



# ACE432N

## Precision adjustable shunt voltage reference

### Description

The ACE432N is low-voltage three-terminal adjustable voltage references, with specified thermal stability over applicable industrial and commercial temperature ranges. Output voltage can be set to any value between VREF (1.24V) and 20V with two external resistors. These devices have a typical output impedance of 0.25Ω. Active output circuitry provides a very sharp turn-on characteristic, making the ACE432N excellent replacements for low-voltage Zener diodes in many applications, including onboard regulation and adjustable power supplies.

### Features

- Low-Voltage Operation --- Down to 1.24V
- Adjustable Output Voltage,  $V_o = V_{ref}$  to 20V
- Low Operational Cathode Current --- 80uA (Typ)
- 0.25Ω Typical Output Impedance

### Application

- Battery Power Equipment
- Linear Regulators
- Switch Power Supply
- Cellular Phone
- Digital Cameras
- Computer Disk Drivers
- Instrumentation

### Absolute Maximum Ratings

| Parameter                                                       | Symbol        | Max        | Unit |
|-----------------------------------------------------------------|---------------|------------|------|
| Cathode Voltage                                                 | $V_Z$         | 20         | V    |
| Continuous Cathode Current                                      | $I_Z$         | 100        | mA   |
| Reference Current                                               | $I_{REF}$     | 3          | mA   |
| Thermal resistance junction to ambient<br>SOT-23-5L<br>SOT-23-3 | $\theta_{JA}$ | 206<br>206 | °C/W |
| Operating junction temperature                                  | $T_J$         | -40 to 150 | °C   |
| Storage temperature range                                       | $T_{STG}$     | -65 to 150 | °C   |

The IC has a protection circuit against static electricity. Do not apply high static electricity or high voltage that exceeds the performance of the protection circuit to the IC.

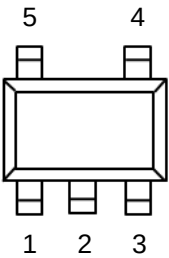


# ACE432N

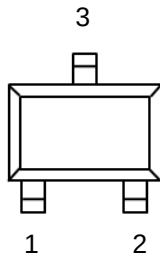
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## Packaging Type

SOT-23-5L



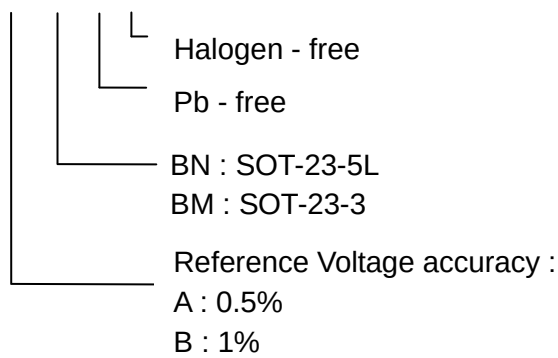
SOT-23-3



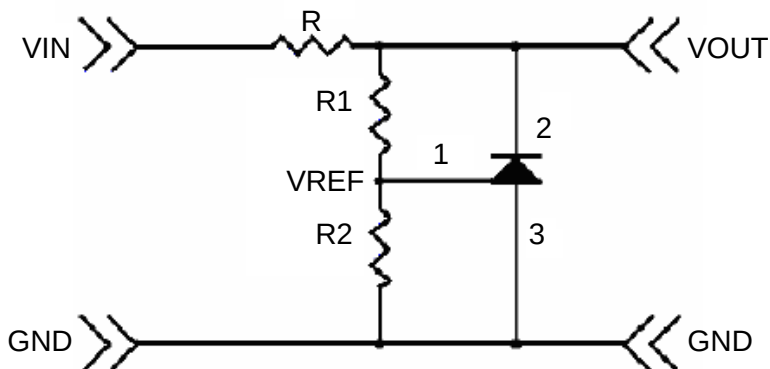
| SOT-23-5L | SOT-23-3 | Description |
|-----------|----------|-------------|
| 3         | 2        | Cathode     |
| 5         | 3        | Anode       |
| 4         | 1        | Ref         |
| 1.2       |          | NC          |

## Ordering information

ACE432N X XX + H



## Typical Application Circuit

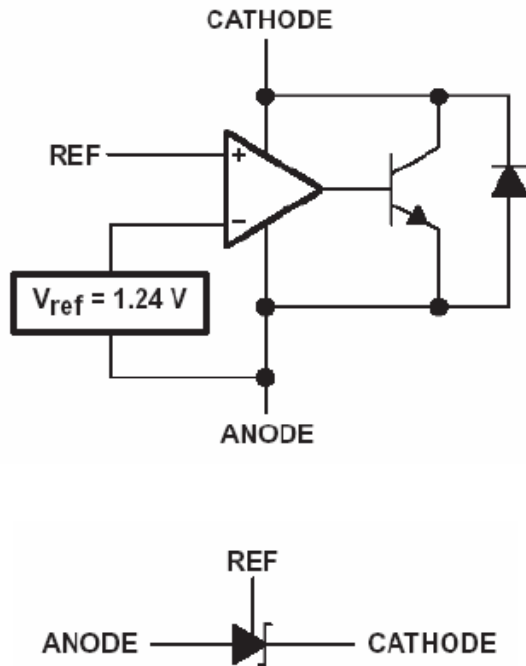




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### Block Diagram



### Electrical Characteristics

| Parameter                                                        |                     | Symbol                             | Test Conditions                                                                     |                          | Min.  | Typ. | Max.  | Unit |
|------------------------------------------------------------------|---------------------|------------------------------------|-------------------------------------------------------------------------------------|--------------------------|-------|------|-------|------|
| Reference Voltage                                                | 0.5%                | V <sub>REF</sub>                   | V <sub>Z</sub> =V <sub>REF</sub> ,<br>I <sub>Z</sub> =10mA                          | T <sub>A</sub> =25℃      | 1.234 | 1.24 | 1.246 | V    |
|                                                                  |                     |                                    |                                                                                     | T <sub>A</sub> =-40℃~80℃ | 1.222 |      | 1.258 |      |
|                                                                  | 1.0%                |                                    |                                                                                     | T <sub>A</sub> =25℃      | 1.228 | 1.24 | 1.252 |      |
|                                                                  |                     |                                    |                                                                                     | T <sub>A</sub> =-40℃~80℃ | 1.215 |      | 1.265 |      |
| V <sub>REF</sub> Temp Deviation                                  |                     | V <sub>DEV</sub>                   | V <sub>Z</sub> =V <sub>REF</sub> , I <sub>Z</sub> =10mA<br>T <sub>A</sub> =-40℃~80℃ |                          |       | 10   | 25    | mV   |
| Ratio of change in V <sub>REF</sub> to change in cathode voltage |                     | ΔV <sub>REF</sub> /ΔV <sub>Z</sub> | I <sub>Z</sub> =10mA<br>ΔV <sub>Z</sub> =16V to V <sub>REF</sub>                    |                          |       | -1.0 | -2.7  | mV/V |
| Reference Input current                                          |                     | I <sub>REF</sub>                   | I <sub>Z</sub> =10mA,<br>R1=10KΩ, R2=∞                                              |                          |       | 0.15 | 0.5   | μA   |
| IREF Temp Deviation                                              |                     | I <sub>REF(DEV)</sub>              | I <sub>Z</sub> =10mA, T <sub>A</sub> =-40℃~80℃<br>R1=10KΩ, R2=∞                     |                          |       | 0.1  | 0.4   | μA   |
| Off-state cathode current                                        | I <sub>Z(OFF)</sub> | V <sub>REF</sub> =0                | V <sub>Z</sub> =6V                                                                  |                          | 0.5   | 1.0  | μA    |      |
|                                                                  |                     |                                    | V <sub>Z</sub> =12V                                                                 |                          |       |      |       |      |
| Dynamic output impedance                                         |                     | R <sub>Z</sub>                     | I <sub>Z</sub> =1mA~100mA<br>V <sub>Z</sub> =V <sub>REF</sub> , f≤1KHz              |                          |       | 0.25 | 0.4   | Ω    |
| Minimum Operation Current                                        |                     | I <sub>Z(MIN)</sub>                | V <sub>Z</sub> =V <sub>REF</sub>                                                    |                          |       | 30   | 80    | μA   |

### Application Circuit

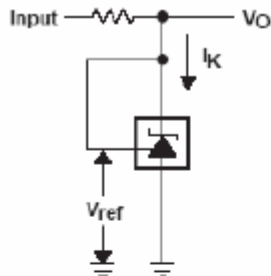


Figure 1. Test Circuit for  $V_{KA}=V_{REF}$   
 $V_O=V_{KA}=V_{REF}$

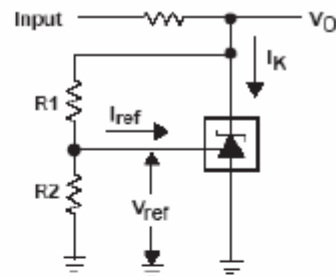


Figure 2. Test Circuit for  $V_{KA}>V_{REF}$ ,  
 $V_O=V_{KA}=V_{REF}*1(1+R1/R2)+I_{REF}*R1$

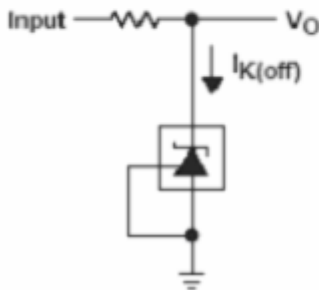


Figure 3. Test Circuit for  $I_{K(OFF)}$

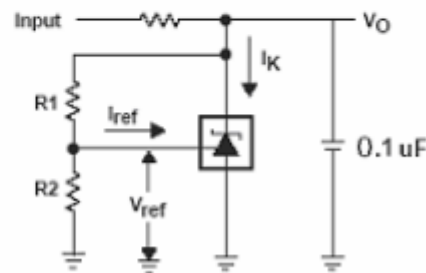


Figure 4. Test Circuit for  $V_{KA}>V_{REF}$ ,  
 $V_O=V_{KA}=V_{REF}*1(1+R1/R2)+I_{REF}*R1$

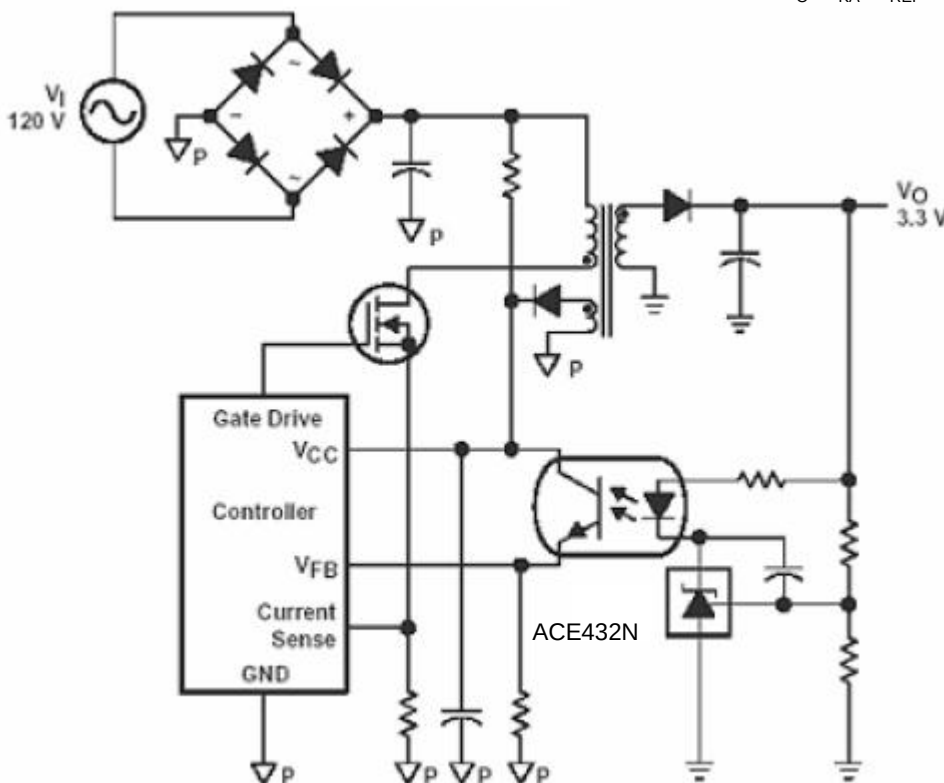
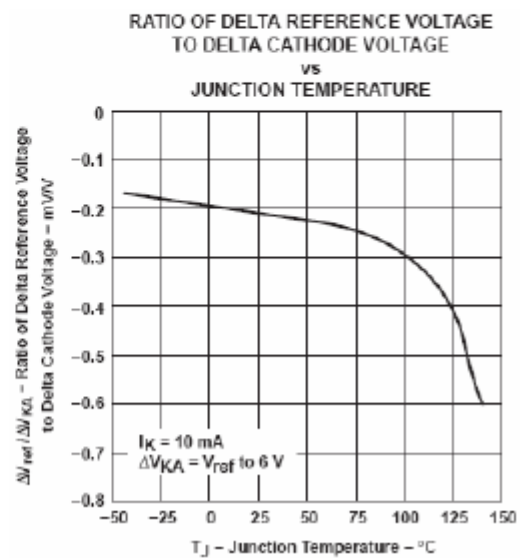
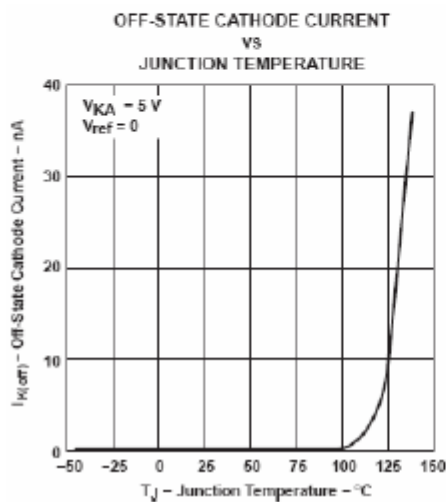
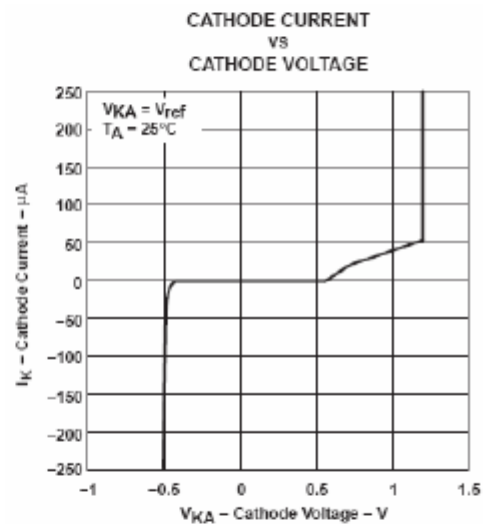
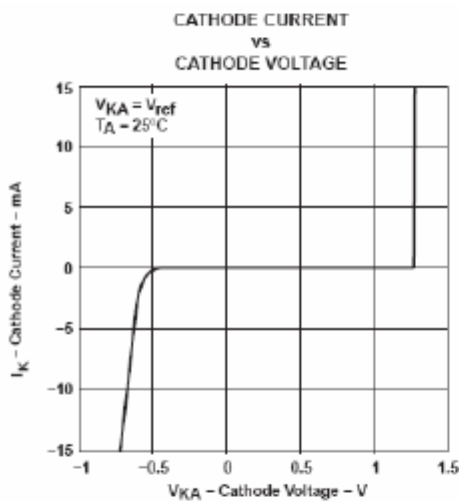
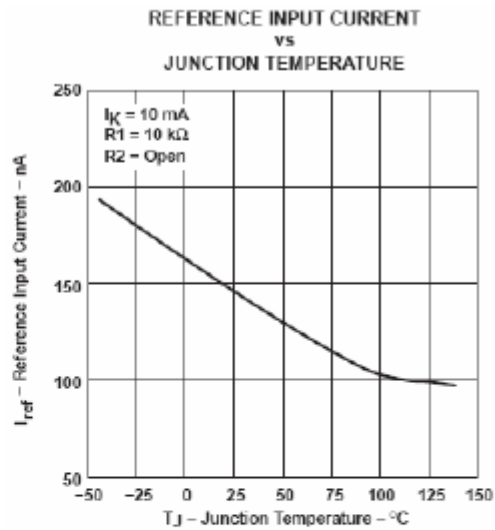
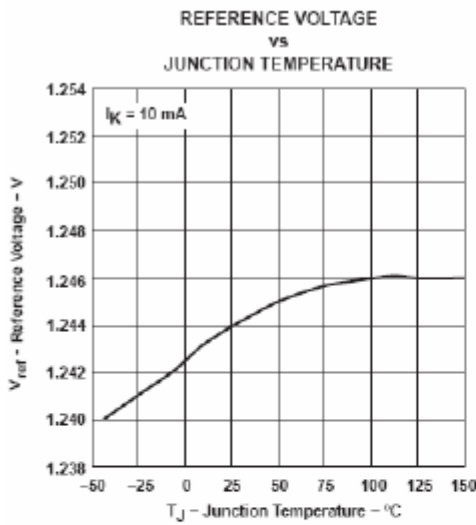


Figure 5. Flyback with isolation using ACE432N as voltage reference and error amplifier

\* To improve the stability of output voltage, Figure 4, a 0.1uF capacitor is recommended between cathode to anode.

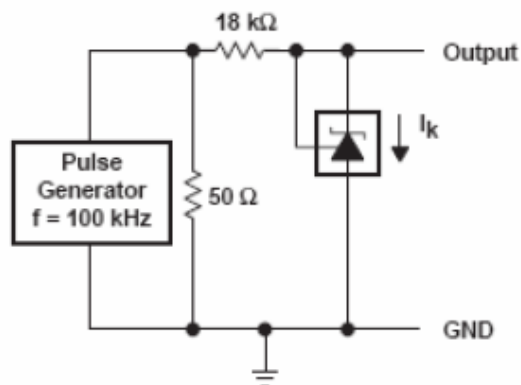
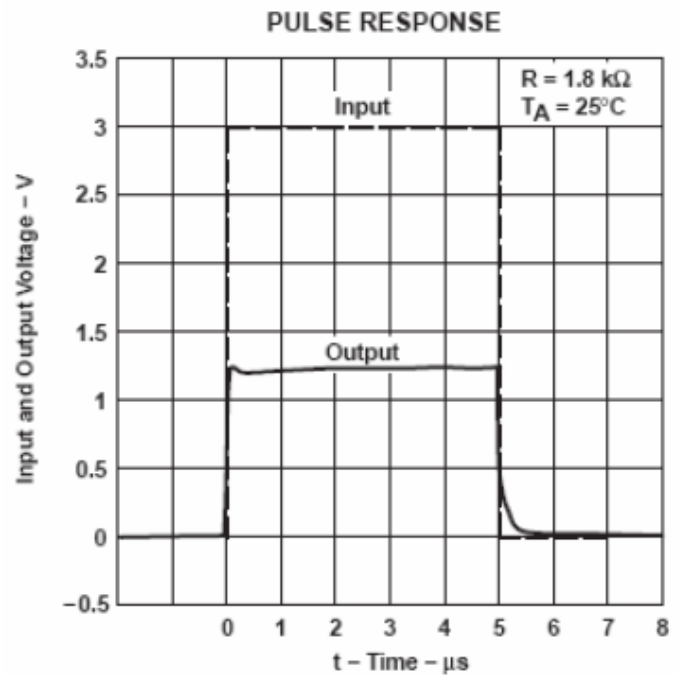
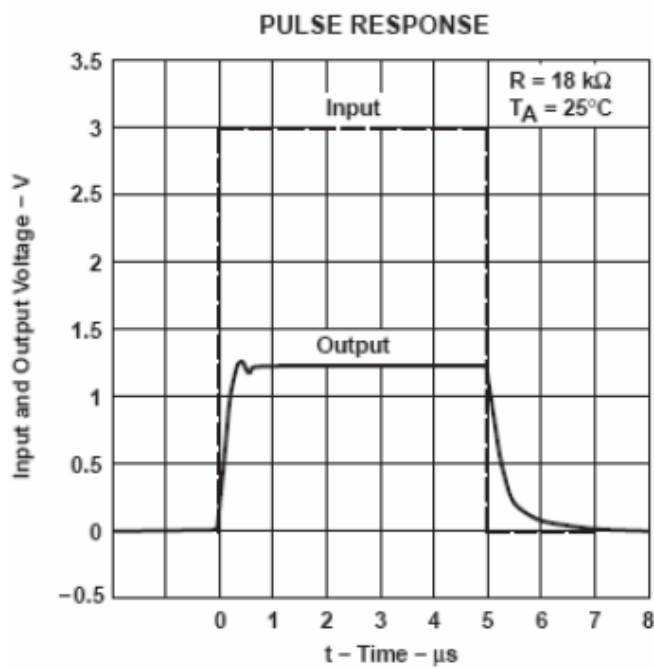


### Performance characteristics

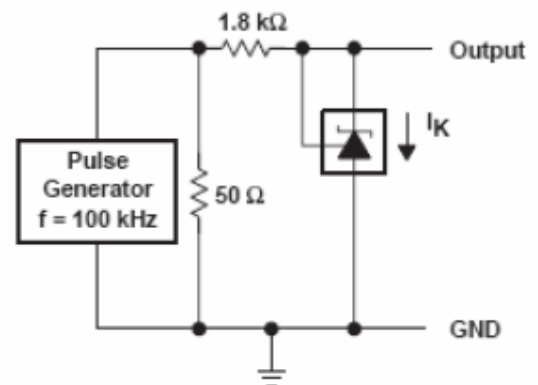




### Performance Characteristics



TEST CIRCUIT FOR PULSE RESPONSE

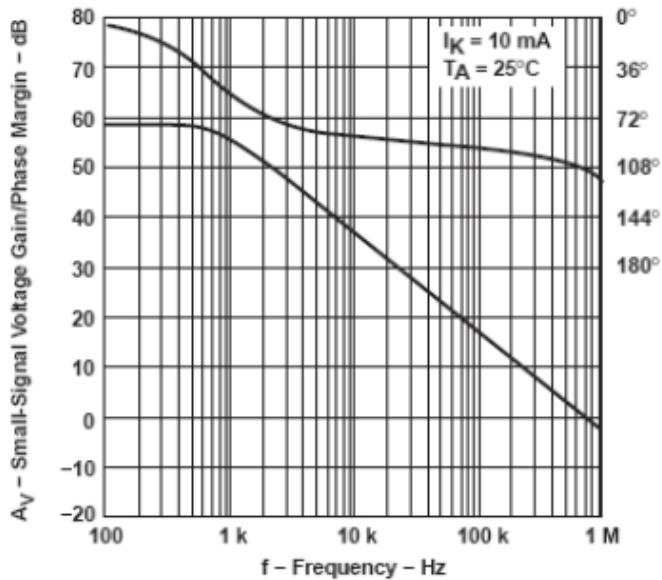


TEST CIRCUIT FOR PULSE RESPONSE

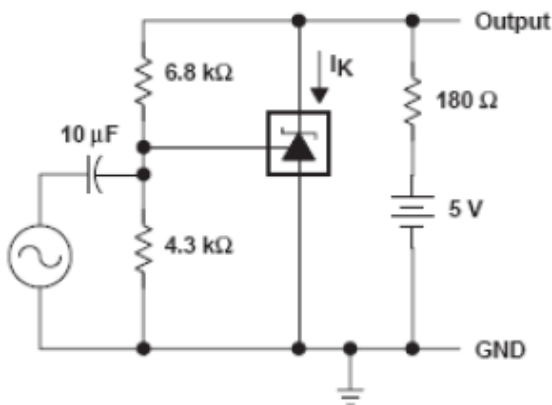
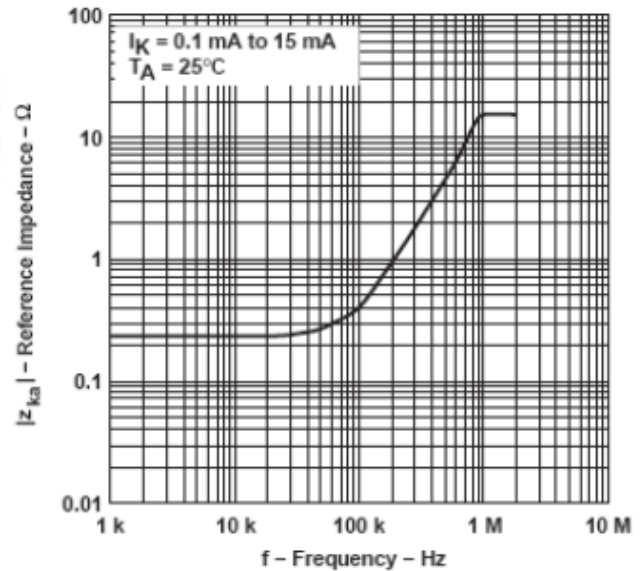


### Performance Characteristics

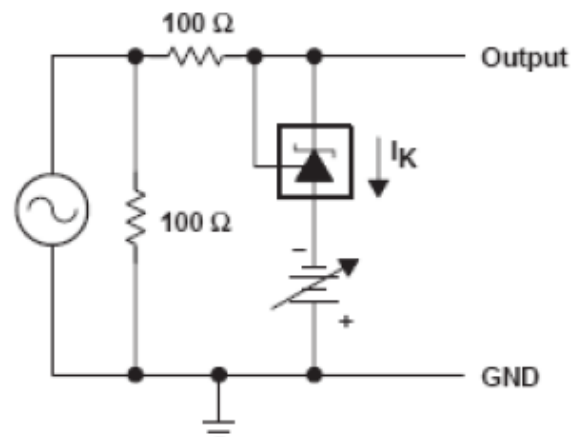
SMALL-SIGNAL VOLTAGE GAIN/PHASE MARGIN  
VS  
FREQUENCY



REFERENCE IMPEDANCE  
VS  
FREQUENCY



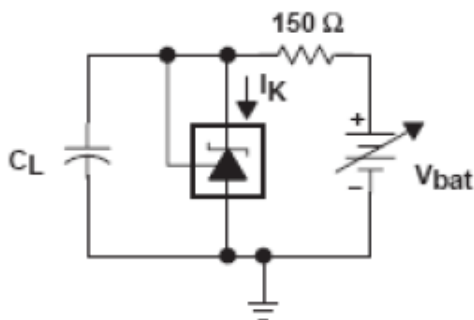
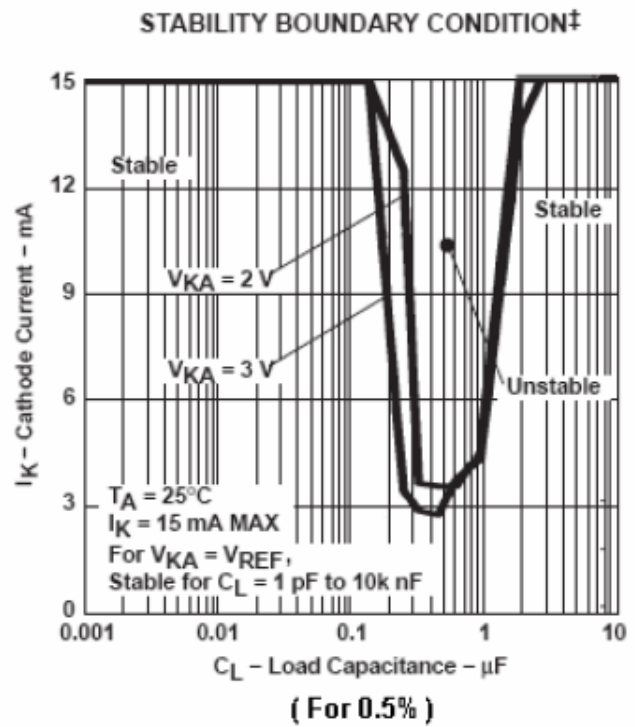
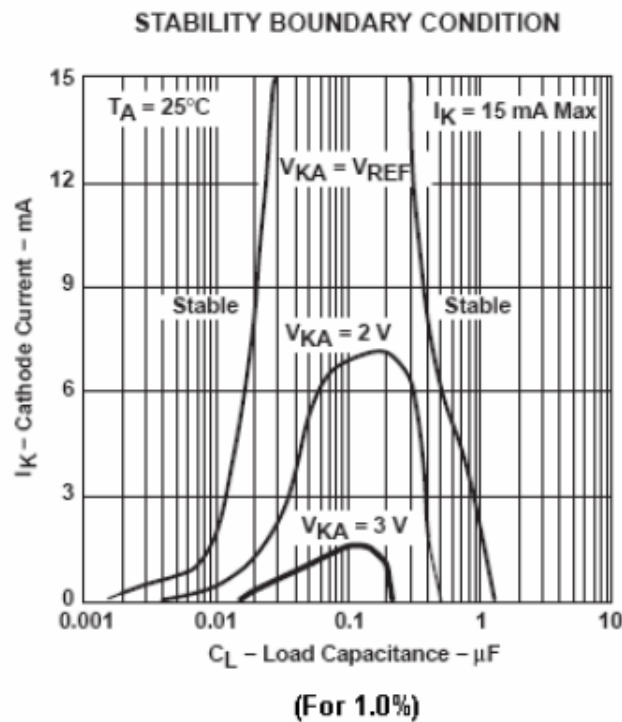
TEST CIRCUIT FOR VOLTAGE GAIN  
AND PHASE MARGIN



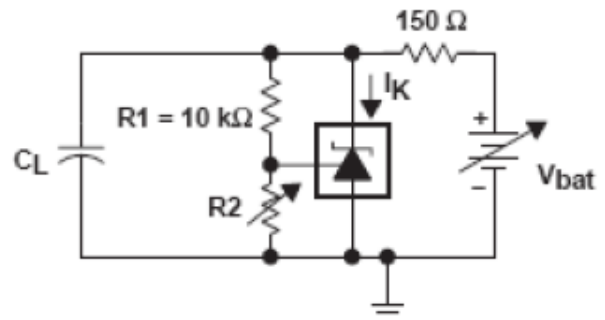
TEST CIRCUIT FOR REFERENCE IMPEDANCE



### Performance Characteristics



TEST CIRCUIT FOR  $V_{KA} = V_{REF}$



TEST CIRCUIT FOR  $V_{KA} = 2 \text{ V}, 3 \text{ V}$



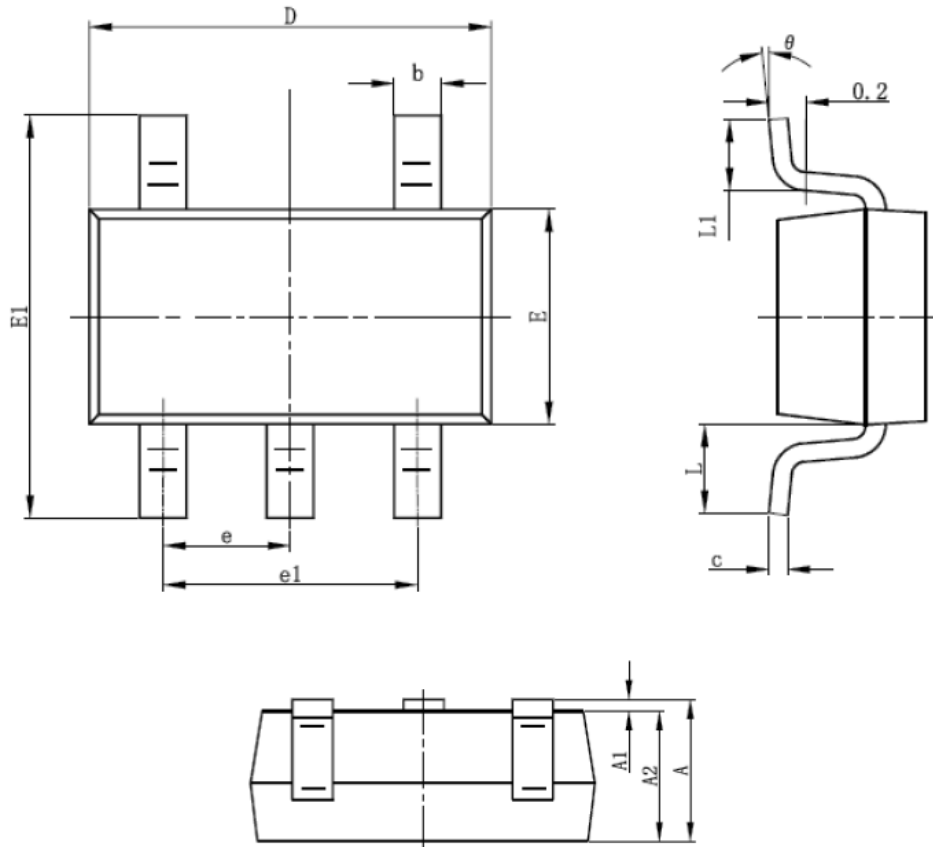


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## Packing Information

SOT-23-5L



| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| A        | 1.050                     | 1.250 | 0.041                | 0.049 |
| A1       | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2       | 1.050                     | 1.150 | 0.041                | 0.045 |
| b        | 0.300                     | 0.400 | 0.012                | 0.016 |
| c        | 0.100                     | 0.200 | 0.004                | 0.008 |
| D        | 2.820                     | 3.020 | 0.111                | 0.119 |
| E        | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1       | 2.650                     | 2.950 | 0.104                | 0.116 |
| e        | 0.950TYP                  |       | 0.037TYP             |       |
| e1       | 1.800                     | 2.000 | 0.071                | 0.079 |
| L        | 0.700REF                  |       | 0.028REF             |       |
| L1       | 0.300                     | 0.600 | 0.012                | 0.024 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

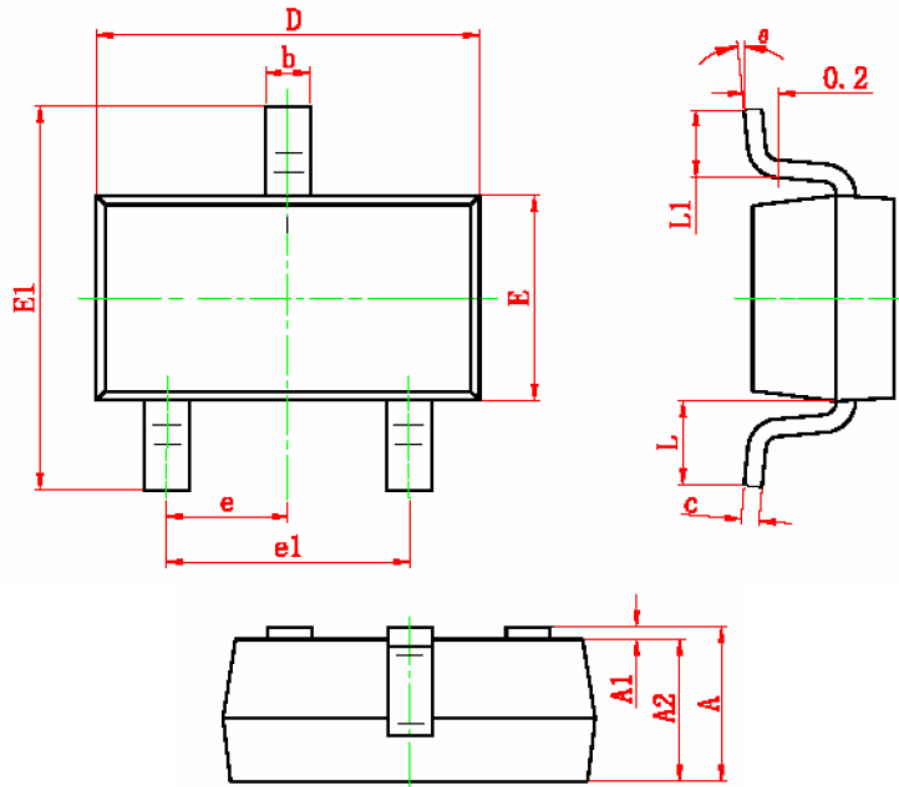


# ACE432N

Precision adjustable shunt voltage reference

## Packing Information

SOT-23-3



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.200 | 0.035                | 0.043 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.100 | 0.035                | 0.039 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.080                     | 0.150 | 0.003                | 0.006 |
| D      | 2.800                     | 3.000 | 0.110                | 0.118 |
| E      | 1.200                     | 1.400 | 0.047                | 0.055 |
| E1     | 2.250                     | 2.550 | 0.089                | 0.100 |
| e      | 0.950 TYP                 |       | 0.037 TYP            |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.550 REF                 |       | 0.022 REF            |       |
| L1     | 0.300                     | 0.500 | 0.012                | 0.020 |
| θ      | 0°                        | 8°    | 0°                   | 6°    |



## ACE432N

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### Notes

ACE does not assume any responsibility for use as critical components in life support devices or systems without the express written approval of the president and general counsel of ACE Electronics Co., LTD. As sued herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) 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 a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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