



**THE DATASHEET OF  
AZ431LBZTR-G1**



## Description

The AZ431L series ICs are low voltage three-terminal adjustable regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger, motherboard and other adjustable regulators.

The output voltage can be set to any value between 1.24V and 18V with two external resistors.

The AZ431L precision reference is offered in two voltage tolerance: 0.5% and 1.0%.

These ICs are available in 4 packages: TO92 (bulk or ammo packing), SOT23, SOT25 and SOT89.

## Features

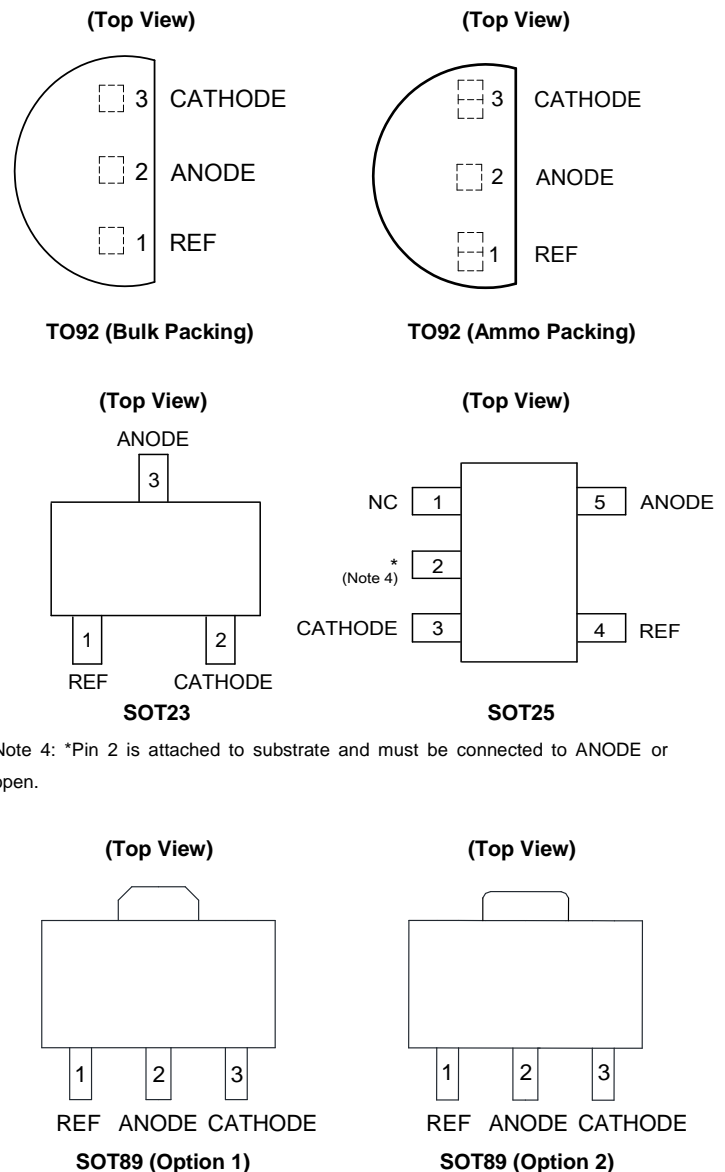
- Wide Programmable Precise Output Voltage from 1.24V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-range Temperature Coefficient: 20PPM/°C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 0.1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages: TO92, SOT23, SOT25, SOT89
  - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in "Green" Molding Compound: TO92, SOT23, SOT25, SOT89
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. "Green" Device (Note 3)**

## Applications

- Graphic Card
- PC Motherboard
- Voltage Adapter
- Switching Power Supply
- Charger

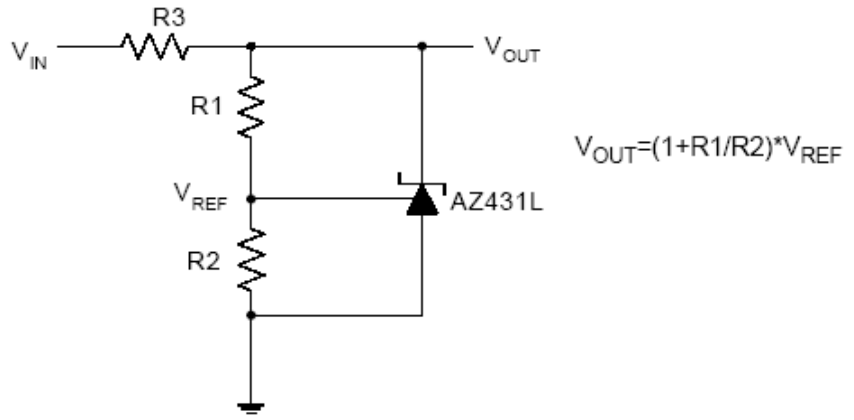
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Assignments



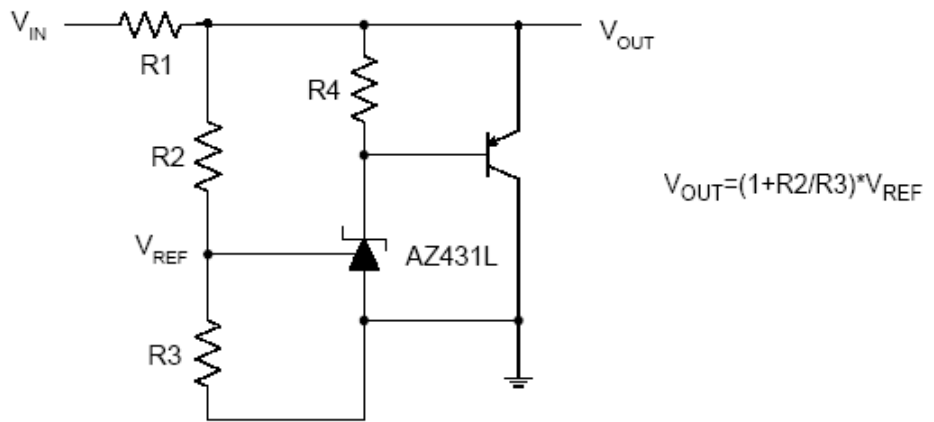
Note 4: \*Pin 2 is attached to substrate and must be connected to ANODE or open.

**Typical Applications Circuit**



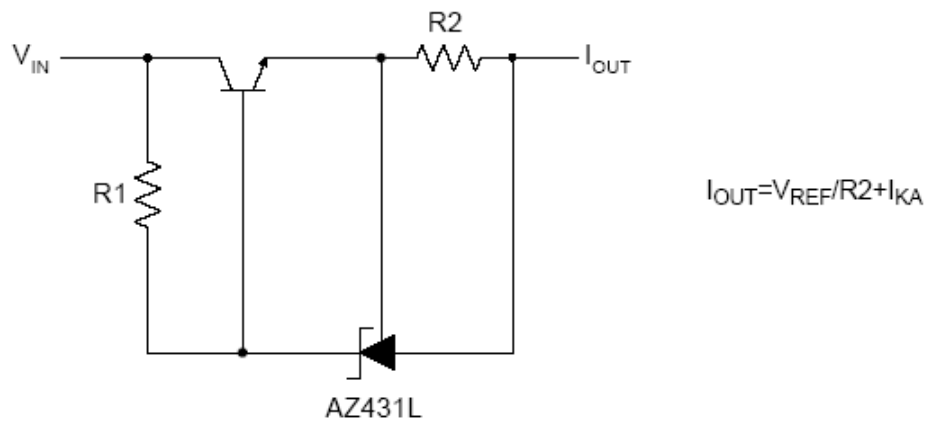
$$V_{OUT} = (1 + R1/R2) \cdot V_{REF}$$

Shunt Regulator



$$V_{OUT} = (1 + R2/R3) \cdot V_{REF}$$

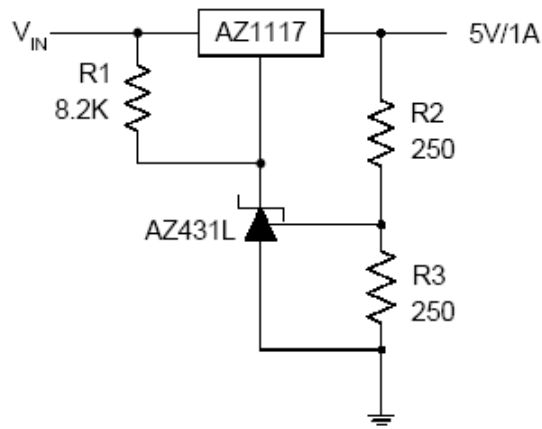
High Current Shunt Regulator



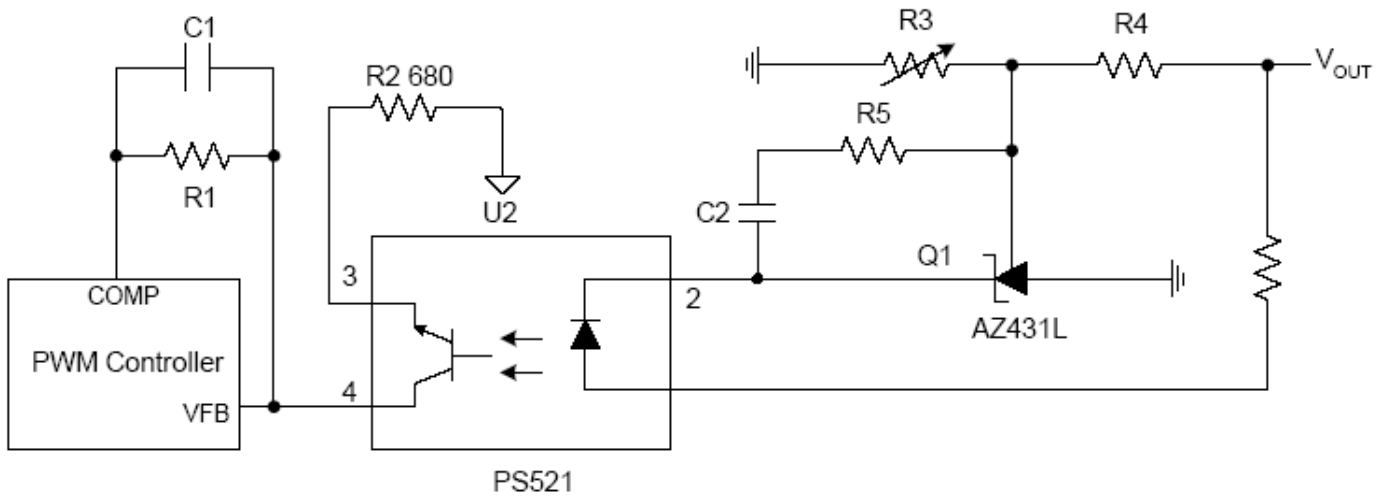
$$I_{OUT} = V_{REF}/R2 + I_{KA}$$

Current Source or Current Limit

**Typical Applications Circuit (Cont.)**

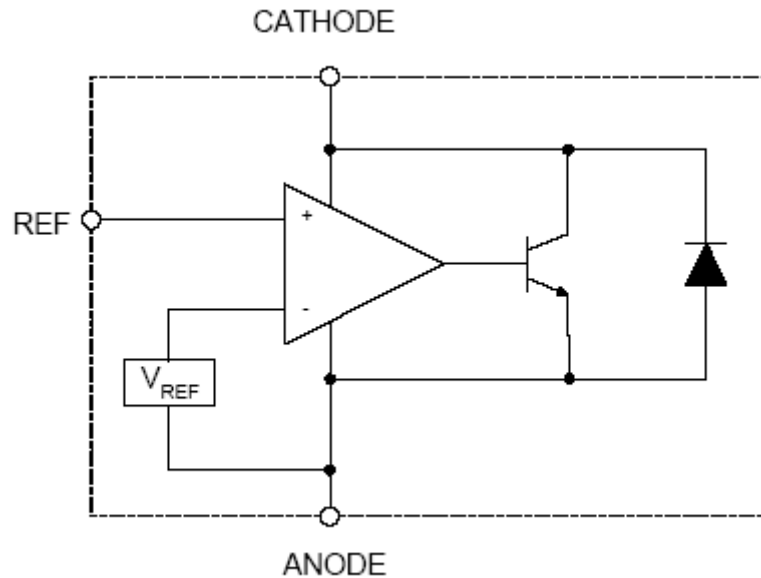


Precision 5V 1A Regulator



PWM Converter with Reference

**Functional Block Diagram**



**Absolute Maximum Ratings** (Note 5)

| Symbol    | Parameter                          | Rating       |     | Unit |
|-----------|------------------------------------|--------------|-----|------|
| $V_{KA}$  | Cathode Voltage                    | 20           |     | V    |
| $I_{KA}$  | Cathode Current Range (Continuous) | -100 to 100  |     | mA   |
| $I_{REF}$ | Reference Input Current Range      | 10           |     | mA   |
| $P_D$     | Power Dissipation                  | Z, R Package | 770 | mW   |
|           |                                    | N, K Package | 370 |      |
| $T_J$     | Junction Temperature               | +150         |     | °C   |
| $T_{STG}$ | Storage Temperature Range          | -65 to +150  |     | °C   |

Note 5: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods may affect device reliability.

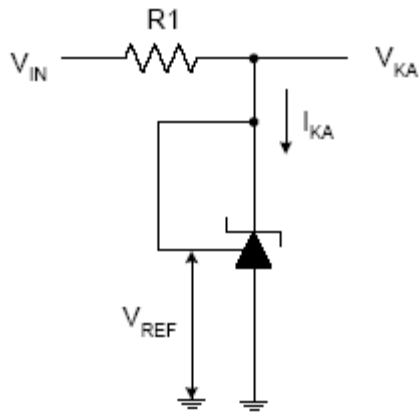
**Recommended Operating Conditions**

| Symbol   | Parameter                           | Min       | Max  | Unit |
|----------|-------------------------------------|-----------|------|------|
| $V_{KA}$ | Cathode Voltage                     | $V_{REF}$ | 18   | V    |
| $I_{KA}$ | Cathode Current                     | 0.1       | 100  | mA   |
| —        | Operating Ambient Temperature Range | -40       | +125 | °C   |

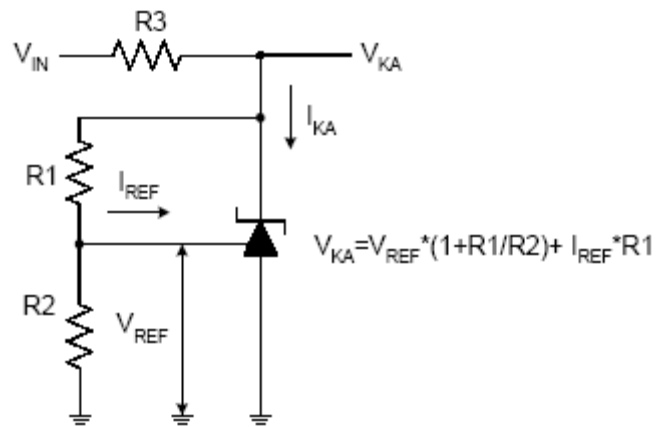
**Electrical Characteristics** (Operating Conditions:  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted.)

| Symbol                                 | Parameter   |      | Test Circuit | Conditions   | Min                                 | Typ    | Max   | Unit               |    |
|--|---|------|--------------|--|-------------------------------------|--------|-------|--------------------|----|
| $V_{REF}$                              | Reference Voltage   | 0.5% | 4            | $V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$   | 1.234                               | 1.240  | 1.246 | V                  |    |
|  |   | 1.0% |              |  | 1.228                               | 1.240  | 1.252 |                    |    |
| $\Delta V_{REF}$                       | Deviation of Reference Voltage Over Full Temperature Range    |      | 4            | $V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$   | 0 to $+70\text{ }^\circ\text{C}$    | —      | 2     | 10                 | mV |
|  |   |      |              |  | -40 to $+85\text{ }^\circ\text{C}$  | —      | 3     | 10                 |    |
|  |   |      |              |  | -40 to $+125\text{ }^\circ\text{C}$ | —      | 4     | 15                 |    |
| $\frac{\Delta V_{REF}}{\Delta V_{KA}}$ | Ratio of Change in $V_{REF}$ to the Change in Cathode Voltage |      | 5            | $I_{KA} = 10\text{mA}, \Delta V_{KA}: V_{REF} \text{ to } 16\text{V}$  | —                                   | -0.5   | -1.5  | mV/V               |    |
| $I_{REF}$                              | Reference Input Current                                       |      | 5            | $I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty$   | —                                   | 0.15   | 0.4   | $\mu\text{A}$      |    |
| $\Delta I_{REF}$                       | Deviation of Reference Current Over Full Temperature Range    |      | 5            | $I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty, T_A = -40 \text{ to } +125\text{ }^\circ\text{C}$ | —                                   | 0.1    | 0.4   | $\mu\text{A}$      |    |
| $I_{KA}$<br>(Min)                      | Minimum Cathode Current for Regulation                        |      | 4            | $V_{KA} = V_{REF}$   | —                                   | 55     | 80    | $\mu\text{A}$      |    |
| $I_{KA}$<br>(Off)                      | Off-state Cathode Current                                     |      | 6            | $V_{REF} = 0, V_{KA} = 18\text{V}$   | —                                   | 0.04   | 0.10  | $\mu\text{A}$      |    |
|  |   |      |              | $V_{KA} = 6, V_{REF} = 0$  | —                                   | 0.01   | 0.05  |                    |    |
| $Z_{KA}$                               | Dynamic Impedance   |      | 4            | $V_{KA} = V_{REF}, I_{KA} = 1 \text{ to } 100\text{mA}, f \leq 1.0\text{kHz}$                                | —                                   | 0.05   | 0.15  | $\Omega$           |    |
| $\theta_{JC}$                          | Thermal Resistance  |      | —            | SOT23  | —                                   | 84.84  | —     | $^\circ\text{C/W}$ |    |
|  |   |      |              | SOT25  | —                                   | 84.84  | —     |                    |    |
|  |   |      |              | TO92   | —                                   | 140.80 | —     |                    |    |
|  |   |      |              | SOT89  | —                                   | 29.80  | —     |                    |    |

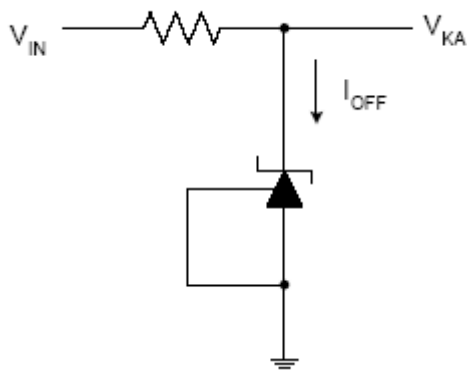
**Electrical Characteristics** (Cont.)



Test Circuit 4 for  $V_{KA} = V_{REF}$



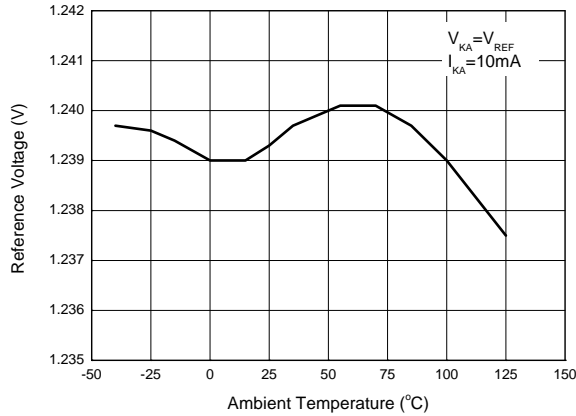
Test Circuit 5 for  $V_{KA} > V_{REF}$



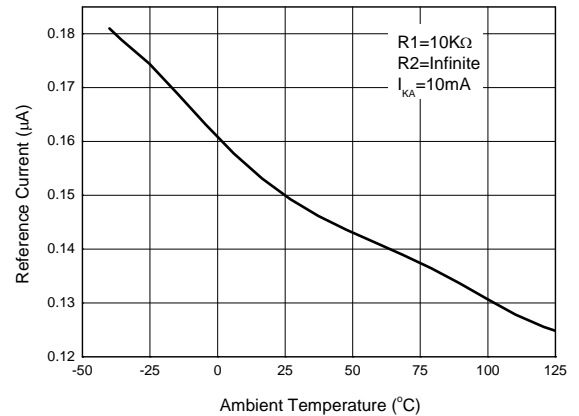
Test Circuit 6 for I<sub>OFF</sub>

**Performance Characteristics**

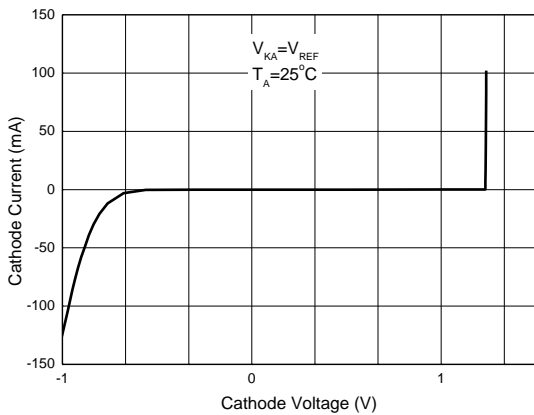
**Reference Voltage vs. Ambient Temperature**



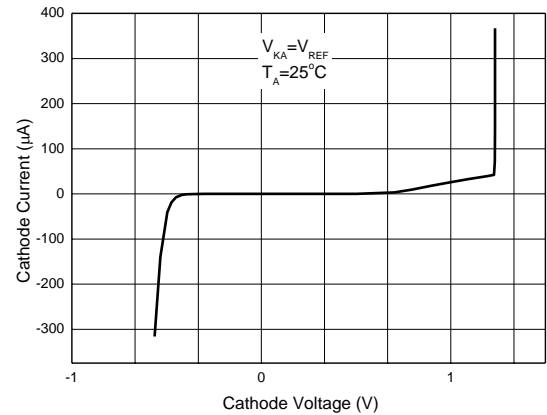
**Reference Current vs. Ambient Temperature**



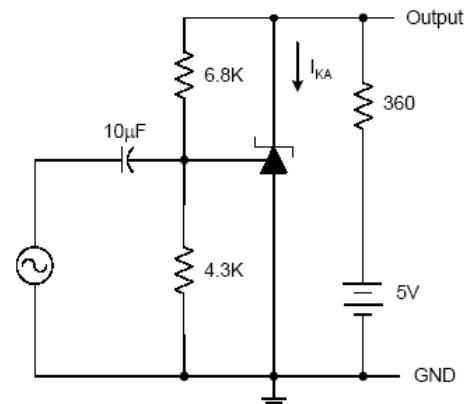
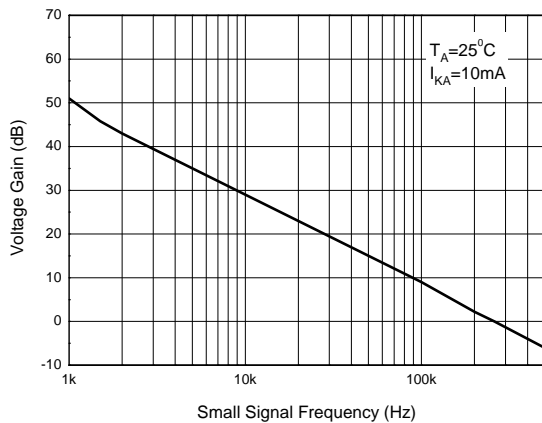
**Cathode Current vs. Cathode Voltage**



**Cathode Current vs. Cathode Voltage**

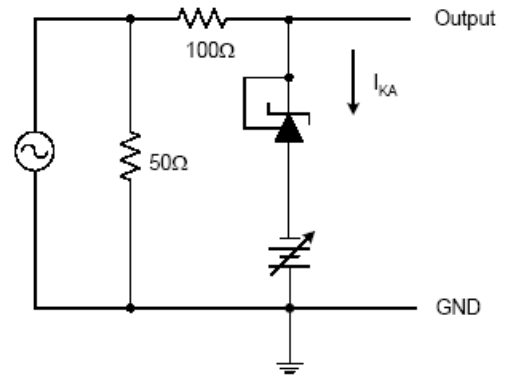
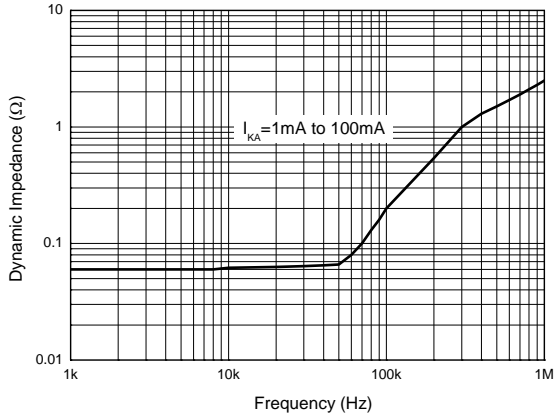


**Small Signal Voltage Gain vs. Frequency**

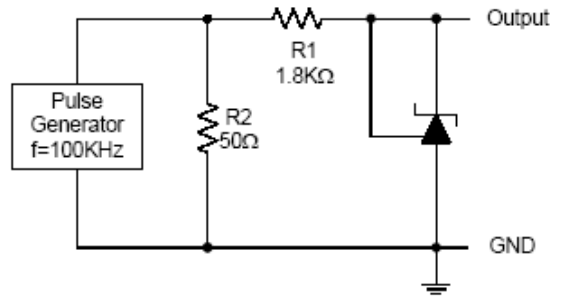
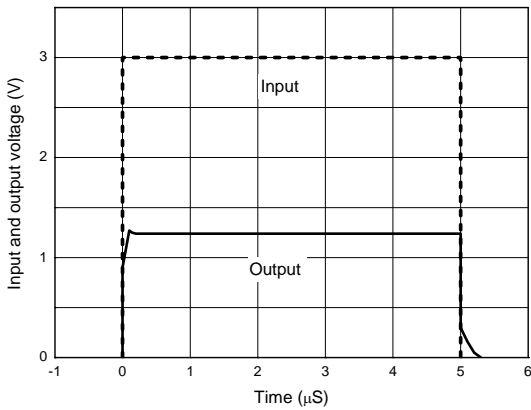


**Performance Characteristics (Cont.)**

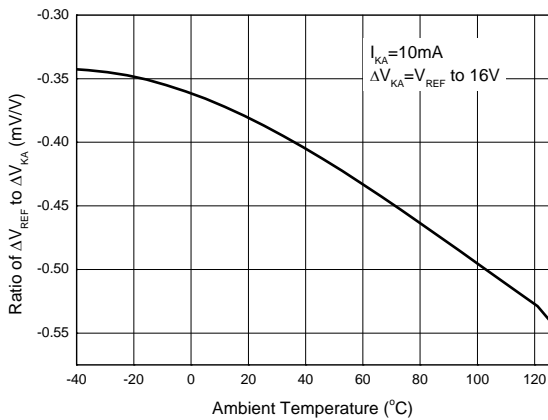
**Dynamic Impedance vs. Frequency**



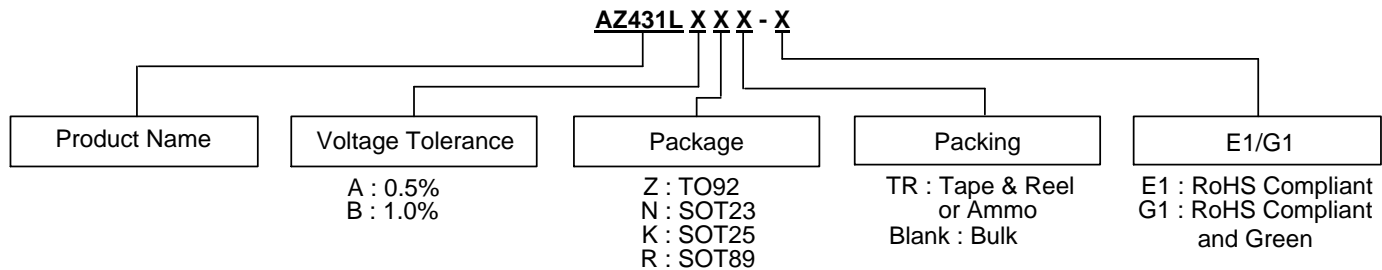
**Pulse Response of Input and Output Voltage**



**Ratio of Delta Reference Voltage to the Ratio of Cathode Voltage vs. Ambient Temperature**



## Ordering Information



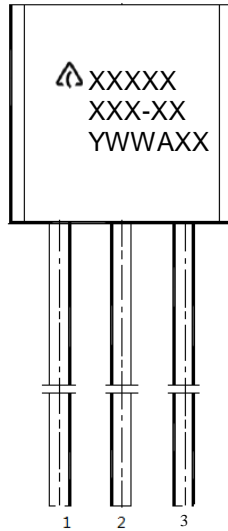
|  | Part Number   | Voltage Tolerance | Package (Note 7) | RoHS Compliant Lead Free / Green | Marking ID  | Packing     | Quantity | Status (Note 6) | Alternative   |
|--|---------------|-------------------|------------------|----------------------------------|-------------|-------------|----------|-----------------|---------------|
|  | AZ431LAZ-E1   | 0.5%              | TO92             | Lead Free                        | AZ431LAZ-E1 | Bulk        | 1000     | End of Life     | AZ431LAZTR-E1 |
|  | AZ431LAZTR-E1 | 0.5%              | TO92             | Lead Free                        | AZ431LAZ-E1 | Ammo        | 2000     | In Production   | —             |
|  | AZ431LBZ-E1   | 1.0%              | TO92             | Lead Free                        | AZ431LBZ-E1 | Bulk        | 1000     | End of Life     | AZ431LBZTR-E1 |
|  | AZ431LBZTR-E1 | 1.0%              | TO92             | Lead Free                        | AZ431LBZ-E1 | Ammo        | 2000     | In Production   | —             |
|  | AZ431LAZ-G1   | 0.5%              | TO92             | Green                            | AZ431LAZ-G1 | Bulk        | 1000     | End of Life     | AZ431LAZTR-E1 |
|  | AZ431LAZTR-G1 | 0.5%              | TO92             | Green                            | AZ431LAZ-G1 | Ammo        | 2000     | In Production   | —             |
|  | AZ431LBZ-G1   | 1.0%              | TO92             | Green                            | AZ431LBZ-G1 | Bulk        | 1000     | In Production   | —             |
|  | AZ431LBZTR-G1 | 1.0%              | TO92             | Green                            | AZ431LBZ-G1 | Ammo        | 2000     | In Production   | —             |
|  | AZ431LANTR-E1 | 0.5%              | SOT23            | Lead Free                        | EA6         | Tape & Reel | 3000     | NRND            | None          |
|  | AZ431LBNTR-E1 | 1.0%              | SOT23            | Lead Free                        | EA7         | Tape & Reel | 3000     | NRND            | None          |
|  | AZ431LANTR-G1 | 0.5%              | SOT23            | Green                            | GA6         | Tape & Reel | 3000     | In Production   | —             |
|  | AZ431LBNTR-G1 | 1.0%              | SOT23            | Green                            | GA7         | Tape & Reel | 3000     | In Production   | —             |
|  | AZ431LAKTR-E1 | 0.5%              | SOT25            | Lead Free                        | E5A         | Tape & Reel | 3000     | NRND            | None          |
|  | AZ431LBKTR-E1 | 1.0%              | SOT25            | Lead Free                        | E6A         | Tape & Reel | 3000     | NRND            | None          |
|  | AZ431LAKTR-G1 | 0.5%              | SOT25            | Green                            | G5A         | Tape & Reel | 3000     | In Production   | —             |
|  | AZ431LBKTR-G1 | 1.0%              | SOT25            | Green                            | G6A         | Tape & Reel | 3000     | In Production   | —             |
|  | AZ431LARTR-E1 | 0.5%              | SOT89            | Lead Free                        | E41A        | Tape & Reel | 1000     | End of Life     | AZ431LARTR-G1 |
|  | AZ431LBRTR-E1 | 1.0%              | SOT89            | Lead Free                        | E41B        | Tape & Reel | 1000     | NRND            | None          |
|  | AZ431LARTR-G1 | 0.5%              | SOT89            | Green                            | G41A        | Tape & Reel | 1000     | In Production   | —             |
|  | AZ431LBRTR-G1 | 1.0%              | SOT89            | Green                            | G41B        | Tape & Reel | 1000     | In Production   | —             |

Notes: 6. NRND: Not Recommended For New Design.  
7. For packaging details, go to our website at: <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information

(1) TO92 (Bulk Packing)

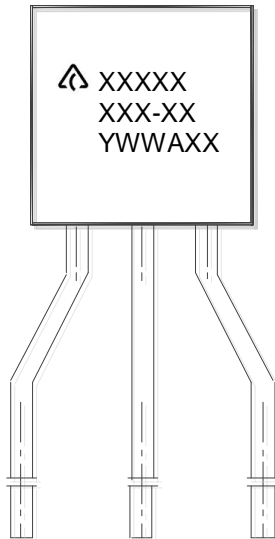
(Front View)



First and Second Lines: Logo and Marking ID  
(See Ordering Information)  
Third Line: Date Code  
Y: Year  
WW: Work Week of Molding  
A: Assembly House Code  
XX: Internal Code

(2) TO92 (Ammo Packing)

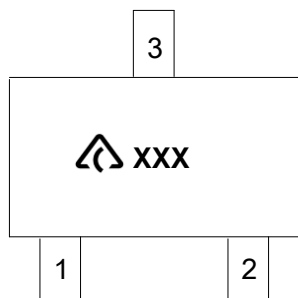
(Front View)




First and Second Lines: Logo and Marking ID  
(See Ordering Information)  
Third Line: Date Code  
Y: Year  
WW: Work Week of Molding  
A: Assembly House Code  
XX: Internal Code

(3) SOT23

(Top View)

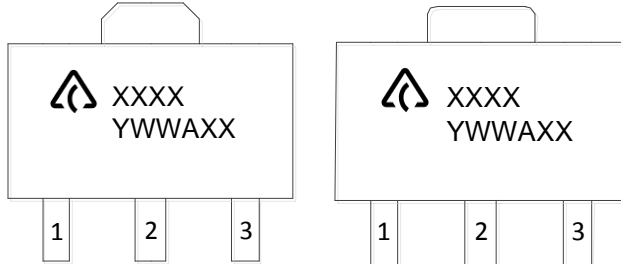


 : Logo  
XXX: Marking ID (See Ordering Information)

**Marking Information** (Cont.)

(4) SOT89

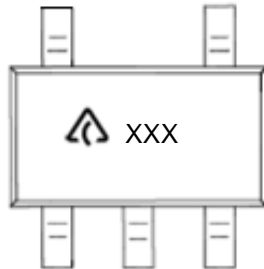
(Top View)




First Line: Logo and Marking ID (See Ordering Information)  
 Second Line: Date Code  
 Y: Year  
 WW: Work Week of Molding  
 A: Assembly House Code  
 XX: Internal Code

(5) SOT25

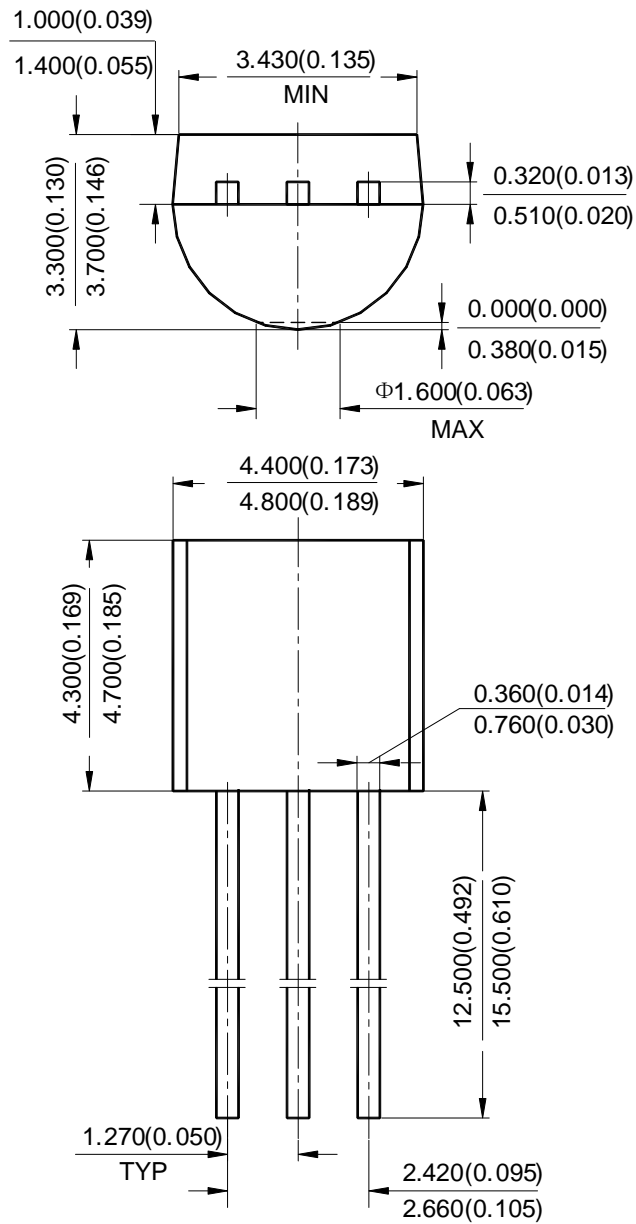
(Top View)



 : Logo  
 XXX: Marking ID (See Ordering Information)

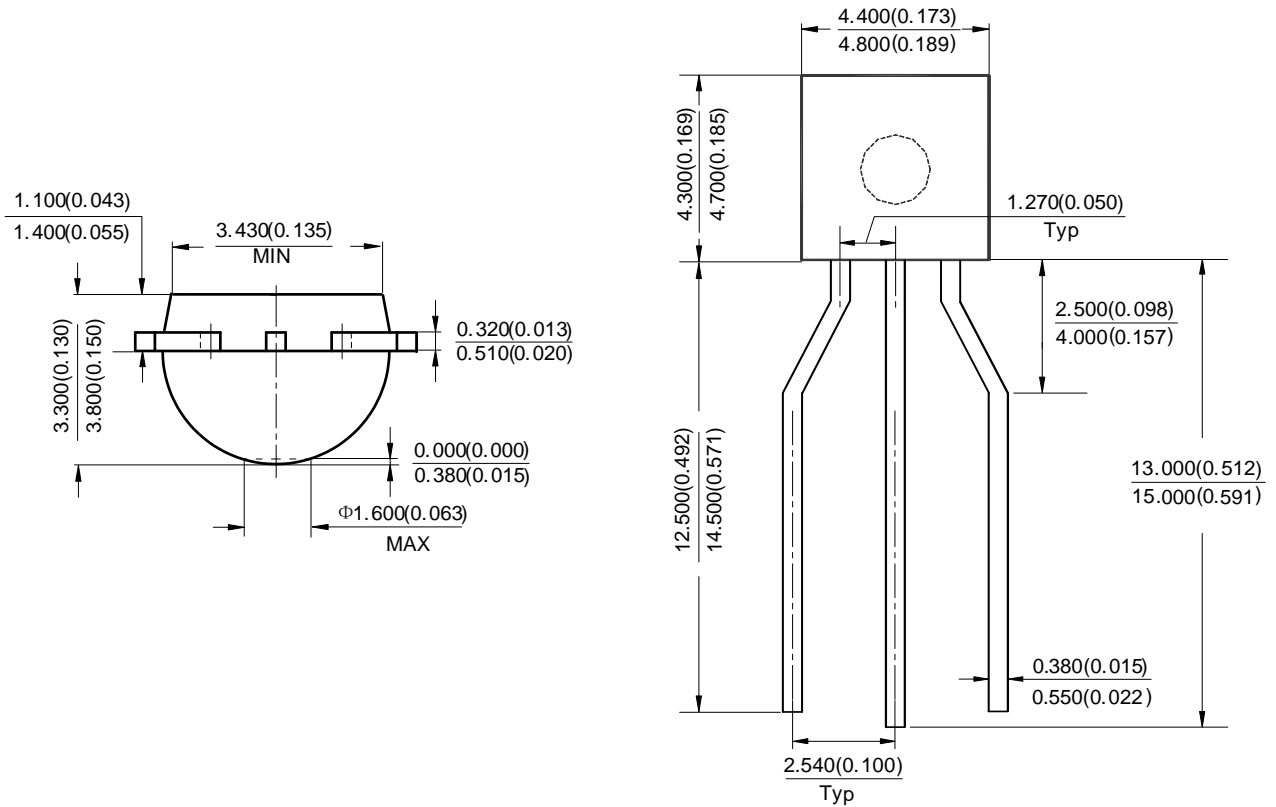
**Package Outline Dimensions** (All dimensions in mm (inch).)

(1) Package Type: TO92 (Bulk Packing)



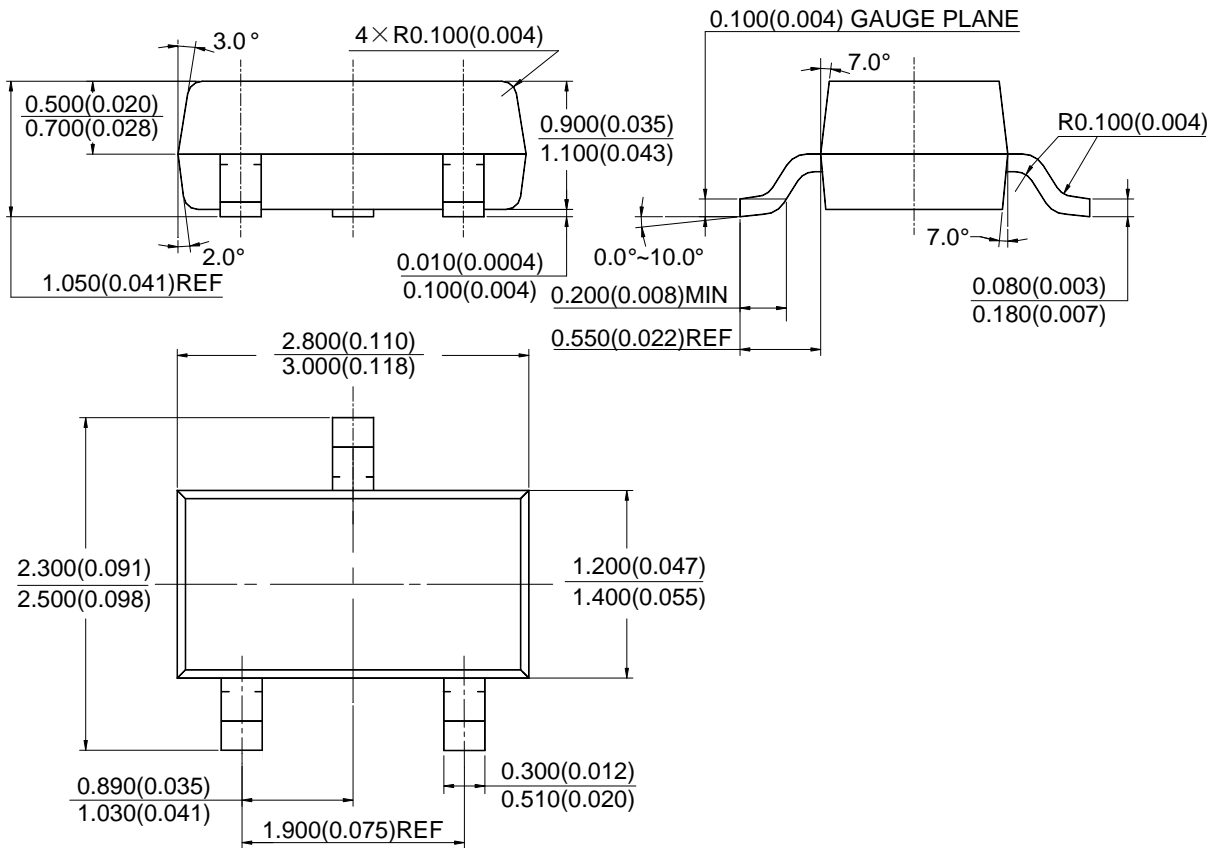
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(2) Package Type: TO92 (Ammo Packing)



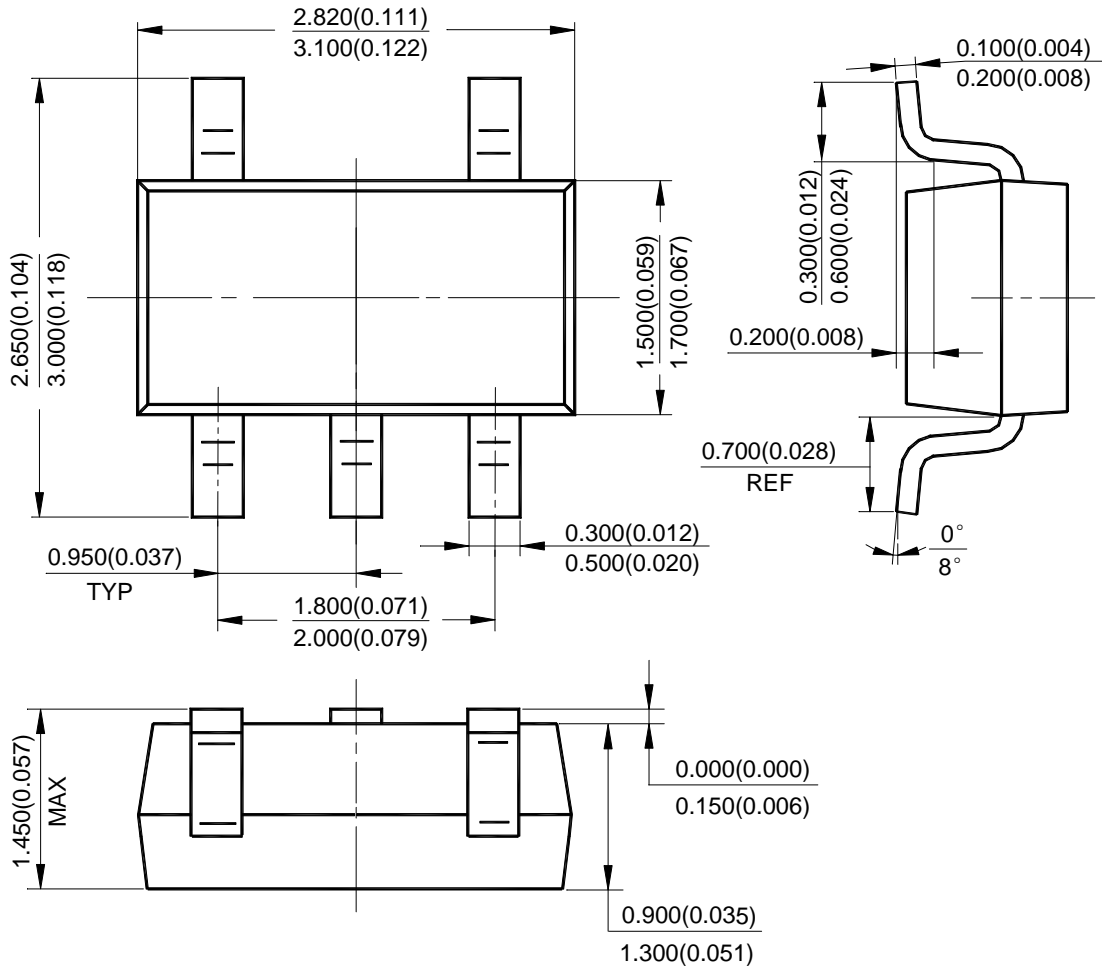
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(3) Package Type: SOT23



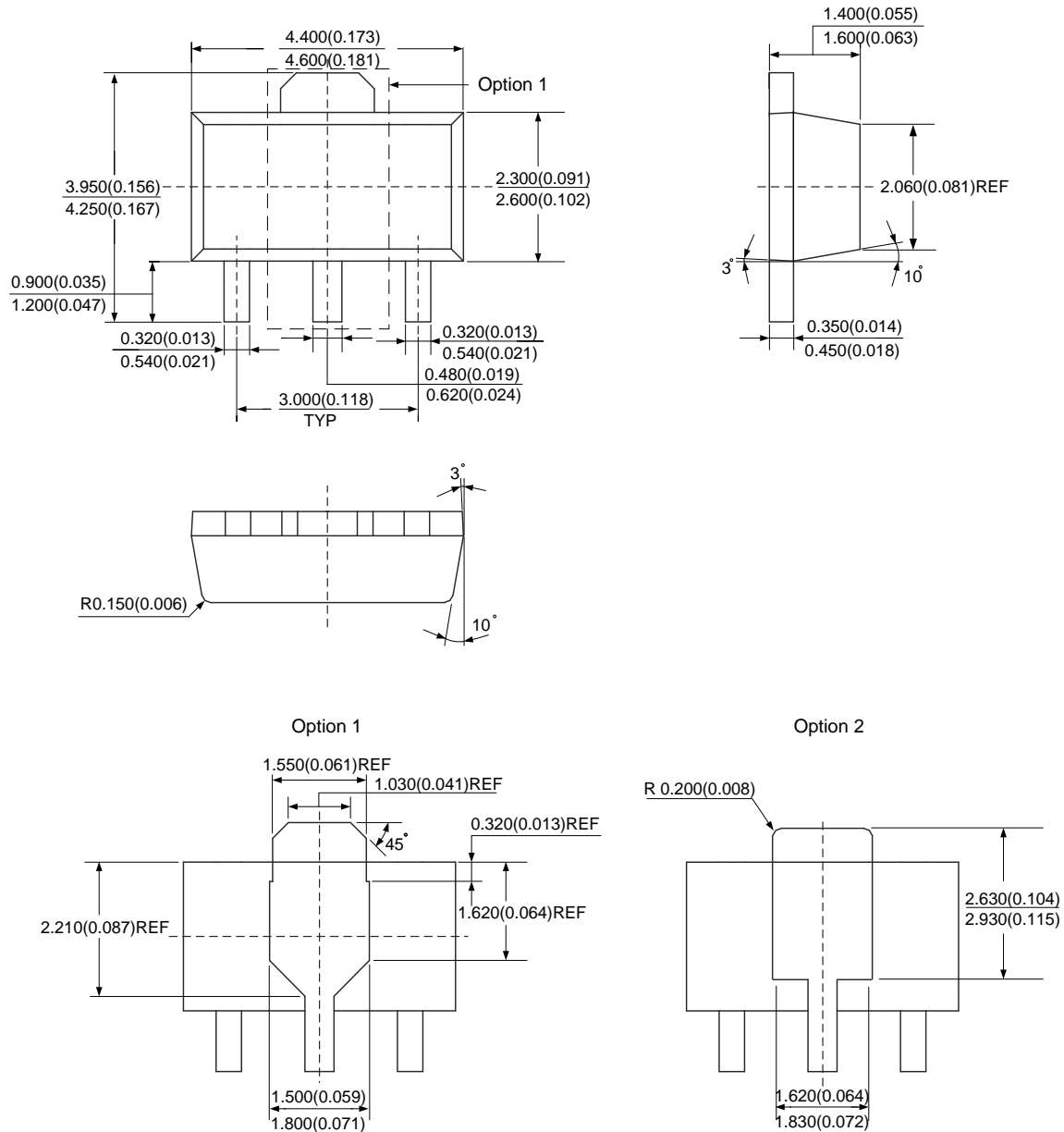
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(4) Package Type: SOT25



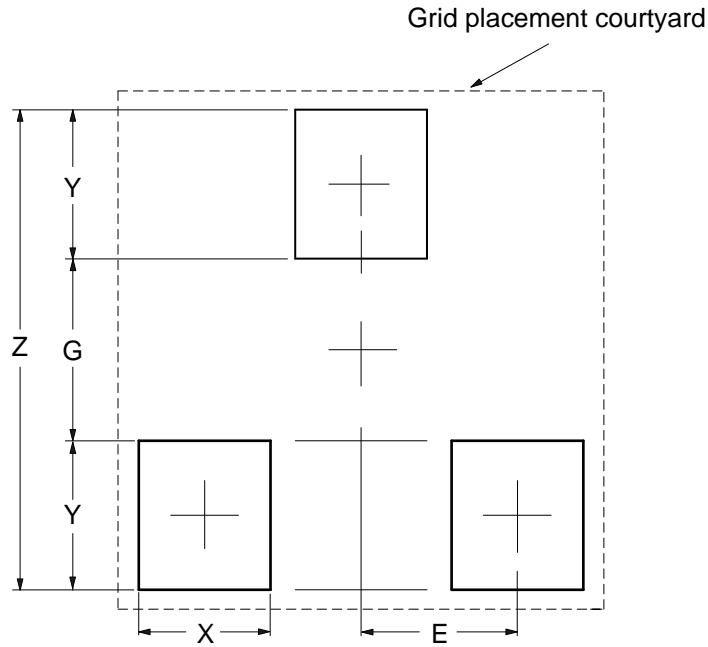
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(5) Package Type: SOT89



**Suggested Pad Layout**

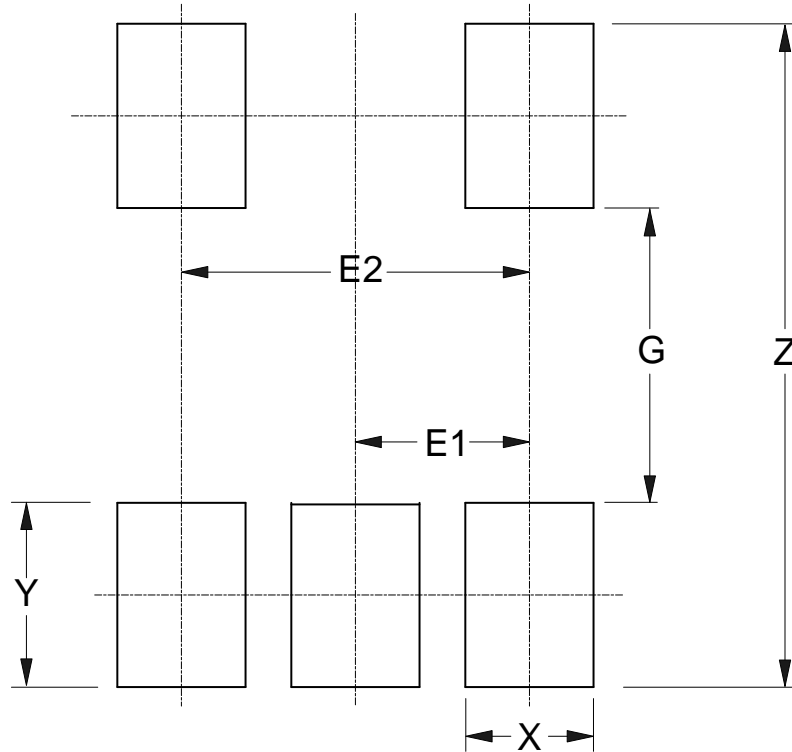
(1) Package Type: SOT23



| Dimensions | Z<br>(mm)/(inch) | G<br>(mm)/(inch) | X<br>(mm)/(inch) | Y<br>(mm)/(inch) | E<br>(mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|------------------|
| Value      | 2.900/0.114      | 1.100/0.043      | 0.800/0.031      | 0.900/0.035      | 0.950/0.037      |

**Suggested Pad Layout** (Cont.)

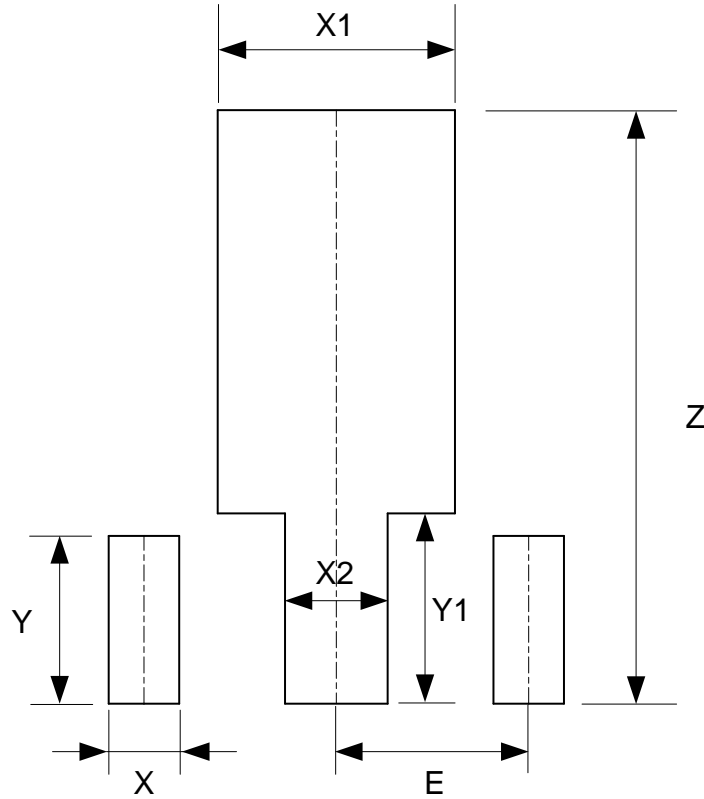
(2) Package Type: SOT25



| Dimensions | Z<br>(mm)/(inch) | G<br>(mm)/(inch) | X<br>(mm)/(inch) | Y<br>(mm)/(inch) | E1<br>(mm)/(inch) | E2<br>(mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|-------------------|-------------------|
| Value      | 3.600/0.142      | 1.600/0.063      | 0.700/0.028      | 1.000/0.039      | 0.950/0.037       | 1.900/0.075       |

**Suggested Pad Layout** (Cont.)

(3) Package Type: SOT89



| Dimensions | Z<br>(mm)/(inch) | X<br>(mm)/(inch) | X1<br>(mm)/(inch) | X2<br>(mm)/(inch) | Y<br>(mm)/(inch) | Y1<br>(mm)/(inch) | E<br>(mm)/(inch) |
|------------|------------------|------------------|-------------------|-------------------|------------------|-------------------|------------------|
| Value      | 4.600/0.181      | 0.550/0.022      | 1.850/0.073       | 0.800/0.031       | 1.300/0.051      | 1.475/0.058       | 1.500/0.059      |

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A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

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