

# MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

## **TL431Bxxxx-MS**

**Product specification**

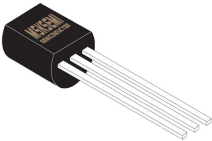
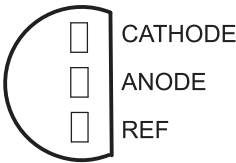
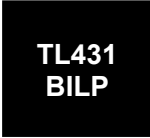
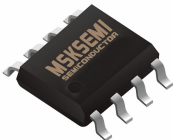
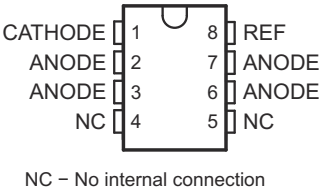
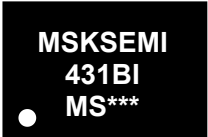
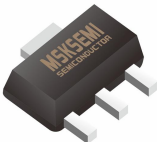
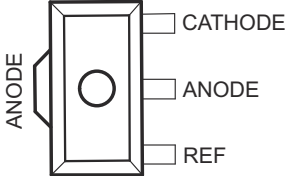

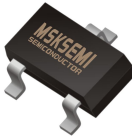
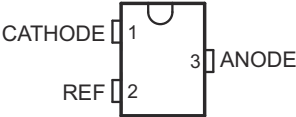

DESCRIPTION

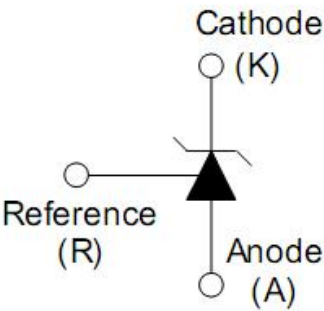
The TL431Blxxxx-MS is a three-terminal adjustable regulator series with a guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between Vref (approximately 2.5 volts) and 40 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

FEATURES

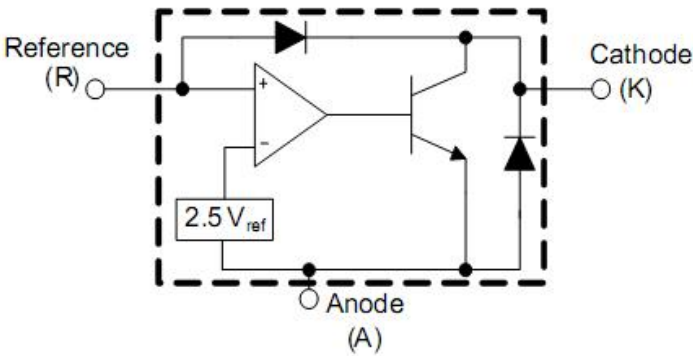
- Programmable Output Voltage to 36V
  - Low Dynamic Output Impedance 0.27Ω (Typ)
  - Sink Current Capability of 0.1 mA to 100 mA
  - Equivalent Full-Range Temperature Coefficient of 50 ppm/°C
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
  - Low Output Noise Voltage
  - Fast Turn on Respons
  - TO-92, SOP-8, SOT-89 or SOT-23 packages

Reference News

| TO-92   | PIN CONFIGURATION   | MARKING   |
|---|---|---|
|   |   |   |
| SOP-8   | PIN CONFIGURATION   | MARKING   |
|  |  |  |
| SOT-89  | PIN CONFIGURATION   | MARKING   |
|  |  |  |
| SOT-23  | PIN CONFIGURATION   | MARKING   |
|  |  |  |



Symbol



Representative Block diagram

**ORDER INFORMATION**

| P/N            | PKG     | QTY  |
|----------------|---------|------|
| TL431BILP-MS   | TO-92   | 1000 |
| TL431BIDBZR-MS | SOT-23  | 3000 |
| TL431BIPK-MS   | SOT89-3 | 1000 |
| TL431BIDR-MS   | SOP-8   | 2500 |

**ABSOLUTE MAXIMUM RATINGS**

(Operating temperature range applies unless otherwise specified)

| Characteristic  | Symbol    | Value       | Unit   |
|---|-----------|-------------|--------|
| Cathode Voltage   | $V_{KA}$  | 36          | V      |
| Cathode Current Range (Continuous)  | $I_K$     | -100 ~ 150  | mA     |
| Reference Input Current Range   | $I_{REF}$ | -0.05 ~ +10 | mA     |
| Power Dissipation at 25°C:<br>TO – 92 Package ( $R_{\theta JA} = 178^{\circ}C/W$ )<br>SOT – 23 – 3 Package ( $R_{\theta JA} = 625^{\circ}C/W$ ) | $P_D$     | 0.7<br>0.2  | W<br>W |
| Junction Temperature Range  | $T_J$     | -40 ~ 85    | °C     |
| Storage Temperature Range   | $T_{stg}$ | -65 ~ +150  | °C     |

**RECOMMENDED OPERATING CONDITIONS**

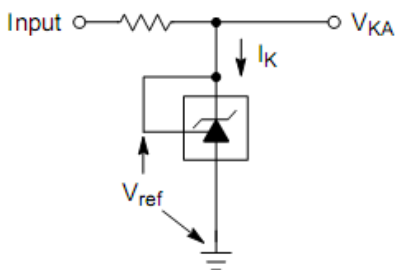
| Characteristic  | Symbol   | Test Condition | Min       | Typ | Max | Unit |
|-----------------|----------|----------------|-----------|-----|-----|------|
| Cathode Voltage | $V_{KA}$ |                | $V_{REF}$ |     | 36  | V    |
| Cathode Current | $I_K$    |                | 0.5       |     | 100 | mA   |

## ELECTRICAL CHARACTERISTICS

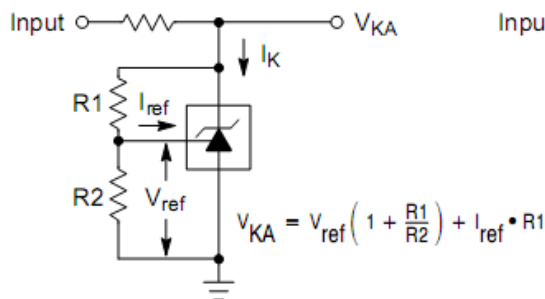
( $T_a = 25^\circ\text{C}$ ,  $V_{KA} = V_{REF}$ ,  $I_K = 10\text{mA}$  unless otherwise specified)

| Characteristic  | Symbol                         | Test Condition  | Min          | Typ        | Max        | Unit          |
|---|--------------------------------|---|--------------|------------|------------|---------------|
| Reference Input Voltage   | $V_{REF}$                      | $V_{KA} = V_{REF}$ , $I_K = 10\text{mA}$  | 2.483        | 2.495      | 2.507      | V             |
| Deviation of Reference Input Voltage Over Full Temperature Range            | $V_{REF(\text{dev})}$          | $T_{\min} \leq T_a \leq T_{\max}$   |              | 3          | 17         | mV            |
| Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage | $\Delta V_{REF}/\Delta V_{KA}$ | $\Delta V_{KA} = 10\text{V} - V_{REF}$<br>$\Delta V_{KA} = 36\text{V} - 10\text{V}$ | -0.4<br>-0.4 | 0.0<br>0.0 | 2.7<br>2.0 | mV/V          |
| Reference Input Current   | $I_{REF}$                      | $R_1 = 10\text{K}\Omega$ , $R_2 = \infty$   |              | 1.8        | 4          | $\mu\text{A}$ |
| Deviation of Reference Input Current Over Full Temperature Range            | $I_{REF(\text{dev})}$          | $R_1 = 10\text{K}\Omega$ , $R_2 = \infty$   |              | 0.4        | 1.2        | $\mu\text{A}$ |
| Minimum Cathode Current for Regulation                                      | $I_{K(\min)}$                  |   |              | 0.25       | 0.5        | mA            |
| Off-State Cathode Current   | $I_{K(\text{off})}$            | $V_{KA} = 40\text{V}$ , $V_{REF} = 0$   |              | 0.17       | 0.9        | $\mu\text{A}$ |
| Dynamic Impedance   | $Z_{KA}$                       | $I_K = 1\text{mA}$ 100 mA, $f \leq 1.0\text{KHz}$                                   |              | 0.27       | 0.5        | $\Omega$      |

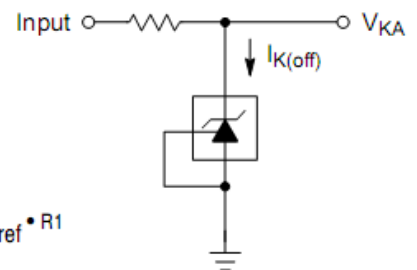
## TEST CIRCUITS



**Test Circuit**  
for  $V_{KA} = V_{ref}$

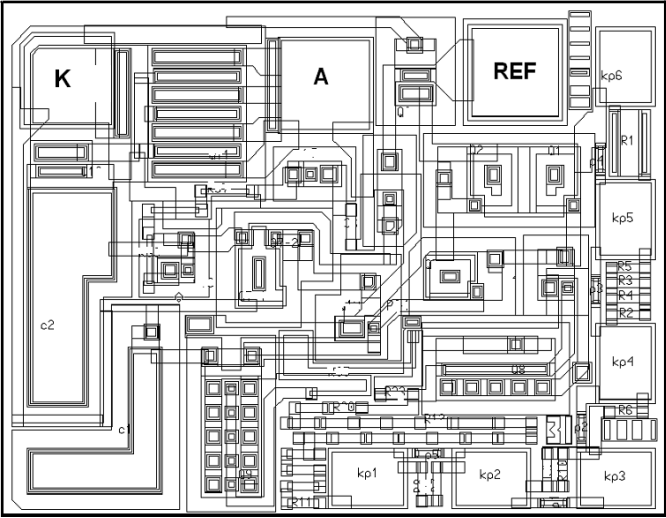


**Test Circuit**  
for  $V_{KA} > V_{ref}$



**Test Circuit**  
for  $I_{K(\text{off})}$

**PAD LAYOUT**



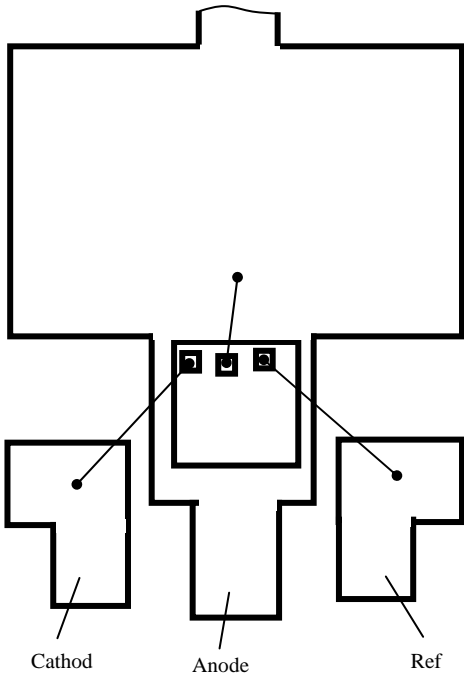
**PHISICAL CHARACTERISTICS:**

- Wafer Diameter.....100 ± 0.5mm
- Wafer Thickness..... 260 ±20 μm
- Die size.....0.76 x 0.60 mm<sup>2</sup>
- Scribe Width.....60 μm
- Pad Size .....86 x 86 μm
- Passivation.....PECVD
- Backside metallization .....without metallization

**PAD LOCATION**

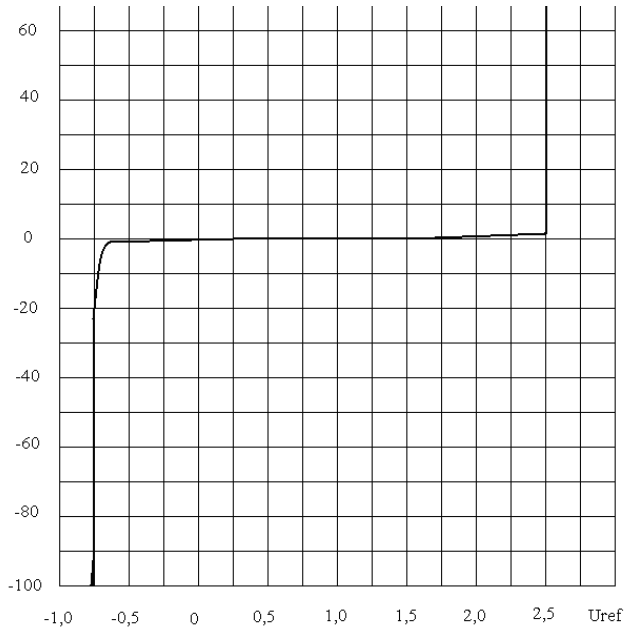
| Pad Name | Description | X   | Y   |
|----------|-------------|-----|-----|
| K        | Cathode     | 56  | 445 |
| A        | Anode       | 328 | 440 |
| R        | Reference   | 528 | 453 |

**BONDING DIAGRAM**

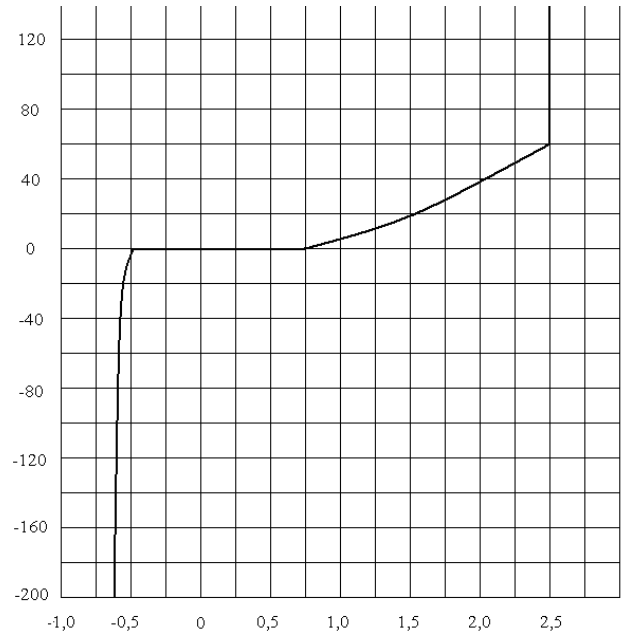


## TYPICAL PERFORMANCE CHARACTERISTICS

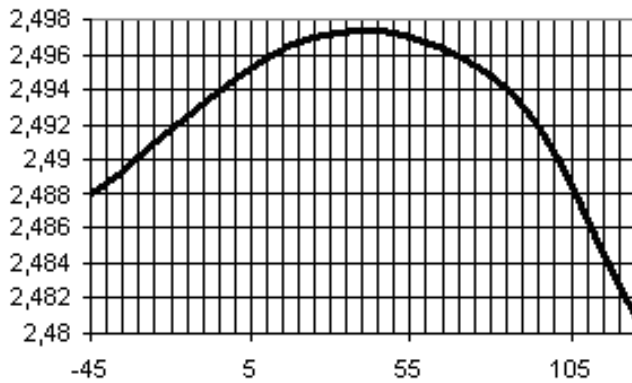
**Cathode Current  $I_k$  (mA)  
vs. Cathode Voltage  $U_k$  (V)**



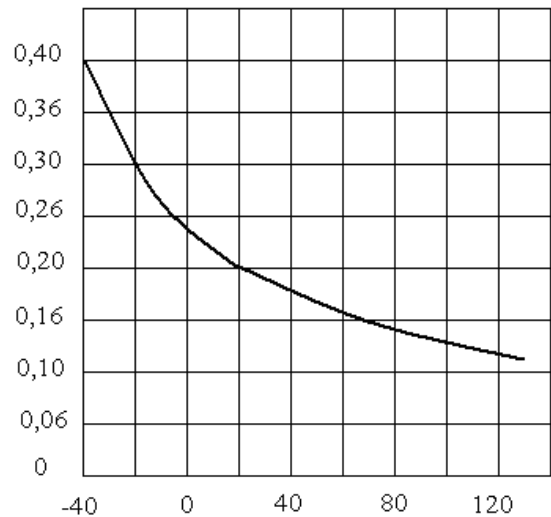
**Cathode Current  $I_k$  (μA)  
vs. Cathode Voltage  $U_k$  (V)**



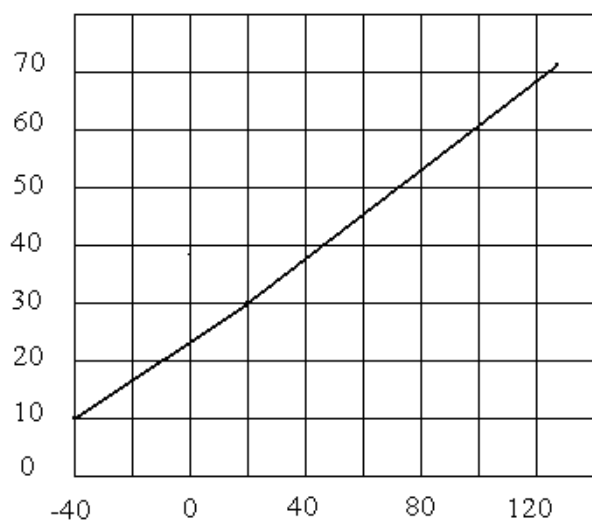
**Reference Voltage  $U_{ref}$  (V)  
vs. Junction Temperature  $T_j$  (°C)  
 $I_k=10\text{mA}$**



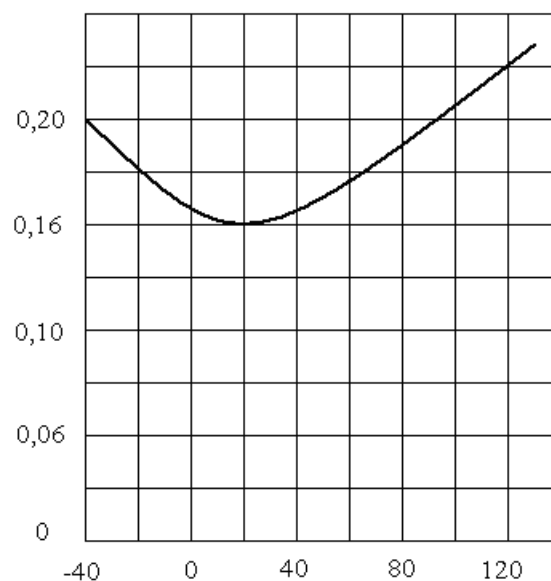
**Reference Input Current  $I_{ref}$  (μA)  
vs. Junction Temperature  $T_j$  (°C)  
 $I_k=10\text{mA}$**



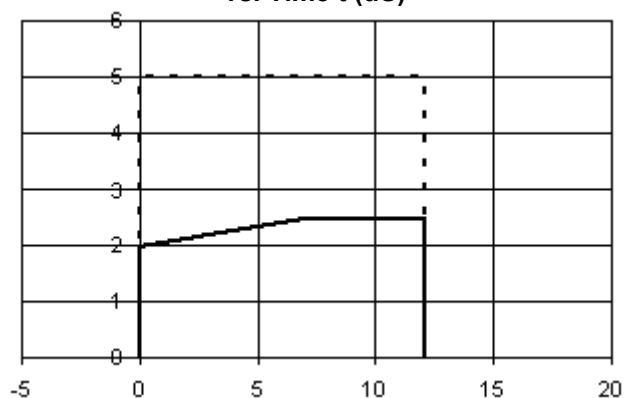
**Off-State Cathode Current  $I_{koff}$  (uA)  
vs. Junction Temperature  $T_j$  (°C)  
 $U_{ka}=36V$**



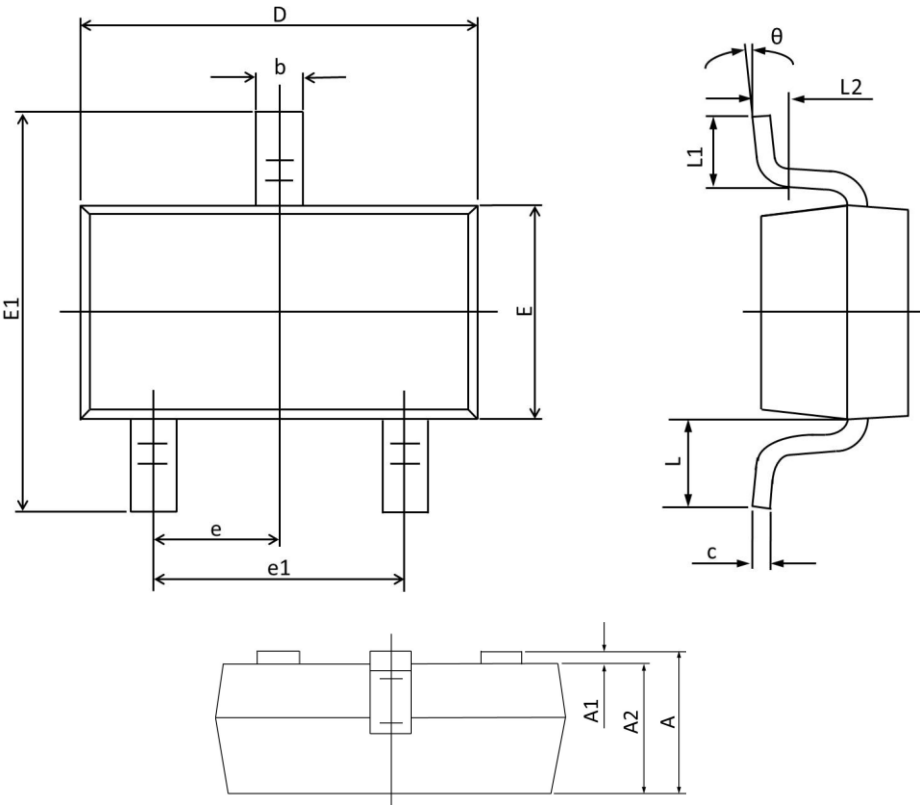
**Dynamic Impedance  $Z_{ka}$  (Ohm)  
vs. Junction Temperature  $T_j$  (°C)  
 $I_k = 1 \div 100$  mA**



**Pulse Response Input and Output Voltage (V)  
vs. Time  $t$  (uS)**



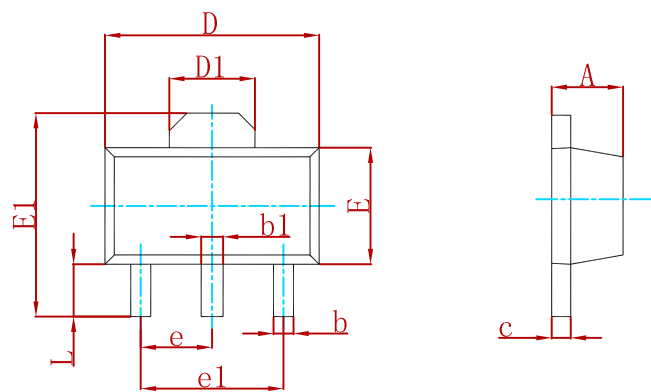
SOT-23 PACKAGE INFORMATION



| Symbol | DimensionsIn Millimeters |       | Dimensions In Inches |       |
|--------|--------------------------|-------|----------------------|-------|
|        | Max                      | Min   | Max                  | Min   |
| A      | 1.150                    | 0.900 | 0.045                | 0.035 |
| A1     | 0.100                    | 0.000 | 0.004                | 0.000 |
| A2     | 1.050                    | 0.900 | 0.041                | 0.035 |
| b      | 0.500                    | 0.300 | 0.020                | 0.012 |
| c      | 0.150                    | 0.080 | 0.006                | 0.003 |
| D      | 3.000                    | 2.800 | 0.118                | 0.110 |
| E      | 1.400                    | 1.200 | 0.055                | 0.047 |
| E1     | 2.550                    | 2.250 | 0.100                | 0.089 |
| e      | 0.95 TYP.                |       | 0.037 TYP.           |       |
| e1     | 2.000                    | 1.800 | 0.079                | 0.071 |
| L      | 0.55 REF.                |       | 0.022 REF.           |       |
| L1     | 0.500                    | 0.300 | 0.020                | 0.012 |
| L2     | 0.25 TYP.                |       | 0.01 TYP.            |       |
| θ      | 8°                       | 0°    | 8°                   | 0°    |

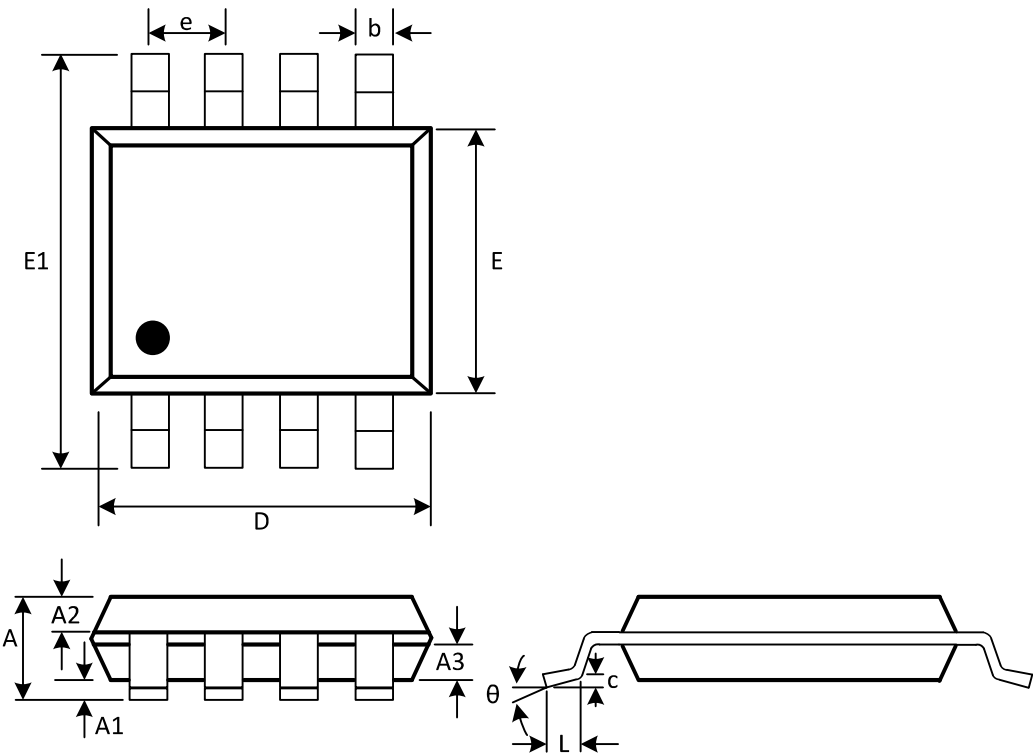


**SOT-89 PACKAGE MECHANICAL DATA**



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 1.400                     | 1.600 | 0.055                | 0.063 |
| b      | 0.320                     | 0.520 | 0.013                | 0.020 |
| b1     | 0.400                     | 0.580 | 0.016                | 0.023 |
| c      | 0.350                     | 0.440 | 0.014                | 0.017 |
| D      | 4.400                     | 4.600 | 0.173                | 0.181 |
| D1     | 1.550 REF.                |       | 0.061 REF.           |       |
| E      | 2.300                     | 2.600 | 0.091                | 0.102 |
| E1     | 3.940                     | 4.250 | 0.155                | 0.167 |
| e      | 1.500 TYP.                |       | 0.060 TYP.           |       |
| e1     | 3.000 TYP.                |       | 0.118 TYP.           |       |
| L      | 0.900                     | 1.200 | 0.035                | 0.047 |

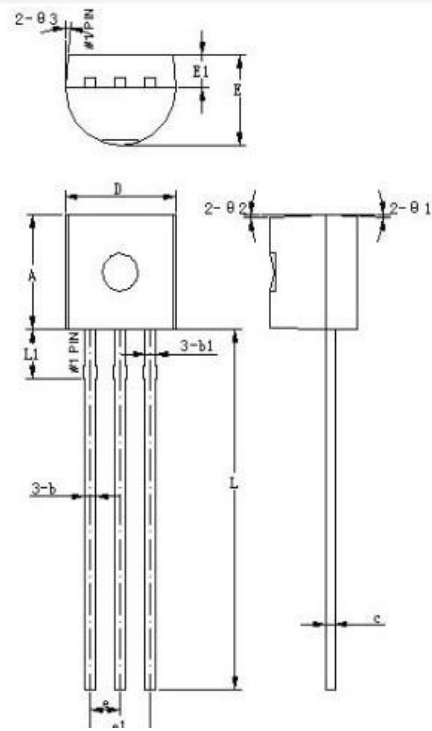
SOP-8 PACKAGE MECHANICAL DATA



(Unit: mm)

| Symbol | Min        | Max   |
|--------|------------|-------|
| A      | 1.300      | 1.600 |
| A1     | 0.050      | 0.200 |
| A2     | 0.550      | 0.650 |
| A3     | 0.550      | 0.650 |
| b      | 0.356      | 0.456 |
| c      | 0.203      | 0.233 |
| D      | 4.800      | 5.000 |
| e      | 1.270(BSC) |       |
| E      | 3.800      | 4.000 |
| E1     | 5.800      | 6.200 |
| L      | 0.400      | 0.800 |
| θ      | 0°         | 8°    |

TO-92 PACKAGE MECHANICAL DATA



| 符号         | 机械尺寸/mm |      |      |
|------------|---------|------|------|
|            | 最小值     | 典型值  | 最大值  |
| A          | 4.5     | 4.6  | 4.7  |
| b          | 0.38    | 0.46 | 0.56 |
| b1         |         | 0.46 |      |
| c          | 0.36    | 0.38 | 0.51 |
| D          | 4.5     | 4.6  | 4.7  |
| E          | 3.45    | 3.6  | 3.75 |
| E1         | 1.2     | 1.3  | 1.4  |
| e          |         | 1.27 |      |
| e1         |         | 2.54 |      |
| L          | 13.5    | 14.5 | 15.3 |
| L1         |         | 1.96 |      |
| $\theta 1$ |         | 2°   |      |
| $\theta 2$ |         | 2°   |      |
| $\theta 3$ |         | 5°   |      |

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