



ALPHA & OMEGA
SEMICONDUCTOR, LTD

AO6804

Dual N-Channel Enhancement Mode Field Effect Transistor



General Description

The AO6804 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. AO6804 is Pb-free (meets ROHS & Sony 259 specifications).

Features

$V_{DS} = 20V$

$I_D = 5.0A$ ($V_{GS} = 4.5V$)

Typical R_{ds}

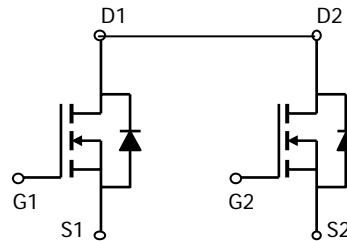
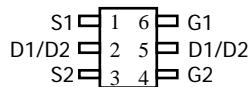
$R_{DS(ON)} < 24m\Omega$ ($V_{GS} = 4.5V$)

$R_{DS(ON)} < 26m\Omega$ ($V_{GS} = 4.0V$)

$R_{DS(ON)} < 28m\Omega$ ($V_{GS} = 3.1V$)

$R_{DS(ON)} < 31m\Omega$ ($V_{GS} = 2.5V$)

TSOP6
Top View



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

| Parameter | Symbol | 10 Sec | Steady State | Units |
|--|------------------|------------|--------------|------------|
| Drain-Source Voltage | V_{DS} | 20 | | V |
| Gate-Source Voltage | V_{GS} | ± 12 | | V |
| Continuous Drain Current ^A | $T_A=25^\circ C$ | 5 | 4 | A |
| | $T_A=70^\circ C$ | 4 | 3.2 | |
| Pulsed Drain Current ^B | I_{DM} | 25 | | |
| Power Dissipation ^A | $T_A=25^\circ C$ | 1.3 | 0.8 | W |
| | $T_A=70^\circ C$ | 0.8 | 0.5 | |
| Junction and Storage Temperature Range | T_J, T_{STG} | -55 to 150 | | $^\circ C$ |

Thermal Characteristics

| Parameter | Symbol | Typ | Max | Units |
|--|-----------------|-----|-----|--------------|
| Maximum Junction-to-Ambient ^A | $R_{\theta JA}$ | 76 | 95 | $^\circ C/W$ |
| Maximum Junction-to-Ambient ^A | | 118 | 150 | $^\circ C/W$ |
| Maximum Junction-to-Lead ^C | $R_{\theta JL}$ | 54 | 68 | $^\circ C/W$ |

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 | $I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$ | 20 | | | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 20\text{V}$, $V_{GS} = 0\text{V}$ $T_J = 55^{\circ}\text{C}$ | | | 1 5 | μA |
| I_{GSS} | Gate-Body leakage current | $V_{DS} = 0\text{V}$, $V_{GS} = \pm 12\text{V}$ | | | ± 500 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$ | 0.5 | 0.75 | 1.2 | V |
| $I_{D(ON)}$ | On state drain current | $V_{GS} = 4.5\text{V}$, $V_{DS} = 5\text{V}$ | 25 | | | A |
| $R_{DS(ON)}$ | Static Drain-Source On-Resistance | $V_{GS} = 4.5\text{V}$, $I_D = 5.0\text{A}$ $T_J = 125^{\circ}\text{C}$ | 18 25 | 24 33 | 32 43 | $\text{m}\Omega$ |
| | | $V_{GS} = 4.0\text{V}$, $I_D = 4.5\text{A}$ | 22 | 26 | 34 | $\text{m}\Omega$ |
| | | $V_{GS} = 3.1\text{V}$, $I_D = 4.5\text{A}$ | 21 | 28 | 37 | $\text{m}\Omega$ |
| | | $V_{GS} = 2.5\text{V}$, $I_D = 4.0\text{A}$ | 22 | 31 | 42 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS} = 5\text{V}$, $I_D = 5.0\text{A}$ | | 7 | | S |
| V_{SD} | Diode Forward Voltage | $I_S = 1\text{A}$, $V_{GS} = 0\text{V}$ | | 0.65 | 1 | V |
| I_S | Maximum Body-Diode Continuous Current | | | | 1.1 | A |
| DYNAMIC PARAMETERS | | | | | | |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}$, $V_{DS}=10\text{V}$, $f=1\text{MHz}$ | | 580 | 725 | pF |
| C_{oss} | Output Capacitance | | | 95 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 70 | | pF |
| R_g | Gate resistance | $V_{GS}=0\text{V}$, $V_{DS}=0\text{V}$, $f=1\text{MHz}$ | | 3.5 | 5.3 | Ω |
| SWITCHING PARAMETERS | | | | | | |
| Q_g | Total Gate Charge | $V_{GS} = 4.5\text{V}$, $V_{DS} = 10\text{V}$, $I_D = 5\text{A}$ | | 5.8 | 7.7 | nC |
| Q_{gs} | Gate Source Charge | | | 1 | | nC |
| Q_{gd} | Gate Drain Charge | | | 1.6 | | nC |
| $t_{D(on)}$ | Turn-On DelayTime | $V_{GS}=10\text{V}$, $V_{DS}=10\text{V}$, $R_L=2.0\Omega$, $R_{GEN}=3\Omega$ | | 2.4 | | ns |
| t_r | Turn-On Rise Time | | | 6.4 | | ns |
| $t_{D(off)}$ | Turn-Off DelayTime | | | 38 | | ns |
| t_f | Turn-Off Fall Time | | | 9.5 | | ns |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F=5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 18 | 24 | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | $I_F=5\text{A}$, $dI/dt=100\text{A}/\mu\text{s}$ | | 6 | | 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 $T_A = 25^{\circ}\text{C}$. 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.

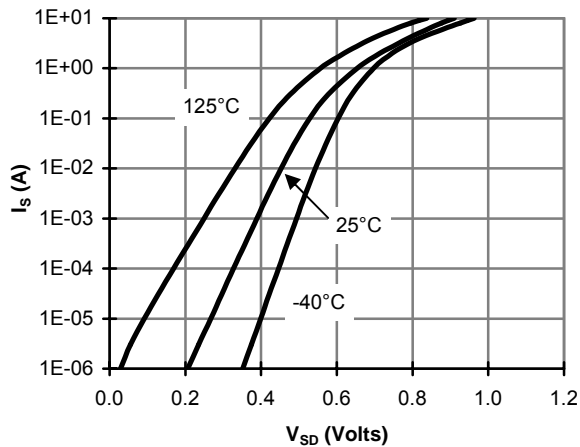
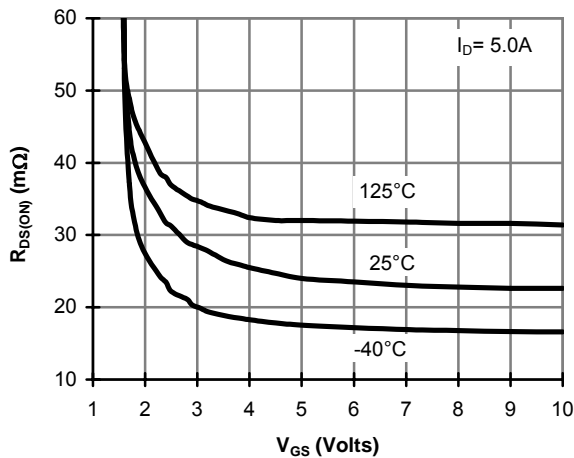
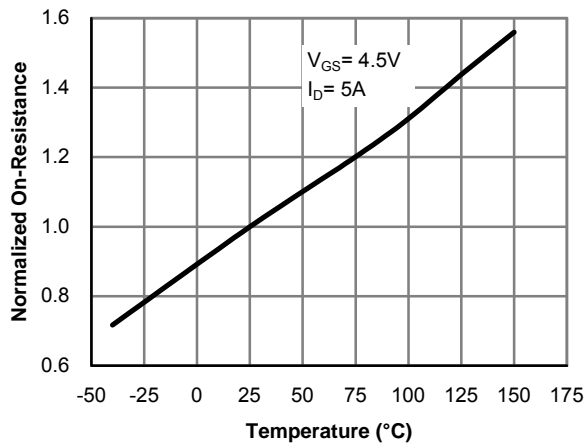
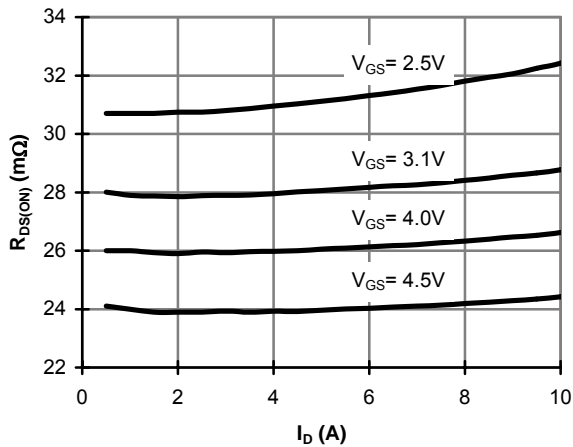
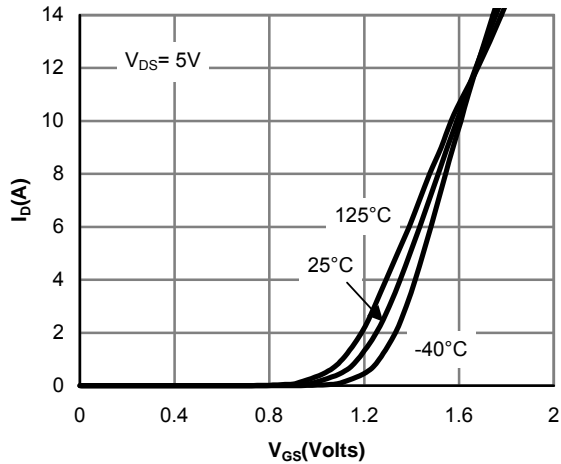
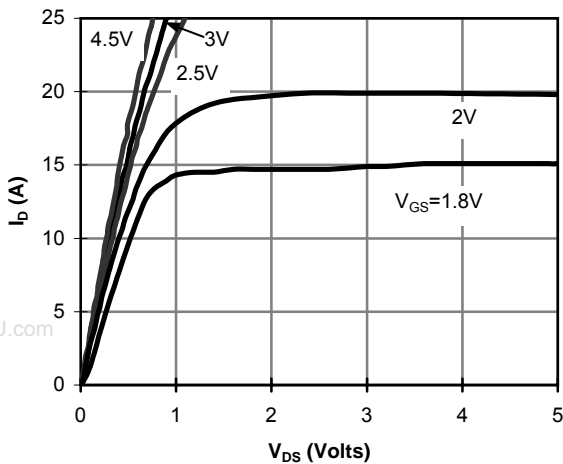
D: The static characteristics in Figures 1 to 6 are obtained using $< 300\mu\text{s}$ pulses, duty cycle 0.5% max.

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



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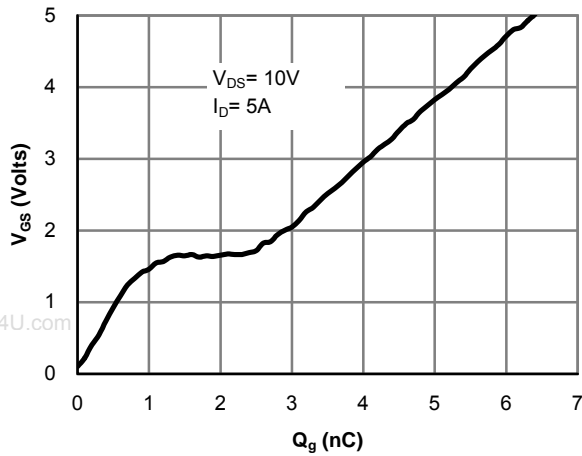


Figure 7: Gate-Charge Characteristics

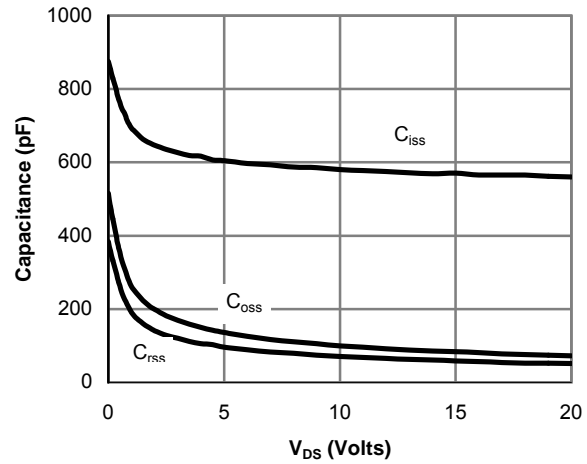


Figure 8: Capacitance Characteristics

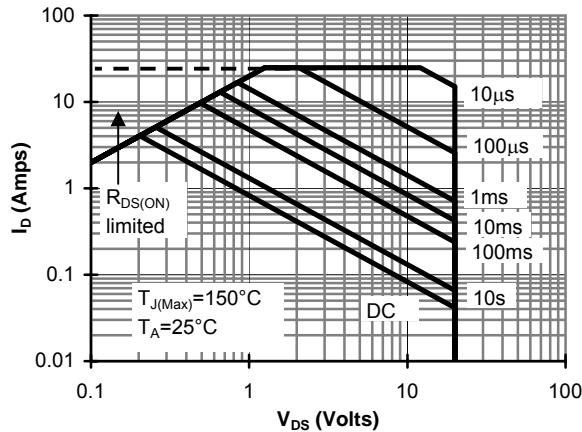


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

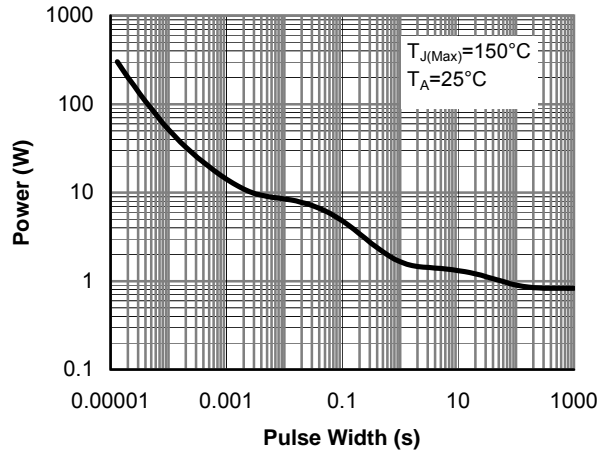


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

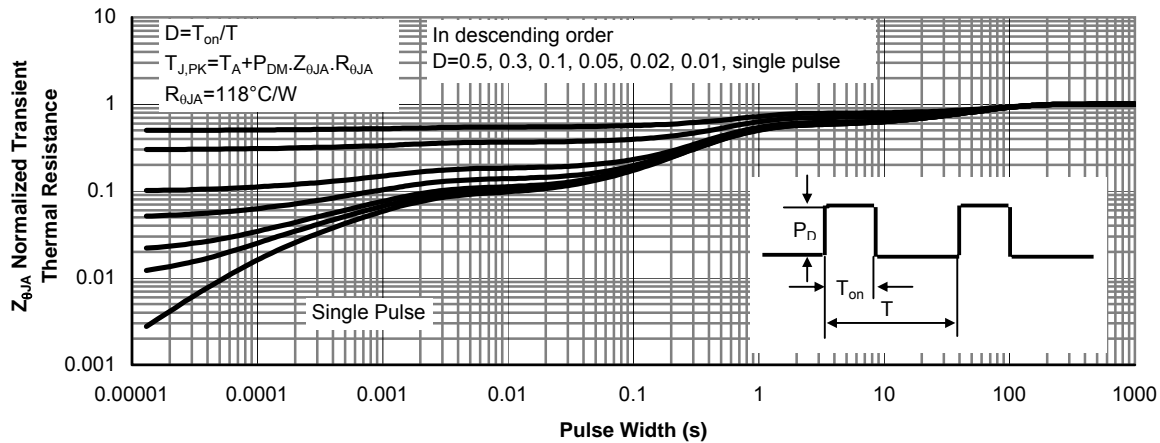
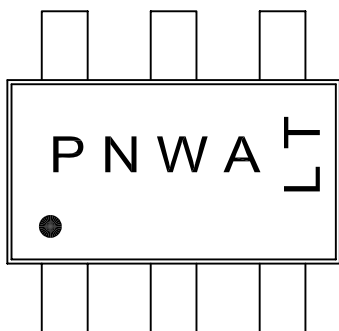


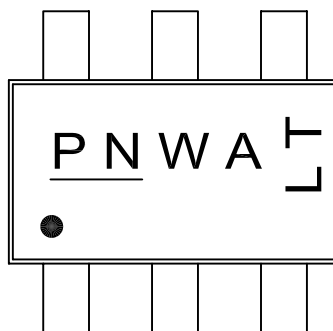
Figure 11: Normalized Maximum Transient Thermal Impedance (Note E)



TSOP-6 PACKAGE MARKING DESCRIPTION



Standard product



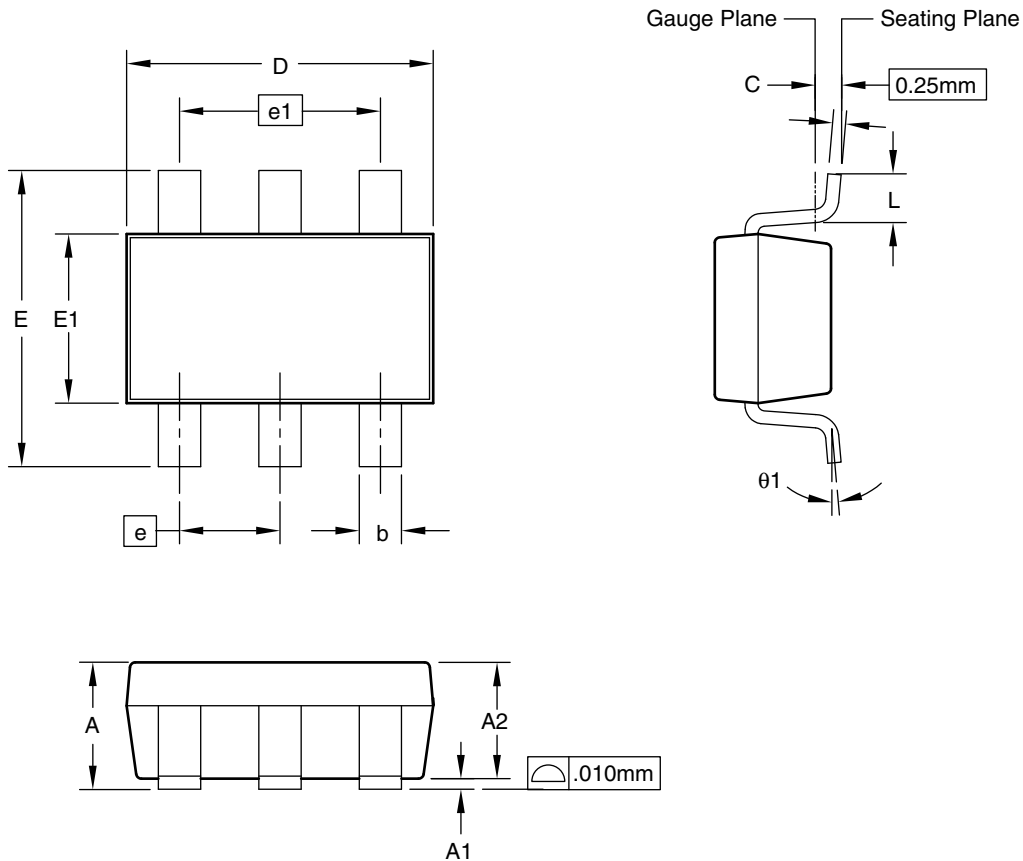
Green product

NOTE:

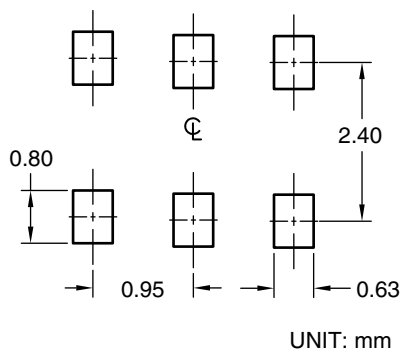
P - Package and product type
N - Last digital of product number
W - Year and week code
A - Assembly location code
L&T - Assembly lot code

| PART NO. | DESCRIPTION | CODE (PN) |
|----------|------------------|------------|
| AO6804 | Standard product | H4 |
| AO6804L | Green product | <u>H</u> 4 |

TSOP-6L Package Dimensions



RECOMMENDED LAND PATTERN



Dimensions in millimeters

| Symbols | Min. | Nom. | Max. |
|------------|----------|------|------|
| A | 0.90 | — | 1.25 |
| A1 | 0.00 | — | 0.15 |
| A2 | 0.70 | 1.10 | 1.20 |
| b | 0.30 | 0.40 | 0.50 |
| C | 0.08 | 0.13 | 0.20 |
| D | 2.70 | 2.90 | 3.10 |
| E | 2.50 | 2.80 | 3.10 |
| E1 | 1.50 | 1.60 | 1.70 |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |
| L | 0.30 | — | 0.60 |
| $\theta 1$ | 0° | — | 8° |

Dimensions in inches

| Symbols | Min. | Nom. | Max. |
|------------|-----------|-------|-------|
| A | 0.035 | — | 0.049 |
| A1 | 0.00 | — | 0.006 |
| A2 | 0.028 | 0.043 | 0.047 |
| b | 0.012 | 0.016 | 0.020 |
| C | 0.003 | 0.005 | 0.008 |
| D | 0.106 | 0.114 | 0.122 |
| E | 0.098 | 0.110 | 0.122 |
| E1 | 0.059 | 0.063 | 0.067 |
| e | 0.037 BSC | | |
| e1 | 0.075 BSC | | |
| L | 0.012 | — | 0.024 |
| $\theta 1$ | 0° | — | 8° |

Notes:

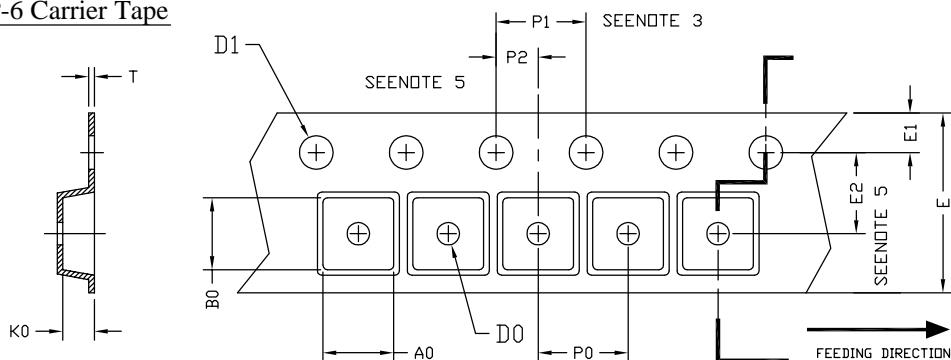
- Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
- Dimension L is measured in gauge plane.
- Tolerance: ± 0.100 mm (4 mils) unless otherwise specified.
- Followed from JEDEC MO-178C & MO-193C.
- Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.



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TSOP-6 Tape and Reel Data

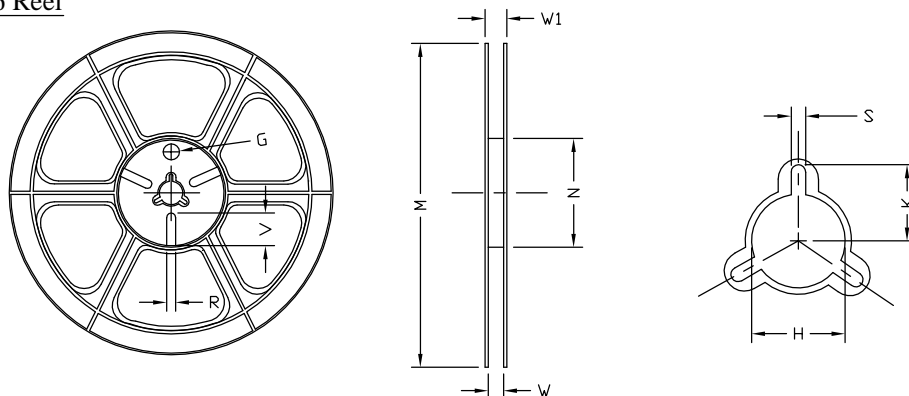
TSOP-6 Carrier Tape



UNIT: MM

| PACKAGE | A0 | B0 | K0 | D0 | D1 | E | E1 | E2 | P0 | P1 | P2 | T |
|------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| SDT-23 (8 mm) | 3.15 ±0.10 | 3.27 ±0.10 | 1.34 ±0.10 | 1.10 ±0.01 | 1.50 ±0.10 | 8.00 ±0.20 | 1.75 ±0.10 | 3.50 ±0.05 | 4.00 ±0.10 | 4.00 ±0.10 | 2.00 ±0.10 | 0.25 ±0.05 |

TSOP-6 Reel



UNIT: MM

| TAPE SIZE | REEL SIZE | M | N | W | W1 | H | K | S | G | R | V |
|-----------|-----------|------------------|--------|---------------|----------------|--------------------------|-------|---------------|-------|------|-------|
| 8 mm | ø180 | ø180.00 ±0.50 | ø60.50 | 9.00 ±0.30 | 11.40 ±1.00 | ø13.00 +0.50 -0.20 | 10.60 | 2.00 ±0.50 | ø9.00 | 5.00 | 18.00 |

TSOP-6 Tape

Leader / Trailer
& Orientation

