LT1009
2.5-V INTEGRATED REFERENCE CIRCUIT

D3191, MAY 1987—REVISED JANUARY 1989

- **Excellent Temperature Stability**
- **Initial Tolerance . . . 0.2% Max**
- **Dynamic Impedance . . . 0.6 Ω Max**
- **Wide Operating Current Range**
- **Directly Interchangeable with LM136**
- **Needs No Adjustment for Minimum Temperature Coefficient**

description

The LT1009 is a precision trimmed 2.5-V shunt regulator featuring a maximum initial tolerance of only ±5 mV, low dynamic impedance, and a wide operating current range. The 0.2% reference tolerance is achieved by on-chip trimming, which minimizes the initial voltage tolerance and the temperature coefficient α_{VZ}.

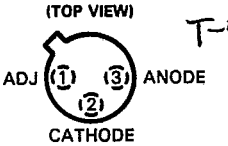
Even though the LT1009 needs no adjustments, a third terminal allows the reference voltage to be adjusted 5% to eliminate system errors. In many applications, the LT1009 can be used as a pin-for-pin replacement for the LM136H-2.5, which eliminates the external trim network.

The uses of the LT1009 include a 5-V system reference, an 8-bit ADC and DAC reference, or a power supply monitor. The LT1009 can also be used in applications such as digital voltmeters and current-loop measurement and control systems.

The LT1009M is characterized for operation over the full military temperature range of −55°C to 125°C. The LT1009C is characterized for operation from 0°C to 70°C.

LT1009M, LT1009C . . . LD PACKAGE
(TOP VIEW)

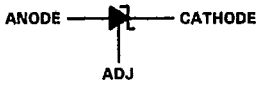
T-58-07



The anode is in electrical contact with the case.

LT1009C . . . LP PACKAGE
(TOP VIEW)

symbol



NOTICE
SEE ORDER OF DATA FOR ERRATA INFORMATION

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LT1009
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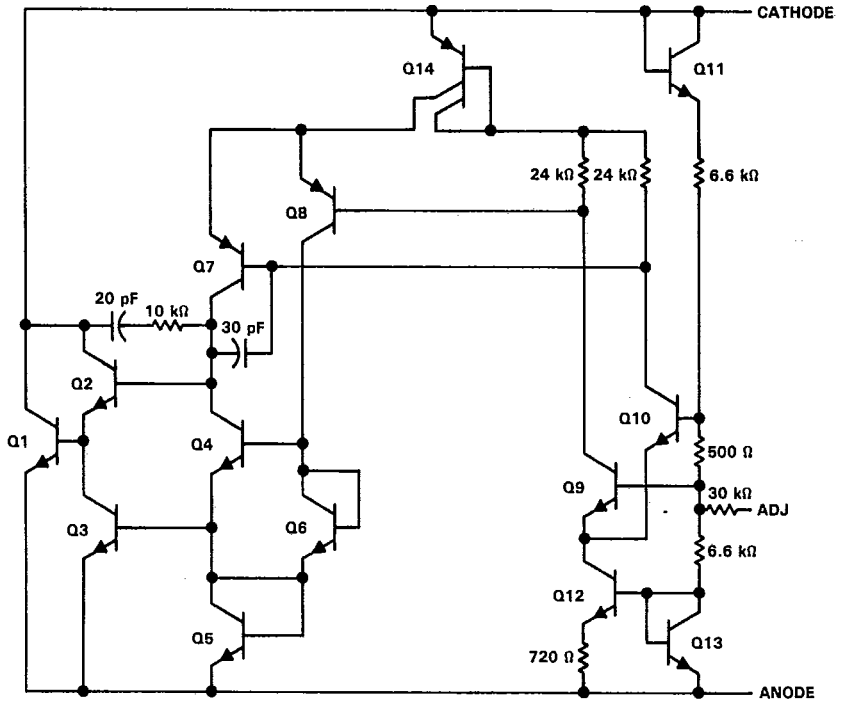
TEXAS INSTR (LIN/INTFC)

schematic



All component values shown are nominal.

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absolute maximum ratings over operating free-air temperature range

Reverse current . . . . . 20 mA
Forward current . . . . . 10 mA
Operating free-air temperature range: LT1009M . . . . . −55°C to 125°C
LT1009C . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or LP package . . . . . 260°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: LD package . . . . . 300°C

electrical characteristics at specified free-air temperature

PARAMETER		TEST CONDITIONS	T_A†	LT1009M			LT1009C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
V_Z	Reference voltage	I_Z = 1 mA	25°C	2.495	2.5	2.505	2.495	2.5	2.505	V
$\Delta V_{Z(temp)}$	Change in reference voltage with temperature		MIN to MAX			15			4	mV
α_{VZ}	Average temperature coefficient of reference voltage‡		0°C to 70°C		15	25		15	25	ppm/°C
			−55°C to 125°C		25	35				
ΔV_Z	Change in reference voltage with current	I_Z = 400 μA to 10 mA	25°C		2.6	6		2.6	10	mV
			Full range			10			12	
$\Delta V_Z/\Delta t$	Long-term change in reference voltage	I_Z = 1 mA	25°C		20			20		ppm/khr
Z_Z	Reference impedance	I_Z = 1 mA	25°C		0.3	0.6		0.3	1	Ω
			Full range			1			1.4	

† Full range is −55°C to 125°C for the LT1009M and 0°C to 70°C for the LT1009C.
‡ The average temperature coefficient of reference voltage is defined as the total change in reference voltage divided by the specified temperature range.

TYPICAL CHARACTERISTICS†

T-58-07

REFERENCE VOLTAGE
vs
FREE-AIR TEMPERATURE

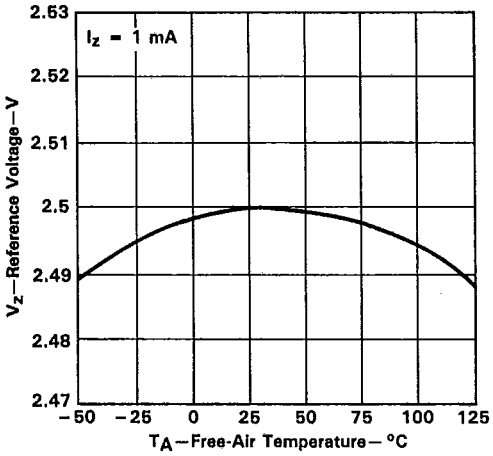

FIGURE 1

CHANGE IN REFERENCE VOLTAGE
vs
REFERENCE CURRENT

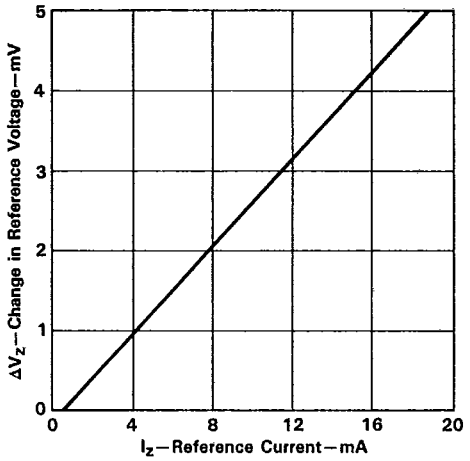

FIGURE 2

REVERSE CHARACTERISTICS

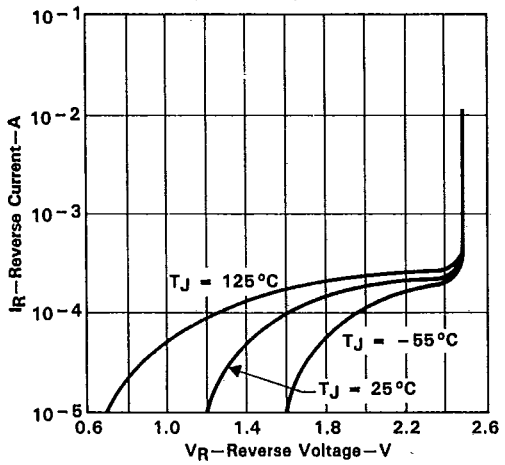

FIGURE 3

FORWARD CHARACTERISTICS

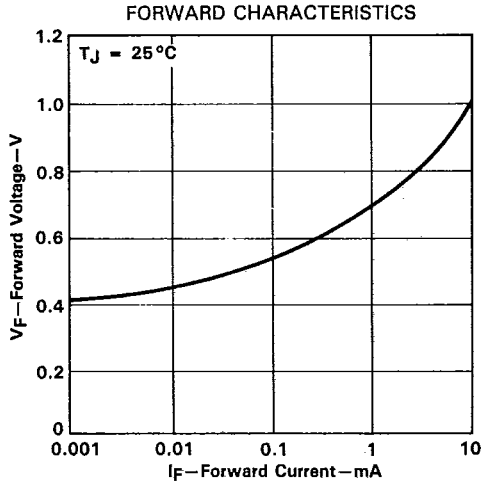

FIGURE 4

† Data at the high and low temperatures are applicable only within the rated operating free-air temperature ranges of the various devices.

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TYPICAL CHARACTERISTICS

REFERENCE IMPEDANCE
vs
FREQUENCY

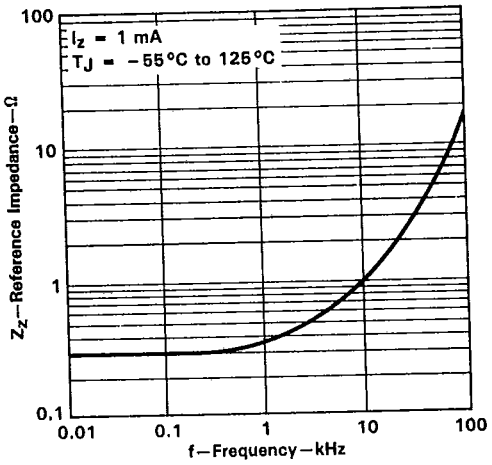


FIGURE 5

NOISE VOLTAGE
vs
FREQUENCY

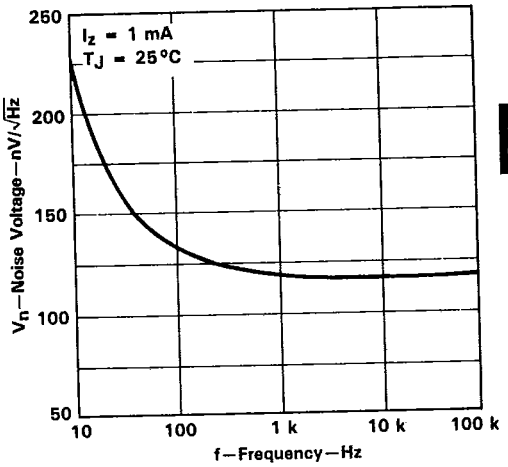


FIGURE 6

TRANSIENT RESPONSE

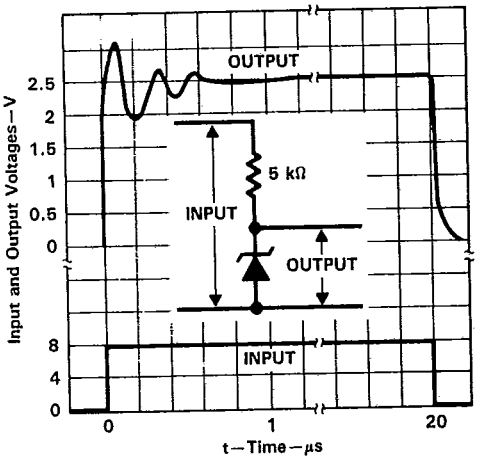
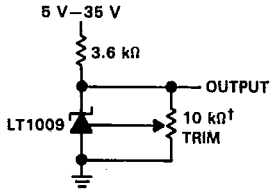


FIGURE 7

TYPICAL APPLICATION DATA

T-58-07



† Does not affect temperature coefficient. Provides ±5% trim range.

FIGURE 8. 2.5-V REFERENCE

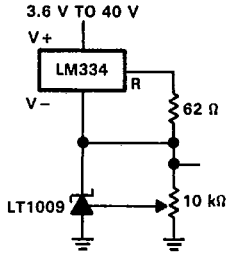


FIGURE 9. ADJUSTABLE REFERENCE WITH WIDE-SUPPLY RANGE

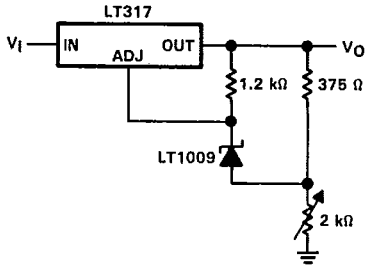


FIGURE 10. POWER REGULATOR WITH LOW TEMPERATURE COEFFICIENT

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TYPICAL APPLICATION DATA

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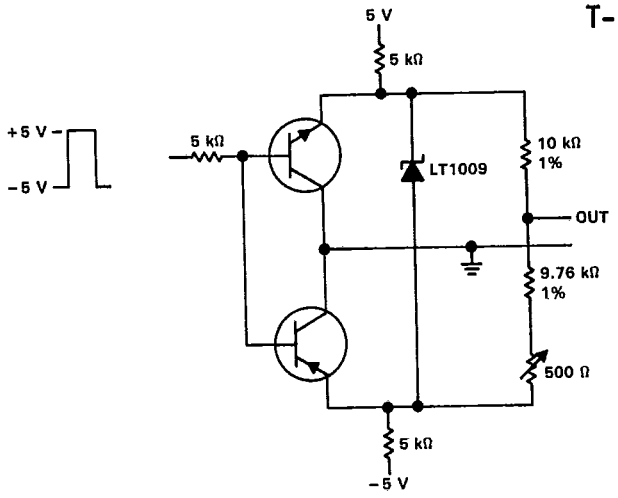

FIGURE 11. SWITCHABLE ±1.25-V BIPOLAR REFERENCE

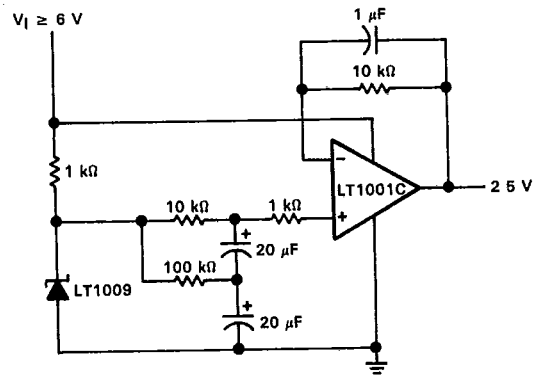

FIGURE 12. LOW-NOISE 2.5-V BUFFERED REFERENCE