# 6.9V Precision Voltage Reference

## FEATURES

- *Guaranteed* 10 ppm/°C temperature coefficient
- *Guaranteed* 1.0Ω max. dynamic impedance
- *Guaranteed* 20μV max. wideband noise
- Wide operating current range 0.6mA to 15mA

## APPLICATIONS

- Transducers
- A/D and D/A Converters
- Calibration Standards
- Instrumentation Reference

## DESCRIPTION

The LM129 temperature compensated 6.9 Volt zener references provide excellent stability over time and temperature, very low dynamic impedance and a wide operating current range. The device achieves low dynamic impedance by incorporating a high gain shunt regulator around the zener. The excellent noise performance of the device is achieved by using a "buried zener" design which eliminates surface noise phenomenon associated with ordinary zeners. To serve a wide variety of applications, the LM129 is available in several temperature coefficient grades and two package styles. A 20mA positive current source application is shown below.

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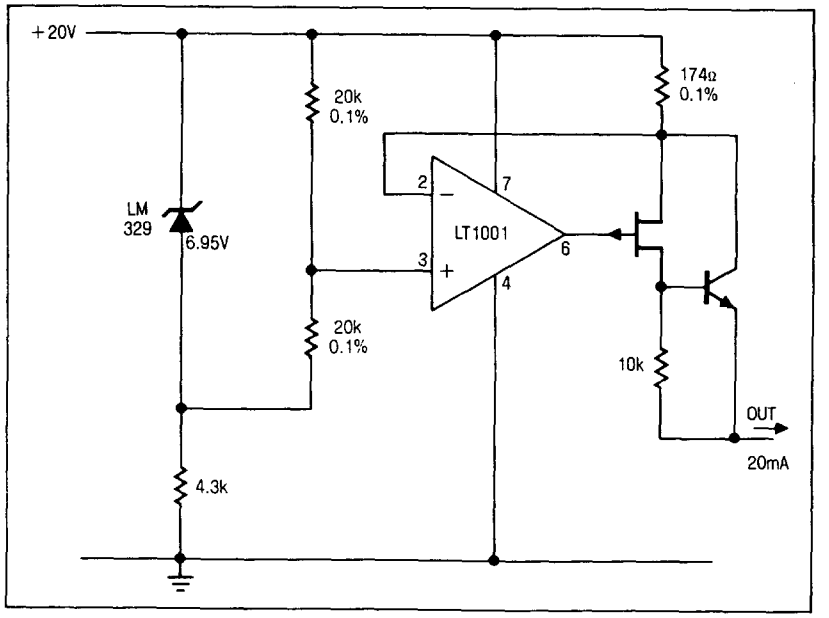
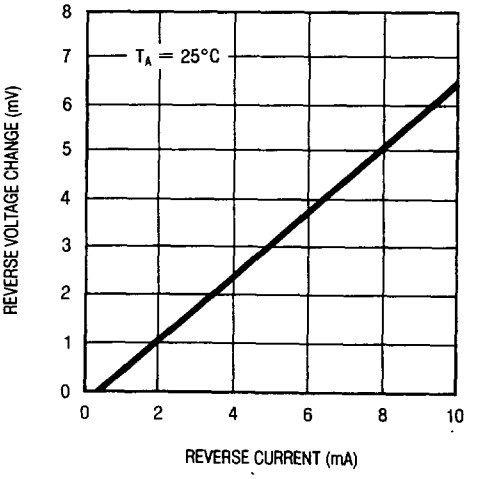
**20mA Positive Current Source**



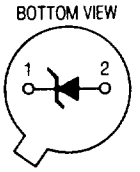

**Reverse Voltage Change**



## ABSOLUTE MAXIMUM RATINGS

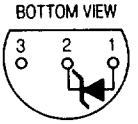
Reverse Breakdown Current ..... 30mA
Forward Current ..... 2mA
Operating Temperature Range
LM129 ..... −55°C to 125°C
LM329 ..... 0°C to 70°C
Storage Temperature Range
LM129 ..... −65°C to 150°C
LM329 ..... −65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

## PACKAGE/ORDER INFORMATION




H PACKAGE
TO-46 METAL CAN

LM129AH LM329AH
LM129BH LM329BH
LM129CH LM329CH
LM329DH




Z PACKAGE
TO-92 PLASTIC

LM329AZ
LM329BZ
LM329CZ
LM329DZ

## ELECTRICAL CHARACTERISTICS (See Note 1)

| SYMBOL | PARAMETER | CONDITIONS | | LM129A,B,C MIN | LM129A,B,C TYP | LM129A,B,C MAX | LM329A,B,C,D MIN | LM329A,B,C,D TYP | LM329A,B,C,D MAX | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_Z$ | Reverse Breakdown Voltage | $T_A = 25°C$<br>$0.6mA \leq I_R \leq 15mA$ | | 6.7 | 6.9 | 7.2 | 6.6 | 6.9 | 7.25 | V |
| $\frac{\Delta V_Z}{\Delta I_R}$ | Reverse Breakdown Voltage Change with Current | $T_A = 25°C$<br>$0.6mA \leq I_R \leq 15mA$ | | | 9 | 14 | | 9 | 20 | mV |
| $\frac{\Delta V_Z}{\Delta I_R}$ | Reverse Breakdown Voltage Change with Current | $1mA \leq I_R \leq 15mA$ | ● | | 12 | | | 12 | | mV |
| $\frac{\Delta V_Z}{\Delta \text{ Temp}}$ | Temperature Coefficient | $I_R = 1mA$<br>LM129A/LM329A<br>LM129B/LM329B<br>LM129C/LM329C<br>LM329D | <br>●<br>●<br>●<br>● | | <br>6<br>15<br>30 | <br>10<br>20<br>50 | | <br>6<br>15<br>30<br>50 | <br>10<br>20<br>50<br>100 | <br>ppm/°C<br>ppm/°C<br>ppm/°C<br>ppm/°C |
| | Change in Temperature Coefficient | $1mA \leq I_R \leq 15mA$ | ● | | 1 | | | 1 | | ppm/°C |
| $r_Z$ | Dynamic Impedance (Note 2) | $T_A = 25°C$, $I_R = 1mA$ (10Hz ≤ f ≤ 100Hz) | | | 0.6 | 1 | | 0.8 | 2 | Ω |
| $r_Z$ | Dynamic Impedance (Note 2) | $1mA \leq I_R \leq 15mA$ (10Hz ≤ f ≤ 100Hz) | ● | | 0.8 | | | 1 | | Ω |
| $e_n$ | RMS Noise | $T_A = 25°C$,<br>$10Hz \leq f \leq 10kHz$ | | | 7 | 20 | | 7 | 100 | μV |
| $\frac{\Delta V_Z}{\Delta \text{ Time}}$ | Long Term Stability | $T_A = 45°C \pm 0.1°C$<br>$I_R = 1mA \pm 0.3\%$ | | | 20 | | | 20 | | ppm/kHr |

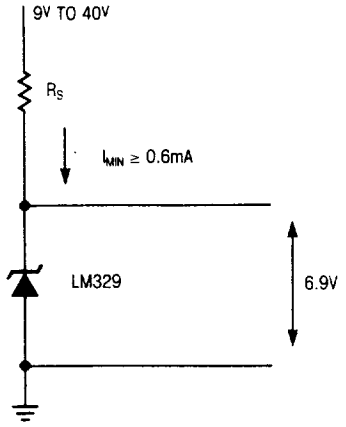
The ● denotes the specifications which apply over full operating temperature range.

**Note 1:** These specifications apply over the full operating temperature range unless otherwise noted. To determine the junction temperature as a function of the ambient temperature, see $\theta_{JA}$ for each package.

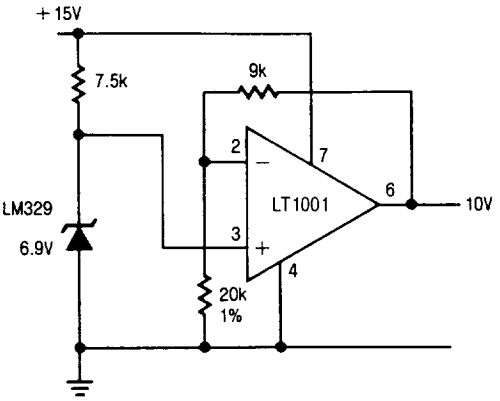
**Note 2:** Dynamic impedance guaranteed by "Reverse Breakdown Voltage Change with Current".

# TYPICAL APPLICATIONS

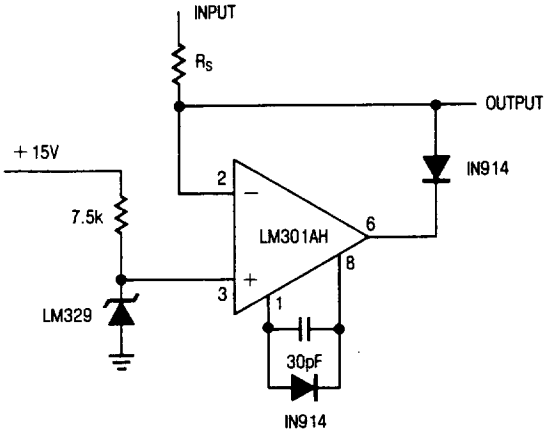
### Common Reference




### Buffered Reference Using a Single Supply




### Precision Clamp




# TYPICAL PERFORMANCE CHARACTERISTICS

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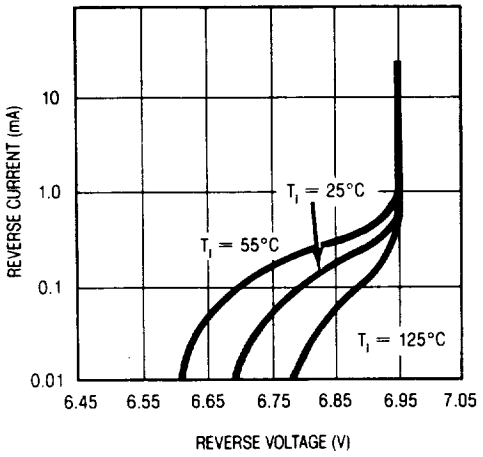
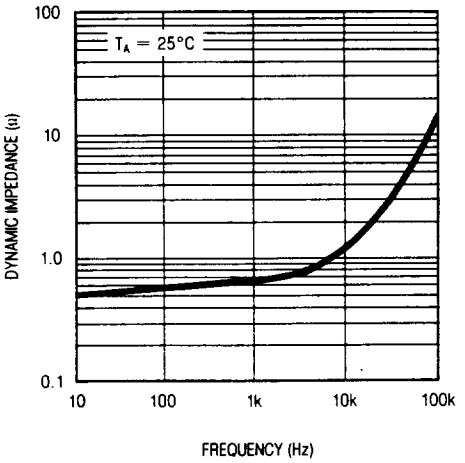
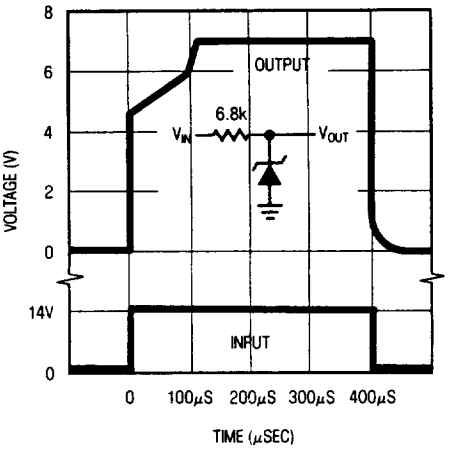
### Reverse Characteristics



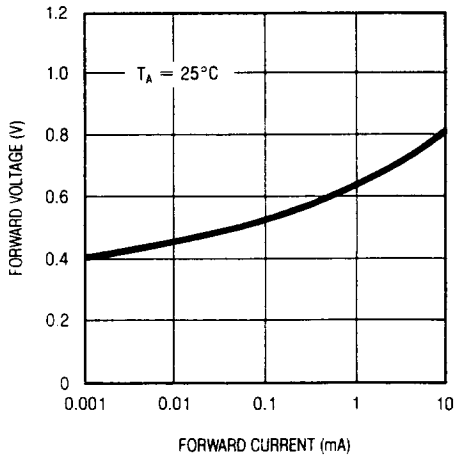

### Dynamic Impedance



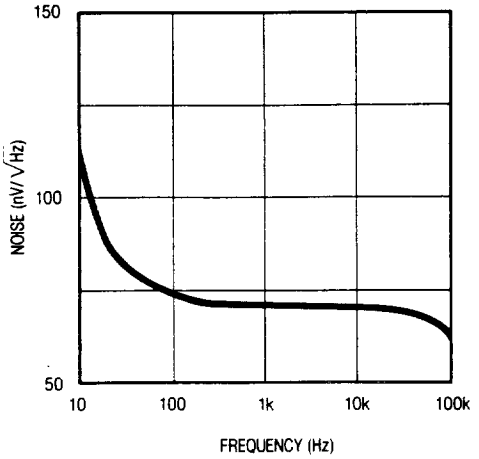

### Response Time



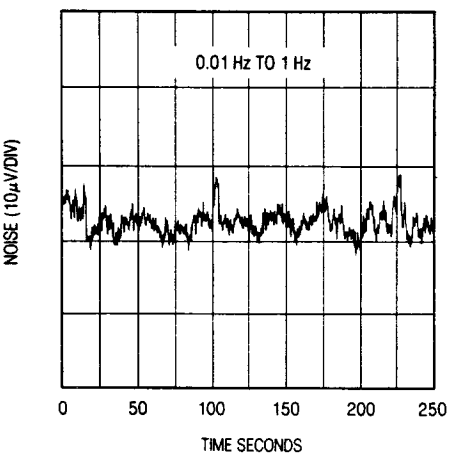

### Forward Characteristics



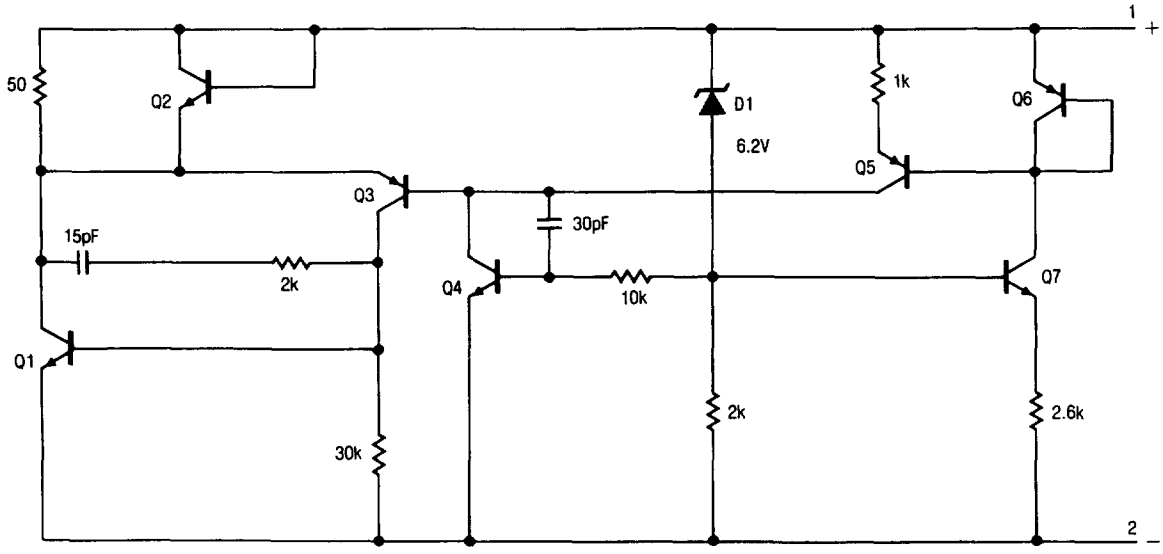

### Noise Voltage




### Low Frequency Noise Voltage

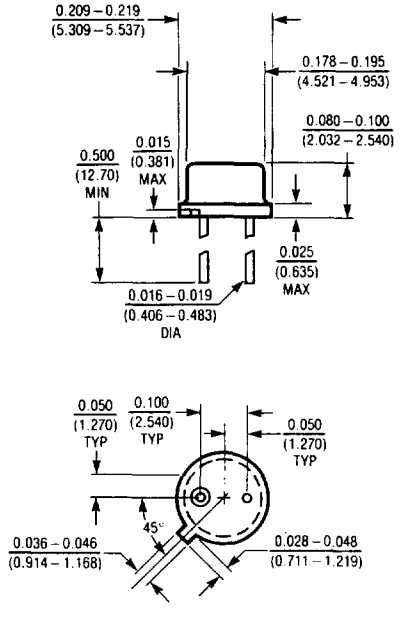


## SCHEMATIC DIAGRAM



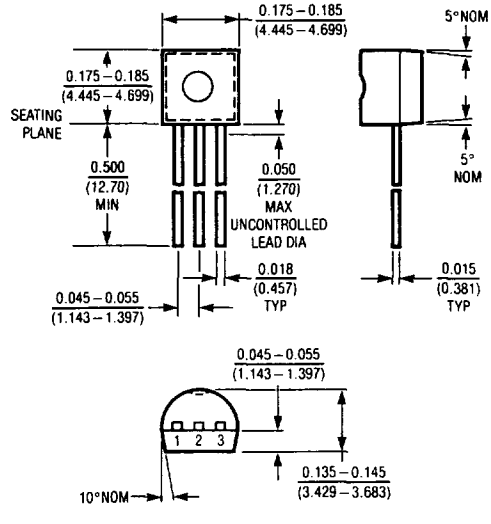

## PACKAGE DESCRIPTION

### H Package, 2 Lead TO-46 Metal Can




| $T_j$max | $\Theta_{ja}$ | $\Theta_{jc}$ |
|---|---|---|
| 150°C | 440°C/W | 80°C/W |

### Z Package, 3 Lead TO-92 Plastic




| $T_j$max | $\Theta_{ja}$ |
|---|---|
| 100°C | 160°C/W |