

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
- Available in 8-Lead SO and MSOP Packages and 3-Lead TO-92 Package

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

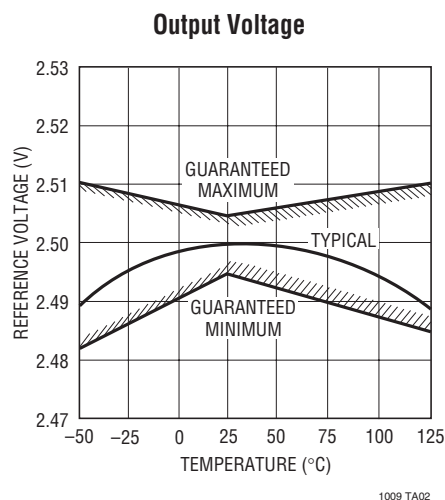
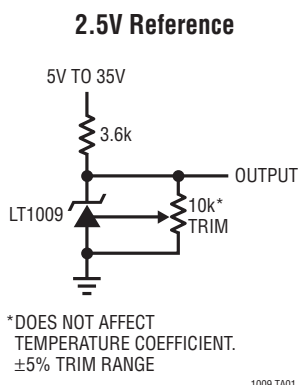
The LT[®]1009 is a precision trimmed 2.5V shunt regulator diode featuring a maximum initial tolerance of only $\pm 5\text{mV}$. The low dynamic impedance and wide operating current range enhances its versatility. The 0.2% reference tolerance is achieved by on-chip trimming which not only minimizes the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



LT1009 Series

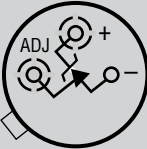
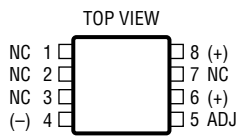
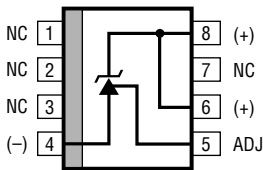
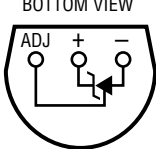
ABSOLUTE MAXIMUM RATINGS (Note 1)

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

 BOTTOM VIEW H PACKAGE 3-LEAD TO-46 METAL CAN $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 440^{\circ}\text{C/W}$, $\theta_{JC} = 80^{\circ}\text{C/W}$ OBSOLETE PACKAGE Consider the MS8, S8 or Z Packages for Alternate Source	ORDER PART NUMBER	 TOP VIEW MS8 PACKAGE 8-LEAD PLASTIC MSOP $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 250^{\circ}\text{C/W}$	ORDER PART NUMBER
	LT1009MH LT1009CH		LT1009CMS8
			MS8 PART MARKING
			LTQZ
 TOP VIEW S8 PACKAGE 8-LEAD PLASTIC SO $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 190^{\circ}\text{C/W}$	ORDER PART NUMBER	 BOTTOM VIEW Z PACKAGE 3-LEAD PLASTIC TO-92 $T_{JMAX} = 100^{\circ}\text{C}$, $\theta_{JA} = 160^{\circ}\text{C/W}$	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 0.40	25 25	LT1009CH	LT1009CMS8	LT1009S8	LT1009CZ
-40°C to 85°C	0.20 0.40	35 35			LT10098IS8	LT1009IZ
-55°C to 125°C	0.20	35	LT1009MH			

ELECTRICAL CHARACTERISTICS

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

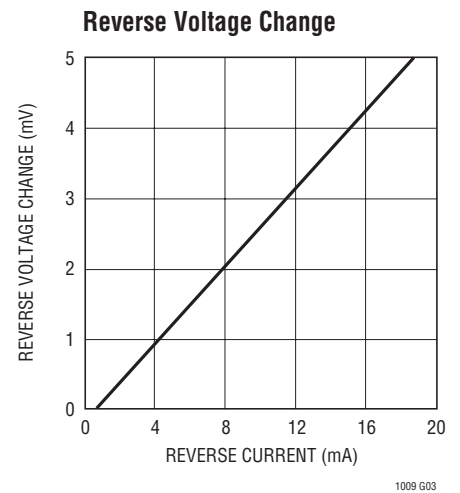
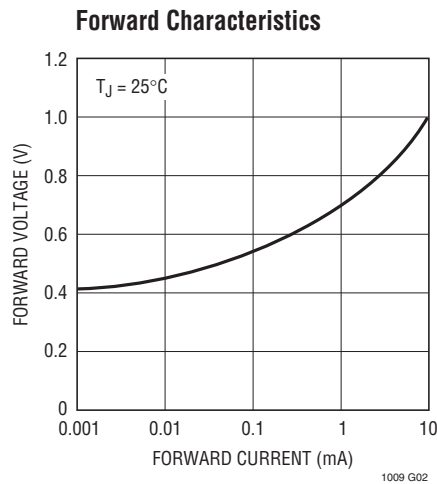
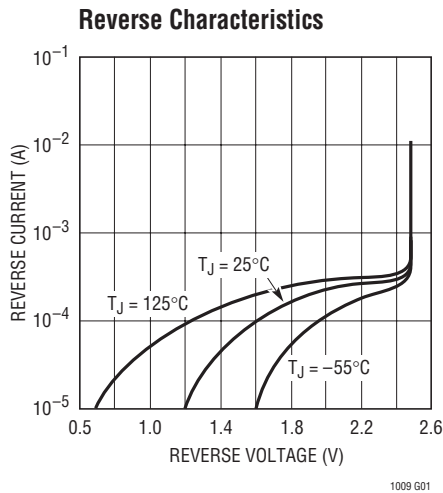
SYMBOL	PARAMETER	CONDITIONS		LT1009M			LT1009I			LT1009/LT1009C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_Z	Reverse Breakdown Voltage	$T_A = 25^\circ\text{C}$, $I_R = 1\text{mA}$	H, Z Pkg MS, S Pkg	2.485	2.500	2.505	2.495	2.500	2.505	2.495	2.500	2.505	V
							2.49	2.50	2.51	2.49	2.50	2.51	V
$\frac{\Delta V_Z}{\Delta I_R}$	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
					3.0	10		3.0	12		3.0	12	mV
r_Z	Reverse Dynamic Impedance	$I_R = 1\text{mA}$	●		0.2	0.6		0.2	1.0		0.2	1.0	Ω
					0.4	1.0		0.4	1.4		0.4	1.4	Ω
	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		15	25	ppm/ $^\circ\text{C}$
									35				ppm/ $^\circ\text{C}$
					25	35							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.

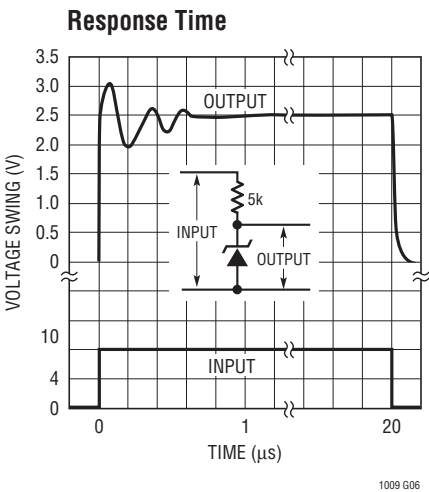
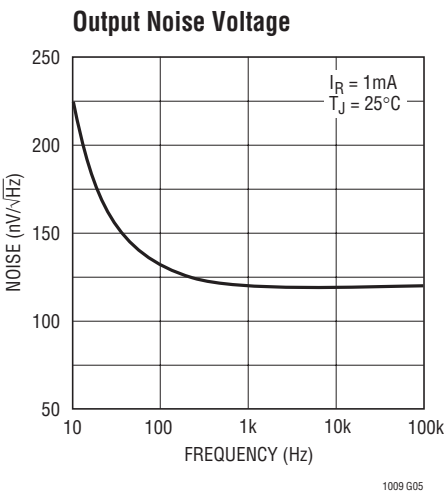
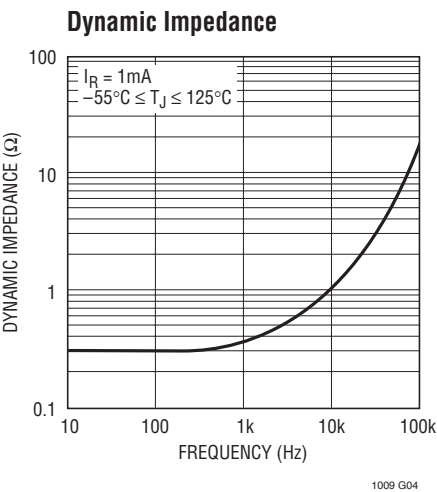
Note 2: Guaranteed by Design.

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

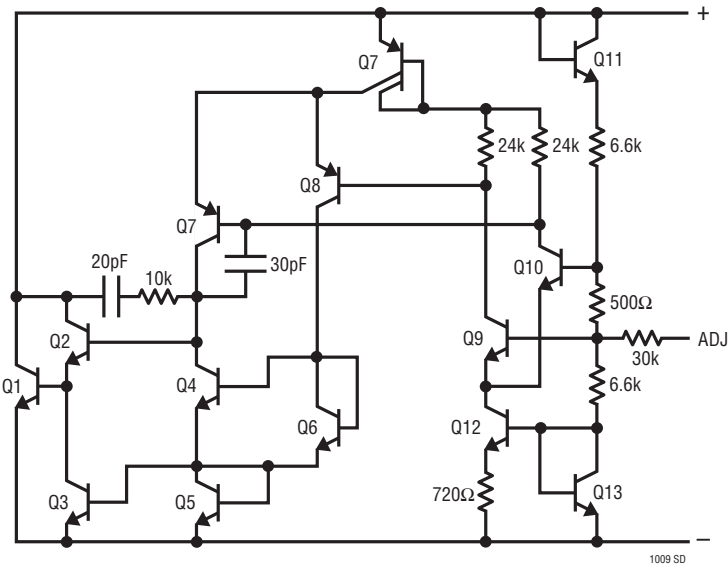
TYPICAL PERFORMANCE CHARACTERISTICS



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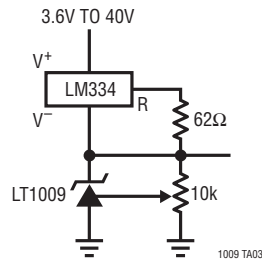


SCHEMATIC DIAGRAM

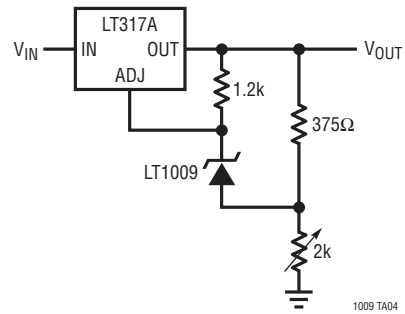


TYPICAL APPLICATIONS

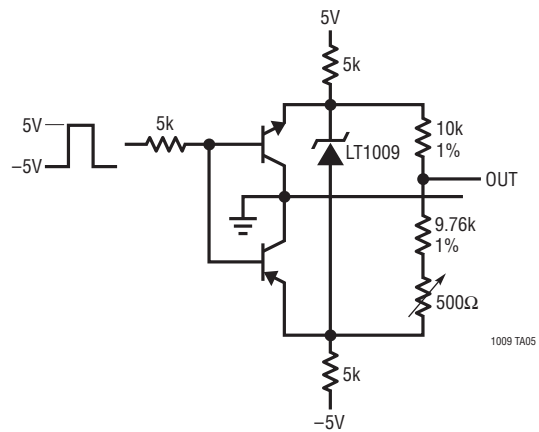
Wide Supply Range, Adjustable Reference



Low Temperature Coefficient Power Regulator



Switchable $\pm 1.25\text{V}$ Bipolar Reference



The drawing shows a 3-lead package with the following dimensions:

- Top View:**
 - Overall width: $0.209 - 0.219$ (5.309 - 5.537)
 - Lead width: $0.178 - 0.195$ (4.521 - 4.953)
 - Lead thickness: $0.085 - 0.105$ (2.159 - 2.667)
 - Lead pitch: 0.500 (12.700) MIN
 - Lead diameter: 0.025 (0.635) MAX
 - Lead diameter at bottom: $0.016 - 0.021^{**}$ (0.406 - 0.533) DIA
 - Lead angle: 45°
 - Pin 1 location: 0.050 (1.270) TYP
 - Pin 1 diameter: 0.050 (1.270) TYP
 - Pin 1 to center distance: 0.100 (2.540) TYP
 - Pin 1 to lead center distance: $0.036 - 0.046$ (0.914 - 1.168)
 - Pin 1 to lead center distance (H02/03(T0-46) 1098): $0.028 - 0.048$ (0.711 - 1.219)
- Side View:**
 - Lead height: 0.025 (0.635) MAX

* LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND 0.045" BELOW THE REFERENCE PLANE

**FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $0.016 - 0.024$ (0.406 - 0.610)

OBSOLETE PACKAGE

RECOMMENDED SOLDER PAD LAYOUT

DETAIL "A"

GAUGE PLANE

DETAIL "A"

NOTE:

SEATING PLANE

MSOP (MS8) 0204

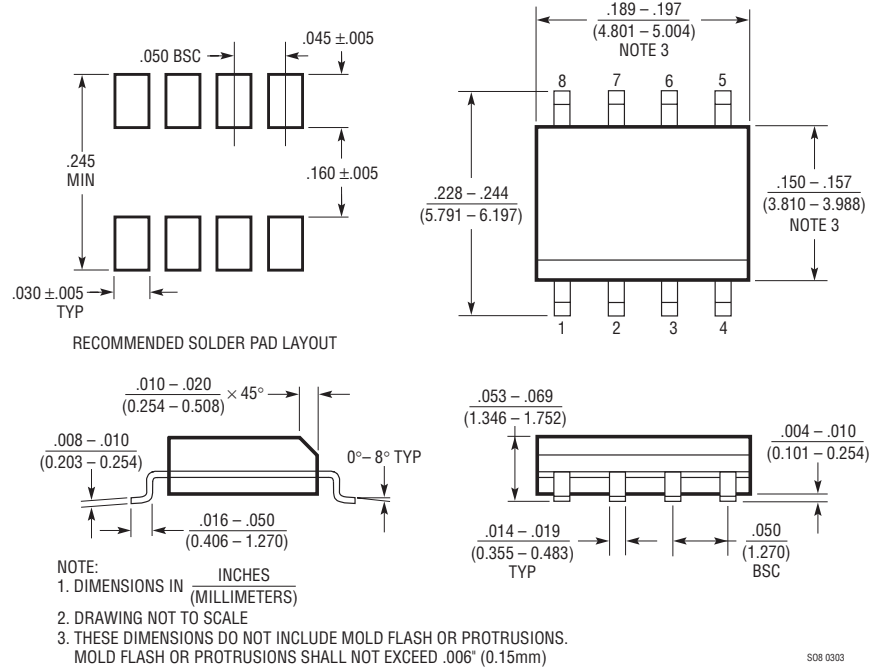
Dimensions in millimeters (inches):

- Pin pitch: 0.889 ± 0.127 ($.035 \pm .005$)
- Pin width: 0.523 ($.206$) MIN
- Pin height: $3.20 - 3.45$ ($.126 - .136$)
- Pin spacing: 0.42 ± 0.038 ($.0165 \pm .0015$) TYP
- Pin width: 0.65 ($.0256$) BSC
- Pin height: 0.254 ($.010$)
- Pin angle: $0^\circ - 6^\circ$ TYP
- Pin width: 0.53 ± 0.152 ($.021 \pm .006$)
- Pin width: 0.18 ($.007$)
- Pin width: 1.10 ($.043$) MAX
- Pin height: 0.86 ($.034$) REF
- Pin width: $0.22 - 0.38$ ($.009 - .015$) TYP
- Pin width: 0.65 ($.0256$) BSC
- Pin height: 0.127 ± 0.076 ($.005 \pm .003$)
- Pin width: 3.00 ± 0.102 ($.118 \pm .004$) (NOTE 3)
- Pin height: 4.90 ± 0.152 ($.193 \pm .006$)
- Pin width: 0.52 ($.0205$) REF
- Pin height: 3.00 ± 0.102 ($.118 \pm .004$) (NOTE 4)

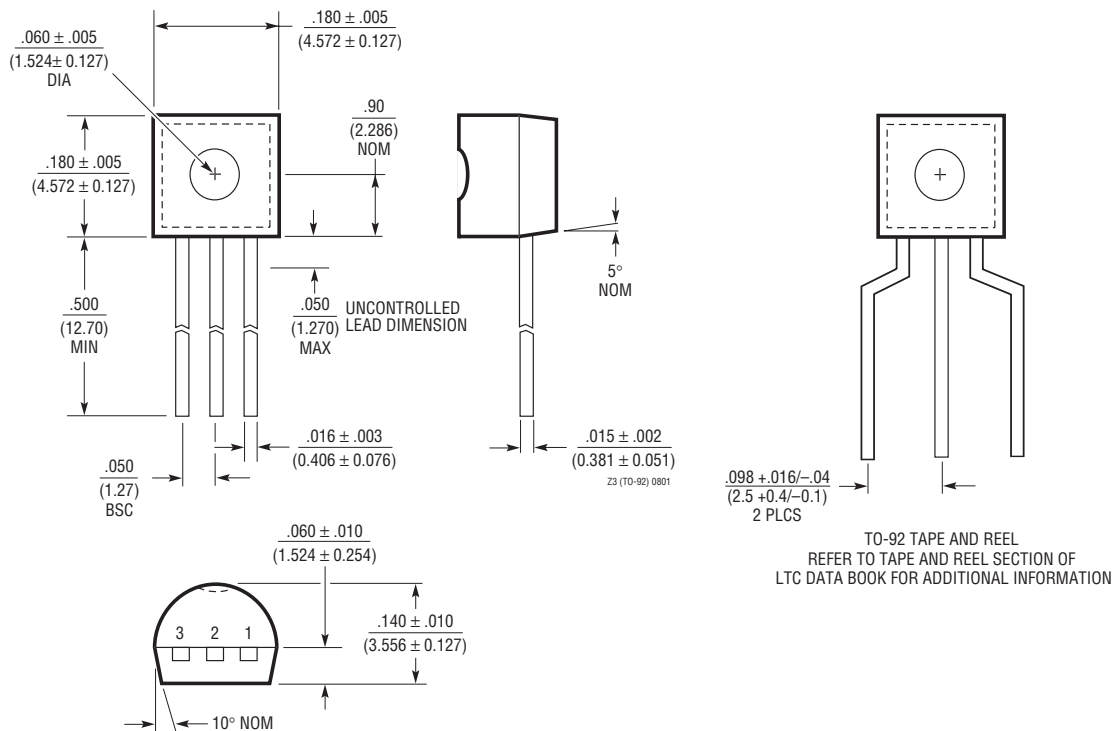
- NOTE: (0.0256)
BSC
1. DIMENSIONS IN MILLIMETER/(INCH)
2. DRAWING NOT TO SCALE
3. DRAWING DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.152mm (.006") PER SIDE
4. DRAWING DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
INTERLEAD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.152mm (.006") PER SIDE
5. LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.102mm (.004") MAX

PACKAGE DESCRIPTION

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

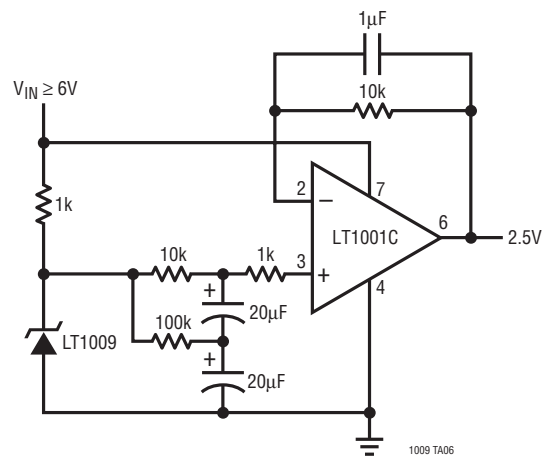


Z Package 3-Lead Plastic TO-92 (Similar to TO-226) (Reference LTC DWG # 05-08-1410)



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