# LM329

***LM329 Precision Reference***


Literature Number: SNVS748E

National Semiconductor

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# Precision Reference

## General Description

The LM329 is a precision multi-current temperature-compensated 6.9V zener reference with dynamic impedance a factor of 10 to 100 less than discrete diodes. Constructed in a single silicon chip, the LM329 uses active circuitry to buffer the internal zener allowing the device to operate over a 0.5 mA to 15 mA range with virtually no change in performance. The LM329 is available with a temperature coefficients of 0.01%/°C. This reference also has excellent long term stability and low noise.

A new subsurface breakdown zener used in the LM329 gives lower noise and better long-term stability than conventional IC zeners. Further the zener and temperature compensating transistor are made by a planar process so they are immune to problems that plague ordinary zeners. For example, there is virtually no voltage shift in zener voltage due to temperature cycling and the device is insensitive to stress on the leads.

The LM329 can be used in place of conventional zeners with improved performance. The low dynamic impedance simplifies biasing and the wide operating current allows the replacement of many zener types.

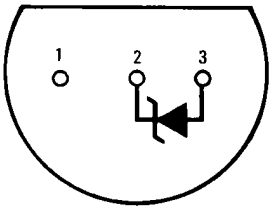
The LM329 for operation over 0°C to 70°C is available in a TO-92 epoxy package.

## Features

- 0.6 mA to 15 mA operating current
- 0.8Ω dynamic impedance at any current
- Available with temperature coefficient of 0.01%/°C
- 7µV wideband noise
- 5% initial tolerance
- 0.002% long term stability
- Low cost
- Subsurface zener

## Connection Diagram

**Plastic Package (TO-92)**

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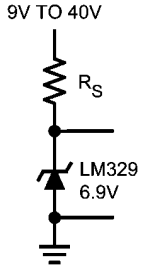
**Bottom View**
**Order Number LM329DZ**
**See NS Package Z03A**

## Typical Applications

**Simple Reference**

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## Absolute Maximum Ratings (Note 1)

**If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.**

| | |
|---|---|
| Reverse Breakdown Current | 30 mA |
| Forward Current | 2 mA |

| | |
|---|---|
| Operating Temperature Range | |
| LM329 | 0°C to +70°C |
| Storage Temperature Range | −55°C to +150°C |
| Soldering Information | |
| TO-92 package: 10 sec. | 260°C |

## Electrical Characteristics (Note 2)

| Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Reverse Breakdown Voltage | $T_A$ = 25°C, 0.6 mA ≤ $I_R$ ≤ 15 mA | 6.6 | 6.9 | 7.25 | V |
| Reverse Breakdown Change with Current (Note 3) | $T_A$ = 25°C, 0.6 mA ≤ $I_R$ ≤ 15 mA | | 9 | 20 | mV |
| Reverse Dynamic Impedance (Note 3) | $T_A$ = 25°C, $I_R$ = 1 mA | | 0.8 | 2 | Ω |
| RMS Noise | $T_A$ = 25°C, 10 Hz ≤ F ≤ 10 kHz | | 7 | 100 | µV |
| Long Term Stability (1000 hours) | $T_A$ = 45°C ± 0.1°C, $I_R$ = 1 mA ± 0.3% | | 20 | | ppm |
| Temperature Coefficient | $I_R$ = 1 mA | | 50 | 100 | ppm/°C |
| Change In Reverse Breakdown Temperature Coefficient | 1 mA ≤ $I_R$ ≤ 15 mA | | 1 | | ppm/°C |
| Reverse Breakdown Change with Current | 1 mA ≤ $I_R$ ≤ 15 mA | | 12 | | mV |
| Reverse Dynamic Impedance | 1 mA ≤ $I_R$ ≤ 15 mA | | 1 | | Ω |

**Note 1:** "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

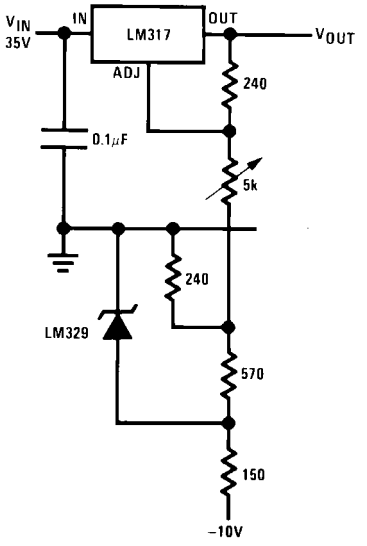
**Note 2:** These specifications apply for 0°C ≤ $T_A$ ≤ +70°C for the LM329 unless otherwise specified. The maximum junction temperature for a LM329 is 100°C. For operating at elevated temperature. The TO-92 package, the derating is based on 180°C/W junction to ambient with 0.4″ leads from a PC board and 160°C/W junction to ambient with 0.125″ lead length to a PC board.

**Note 3:** These changes are tested on a pulsed basis with a low duty-cycle. For changes versus temperature, compute in terms of tempco.

**Note 4:**

## Typical Applications

**Low Cost 0–25V Regulator**

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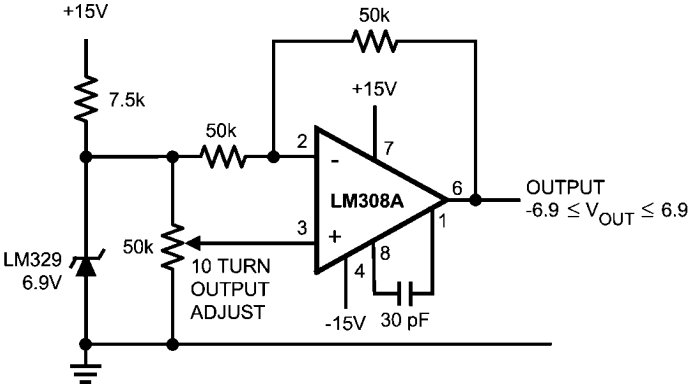
**Adjustable Bipolar Output Reference**

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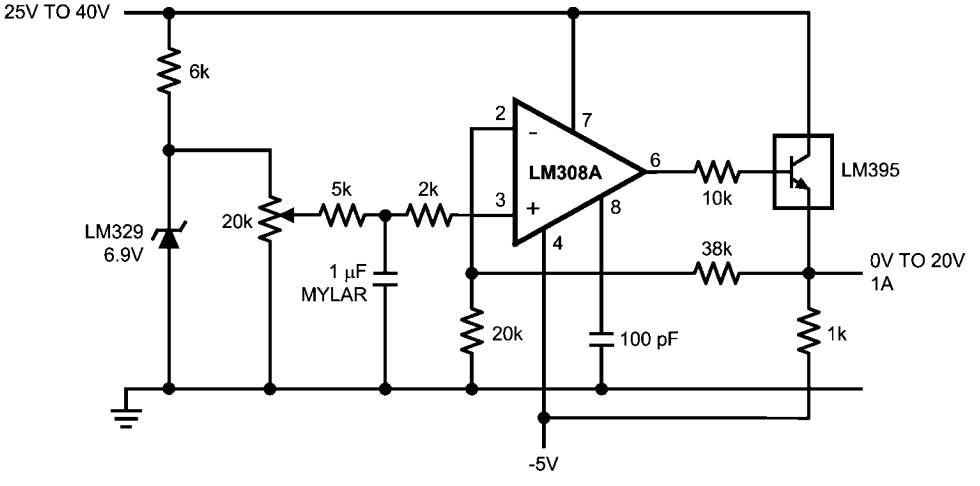
**0V to 20V Power Reference**

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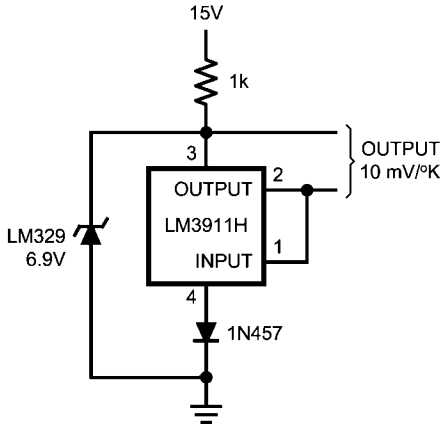
**External Reference for Temperature Transducer**

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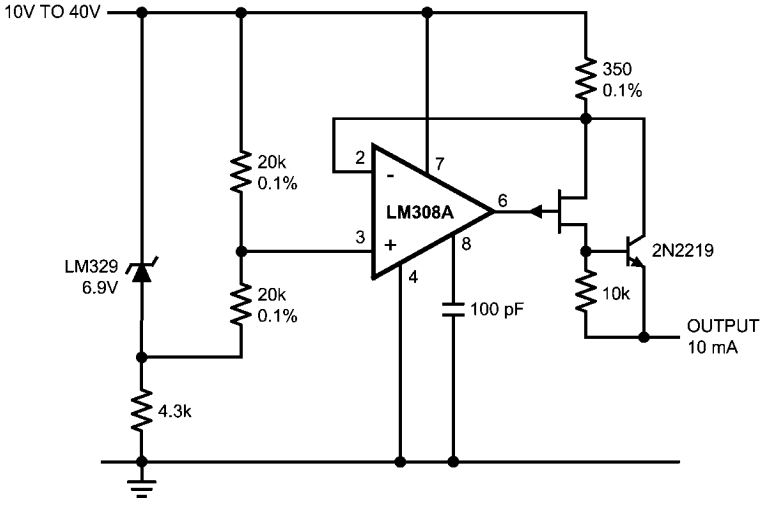
**Positive Current Source**

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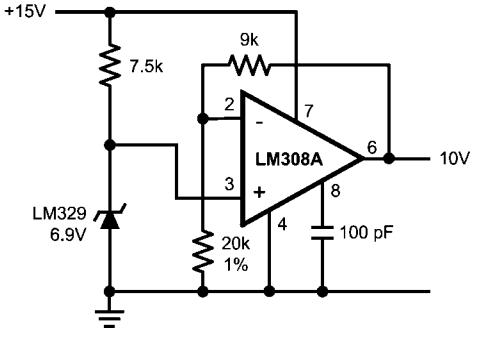
**Buffered Reference with Single Supply**

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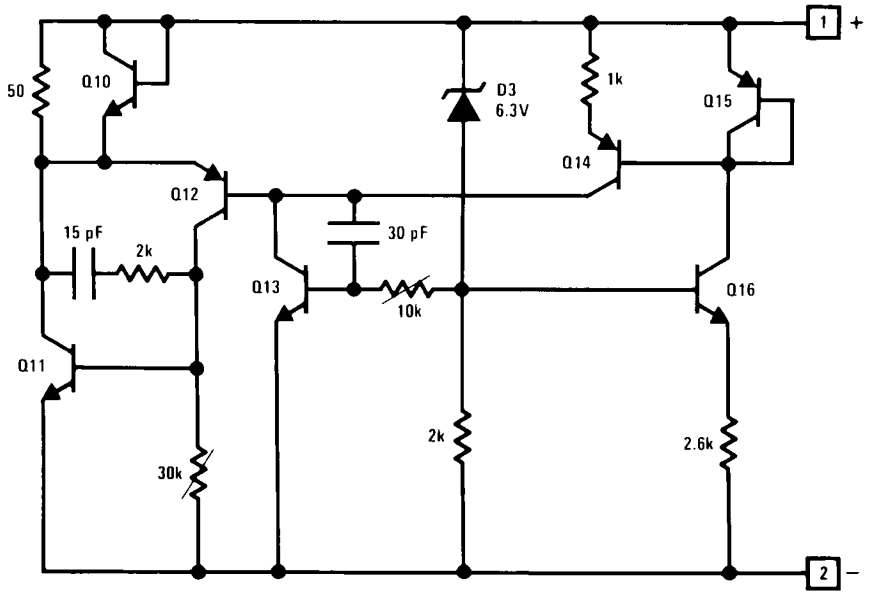
## Schematic Diagram

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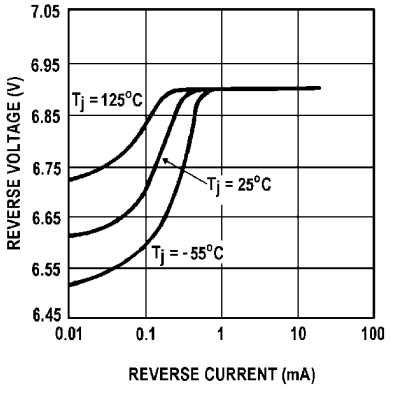
## Typical Performance Characteristics

**Reverse Characteristics**

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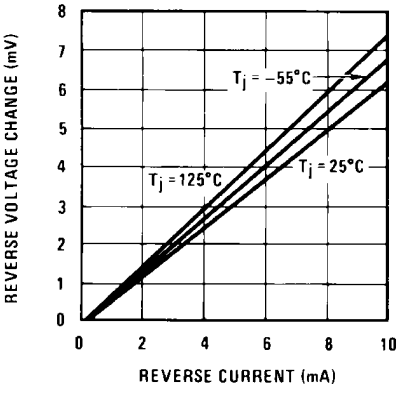
**Reverse Voltage Change**

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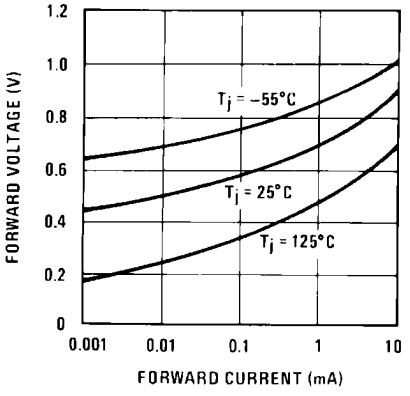
**Forward Characteristics**

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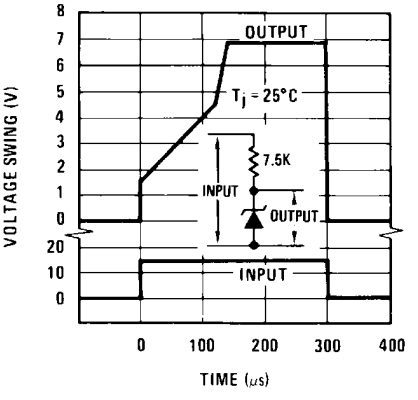
**Response Time**

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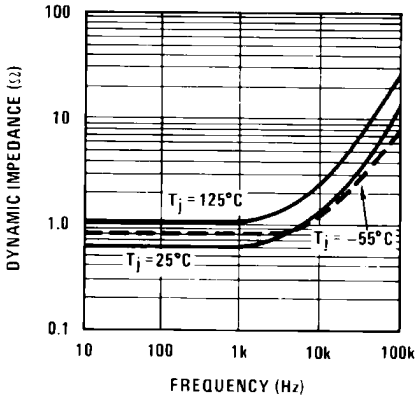
**Dynamic Impedance**

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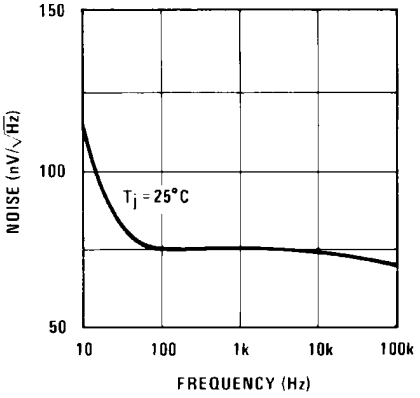
**Zener Noise Voltage**

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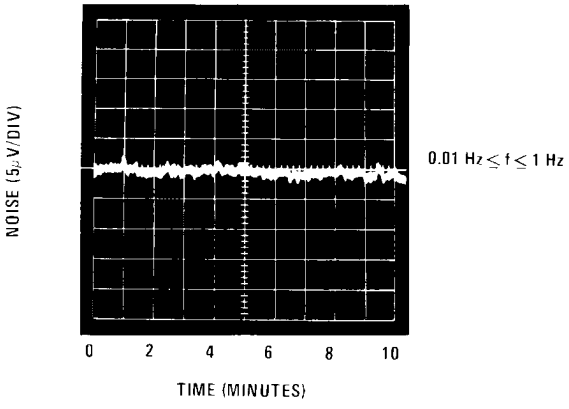
**Low Frequency Noise Voltage**

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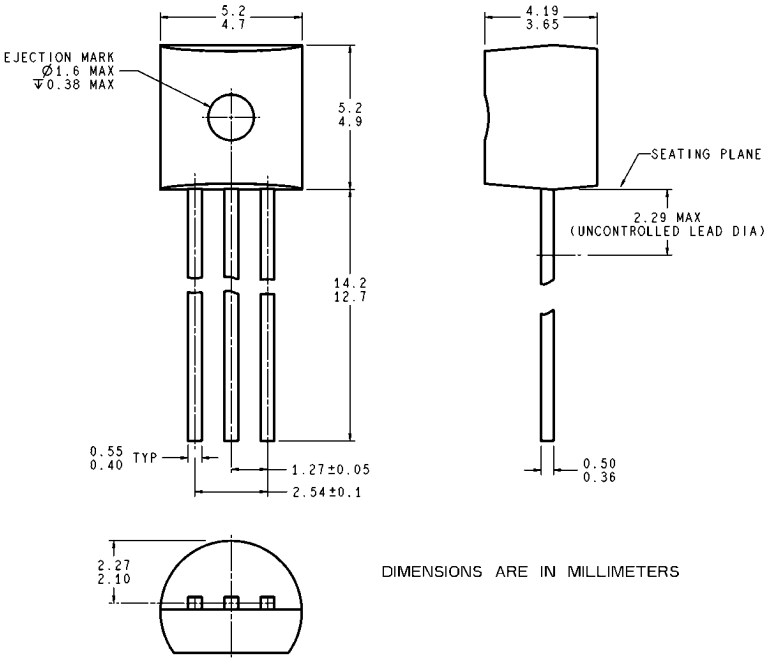
## Physical Dimensions inches (millimeters) unless otherwise noted




**Plastic Package**
**Order Number LM329DZ,**
**NS Package Z03A**

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