# KA431/KA431A/KA431L

## Programmable Shunt Regulator

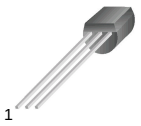
### Features

- Programmable Output Voltage to 36 Volts
- Low Dynamic Output Impedance 0.20 Typical
- Sink Current Capability of 1.0 to 100mA
- Equivalent Full-Range Temperature Coefficient of 50ppm/°C Typical
- Temperature Compensated for Operation Over Full Rated Operating Temperature Range
- Low Output Noise Voltage
- Fast Turn-on Response

### Description

The KA431/KA431A/KA431L are 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 36 volts with two external resistors These devices have a typical dynamic output impedance of 0.2W Active output circuitry provides a very sharp turn on characteristic, making these devices excellent replacement for zener diodes in many applications.

**TO-92**




1. Ref 2. Anode 3. Cathode

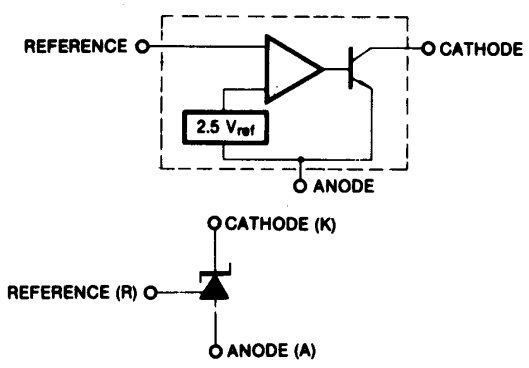
**8-DIP**


1.Cathode 2.3.4.5.7.NC 6.Anode 8.Ref

**8-SOP**


1.Cathode 2.3.6.7.Anode 4.5.NC 8.Ref

### Internal Block Diagram



## Absolute Maximum Ratings

(Operating temperature range applies unless otherwise specified.)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | 37 | V |
| Cathode Current Range (Continuous) | $I_{KA}$ | -100~ + 150 | mA |
| Reference Input Current Range | $I_{REF}$ | 0.05~ + 10 | mA |
| Power Dissipation<br>D, Z Suffix Package<br>DIP Package | $P_D$ | <br>770<br>1000 | <br>mW<br>mW |
| Operating Temperature Range | $T_{OPR}$ | -25 ~ + 85 | $^oC$ |
| Storage Temperature Range | $T_{STG}$ | -65 ~ + 150 | $^oC$ |

## Recommended Operating Conditions

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Cathode Voltage | $V_{KA}$ | $V_{REF}$ | - | 36 | V |
| Cathode Current | $I_{KA}$ | 1.0 | - | 100 | mA |

## Electrical Characteristics

($T_A$ = +25°C, unless otherwise specified)

| Parameter | Symbol | Conditions | KA431 | | | KA431A | | | KA431L | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| Reference Input Voltage | $V_{REF}$ | $V_{KA}=V_{REF}$, $I_{KA}$=10mA | 2.450 | 2.500 | 2.550 | 2.470 | 2.495 | 2.520 | 2.482 | 2.495 | 2.508 | V |
| Deviation of Reference Input Voltage Over-Temperature | ΔVREF/ ΔT | VKA=VREF, IKA=10mA TMIN≤TA≤TMAX | - | 4.5 | 17 | - | 4.5 | 17 | - | 4.5 | 17 | mV |
| Ratio of Change in Reference Input Voltage | ΔVREF/ ΔVKA | IKA =10mA, ΔVKA=10 V-VREF | - | - 1.0 | - 2.7 | - | - 1.0 | - 2.7 | - | - 1.0 | - 2.7 | mV/V |
| to the Change in Cathode Voltage | | IKA =10mA, ΔVKA=36 V-10V | - | -0.5 | -2.0 | - | -0.5 | -2.0 | - | -0.5 | -2.0 | mV/V |
| Reference Input Current | IREF | IKA=10mA, R1=10KΩ,R2=∞ | - | 1.5 | 4 | - | 1.5 | 4 | - | 1.5 | 4 | mA |
| Deviation of Reference Input Current Over Full Temperature Range | ΔIREF/ΔT | IKA=10mA, R1=10KΩ,R2=∞ TA =Full Range | - | 0.4 | 1.2 | - | 0.4 | 1.2 | - | 0.4 | 1.2 | mA |
| Minimum Cathode Current for Regulation | IKA(MIN) | VKA=VREF | - | 0.45 | 1.0 | - | 0.45 | 1.0 | - | 0.45 | 1.0 | mA |
| Off - Stage Cathode Current | IKA(OFF) | VKA=36V, VREF=0 | - | 0.05 | 1.0 | - | 0.05 | 1.0 | - | 0.05 | 1.0 | mA |
| Dynamic Impedance | ZKA | VKA=VREF, IKA=1 to 100mA f ≥1.0KHz | - | 0.15 | 0.5 | - | 0.15 | 0.5 | - | 0.15 | 0.5 | Ω |

• $T_{MIN}$= -25 °C, $T_{MAX}$= +85 °C

## Test Circuits

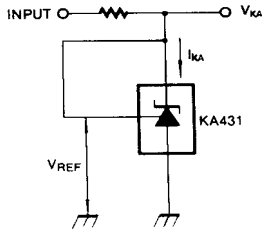



**Figure 1.Test Circuit for $V_{KA}=V_{REF}$**

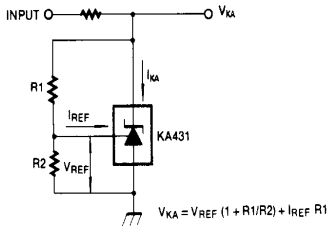



**Figure 2.Test Circuit for $V_{KA}$ 3$V_{REF}$**

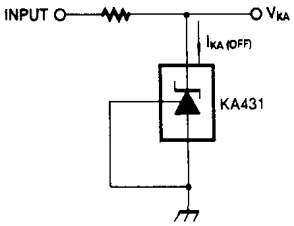



**Figure 3. Test Circuit for $I_{KA(OFF)}$**

# Typical Perfomance Characteristics

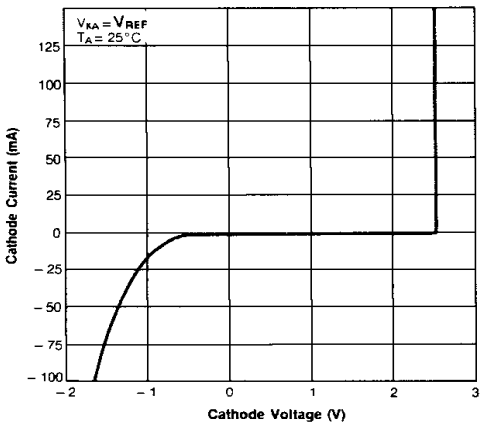



**Figure 4. Cathode Current vs. Cathode Voltage**

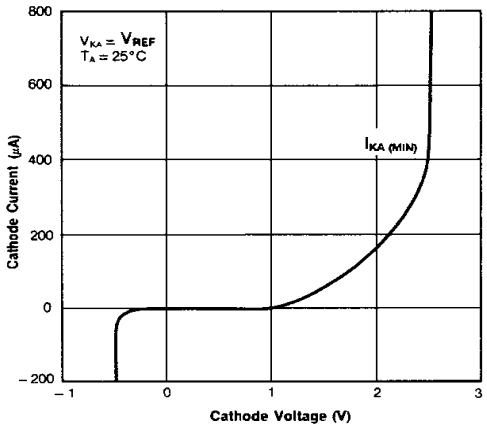



**Figure 5. Cathode Current vs. Cathode Voltage**

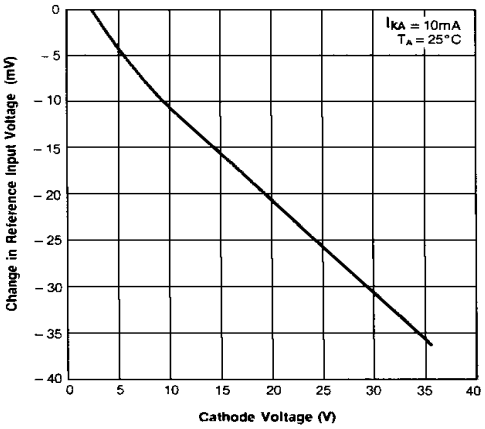



**Figure 6. Change In Reference Input Voltage vs. Cathode Voltage**

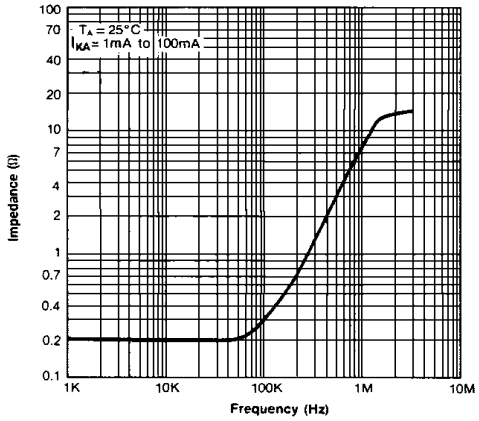



**Figure7. Dynamic Impedance Frequency**

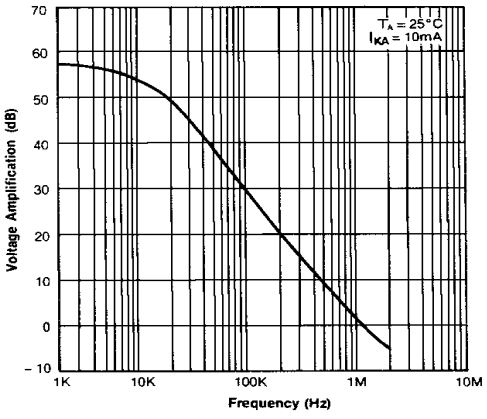



**Figure 8. Small Signal Voltage Amplification vs. Frequency**

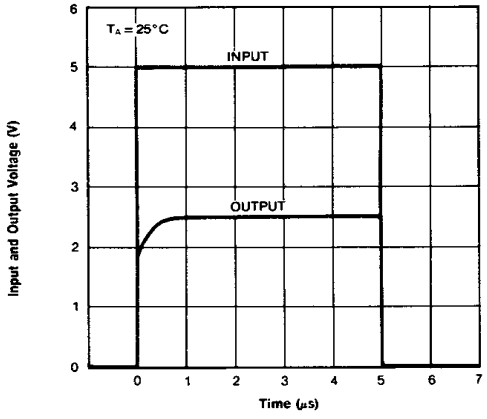



**Figure 9. Pulse Response**

## Typical Perfomance Characteristics (Continued)

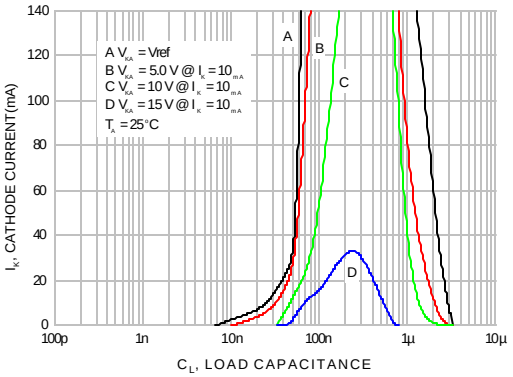



**Figure 10. Stability Boundary Conditions**

## Typical Application

$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{ref}$$

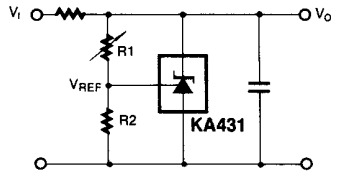



**Figure 11. Shunt Regulator**

$$V_O = V_{ref}\left(1 + \frac{R_1}{R_2}\right)$$

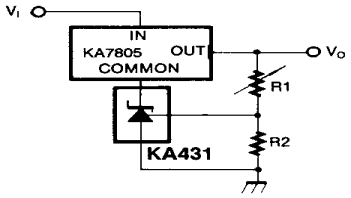



**Figure 12. Output Control for Three-Terminal Fixed Regulator**

$$V_O = \left(1 + \frac{R_1}{R_2}\right) V_{ref}$$

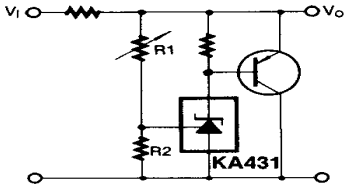



**Figure 13. High Current Shunt Regulator**

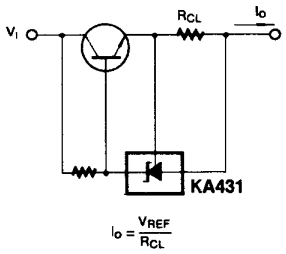



**Figure 14. Current Limit or Current Source**

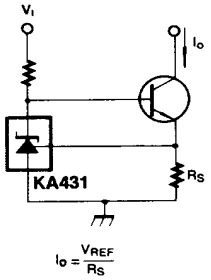


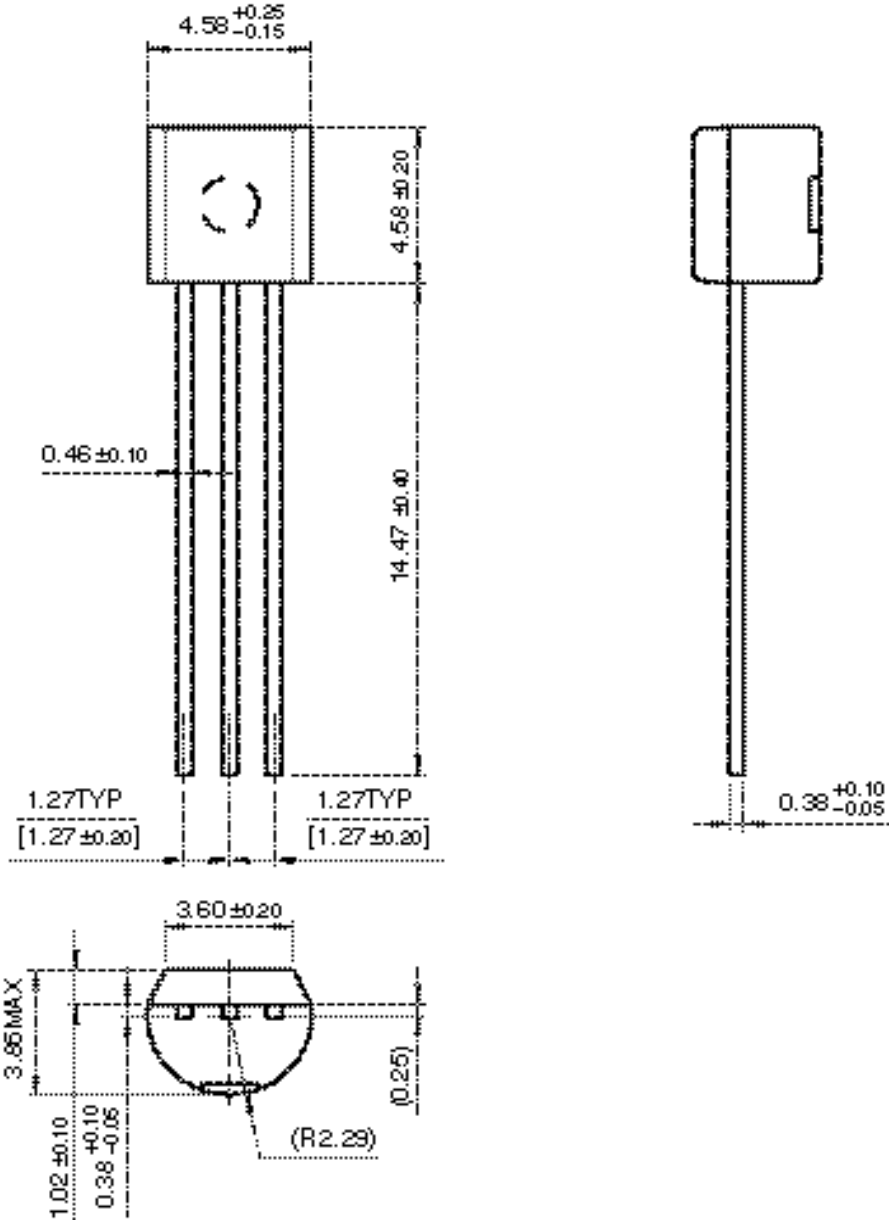

**Figure 15. Constant-Current Sink**

## Mechanical Dimensions

### Package

**Dimensions in millimeters**

# TO-92

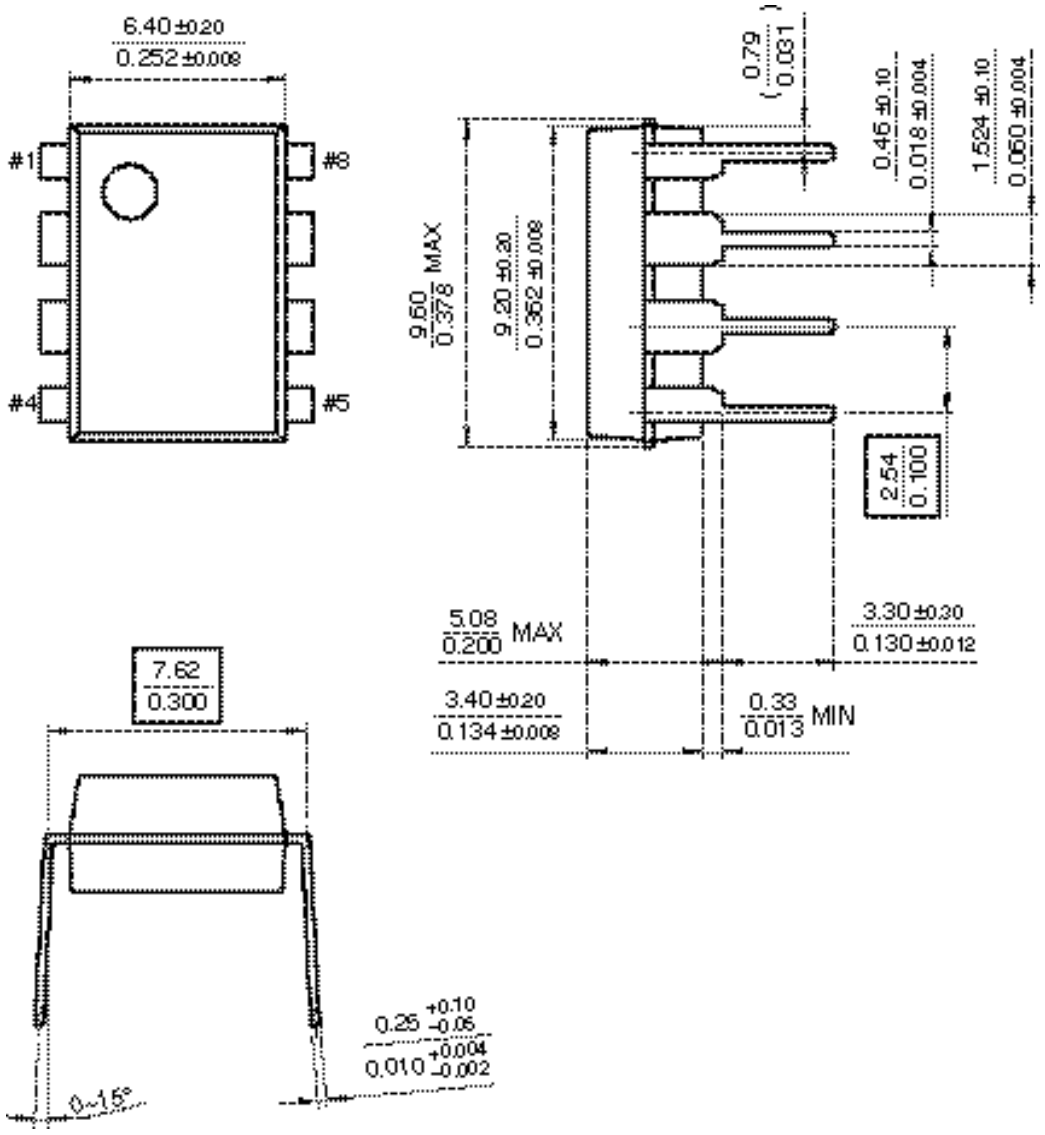


## Mechanical Dimensions (Continued)

### Package

**Dimensions in millimeters**

# 8-DIP

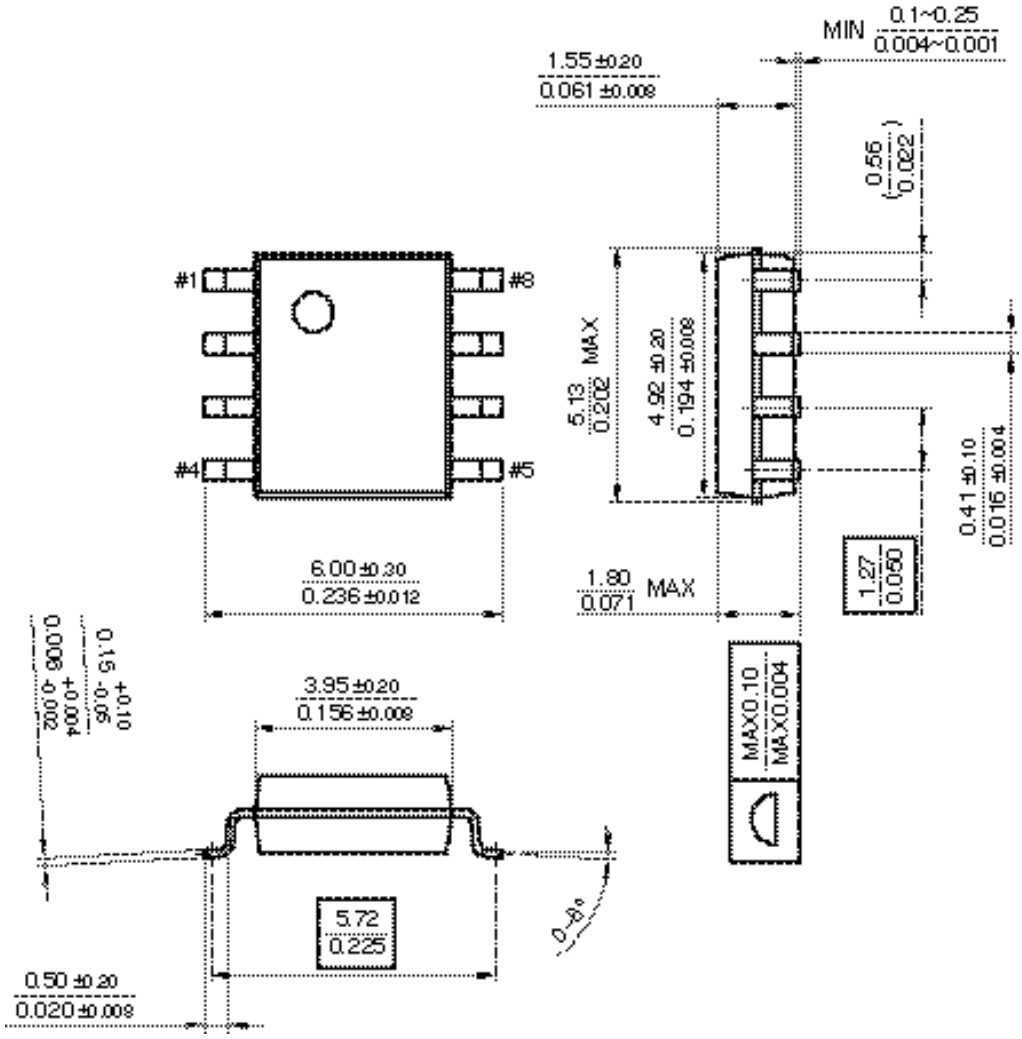


## Mechanical Dimensions (Continued)

### Package

**Dimensions in millimeters**

# 8-SOP



## Ordering Information

| Product Number | Output Voltage Tolerance | Package | Operating Temperature |
|---|---|---|---|
| KA431LZ | 0.5% | TO-92 | -25 ~ + 85 °C |
| KA431LD | | 8-SOP | |
| KA431AZ | 1% | TO-92 | |
| KA431AD | | 8-SOP | |
| KA431 | 2% | 8-DIP | |
| KA431Z | | TO-92 | |
| KA431D | | 8-SOP | |

3/5/02 0.0m 001
Stock#DSxxxxxxxx

# KA431A
Adjustable/2.5V, 1% Tolerance Shunt Regulator

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## General description

The KA431/KA431A/KA431L are 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 36 volts with two external resistors. These devices have a typical dynamic output impedance of 0.2W. Active output circuitry provides a very sharp turn-on characteristic, making these devices excel lent replacement for zener diodes in many applications.

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## Features

- Programmable output voltage to 36 volts
- Low dynamic output impedance 0.20 typical
- Sink current capability of 1.0 to 100mA
- Equivalent full-range temperature coefficient of 50ppm/°C typical
- Temperature compensated for operation over full rated operating temperature range
- Low output noise voltage
- Fast turn-on response

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Product status/pricing/packaging

| Product | Product status | Package type | Leads | Packing method |
|---|---|---|---|---|
| KA431AZMBU | Not recommended for new designs | TO-92 | 3 | BULK |
| KA431AZTF | Full Production | TO-92 | 3 | TAPE REEL |
| KA431AZBU | Full Production | TO-92 | 3 | BULK |
| KA431ADTF | Full Production | SOIC | 8 | TAPE REEL |
| KA431AZMTA | Not recommended for new designs | TO-92 | 3 | TAPE REEL |
| KA431AZTA | Full Production | TO-92 | 3 | TAPE REEL |

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