

# MB431A

## Adjustable Precision Shunt Regulator

### Description

The MB431A is a 3-terminal adjustable shunt regulator with guaranteed temperature stability over the entire temperature range of operation. The output voltage may be set at any level greater than 2.5V ( $V_{REF}$ ) up to 36V merely by selecting two external resistors that act as a voltage divided network. Due to the sharp turn-on characteristics this device is an excellent replacement for many zener diode applications.

### Features

- Average temperature coefficient 20 ppm/°C
- Temperature compensated for operation over the full temperature range
- Programmable output voltage
- Fast turn-on response low output noise
- Wide Operating Range of -40 to 125 °C
- Wide Programmable Precise Output Voltage from 2.5V to 36V



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### Pin Configuration

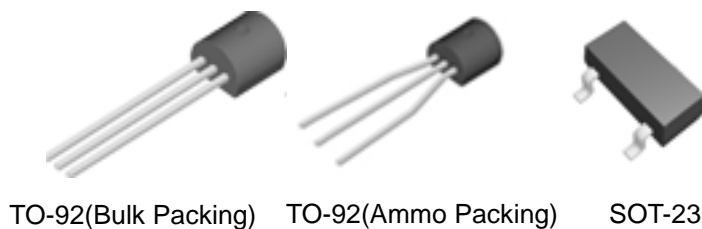
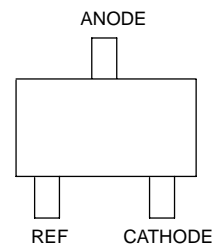
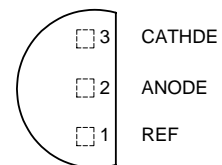
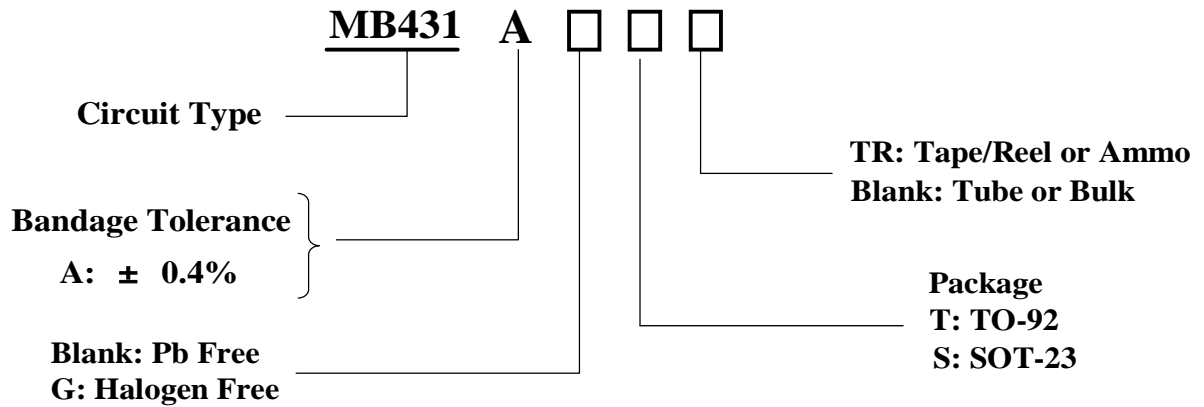


Figure 1. Package Types of MB431A

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## Order Information



| Package | Part Number |              | Marking ID |              | Packing Type |
|---------|-------------|--------------|------------|--------------|--------------|
|         | Pb-free     | Halogen-Free | Pb-free    | Halogen-Free |              |
| TO-92   | MB431AT     | MB431AGT     | MB431A     | MB431AG      | Bulk         |
| TO-92   | MB431ATTR   | MB431AGTTR   | MB431A     | MB431AG      | Ammo         |
| SOT-23  | MB431ASTR   | MB431AGSTR   | 31A        | 31AG         | Tape & Reel  |

## Functional Block Diagram

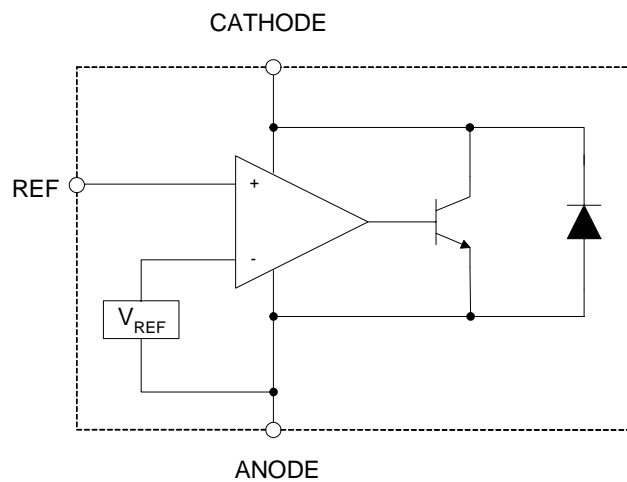


Figure 2. Functional Block Diagram of MB431A

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## Absolute Maximum Ratings

| Parameter                          | Symbol        | Value            | Unit |
|------------------------------------|---------------|------------------|------|
| Cathode Voltage                    | $V_{KA}$      | 40               | V    |
| Cathode Current Range (Continuous) | $I_{KA}$      | -100 to 100      | mA   |
| Reference Input Current Range      | $I_{REF}$     | 10               | mA   |
| Power Dissipation                  | $P_D$         | T,Z Package: 750 | mW   |
|                                    |               | S Package: 350   |      |
| Junction Temperature               | $T_J$         | 150              | °C   |
| Storage Temperature Range          | $T_{STG}$     | -65 to +150      | °C   |
| Package Thermal Impedance          | $\theta_{JA}$ | TO-92: 150       | °C/W |
|                                    |               | SOT-23-3: 90     |      |
|                                    |               | SOT-89: 100      |      |

## Recommended Operating Conditions

| Parameter                           | Symbol   | Min       | Max  | Unit |
|-------------------------------------|----------|-----------|------|------|
| Cathode Voltage                     | $V_{KA}$ | $V_{REF}$ | 36   | V    |
| Cathode Current                     | $I_{KA}$ | 1.0       | 100  | mA   |
| Operating Ambient Temperature Range | $T_A$    | -40       | +125 | °C   |

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## Electrical Characteristics

Operating Conditions: TA= 25 °C unless otherwise specified.

| Parameter   | Test Circuit | Symbol                           | Conditions  |   | MB431 |       |       | Unit    |
|---|--------------|----------------------------------|---|---|-------|-------|-------|---------|
|   |              |                                  |   |   | Min   | Typ   | Max   |         |
| Reference Voltage   | 3            | $V_{REF}$                        | $V_{KA}=V_{REF}$<br>$I_{KA}=10mA$   | A | 2.490 | 2.500 | 2.510 | V       |
| Deviation of Reference Voltage Over-Temperature                       | 3            | $\Delta V_{REF}$                 | 0 to 70°C   |   |       | 5     | 12    | mV      |
|   |              |                                  | -20 to +85°C  |   |       | 5     | 15    |         |
| Ratio of Change in Reference Voltage to the Change in Cathode Voltage | 4            | $\Delta V_{REF} / \Delta V_{KA}$ | $I_{KA}=10mA$<br>$\Delta V_{KA}=10V$ to $V_{REF}$                         |   |       | -1.2  | -2.7  | mV/V    |
|   |              |                                  | $I_{KA}=10mA$<br>$\Delta V_{KA}=36V$ to 10V                               |   |       | -0.8  | -2.2  |         |
| Reference Current   | 4            | $I_{REF}$                        | $I_{KA}=10mA$<br>$R1=10k \Omega, R2=\infty$                               |   |       | 0.8   | 4     | $\mu A$ |
| Deviation of Reference Current Over Full Temperature Range            | 4            | $\Delta I_{REF}$                 | $I_{KA}=10mA$<br>$R1=10k \Omega, R2=\infty$<br>$T_A=-20$ to $+85^\circ C$ |   |       | 0.03  | 0.3   | $\mu A$ |
| Minimum Cathode Current for Regulation                                | 3            | $I_{KA(min)}$                    | $V_{KA}=V_{REF}$  |   |       | 0.4   | 1.0   | mA      |
| Off-State Cathode Current   | 5            | $I_{KA(off)}$                    | $V_{KA}=36V, V_{REF}=0$   |   |       | 0.1   | 1.0   | $\mu A$ |
| Dynamic Impedance   | 3            | $Z_{KA}$                         | $V_{KA}=V_{REF}$<br>$I_{KA}=1$ to $100mA$<br>$f \leq 1.0KHz$              |   |       | 0.2   | 0.5   | ohm     |

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## Test Circuits

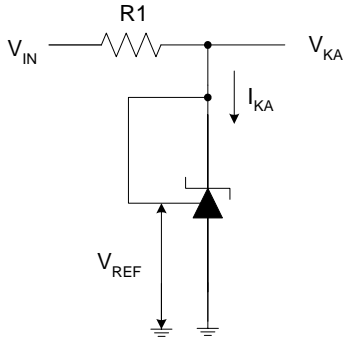


Figure 3 .Test Circuit 3 for  $V_{KA} > V_{REF}$

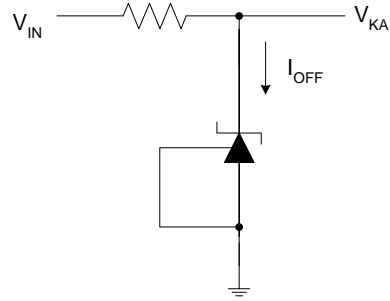


Figure 4 .Test Circuit 4 for  $I_{off}$

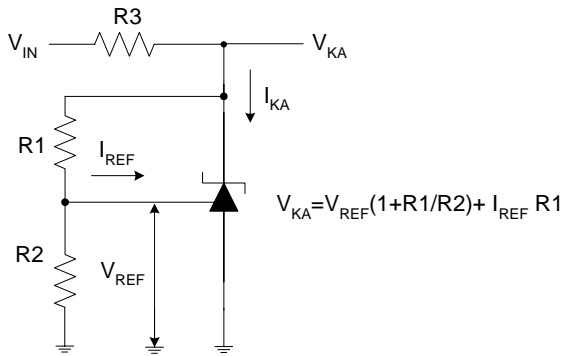


Figure 5 .Test Circuit 5 for  $V_{KA} > V_{REF}$

## Typical Performance Characteristics

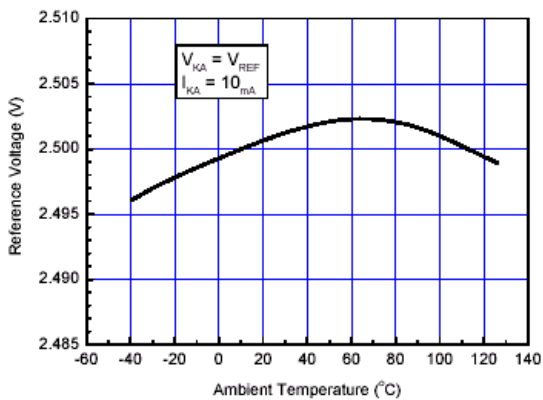


Figure 6.  $V_{REF}$  vs. Ambient Temperature

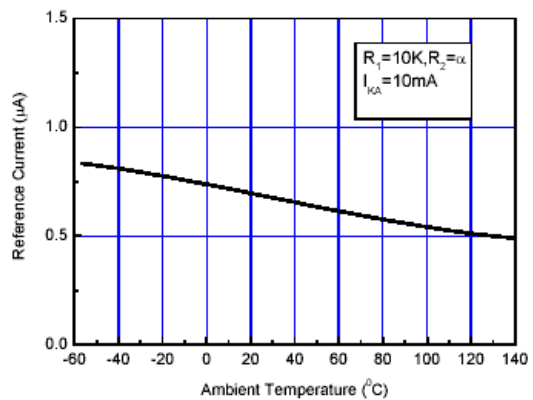


Figure 7.  $I_{REF}$  vs. Ambient Temperature

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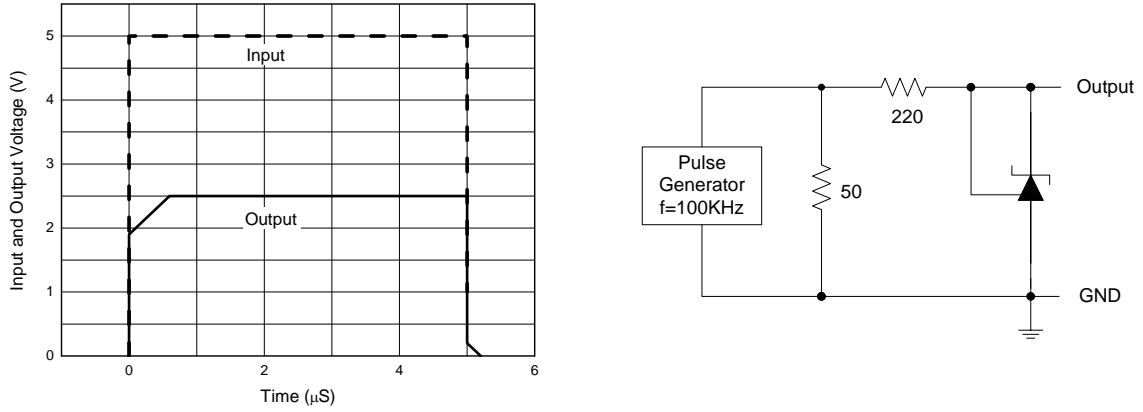


Figure 8. Pulse Response of Input and Output Voltage

## Typical Applications

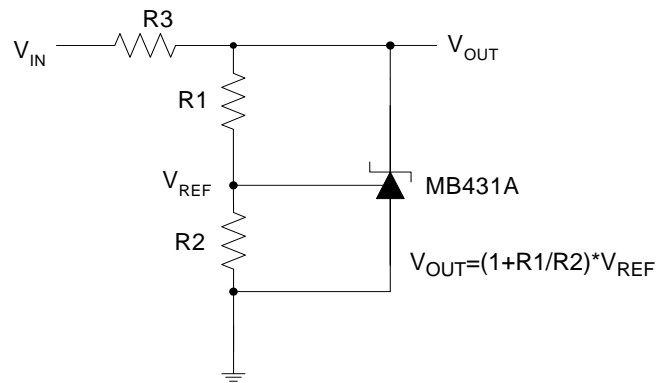


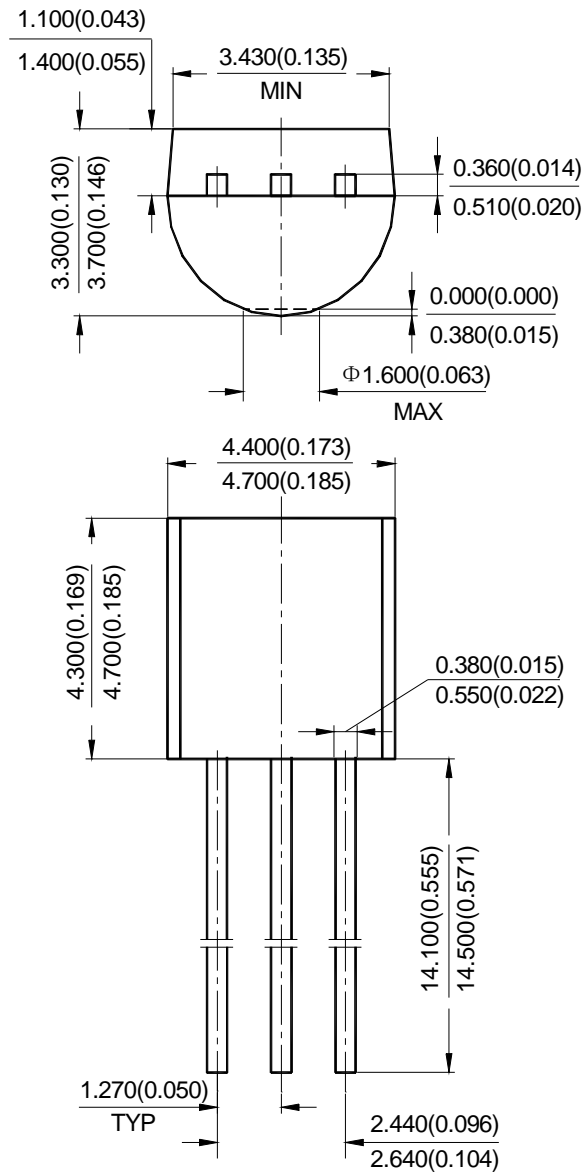
Figure 9. Shunt Regulator

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## Mechanical Dimensions

TO-92(Bulk Packing)

Unit: mm(inch)

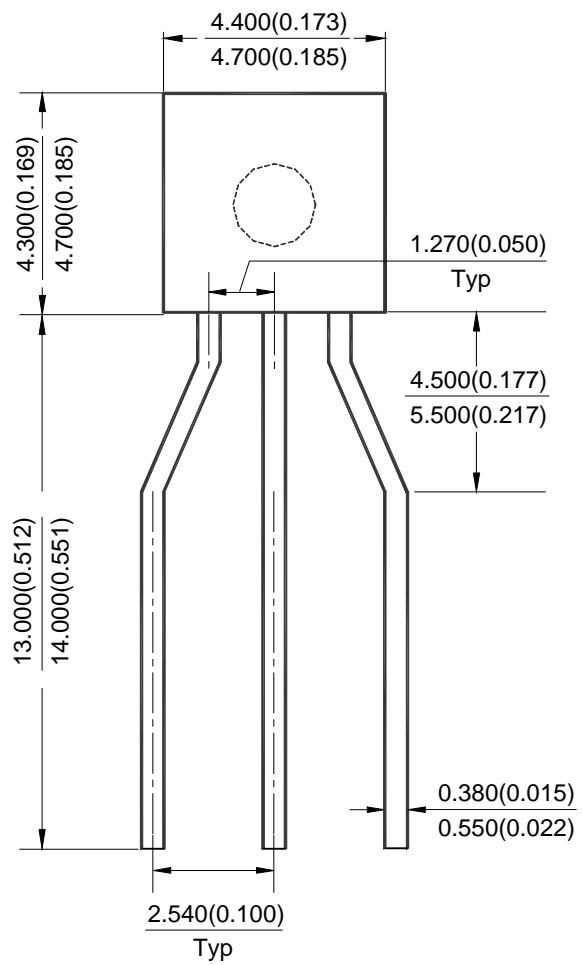
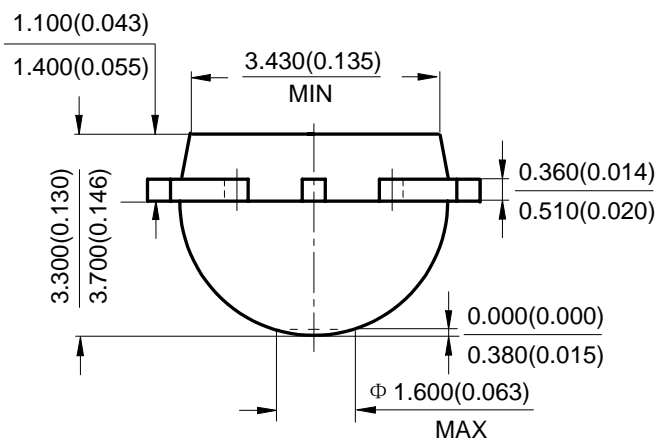


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## Mechanical Dimensions (Cont'd)

TO-92(Ammo Packing)

Unit: mm(inch)

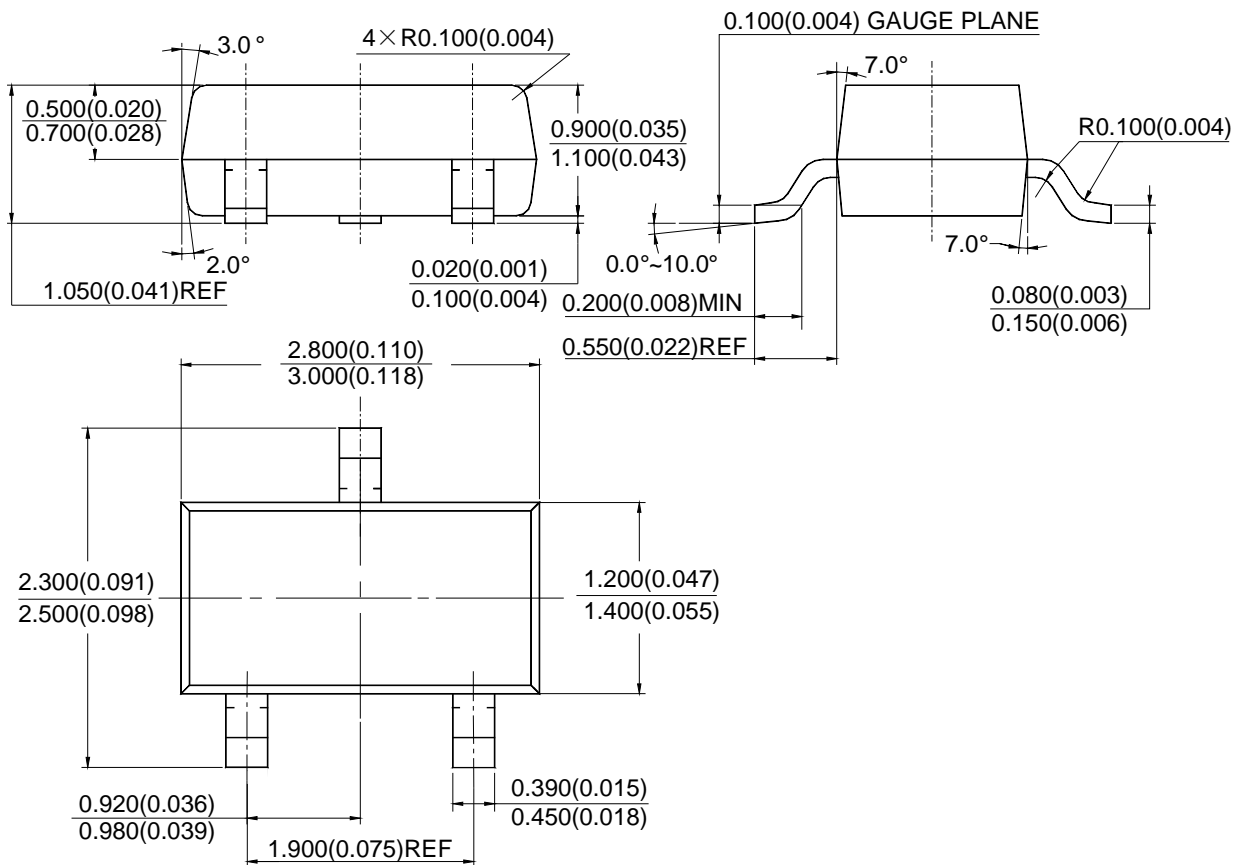


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## Mechanical Dimensions (Cont'd)

SOT-23

Unit: mm(inch)



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## IMPORTANT NOTICE

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