

#### FEATURES

- Trimmed 0.25% Reference
- Wide Operating Current Range 250 $\mu$ A to 150mA
- Low Dynamic Output Impedance
- Low Output Noise
- Nominal Temperature Range to 85°C
- Temperature-Compensated: 60ppm/°C
- Internal Amplifier with 150mA Capability

#### APPLICATIONS

- Battery Powered Systems
- Switching Power Supplies
- Adjustable Power Supplies
- Linear Regulators
- Error Amplifiers
- Notebook/Personal Computer
- Monitors/ VCR/ TV
- Pagers

#### GENERAL DESCRIPTION

The AMS3431 is a three-terminal adjustable shunt regulator with guaranteed temperature stability over the entire range of operation. The output voltage can be set to any value between 2.5V (VREF) and 36V by adding two external resistors. Due to the sharp turn-on characteristics this device is an excellent replacement for zener diodes in many applications.

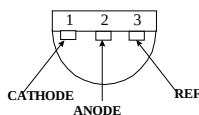
AMS3431 is available in the space saving SOT-23 package and in the TO-92 package.

#### ORDERING INFORMATION:

| TOL.         | PACKAGE TYPE |               | OPERATING<br>TEMPERATURE RANGE |
|--------------|--------------|---------------|--------------------------------|
|              | TO-92        | 3 LEAD SOT-23 |                                |
| $\pm 0.25\%$ | AMS3431AN    | AMS3431AM     | -40 to +85° C                  |
| $\pm 0.5\%$  | AMS3431BN    | AMS3431BM     | -40 to +85° C                  |
| $\pm 1.0\%$  | AMS3431CN    | AMS3431CM     | -40 to +85° C                  |

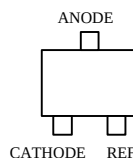
#### PIN CONNECTIONS

**TO-92**  
**Plastic Package (N)**



**Bottom View**

**3L SOT-23**  
**(M)**



**Top View**

## ABSOLUTE MAXIMUM RATINGS (Note 1)

|                                       |                 |                                      |         |
|---------------------------------------|-----------------|--------------------------------------|---------|
| Cathode Voltage ( $V_Z$ )             | 37V             | Internal Power Dissipation ( $P_D$ ) |         |
| Continuous Cathode Current ( $I_Z$ )  | -10mA to +150mA | TO-92 Package                        | 0.78W   |
| Reference Input Current ( $I_{REF}$ ) | 10mA            | SOT-23 Package                       | 0.28W   |
| Junction Temperature ( $T_J$ )        | -40°C to +125°C | Thermal Resistance ( $\phi_{JA}$ )   |         |
| Storage Temperature                   | -65°C to +150°C | TO-92 Package                        | 160°C/W |
| Lead Temperature (Soldering, 25sec.)  | 265°C           | SOT-23 Package                       | 410°C/W |

**Note 1:** Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed.

## ELECTRICAL CHARACTERISTICS

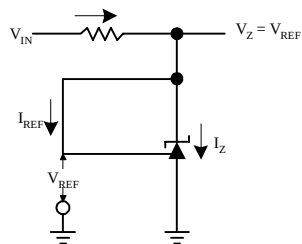
Electrical Characteristics at  $I_Z = 10$  mA and  $T_A = +25^\circ\text{C}$  unless otherwise specified.

| Parameter                                               | Conditions                                                                                           | AMS3431A |       |       | AMS3431B |       |       | AMS3431C |       |       | Units         |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------|----------|-------|-------|----------|-------|-------|----------|-------|-------|---------------|
|                                                         |                                                                                                      | Min      | Typ   | Max   | Min      | Typ   | Max   | Min      | Typ   | Max   |               |
| Reference Voltage                                       |                                                                                                      | 2.489    | 2.495 | 2.501 | 2.483    | 2.495 | 2.507 | 2.470    | 2.495 | 2.520 | V             |
| Deviation of Reference Input Voltage over Temperature   | $V_Z = V_{REF}$ (circuit 1)                                                                          |          | 8.0   | 15    |          | 8.0   | 15    |          | 8.0   | 15    | mV            |
|                                                         | $T_A = +25^\circ\text{C}$ to $+85^\circ\text{C}$<br>$T_A = -40^\circ\text{C}$ to $+25^\circ\text{C}$ |          | 8.0   | 15    |          | 8.0   | 15    |          | 8.0   | 15    | mV            |
| Ratio of Change in Reference Voltage to Cathode Voltage | $V_Z$ from $V_{REF}$ to 10V                                                                          |          | -0.5  | -2.7  |          | -0.5  | -2.7  |          | -0.5  | -2.7  | mV/V          |
|                                                         | $V_Z$ from $V_{REF}$ to 36V                                                                          |          | -1.0  | -2.0  |          | -1.0  | -2.0  |          | -1.0  | -2.0  | mV/V          |
| Reference Input Current                                 | $R1 = 10\text{k}\Omega$ , $R2 = \infty\Omega$<br>(test circuit 2)                                    |          | 0.5   | 4.0   |          | 0.5   | 4.0   |          | 0.5   | 4.0   | $\mu\text{A}$ |
| Reference Input Current Deviation over Temperature      | $R1 = 10\text{k}\Omega$ , $R2 = \infty\Omega$<br>$T_A = \text{Full Range}$<br>(test circuit 2)       |          | 0.4   | 1.2   |          | 0.4   | 1.2   |          | 0.4   | 1.2   | $\mu\text{A}$ |
| Off State Cathode Current                               | $V_Z = 36\text{V}$ , $V_{REF} = 0\text{V}$<br>( test circuit 3)                                      |          | 0.04  | 0.5   |          | 0.04  | 0.5   |          | 0.04  | 0.5   | $\mu\text{A}$ |
| Dynamic Output Impedance                                | $f < 1\text{KHz}$ , $V_Z = V_{REF}$<br>$I_Z = 100\mu\text{A}$ to $100\text{mA}$<br>(test circuit 1)  |          | 0.25  | 0.5   |          | 0.25  | 0.5   |          | 0.25  | 0.5   | $\Omega$      |
| Minimum Operating Current                               | $V_Z = V_{REF}$<br>(test circuit 1)                                                                  |          | 100   | 250   |          | 100   | 250   |          | 100   | 250   | $\mu\text{A}$ |

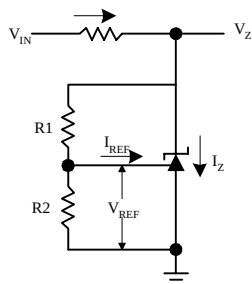
## RECOMMENDED OPERATING CONDITIONS:

|                            | Min       | Max   |
|----------------------------|-----------|-------|
| Cathode Voltage, ( $V_Z$ ) | $V_{REF}$ | 36 V  |
| Cathode Current, ( $I_Z$ ) | 0.25mA    | 120mA |

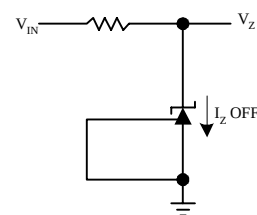
## TEST CIRCUITS



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



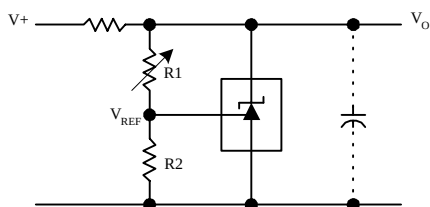
**Figure 2.** Test Circuit for  $V_{REF}$  vs  $I_Z$   
Test circuit for  $I_{REF}$ .



**Figure 3.** Test Circuit for Off-State Current

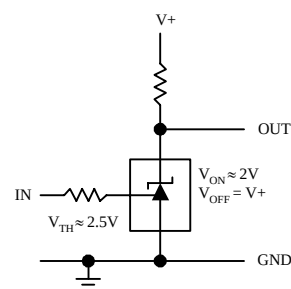
## TYPICAL APPLICATIONS

**Shunt Regulator**

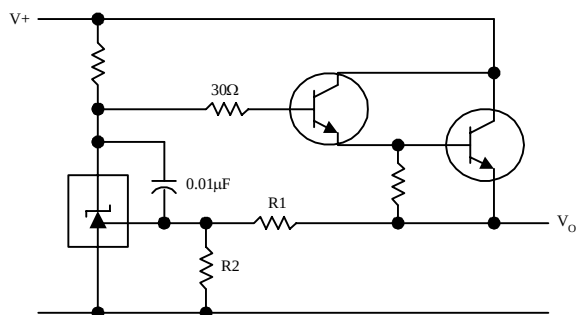


$$V_O \approx (1 + R1/R2)V_{REF}$$

**Single Supply Comparator with Temperature Compensated Threshold**

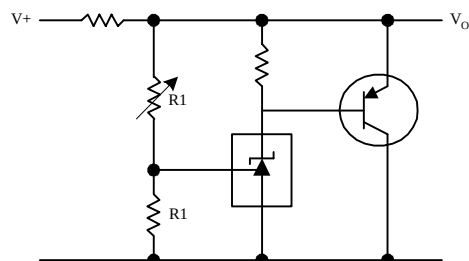


**Series Regulator**



$$V_O \approx (1 + R1/R2)V_{REF}$$

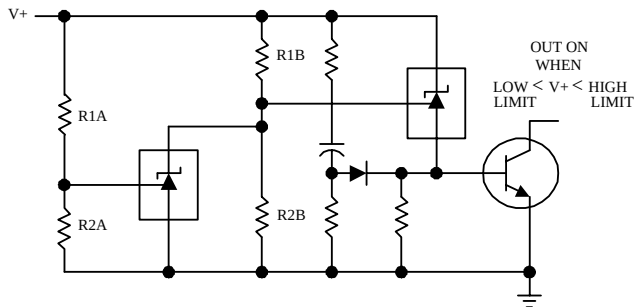
**Higher Current Shunt Regulator**



$$V_O \approx (1 + R1/R2)V_{REF}$$

## TYPICAL APPLICATIONS (Continued)

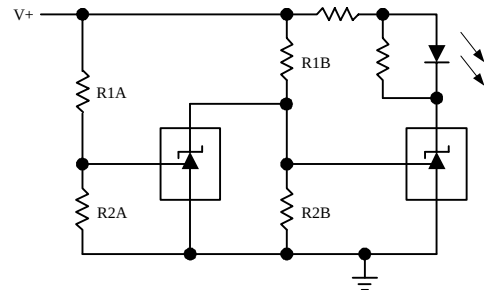
**Over Voltage/Under Voltage Protection Circuit**



$$\text{LOW LIMIT} \approx V_{\text{REF}}(1 + R1B/R2B) + V_{\text{BE}}$$

$$\text{LOW LIMIT} \approx V_{\text{REF}}(1 + R1A/R2A)$$

**Voltage Monitor**

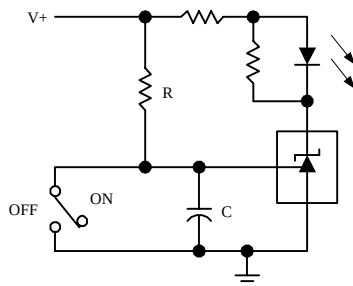


$$\text{LOW LIMIT} \approx V_{\text{REF}}(1 + R1B/R2B) + V_{\text{BE}}$$

$$\text{LOW LIMIT} \approx V_{\text{REF}}(1 + R1A/R2A)$$

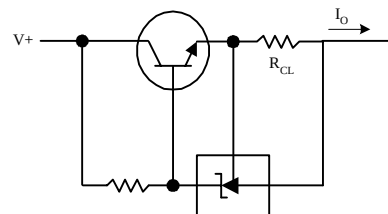
LED ON WHEN LOW LIMIT < V+ < HIGH LIMIT

**Delay Timer**



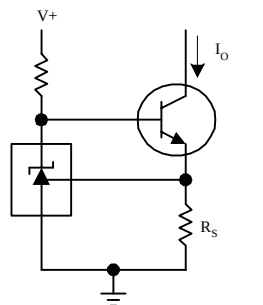
$$\text{DELAY} = R * C * \ln(V+ / (V+ - V_{\text{REF}}))$$

**Current Limiter or Current Source**



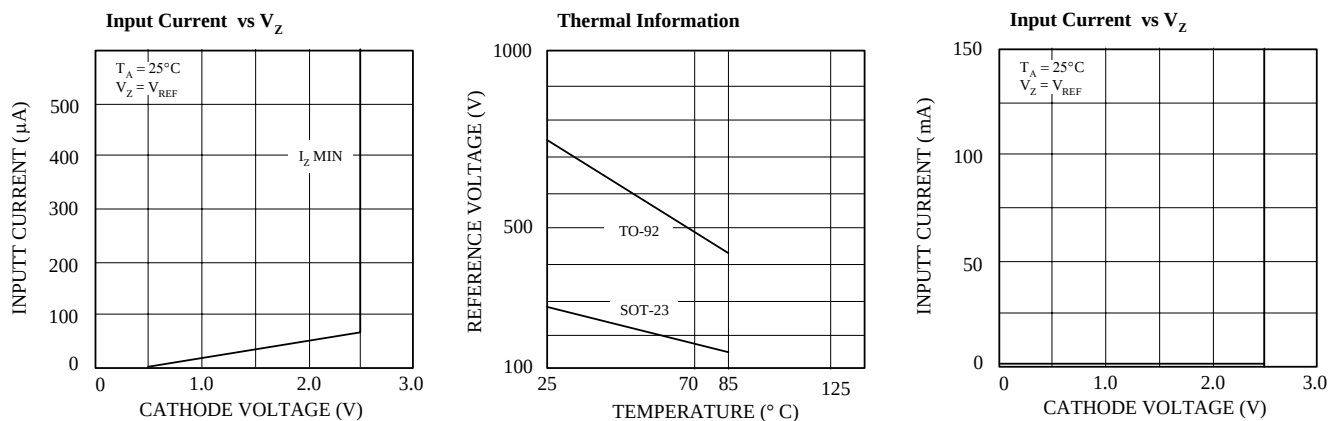
$$I_O = V_{\text{REF}}/R_{\text{CL}}$$

**Constant Current Sink**



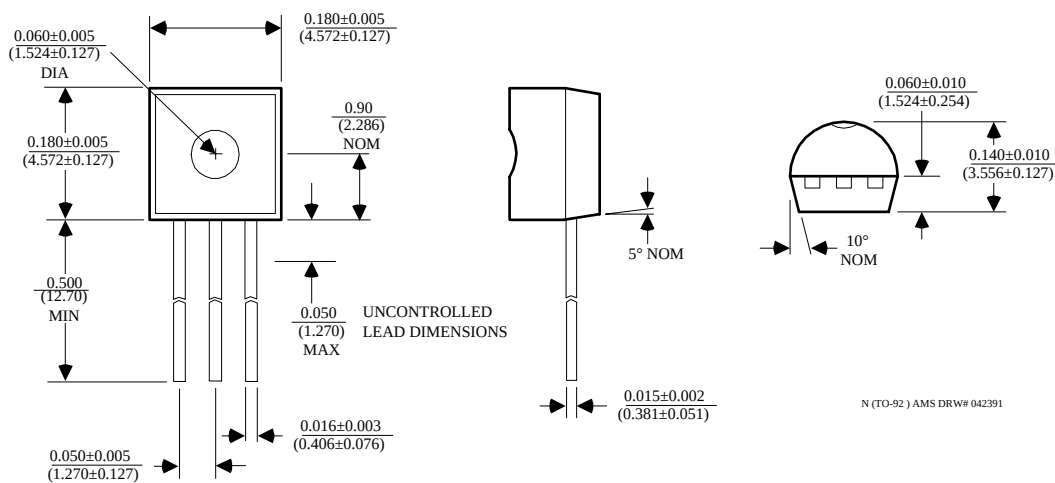
$$I_O = V_{\text{REF}}/R_S$$

## TYPICAL PERFORMANCE CHARACTERISTICS



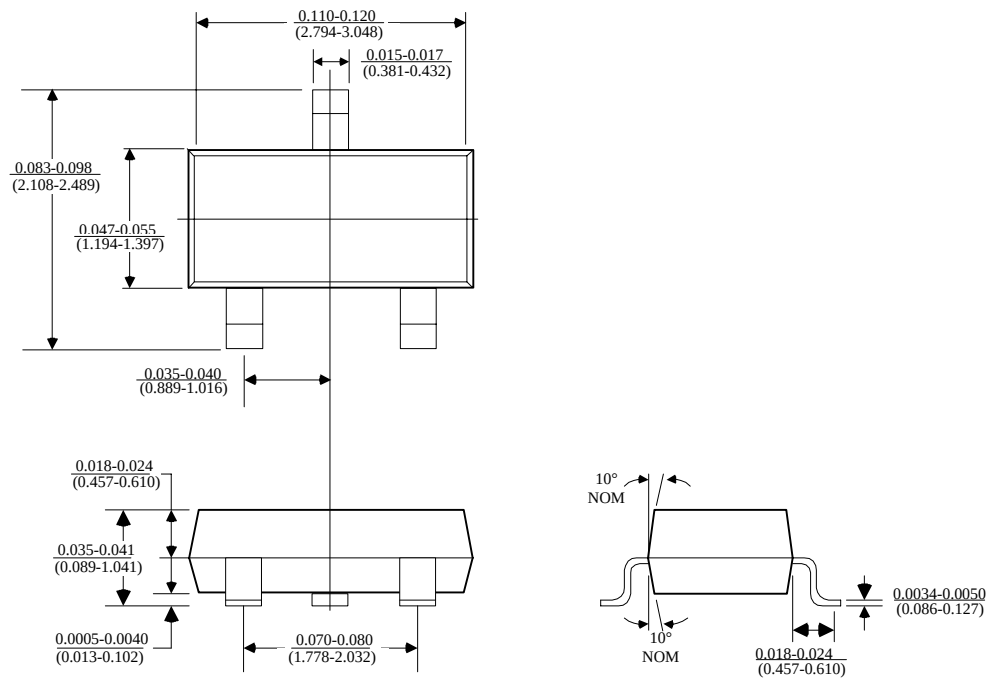
**PACKAGE DIMENSIONS** inches (millimeters) unless otherwise noted.

### 3L TO-92 PLASTIC PACKAGE (N)



**PACKAGE DIMENSIONS** inches (millimeters) unless otherwise noted (Continued).

## 3 LEAD SOT-23 PLASTIC PACKAGE (M)



(SOT-23 ) AMS DRW# 051991