# GM432

**Adjustable Shunt Regulator**

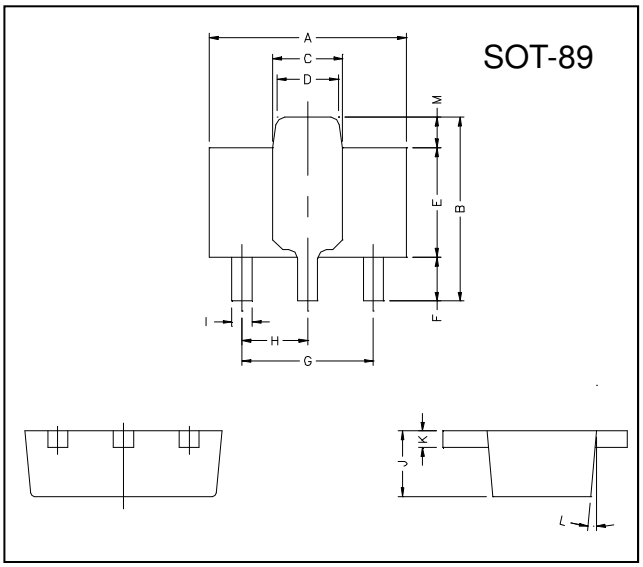
## Description

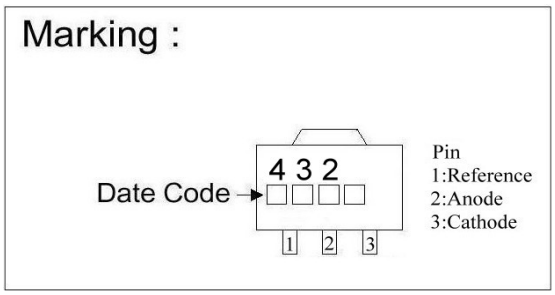
The GM432 series are three-terminal adjustable precision shunt regulators with guaranteed stable temperature over the applicable extended commercial temperature range. The output voltage may be set at any level greater than 1.24V ($V_{REF}$) up to 20V merely by selecting two external resistors that act as a voltage divider network. These devices have a typical output impedance of 0.2Ω. Active output circuitry provides very sharp turn-on characteristics, making these devices excellent improved replacements for Zener diodes in many applications.
The precise +/- 2% reference voltage tolerance of GM432 make it possible in many applications to avoid the use of a variable resistor, consequently saving cost and eliminating drift and reliability problems associated with it.

## Features

*Precision reference voltage
A Rank: 1.24V ±0.5% ,
B Rank: 1.24V ±1% ,
C Rank: 1.24V ±2.0%
*Sink current capability: 200 mA.
*Minimum cathode current for regulation: 150 μA.
*Equivalent full-range temp coefficient: 30 ppm/℃.
*Fast turn-on Response.
*Low dynamic output impedance: 0.2Ω.
*Programmable output voltage to 20V.
*Low output noise.

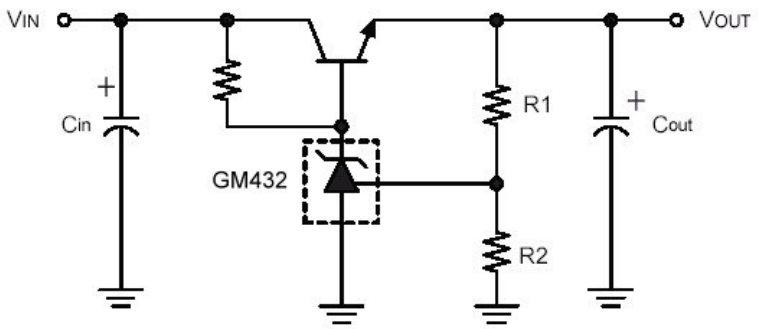
## Package Dimensions




| REF. | Millimeter | | REF. | Millimeter | |
|---|---|---|---|---|---|
| | Min. | Max. | | Min. | Max. |
| A | 4.4 | 4.6 | G | 3.00 REF. | |
| B | 4.05 | 4.25 | H | 1.50 REF. | |
| C | 1.50 | 1.70 | I | 0.40 | 0.52 |
| D | 1.30 | 1.50 | J | 1.40 | 1.60 |
| E | 2.40 | 2.60 | K | 0.35 | 0.41 |
| F | 0.89 | 1.20 | L | 5° TYP. | |
| | | | M | 0.70 REF. | |

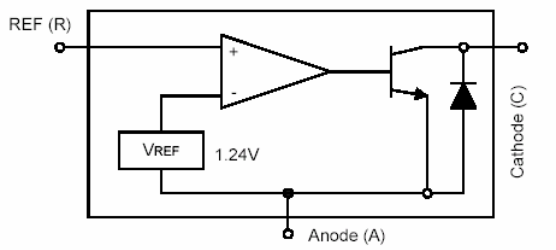
## Typical Application Circuit



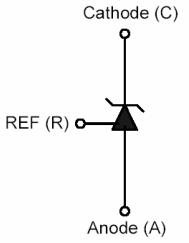

$V_{OUT} = (1+R1/R2)V_{REF}$

Precision Regulator

## Block Diagram




## Symbol

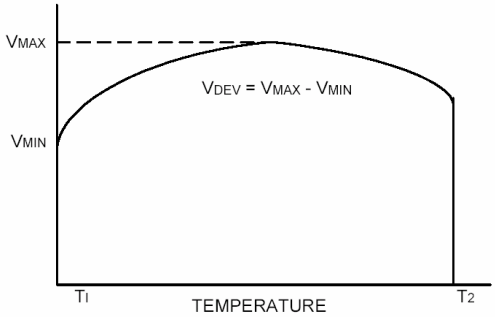



## Absolute Maximum Ratings at Ta = 25℃

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Junction Temperature | Tj | +150 | ℃ |
| Storage Temperature | Tstg | -65 ~ +150 | ℃ |
| Cathode Voltage | $V_{KA}$ | 20 | V |
| Continuous Cathode Current | $I_{KA}$ | -10~+250 | mA |
| Reference Input Current Range | $I_{REF}$ | -0.05~+10 | mA |
| Total Power Dissipation | $P_D$ | 225 | mW |

## Electrical Characteristics(Ta = 25℃,unless otherwise specified.)

| Parameter | Symbol | Min | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Reference Voltage GM432C | $V_{REF}$ | 1.215 | 1.24 | 1.265 | V | $V_{KA}$= $V_{REF}$ , $I_K$=10mA (Fig.1) |
| GM432B | | 1.228 | 1.24 | 1.252 | | |
| GM432A | | 1.234 | 1.24 | 1.246 | | |
| Deviation of reference Input Voltage Over temperature(note1) | $\Delta V_{REF}/\Delta T$ | - | 3.0 | 20 | mV | $V_{KA}$= $V_{REF}$ , $I_K$=10mA Ta=Full range (Fig.1) |
| Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage | $\Delta V_{REF}/\Delta V_{KA}$ | - | -1.4 | -2.0 | mV/V | $I_K$=10mA (Fig.2) $\Delta V_{KA}$=20V~$V_{REF}$ |
| Reference Input Current | $I_{REF}$ | - | 1.4 | 3.5 | uA | $I_K$=10mA,R1=10KΩ,R2=∞ (Fig.2) |
| Deviation of reference Input Current Over Temperature Range | $\alpha I_{REF}$ | - | 0.4 | 1.2 | uA | $I_K$=10mA,R1=10KΩ,R2=∞ Ta=Full range(Fig.2) |
| Minimum Cathode Current for Regulation | $I_{KA}$(min) | - | 0.15 | 0.3 | mA | $V_{KA}$=$V_{REF}$(Fig.1) |
| Off-State Cathode Current | $I_{KA(off)}$ | - | 0.1 | 1.0 | uA | $V_{KA}$=20V,$V_{REF}$=0 (Fig.3) |
| Dynamic Output Impedance (note2) | $\lvert Z_{KA} \rvert$ | - | 0.2 | 0.5 | Ω | $V_{KA}$=$V_{REF}$, $I_K$=1 ~100mA F≤1.0KHz(Fig.1) |




Note1. Deviation of reference input voltage, VDEV, is defined as the maximum variation of the reference over the full temperature range.

The average temperature coefficient of the reference input voltage $\alpha$ VREF is defined as:

$$|\alpha V_{REF}| = \frac{(\frac{V_{DEV}}{V_{REF}(25°C)}) \times 10^6}{T_2 - T_1} \quad \text{.....} \quad (ppm/°C)$$

Where:
T2 – T1 = full temperature change.
$\alpha$ VREF can be positive or negative depending on whether the slope is positive or negative.
Note2. The dynamic output impedance, RZ, is defined as:

$$|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$$

When the device is programmed with two external resistors R1 and R2 (see figure 2.), the dynamic output impedance of the overall circuit, is defined as:

$$|Z_{KA}'| = \frac{\Delta v}{\Delta i} > |Z_{KA}| \quad (1 + \frac{R1}{R2})$$

## Test Circuits

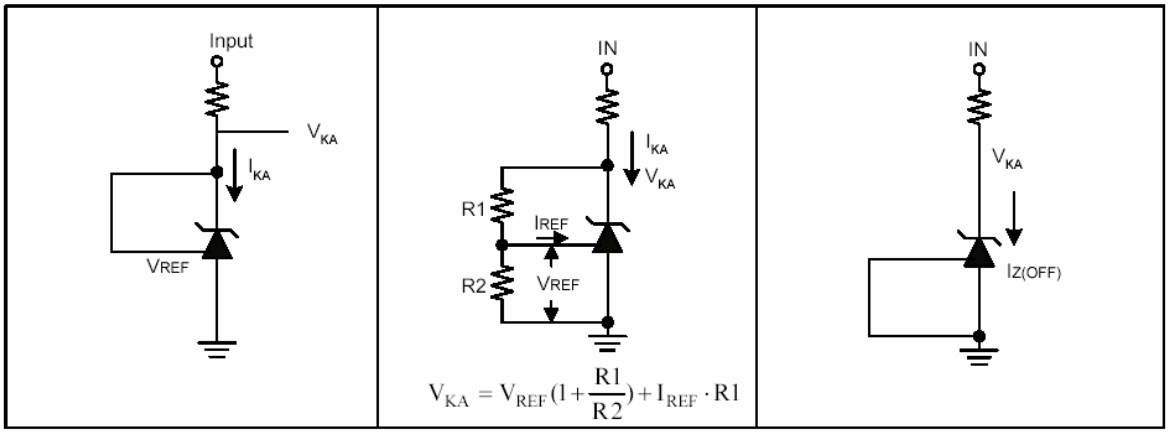
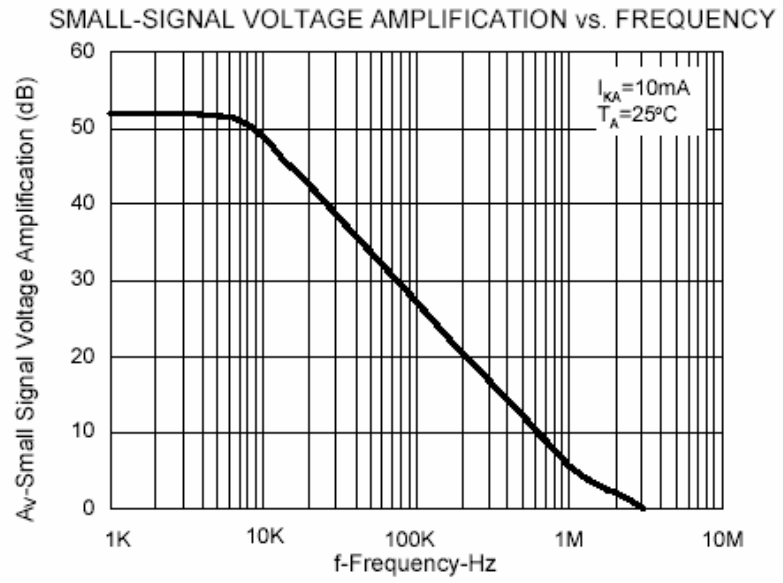
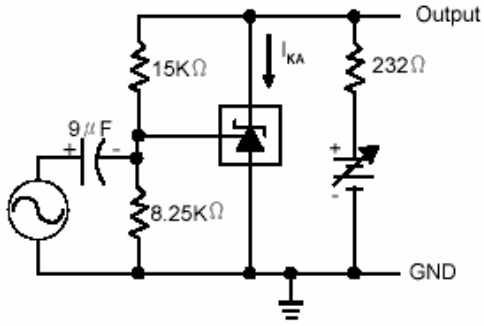



Fig1. Test Circuit for $V_{KA} = V_{REF}$ Fig2. Test circuit for $V_{KA} > V_{REF}$ Fig3. Test Circuit for off-state Current

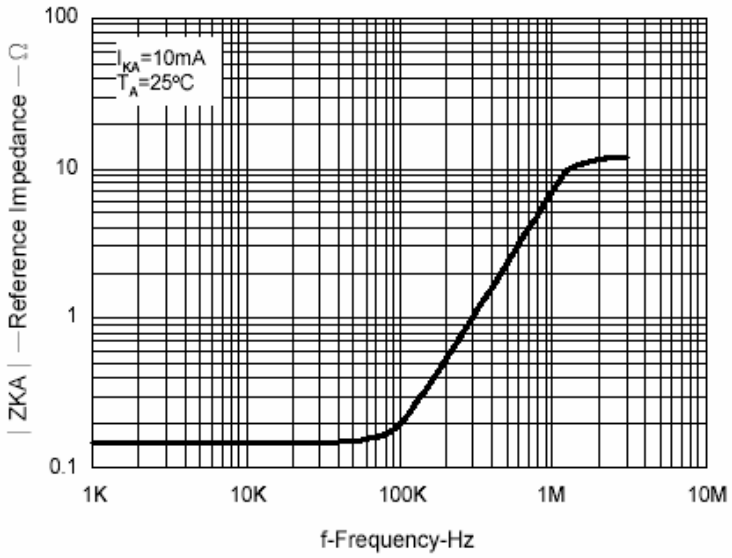
## Typical Performance Characteristics

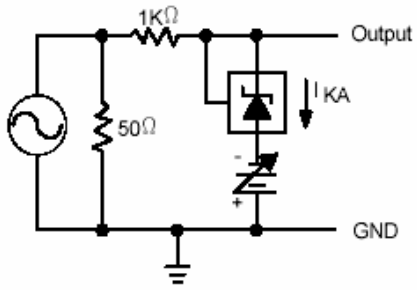



TEST CIRCUIT FOR VOLTAGE AMPLIFICATION

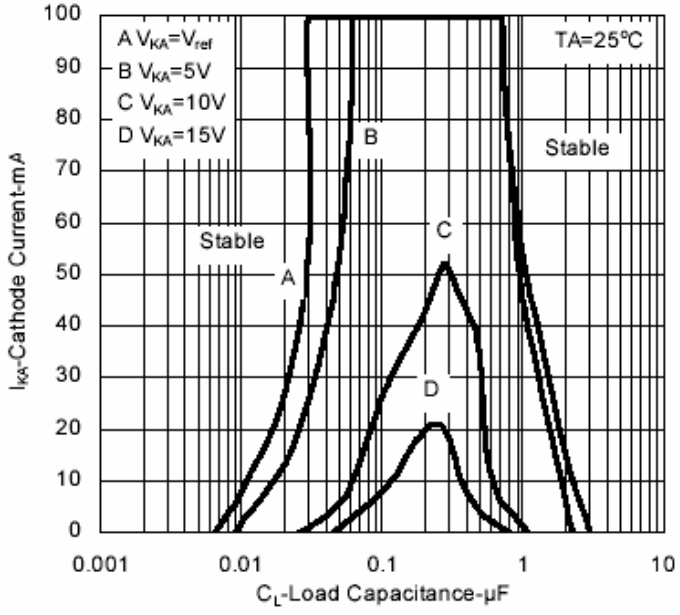
REFERENCE IMPEDANCE vs. FREQUENCY



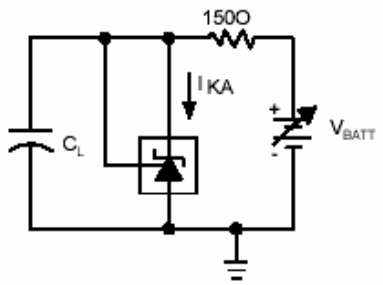




TEST CIRCUIT FOR REFERENCE IMPEDANCE

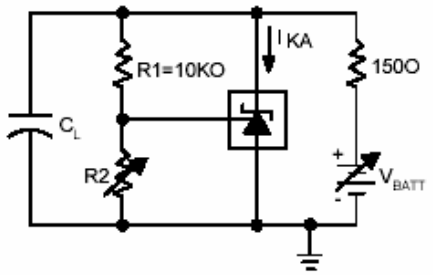
STABILITY BOUNDARY CONDITIONS†




†The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 and V+ were adjusted to establish the initial $V_{KA}$ and $I_{KA}$ conditions with $C_L$=0.$V_{BATT}$ and $C_L$ were then adjusted to determine the ranges of stability.

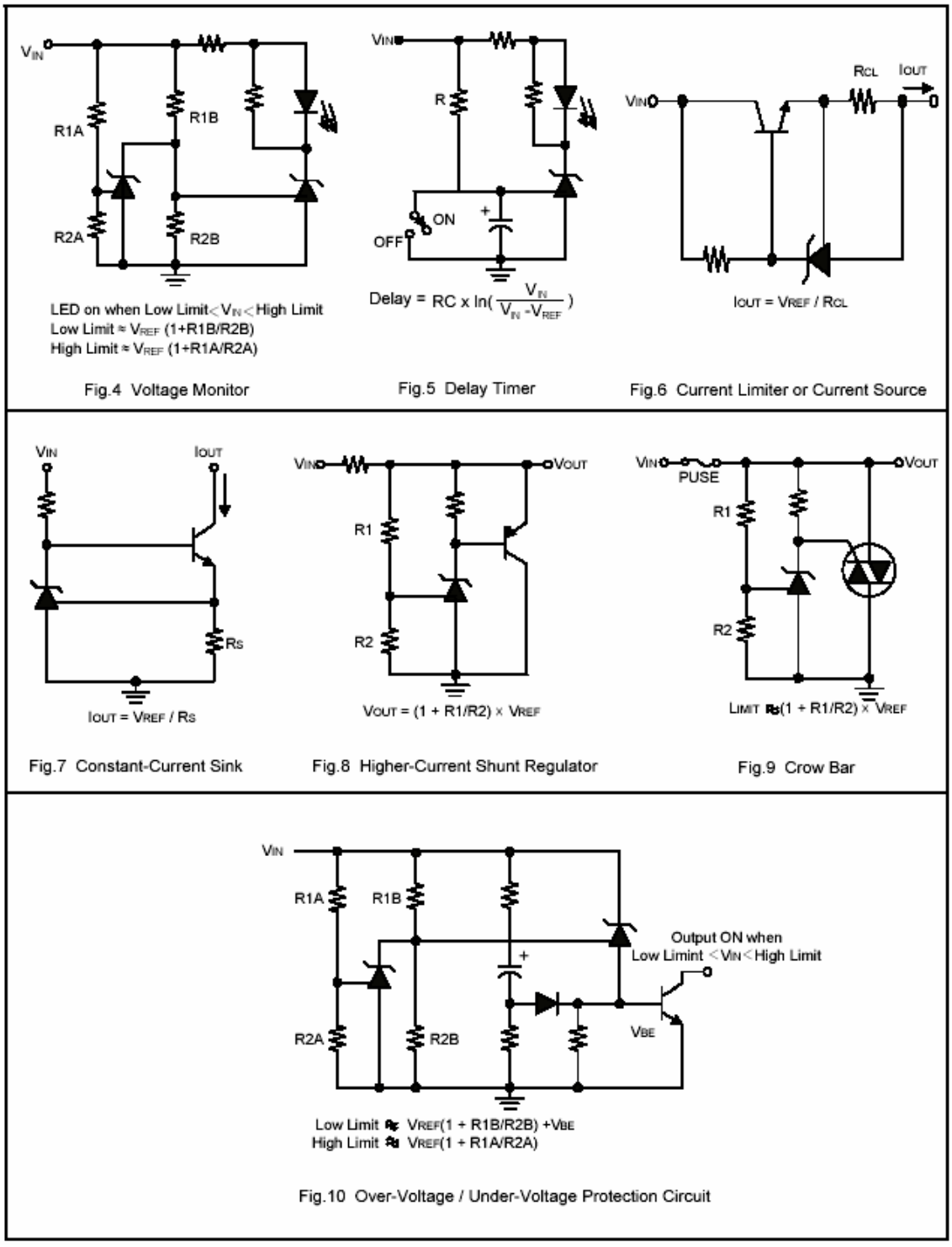



TEST CIRCUIT FOR CURVE A




TEST CIRCUIT FOR CURVE B, C, AND D

## Application Examples




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