | E2            | P0            | P1            | P2            | T             |
|-----------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|
| SO-8<br>(12 mm) | 6.40<br>±0.10 | 5.20<br>±0.10 | 2.10<br>±0.10 | 1.60<br>±0.10 | 1.50<br>+0.10 | 12.00<br>±0.30 | 1.75<br>±0.10 | 5.50<br>±0.05 | 8.00<br>±0.10 | 4.00<br>±0.10 | 2.00<br>±0.05 | 0.25<br>±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<br>±0.50 | φ97.00<br>±0.10 | 13.00<br>±0.30 | 17.40<br>±1.00 | φ13.00<br>+0.50<br>-0.20 | 10.60 | 2.00<br>±0.50 | --- | --- | --- |

### SO-8 Tape

Leader / Trailer  
& Orientation

