

# CS1009

## 2.5 Volt Reference

The CS1009 is a precision trimmed 2.5 V  $\pm 5.0$  mV shunt regulator diode. The low dynamic impedance and wide operating current range enhances its versatility. The tight reference tolerance is achieved by on-chip trimming which minimizes voltage tolerance and temperature drift.

A third terminal allows the reference voltage to be adjusted  $\pm 5.0\%$  to calibrate out system errors. In many applications, the CS1009GZ can be used as a pin-to-pin replacement of the LT1009CZ and the LM136Z-2.5 with the external trim network eliminated.

### Features

- 0.2% Initial Tolerance Max.
- Guaranteed Temperature Stability
- Maximum 0.6  $\Omega$  Dynamic Impedance
- Wide Operating Current Range
- Directly Interchangeable with LT1009 and LM136 for Improved Performance
- No Adjustments Needed for Minimum Temperature Coefficient
- Meets Mil Std 883C ESD Requirements

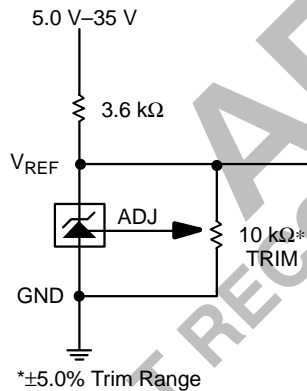


Figure 1. Application Diagram



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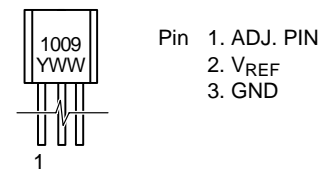
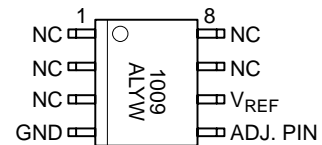


SO-8  
D SUFFIX  
CASE 751



TO-92  
Z SUFFIX  
CASE 29

### PIN CONNECTIONS AND MARKING DIAGRAM



A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week

### ORDERING INFORMATION

| Device     | Package | Shipping         |
|------------|---------|------------------|
| CS1009GD8  | SO-8    | 95 Units/Rail    |
| CS1009GDR8 | SO-8    | 2500 Tape & Reel |
| CS1009GZ3  | TO-92   | 2000 Units       |
| CS1009GZR3 | TO-92   | 2000 Tape & Reel |

# CS1009

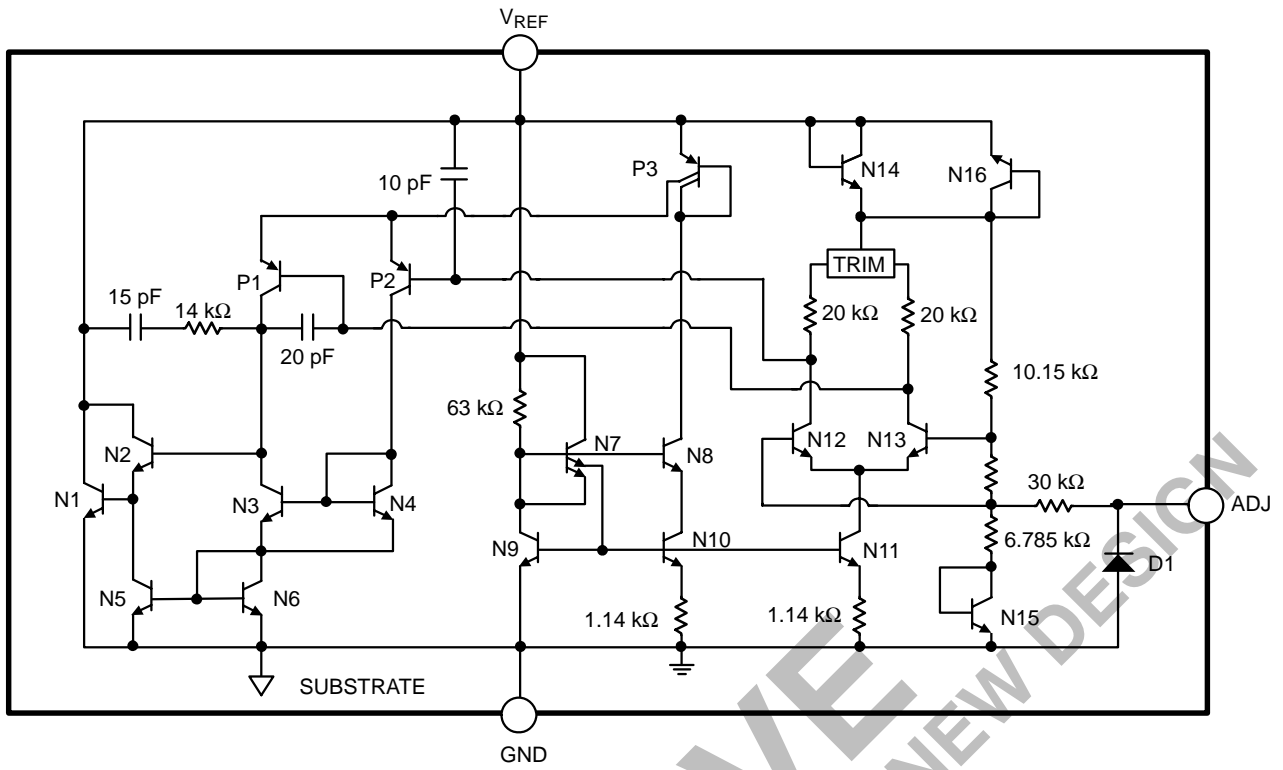


Figure 2. Block Diagram

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**MAXIMUM RATINGS\***

| Rating                      | Value   | Unit                             |
|-----------------------------|---|----------------------------------|
| Reverse Current             | 20  | mA                               |
| Forward                     | 10  | mA                               |
| Operating Temperature Range | -40 to 105  | °C                               |
| Storage Temperature Range   | -65 to +150   | °C                               |
| Lead Temperature Soldering: | Wave Solder (through hole styles only) (Note 1)<br>Reflow: (SMD styles only) (Note 2) | 260 peak<br>230 peak<br>°C<br>°C |

1. 10 second maximum
2. 60 second maximum above 183°C.

\*The maximum package power dissipation must be observed.

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified.)

| Characteristic   | Test Conditions   | Min   | Typ   | Max   | Unit     |
|--|---|-------|-------|-------|----------|
| Reverse Breakdown Voltage                                | $I_R = 1.0\text{ mA}$   | 2.492 | 2.500 | 2.508 | V        |
| Reverse Breakdown Voltage                                | $0^\circ\text{C} \leq T_A \leq 105^\circ\text{C}$                 | 2.492 | 2.500 | 2.508 | V        |
| Reverse Breakdown Voltage                                | $-40^\circ\text{C} \leq T_A \leq 0^\circ\text{C}$                 | 2.480 | 2.500 | 2.508 | V        |
| Reverse Breakdown Voltage<br>Change with Current         | $400\ \mu\text{A} \leq I_R \leq 10\text{ mA}$                     | †     | 2.6   | 10    | mV       |
|  |   | †     | 3.0   | 12    | mV       |
| Reverse Dynamic Impedance                                | $I_R = 1.0\text{ mA}$   | †     | 0.2   | 1.0   | $\Omega$ |
|  |   | †     | 0.4   | 1.4   | $\Omega$ |
| Temperature Stability<br>Average Temperature Coefficient | $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ , Note 3         | -     | -     | -     | mV       |
|  | $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ , Note 3         | -     | -     | -     | ppm/°C   |
| Long Term Stability                                      | $T_A = 25^\circ\text{C} \pm 0.1\text{ C}$ , $I_R = 1.0\text{ mA}$ | -     | 20    | -     | ppm/kHr  |

† Denotes the specifications which apply over full operating temperature range.

3. Average temperature coefficient is defined as the total voltage change divided by the specified temperature range.

**TYPICAL PERFORMANCE CHARACTERISTICS**

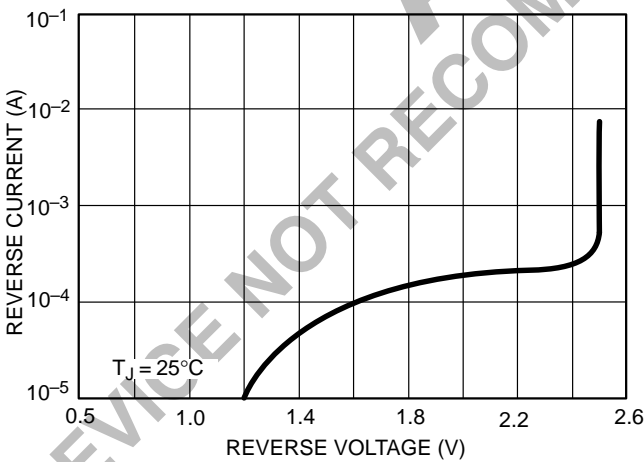


Figure 3. Reverse Current vs. Reverse Voltage

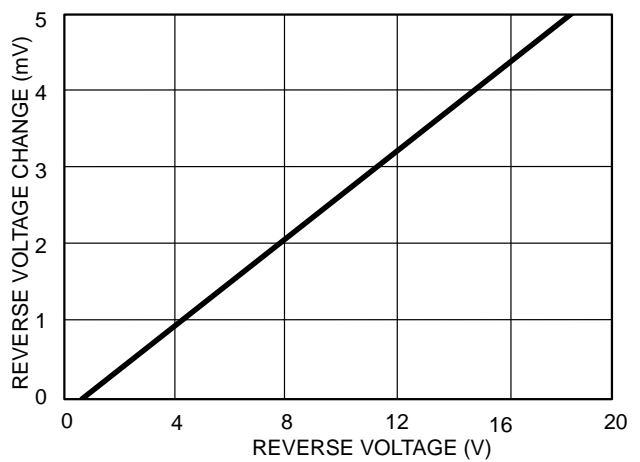


Figure 4. Change in Reverse Voltage vs. Reverse Current

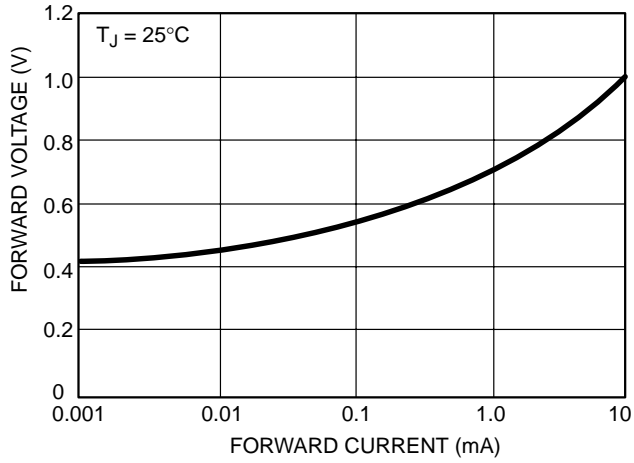


Figure 5. Forward Voltage vs. Forward Current

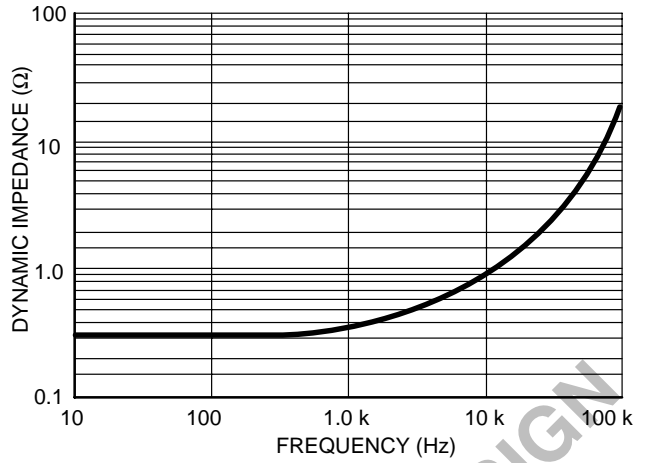


Figure 6. Dynamic Impedance vs. Frequency

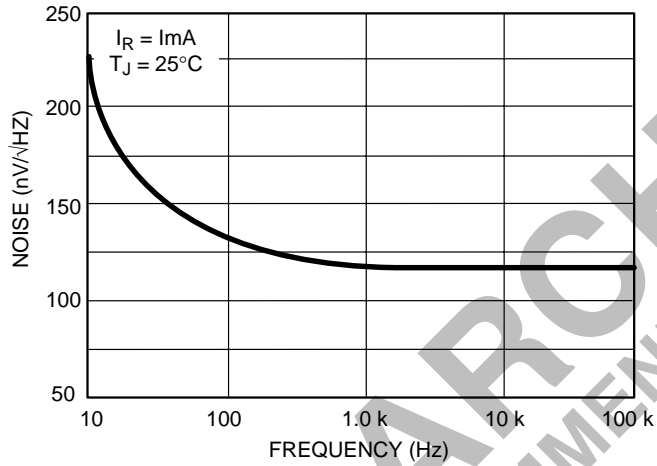


Figure 7. Zener Noise Voltage vs. Frequency

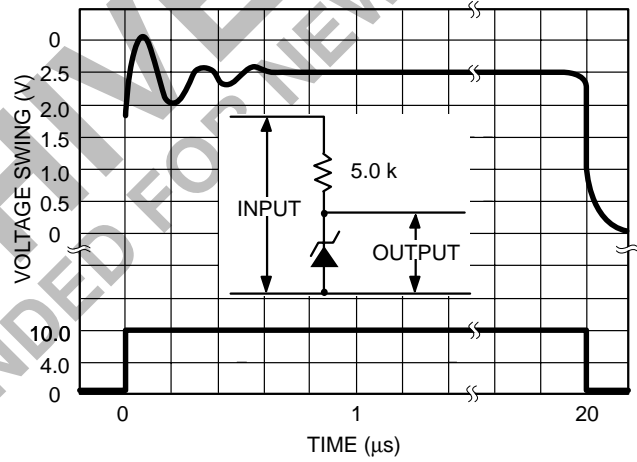


Figure 8. Response Time

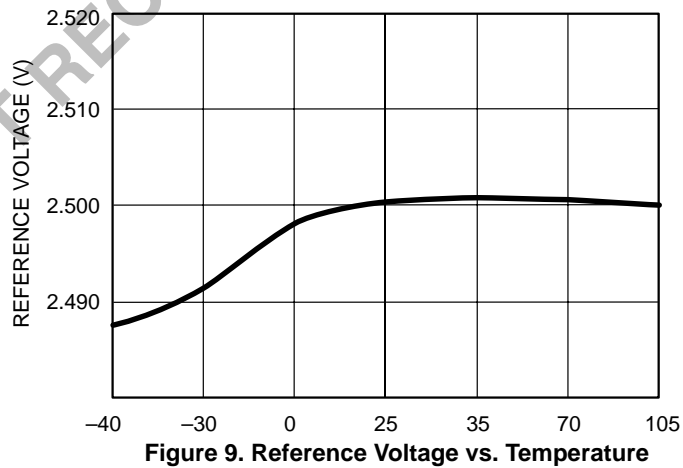
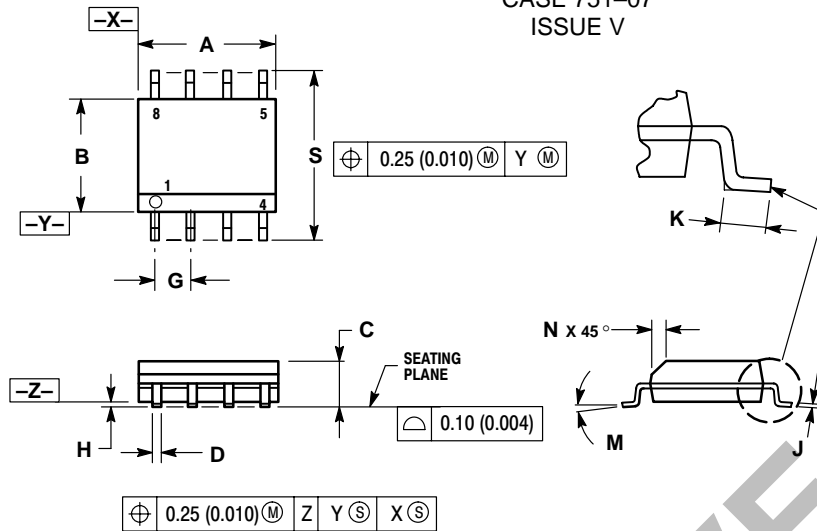


Figure 9. Reference Voltage vs. Temperature

# CS1009

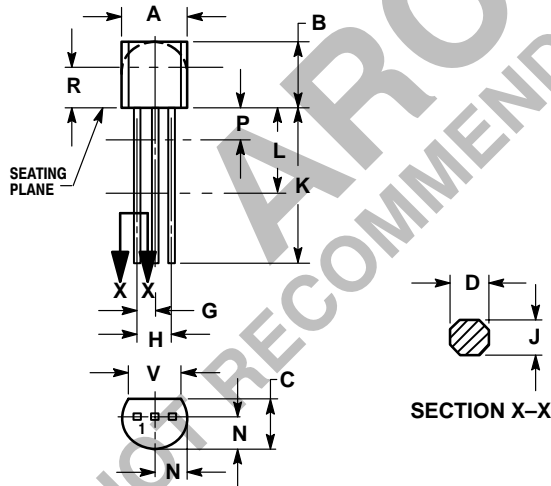
## PACKAGE DIMENSIONS

SO-8  
D SUFFIX  
CASE 751-07  
ISSUE V



| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.80        | 5.00 | 0.189     | 0.197 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.053     | 0.069 |
| D   | 0.33        | 0.51 | 0.013     | 0.020 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 0.10        | 0.25 | 0.004     | 0.010 |
| J   | 0.19        | 0.25 | 0.007     | 0.010 |
| K   | 0.40        | 1.27 | 0.016     | 0.050 |
| M   | 0°          | 8°   | 0°        | 8°    |
| N   | 0.25        | 0.50 | 0.010     | 0.020 |
| S   | 5.80        | 6.20 | 0.228     | 0.244 |

TO-92  
Z SUFFIX  
CASE 29-11  
ISSUE AL



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | ---   | 12.70       | ---   |
| L   | 0.250  | ---   | 6.35        | ---   |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | ---    | 0.100 | ---         | 2.54  |
| R   | 0.115  | ---   | 2.93        | ---   |
| V   | 0.135  | ---   | 3.43        | ---   |

PACKAGE THERMAL DATA

| Parameter        |         | SO-8 | TO-92 | Unit |
|------------------|---------|------|-------|------|
| R <sub>θJC</sub> | Typical | 45   | —     | °C/W |
| R <sub>θJA</sub> | Typical | 165  | 170   | °C/W |


Notes

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