



## AO4403

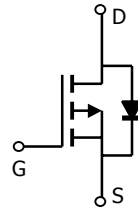
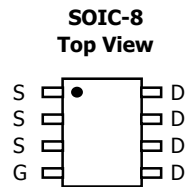
### P-Channel Enhancement Mode Field Effect Transistor

#### General Description

The AO4403 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a load switch or in PWM applications. The source leads are separated to allow a Kelvin connection to the source, which may be used to bypass the source inductance.

#### Features

$V_{DS}$  (V) = -30V  
 $I_D$  = -6.1 A  
 $R_{DS(ON)} < 46m\Omega$  ( $V_{GS} = -10V$ )  
 $R_{DS(ON)} < 61m\Omega$  ( $V_{GS} = -4.5V$ )  
 $R_{DS(ON)} < 117m\Omega$  ( $V_{GS} = -2.5V$ )



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

| Parameter                              | Symbol         | Maximum    | Units            |
|----------------------------------------|----------------|------------|------------------|
| Drain-Source Voltage                   | $V_{DS}$       | -30        | V                |
| Gate-Source Voltage                    | $V_{GS}$       | $\pm 12$   | V                |
| Continuous Drain Current <sup>A</sup>  | $I_D$          | -6.1       | A                |
| $T_A=25^\circ\text{C}$                 |                |            |                  |
| $T_A=70^\circ\text{C}$                 |                | -5.1       |                  |
| Pulsed Drain Current <sup>B</sup>      | $I_{DM}$       | -60        |                  |
| Power Dissipation <sup>A</sup>         | $P_D$          | 3          | W                |
| $T_A=25^\circ\text{C}$                 |                |            |                  |
| $T_A=70^\circ\text{C}$                 |                | 2.1        |                  |
| Junction and Storage Temperature Range | $T_J, T_{STG}$ | -55 to 150 | $^\circ\text{C}$ |

#### Thermal Characteristics

| Parameter                                | Symbol          | Typ | Max | Units              |
|------------------------------------------|-----------------|-----|-----|--------------------|
| Maximum Junction-to-Ambient <sup>A</sup> | $R_{\theta JA}$ | 31  | 40  | $^\circ\text{C/W}$ |
| $t \leq 10s$                             |                 |     |     |                    |
| Maximum Junction-to-Ambient <sup>A</sup> |                 | 59  | 75  | $^\circ\text{C/W}$ |
| Steady-State                             |                 |     |     |                    |
| Maximum Junction-to-Lead <sup>C</sup>    | $R_{\theta JL}$ | 16  | 24  | $^\circ\text{C/W}$ |
| Steady-State                             |                 |     |     |                    |

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>$T_J=55^{\circ}\text{C}$                |      |       | -1<br>-5  | $\mu\text{A}$    |
| $I_{GSS}$                   | Gate-Body leakage current             | $V_{DS}=0\text{V}$ , $V_{GS}=\pm 12\text{V}$                                         |      |       | $\pm 100$ | nA               |
| $V_{GS(th)}$                | Gate Threshold Voltage                | $V_{DS}=V_{GS}$ , $I_D=-250\mu\text{A}$                                              | -0.7 | -1    | -1.3      | V                |
| $I_{D(ON)}$                 | On state drain current                | $V_{GS}=-4.5\text{V}$ , $V_{DS}=-5\text{V}$                                          |      |       |           | A                |
| $R_{DS(ON)}$                | Static Drain-Source On-Resistance     | $V_{GS}=-10\text{V}$ , $I_D=-6.1\text{A}$<br>$T_J=125^{\circ}\text{C}$               |      | 38    | 46        | $\text{m}\Omega$ |
|                             |                                       | $V_{GS}=-4.5\text{V}$ , $I_D=-5\text{A}$                                             |      | 49    | 61        | $\text{m}\Omega$ |
|                             |                                       | $V_{GS}=-2.5\text{V}$ , $I_D=-1\text{A}$                                             |      | 76    | 117       | $\text{m}\Omega$ |
|                             |                                       |                                                                                      |      |       |           |                  |
| $g_{FS}$                    | Forward Transconductance              | $V_{DS}=-5\text{V}$ , $I_D=-5\text{A}$                                               | 7    | 11    |           | 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 |                                                                                      |      |       | -4.2      | A                |
| <b>DYNAMIC PARAMETERS</b>   |                                       |                                                                                      |      |       |           |                  |
| $C_{iss}$                   | Input Capacitance                     | $V_{GS}=0\text{V}$ , $V_{DS}=-15\text{V}$ , $f=1\text{MHz}$                          |      | 940   |           | pF               |
| $C_{oss}$                   | Output Capacitance                    |                                                                                      |      | 104   |           | pF               |
| $C_{rss}$                   | Reverse Transfer Capacitance          |                                                                                      |      | 73    |           | pF               |
| $R_g$                       | Gate resistance                       | $V_{GS}=0\text{V}$ , $V_{DS}=0\text{V}$ , $f=1\text{MHz}$                            |      | 6     |           | $\Omega$         |
| <b>SWITCHING PARAMETERS</b> |                                       |                                                                                      |      |       |           |                  |
| $Q_g$                       | Total Gate Charge                     | $V_{GS}=-4.5\text{V}$ , $V_{DS}=-15\text{V}$ , $I_D=-5\text{A}$                      |      | 9.4   |           | nC               |
| $Q_{gs}$                    | Gate Source Charge                    |                                                                                      |      | 2     |           | nC               |
| $Q_{gd}$                    | Gate Drain Charge                     |                                                                                      |      | 3     |           | nC               |
| $t_{D(on)}$                 | Turn-On DelayTime                     | $V_{GS}=-10\text{V}$ , $V_{DS}=-15\text{V}$ , $R_L=2.4\Omega$ ,<br>$R_{GEN}=6\Omega$ |      | 7.6   |           | ns               |
| $t_r$                       | Turn-On Rise Time                     |                                                                                      |      | 8.6   |           | ns               |
| $t_{D(off)}$                | Turn-Off DelayTime                    |                                                                                      |      | 44.7  |           | ns               |
| $t_f$                       | Turn-Off Fall Time                    |                                                                                      |      | 16.5  |           | ns               |
| $t_{rr}$                    | Body Diode Reverse Recovery Time      | $I_F=-5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                   |      | 22.7  |           | ns               |
| $Q_{rr}$                    | Body Diode Reverse Recovery Charge    | $I_F=-5\text{A}$ , $dI/dt=100\text{A}/\mu\text{s}$                                   |      | 15.9  |           | 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 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 $\mu\text{s}$  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.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

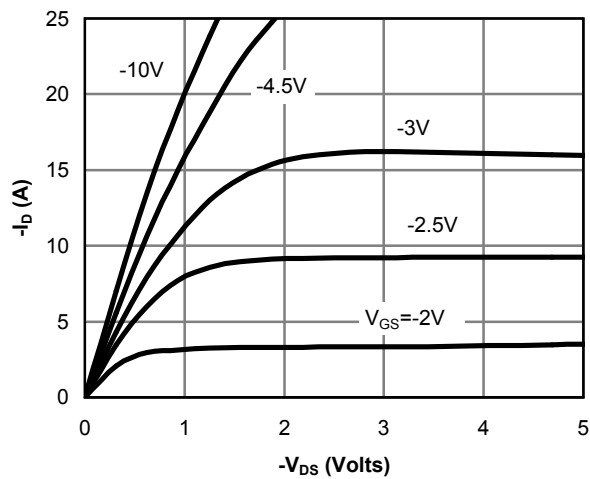


Fig 1: On-Region Characteristics

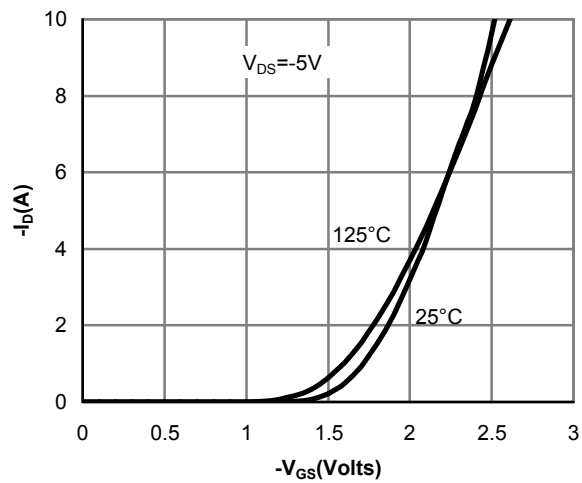


Figure 2: Transfer Characteristics

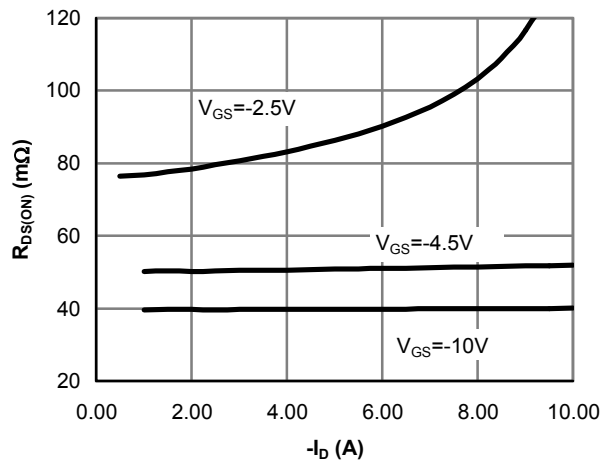


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

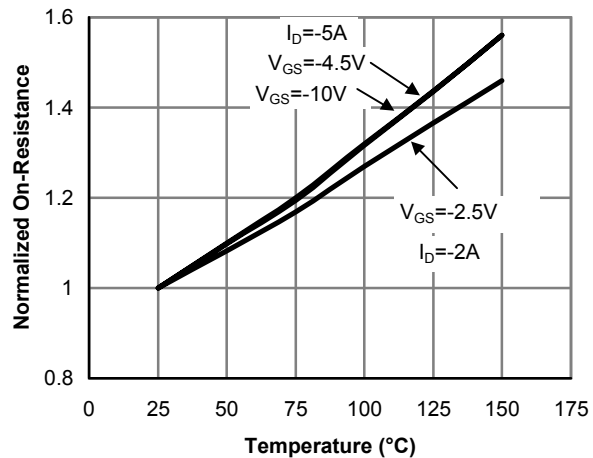


Figure 4: On-Resistance vs. Junction Temperature

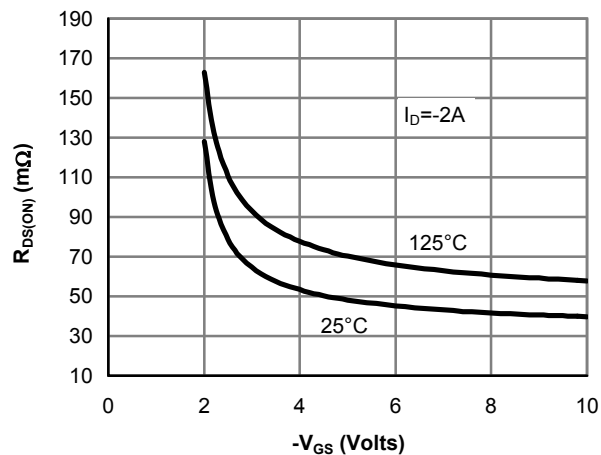


Figure 5: On-Resistance vs. Gate-Source Voltage

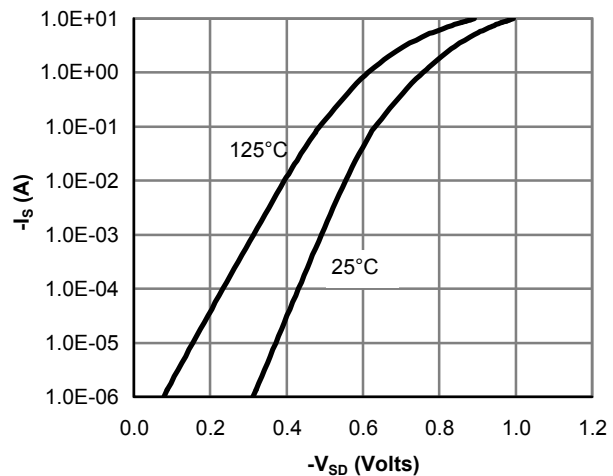


Figure 6: Body-Diode Characteristics

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

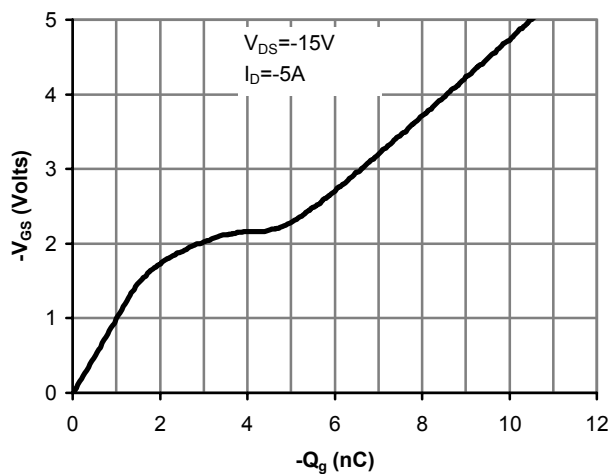


Figure 7: Gate-Charge Characteristics

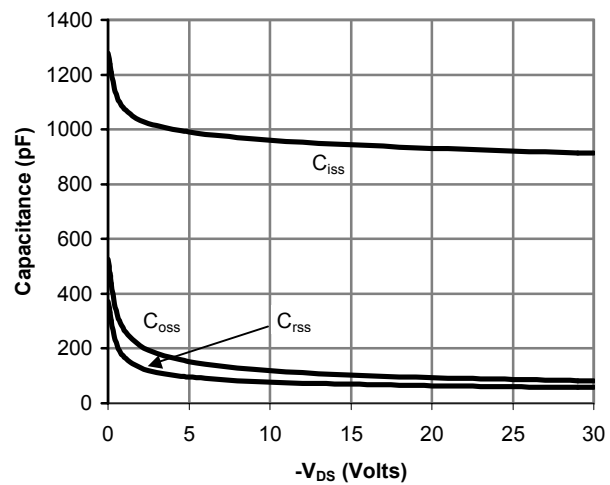


Figure 8: Capacitance Characteristics

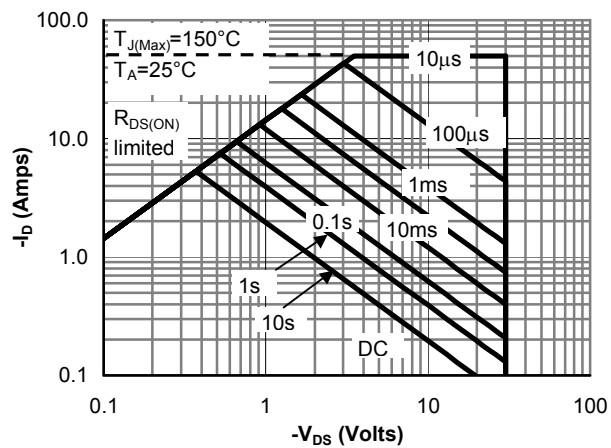


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

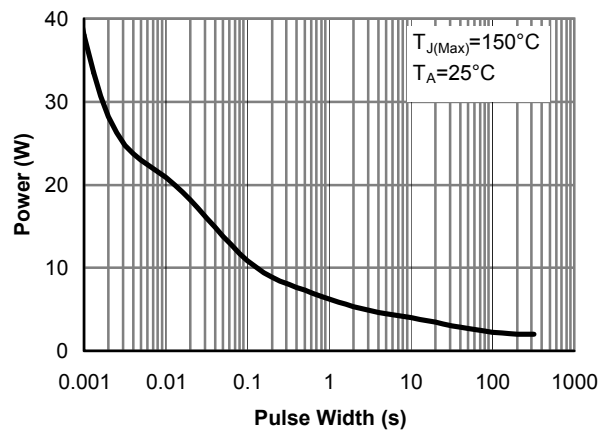


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

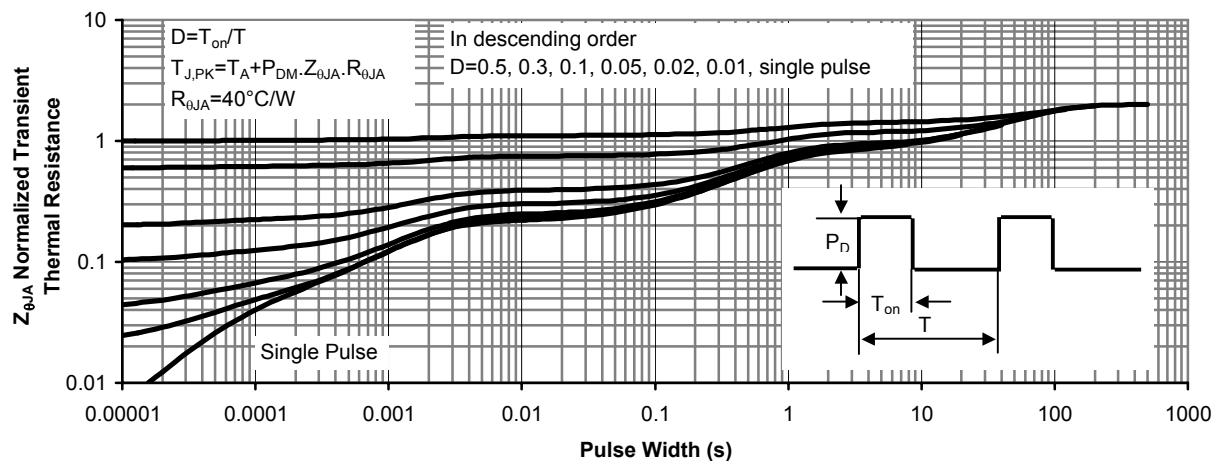
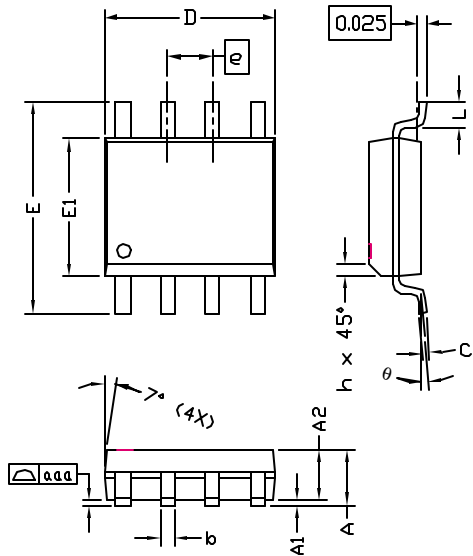


Figure 11: Normalized Maximum Transient Thermal Impedance

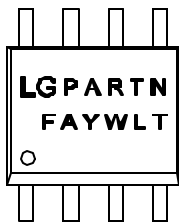
SO-8 Package Data



| 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:
- 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

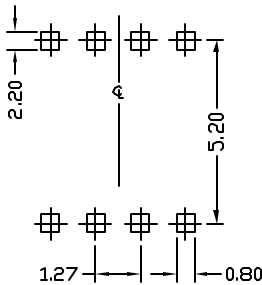


- NOTE:
- LG - AOS LOGO
  - PARTN - PART NUMBER CODE.
  - F - FAB LOCATION
  - A - ASSEMBLY LOCATION
  - Y - YEAR CODE
  - W - WEEK CODE.
  - L N - ASSEMBLY LOT CODE

SO-8 PART NO. CODE

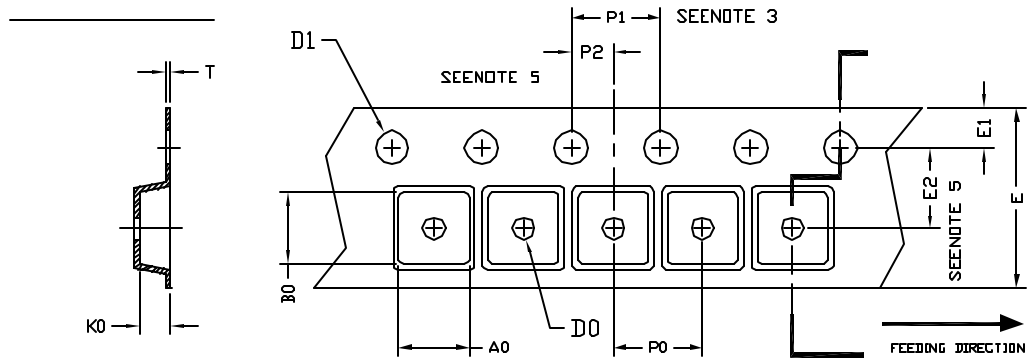
| PART NO. | CODE | PART NO. | CODE | PART NO. | CODE |
|----------|------|----------|------|----------|------|
| AO4400   | 4400 | AO4800   | 4800 | AO4700   | 4700 |
| AO4401   | 4401 | AO4801   | 4801 | AO4701   | 4701 |
|          |      |          |      |          |      |
|          |      |          |      |          |      |
|          |      |          |      |          |      |
|          |      |          |      |          |      |
|          |      |          |      |          |      |
|          |      |          |      |          |      |

RECOMMENDED LAND PATTERN



UNIT: mm

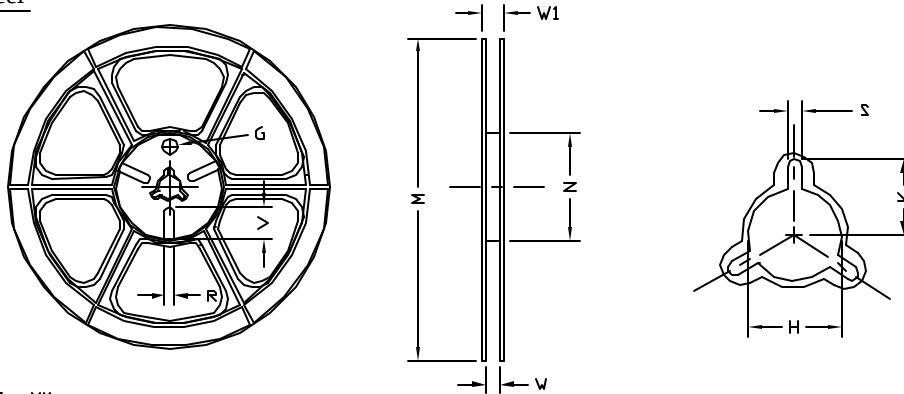
## SO-8 Tape and Reel Data



UNIT: MM

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

### SO-8 Reel



UNIT: MM

| TAPE SIZE | REEL SIZE  | M                           | N                          | W                   | W1                  | H                                  | K     | S                  | G   | R   | V   |
|-----------|------------|-----------------------------|----------------------------|---------------------|---------------------|------------------------------------|-------|--------------------|-----|-----|-----|
| 12 mm     | $\phi 330$ | $\phi 330.00$<br>$\pm 0.50$ | $\phi 97.00$<br>$\pm 0.10$ | 13.00<br>$\pm 0.30$ | 17.40<br>$\pm 1.00$ | $\phi 13.00$<br>$+0.50$<br>$-0.20$ | 10.60 | 2.00<br>$\pm 0.50$ | --- | --- | --- |

### SO-8 Tape

Leader / Trailer  
& Orientation

