

## FEATURES

- Maximum Initial Tolerance: 0.2%
- *Guaranteed* Temperature Stability
- Maximum 0.6Ω Dynamic Impedance
- Wide Operating Current Range
- Directly Interchangeable with LM136 for Improved Performance
- No Adjustments Needed for Minimum Temperature Coefficient

## APPLICATIONS


- Reference for 5V Systems
- 8-Bit A/D and D/A Reference
- Digital Voltmeters
- Current Loop Measurement and Control Systems
- Power Supply Monitor

## DESCRIPTION

The LT<sup>®</sup>1009 is a precision trimmed 2.5V shunt regulator diode featuring a maximum initial tolerance of only  $\pm 5\text{mV}$ . The low dynamic impedance and wide operating current range enhances its versatility. The 0.2% reference tolerance is achieved by on-chip trimming which not only minimizes the initial voltage tolerance but also minimizes the temperature drift.

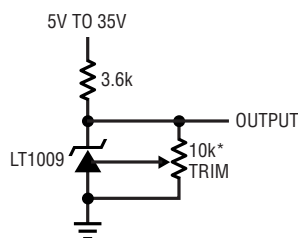
Even though no adjustments are needed with the LT1009, a third terminal allows the reference voltage to be adjusted  $\pm 5\%$  to calibrate out system errors. In many applications, the LT1009 can be used as a pin-to-pin replacement of the LM136 and the external trim network eliminated.

For a lower drift 2.5V reference, see the LT1019 data sheet.

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## TYPICAL APPLICATION

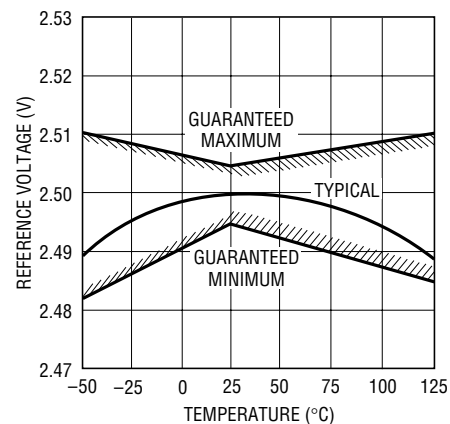
2.5V Reference



\*DOES NOT AFFECT  
 TEMPERATURE COEFFICIENT.  
 $\pm 5\%$  TRIM RANGE

1009 TA01

Output Voltage



1009 TA02

# LT1009 Series

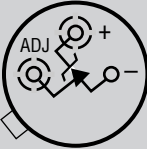
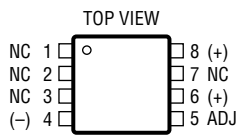
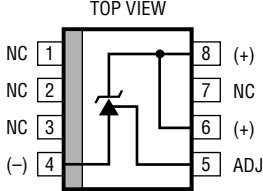
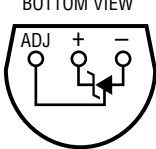
## ABSOLUTE MAXIMUM RATINGS (Note 1)

Reverse Current ..... 20mA  
 Forward Current ..... 10mA  
 Storage Temperature Range ..... -65°C to 150°C  
 Lead Temperature (Soldering, 10 sec)..... 300°C

### Operating Temperature Range

LT1009/LT1009C ..... 0°C to 70°C  
 LT1009I ..... -40°C to 85°C  
 LT1009M (**OBSOLETE**) ..... -55°C to 125°C

## PACKAGE/ORDER INFORMATION

 <p>BOTTOM VIEW</p> <p>H PACKAGE 3-LEAD TO-46 METAL CAN</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 440^{\circ}C/W</math>, <math>\theta_{JC} = 80^{\circ}C/W</math></p> <p><b>OBSOLETE PACKAGE</b> Consider the MS8, S8 or Z Packages for Alternate Source</p>	ORDER PART NUMBER	 <p>TOP VIEW</p> <p>MS8 PACKAGE 8-LEAD PLASTIC MSOP</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 250^{\circ}C/W</math></p>	ORDER PART NUMBER
	LT1009MH LT1009CH		LT1009CMS8
			MS8 PART MARKING
			LTQZ
 <p>TOP VIEW</p> <p>S8 PACKAGE 8-LEAD PLASTIC SO</p> <p><math>T_{JMAX} = 150^{\circ}C</math>, <math>\theta_{JA} = 190^{\circ}C/W</math></p>	ORDER PART NUMBER	 <p>BOTTOM VIEW</p> <p>Z PACKAGE 3-LEAD PLASTIC TO-92</p> <p><math>T_{JMAX} = 100^{\circ}C</math>, <math>\theta_{JA} = 160^{\circ}C/W</math></p>	ORDER PART NUMBER
	LT1009S8 LT1009IS8		LT1009CZ LT1009IZ
	S8 PART MARKING		
	1009 1009I		

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## AVAILABLE OPTIONS

TEMPERATURE	ACCURACY (%)	TEMPERATURE COEFFICIENT (ppm/°C)	PACKAGE STYLE			
			TO-46 (H) OBSOLETE	MSOP-8 (MS8)	SO-8 (S8)	TO-92 (Z)
0°C to 70°C	0.20	25	LT1009CH	LT1009CMS8	LT1009S8	LT1009CZ
	0.40	25				
-40°C to 85°C	0.20	35			LT1009IS8	LT1009IZ
	0.40	35				
-55°C to 125°C	0.20	35	LT1009MH			

# ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are  $T_A = 25^\circ\text{C}$ .

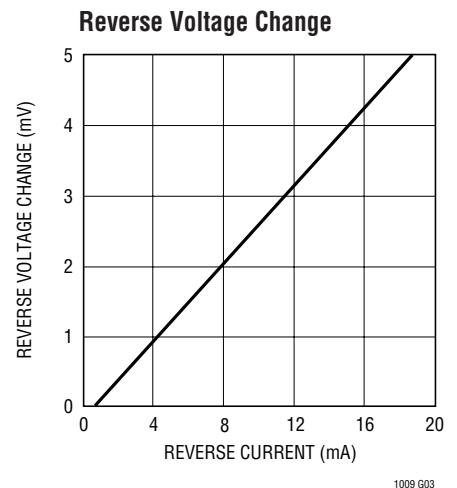
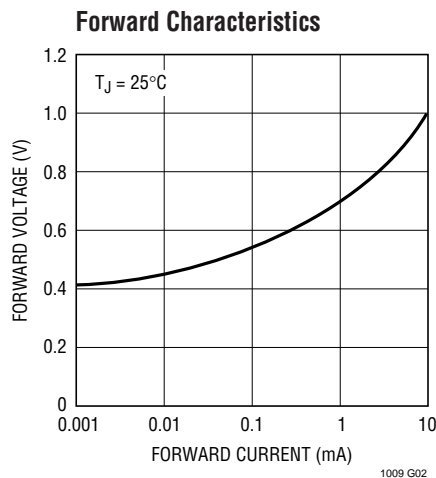
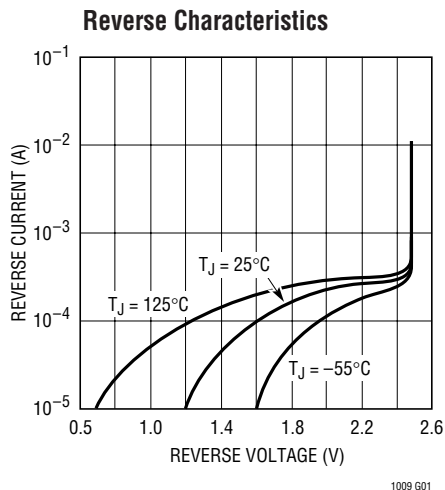
SYMBOL	PARAMETER	CONDITIONS	LT1009M			LT1009I			LT1009/LT1009C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_Z$	Reverse Breakdown Voltage	$T_A = 25^\circ\text{C}$ , $I_R = 1\text{mA}$ , H, Z Pkg MS, S Pkg	2.495	2.500	2.505	2.495	2.500	2.505	2.495	2.500	2.505	V V
$\frac{\Delta V_Z}{\Delta I_R}$	Reverse Breakdown Change with Current	$400\mu\text{A} \leq I_R \leq 10\text{mA}$	●	2.6	6	●	2.6	10	●	2.6	10	mV mV
$r_Z$	Reverse Dynamic Impedance	$I_R = 1\text{mA}$	●	0.2	0.6	●	0.2	1.0	●	0.2	1.0	$\Omega$ $\Omega$
	Temperature Stability	$T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$	●		15	●		15	●	1.8	4	mV
$\frac{\Delta V_Z}{\Delta \text{Temp}}$	Average Temperature Coefficient (Notes 2, 3)	$0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$ $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$		15	25		15	25 35		15	25	ppm/ $^\circ\text{C}$ ppm/ $^\circ\text{C}$ ppm/ $^\circ\text{C}$
$\frac{\Delta V_Z}{\Delta \text{Time}}$	Long-Term Stability	$T_A = 25^\circ\text{C} \pm 0.1^\circ\text{C}$ , $I_R = 1\text{mA}$		20			20			20		ppm/kHr

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** Guaranteed by Design.

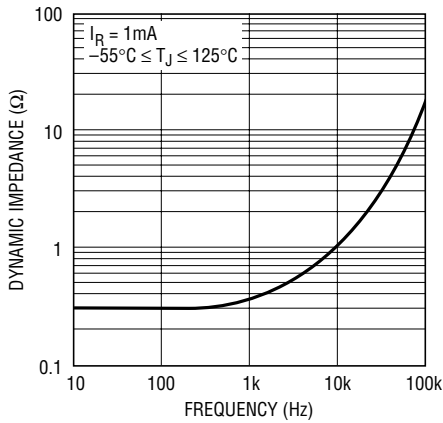
**Note 3:** Average temperature coefficient is defined as the total voltage change divided by the specified temperature change.

# TYPICAL PERFORMANCE CHARACTERISTICS



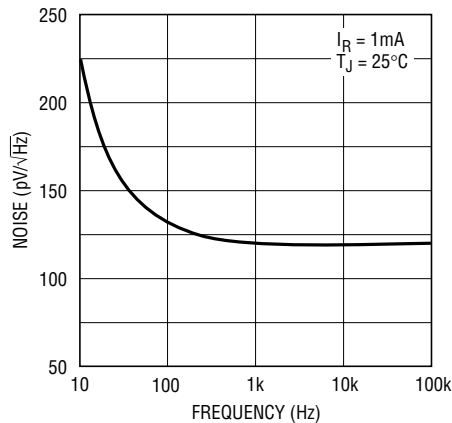
# TYPICAL PERFORMANCE CHARACTERISTICS

**Dynamic Impedance**



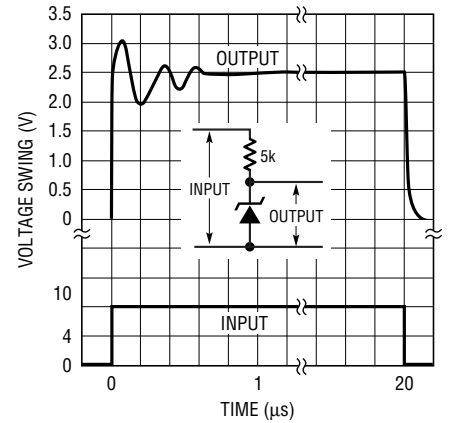
1009 G04

**Output Noise Voltage**



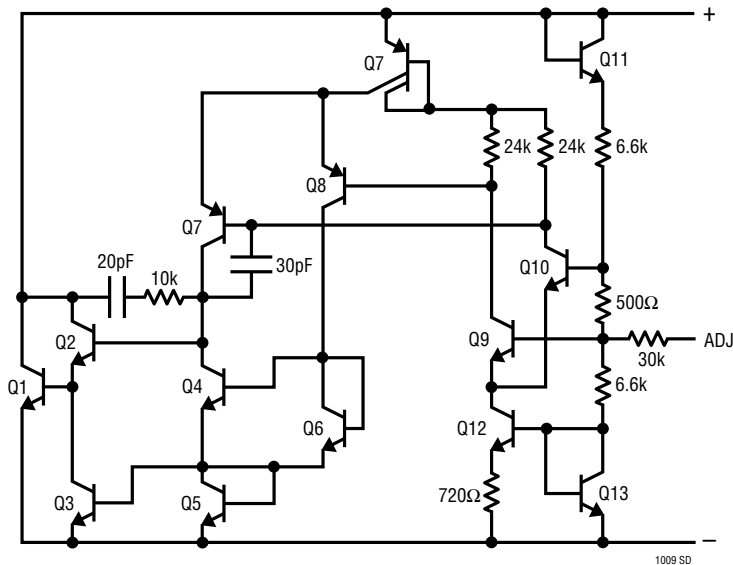
1009 G05

**Response Time**



1009 G06

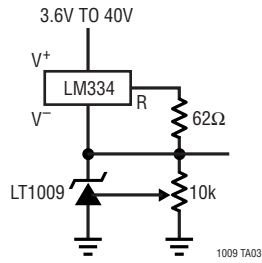
# SCHEMATIC DIAGRAM



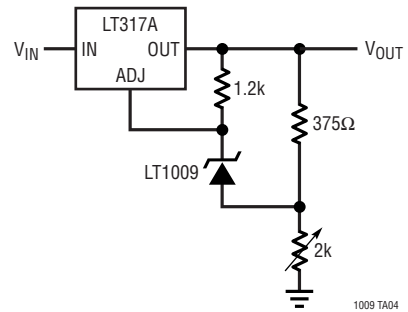
1009 SD

# TYPICAL APPLICATIONS

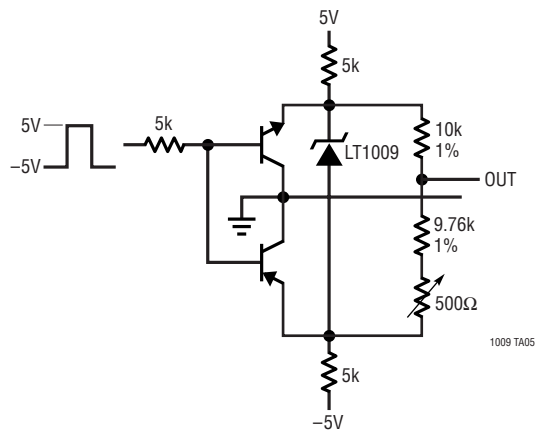
Wide Supply Range, Adjustable Reference



Low Temperature Coefficient Power Regulator



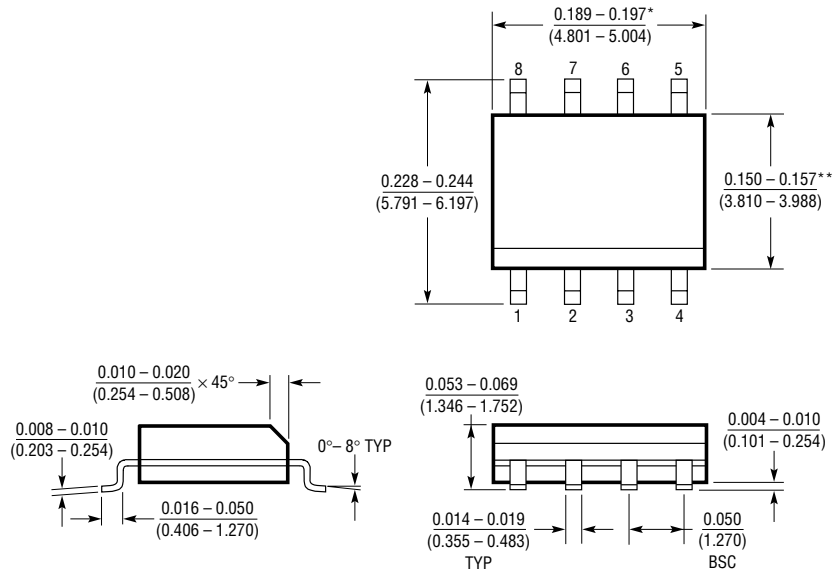
Switchable  $\pm 1.25V$  Bipolar Reference





**PACKAGE DESCRIPTION**

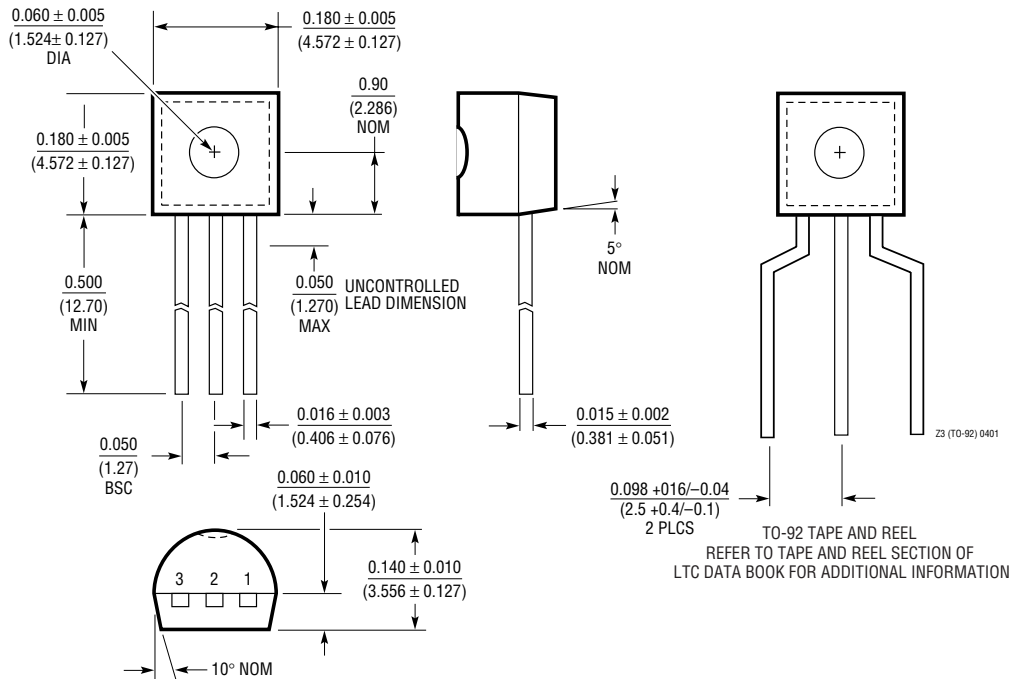
**S8 Package**  
**8-Lead Plastic Small Outline (Narrow .150 Inch)**  
 (Reference LTC DWG # 05-08-1610)



\*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE  
 \*\*DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE

S08 1298

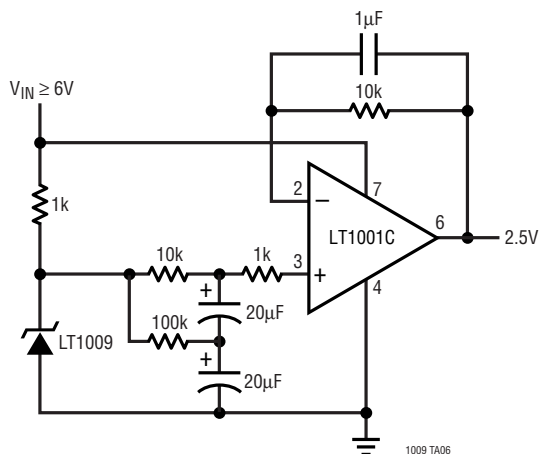
**Z Package**  
**3-Lead Plastic TO-92 (Similar to TO-226)**  
 (Reference LTC DWG # 05-08-1410)



Z3 (TO-92) 0401

## TYPICAL APPLICATION

Low Noise 2.5V Buffered Reference



## RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1019	Precision Series Reference	Bandgap, 0.05%, 5ppm/°C
LT1236	Precision Series Reference	5V and 10V Zener-Based 5ppm/°C, SO-8 Package
LTC®1798	Micropower Low Dropout Series Reference	0.15% Max, 6.5µA Supply Current
LT1460	Micropower Precision Series Reference	Bandgap, 130µA Supply Current 10ppm/°C, Available in SOT-23
LT1634	Micropower Precision Shunt Voltage Reference	Bandgap 0.05%, 10ppm/°C, 10µA Supply Current
LT1461	Micropower Precision Series Reference	0.04% Max, 3ppm/°C Max, 35µA Supply Current