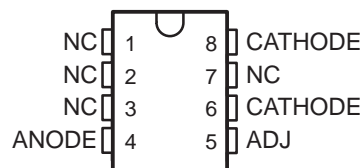


- Excellent Temperature Stability
- Initial Tolerance . . . 0.2% Max
- Dynamic Impedance . . . 0.6 Ω Max
- Wide Operating Current Range
- Directly Interchangeable With LM136
- Needs No Adjustment for Minimum Temperature Coefficient

D OR PW PACKAGE
(TOP VIEW)

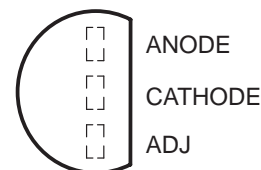


NC – No internal connection

description/ordering information

The LT1009 reference circuit is a precision-trimmed 2.5-V shunt regulator featuring low dynamic impedance and a wide operating current range. The maximum initial tolerance is ±5 mV in the LP package and ±10 mV in the D package. The reference tolerance is achieved by on-chip trimming, which minimizes the initial voltage tolerance and the temperature coefficient α_{VZ} .

LP PACKAGE
(TOP VIEW)



Although the LT1009 needs no adjustments, a third terminal (ADJ) allows the reference voltage to be adjusted ±5% to eliminate system errors. In many applications, the LT1009 can be used as a terminal-for-terminal replacement for the LM136-2.5, which eliminates the external trim network.

The LT1009 uses include 5-V system references, 8-bit analog-to-digital converter (ADC) and digital-to-analog converter (DAC) references, and power-supply monitors. The device also can be used in applications such as digital voltmeters and current-loop measurement and control systems.

The LT1009C is characterized for operation from 0°C to 70°C. The LT1009I is characterized for operation from –40°C to 85°C.

ORDERING INFORMATION

T _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	SOIC (D)	Tube of 75	LT1009CD	1009C
		Reel of 2500	LT1009CDR	
	TO-226 / TO-92 (LP)	Bulk of 1000	LT1009CLP	LT1009C
		Ammo of 2000	LT1009CLPM	
		Reel of 2000	LT1009CLPR	
	TSSOP (PW)	Tube of 150	LT1009CPW	1009C
Reel of 2000		LT1009CPWR		
–40°C to 85°C	SOIC (D)	Tube of 75	LT1009ID	1009I
		Reel of 2500	LT1009IDR	
	TO-226 / TO-92 (LP)	Bulk of 1000	LT1009ILP	LT1009I
		Reel of 2000	LT1009ILPR	
	TSSOP (PW)	Tube of 150	LT1009IPW	1009I
		Reel of 2000	LT1009IPWR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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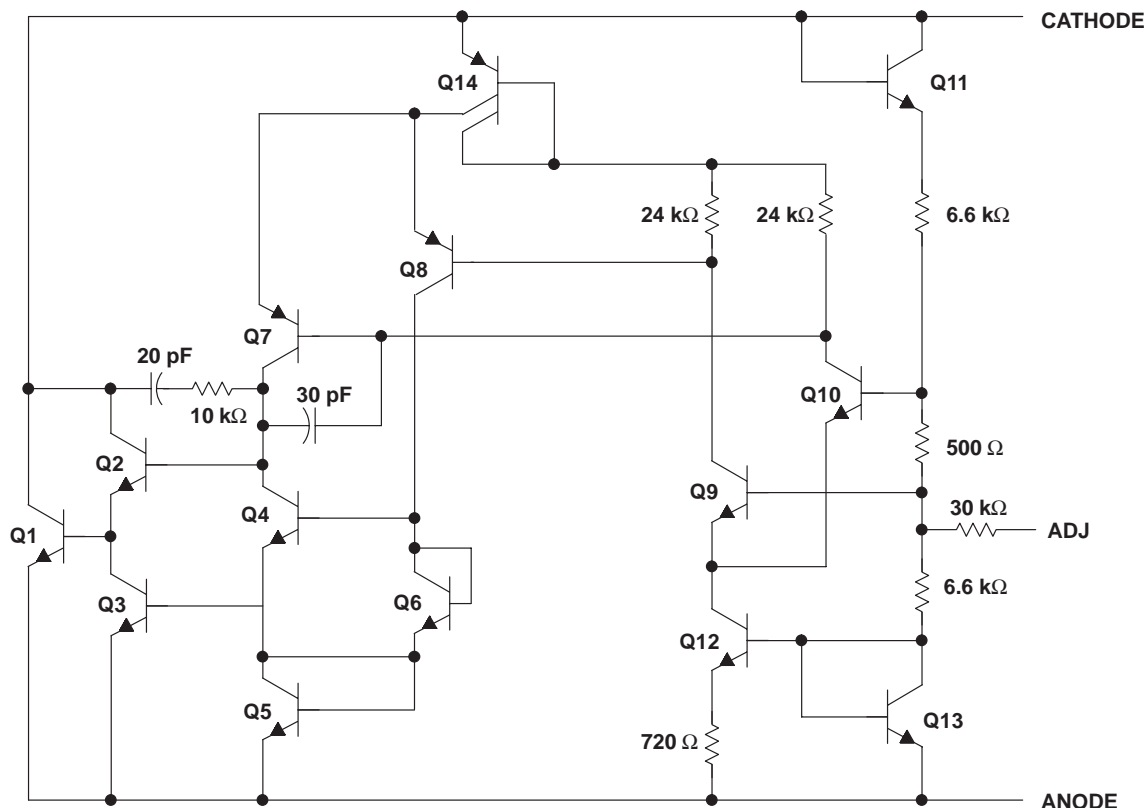
LT1009 2.5-V INTEGRATED REFERENCE CIRCUIT

SLVS013J – MAY 1987 – REVISED SEPTEMBER 2003

symbol



schematic



All component values shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Reverse current, I_R	20 mA
Forward current, I_F	10 mA
Package thermal impedance, θ_{JA} , (see Notes 1 and 2): D package	97°C/W
LP package	140°C/W
PW package	149°C/W
Operating virtual junction temperature, T_J	150°C
Storage temperature range, T_{stg}	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A) / \theta_{JA}$. Operation at the absolute maximum T_J of 150°C can impact reliability.
2. The package thermal impedance is calculated in accordance with JESD 51-7.



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LT1009

2.5-V INTEGRATED REFERENCE CIRCUIT

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recommended operating conditions

		MIN	MAX	UNIT	
T _A	Operating free-air temperature range	LT1009C	0	70	°C
		LT1009I	-40	85	

electrical characteristics at specified free-air temperature

PARAMETER	TEST CONDITIONS	T _A †	LT1009C			LT1009I			UNIT				
			MIN	TYP	MAX	MIN	TYP	MAX					
V _Z	Reference voltage I _Z = 1 mA	25°C	D package		2.49	2.5	2.51	2.49	2.5	2.51	V		
			LP package		2.495	2.5	2.505	2.495	2.5	2.505			
		Full range	D package		2.485		2.515		2.475			2.525	
			LP package		2.491		2.509		2.48			2.52	
V _F	Forward voltage I _F = 2 mA	25°C	0.4		1		0.4		1		V		
	Adjustment range	25°C	I _Z = 1 mA, V _{ADJ} = GND to V _Z		125		125				mV		
			I _Z = 1 mA, V _{ADJ} = 0.6 V to V _Z - 0.6 V		45		45						
ΔV _Z (temp)	Change in reference voltage with temperature	Full range	D package		5		15		mV				
			LP package		4		15						
α _{VZ}	Average temperature coefficient of reference voltage‡	0°C to 70°C	15		25		30		ppm/°C				
		-40°C to 85°C			20								
ΔV _Z	Change in reference voltage with current I _Z = 400 μA to 10 mA	25°C	2.6		10		2.6		6		mV		
		Full range			12				10				
ΔV _Z /Δt	Long-term change in reference voltage I _Z = 1 mA	25°C	20		20		20		ppm/khr				
z _Z	Reference impedance I _Z = 1 mA	25°C	0.3		1		0.3		1		Ω		
		Full range			1.4				1.4				

† Full range is 0°C to 70°C for the LT1009C and -40°C to 85°C for the LT1009I.

‡ The average temperature coefficient of reference voltage is defined as the total change in reference voltage divided by the specified temperature range.



LT1009

2.5-V INTEGRATED REFERENCE CIRCUIT

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TYPICAL CHARACTERISTICS†

REFERENCE VOLTAGE
vs
FREE-AIR TEMPERATURE

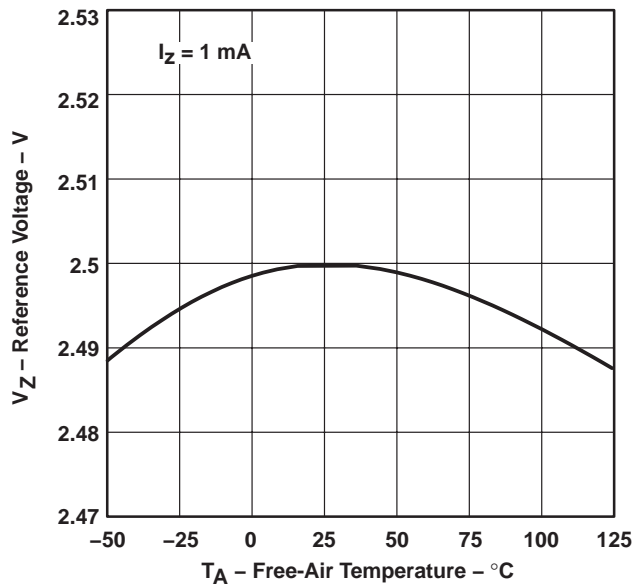


Figure 1

CHANGE IN REFERENCE VOLTAGE
vs
REFERENCE CURRENT

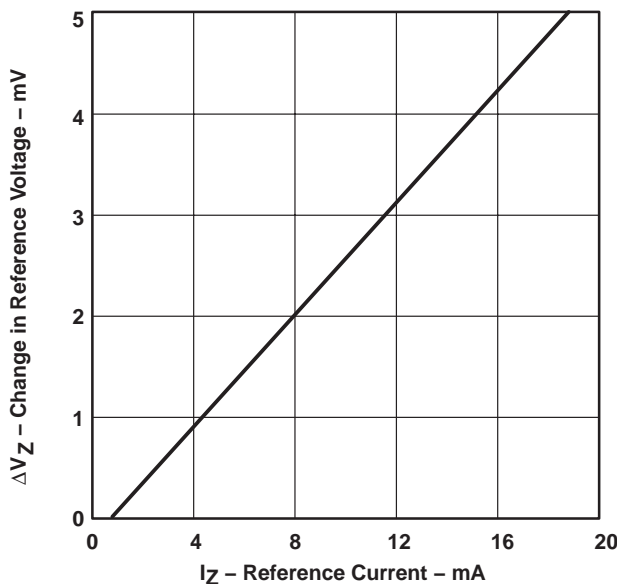


Figure 2

REVERSE CURRENT
vs
REVERSE VOLTAGE

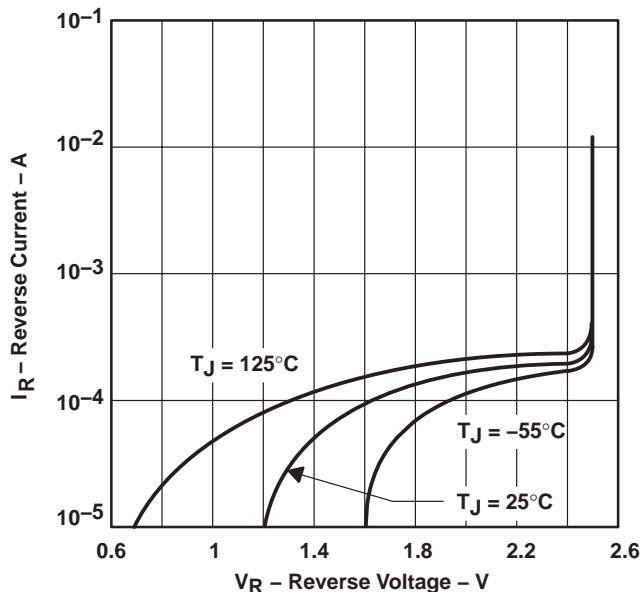


Figure 3

FORWARD VOLTAGE
vs
FORWARD CURRENT

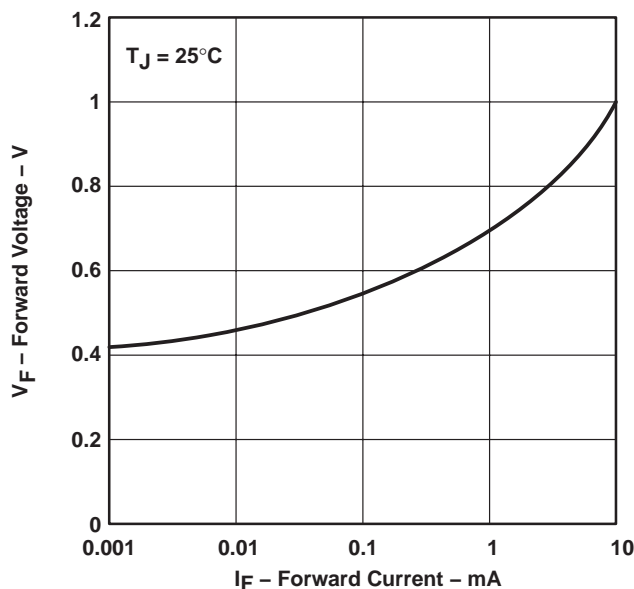


Figure 4

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

TYPICAL CHARACTERISTICS

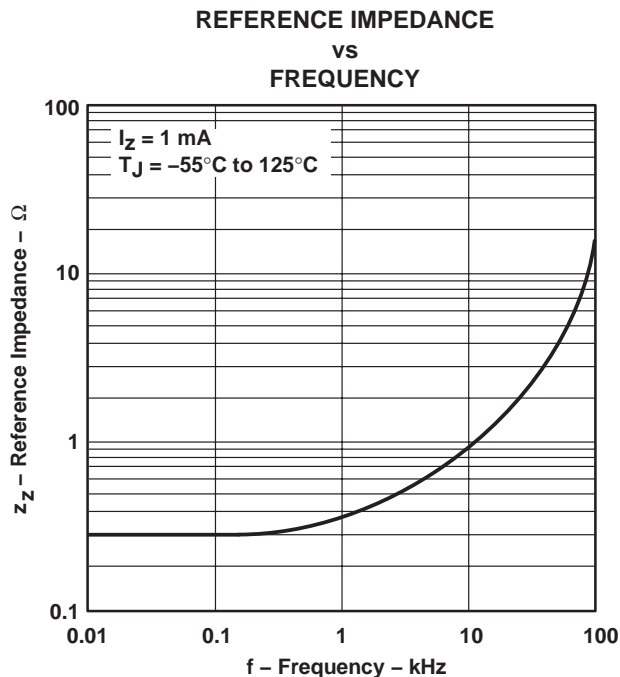


Figure 5

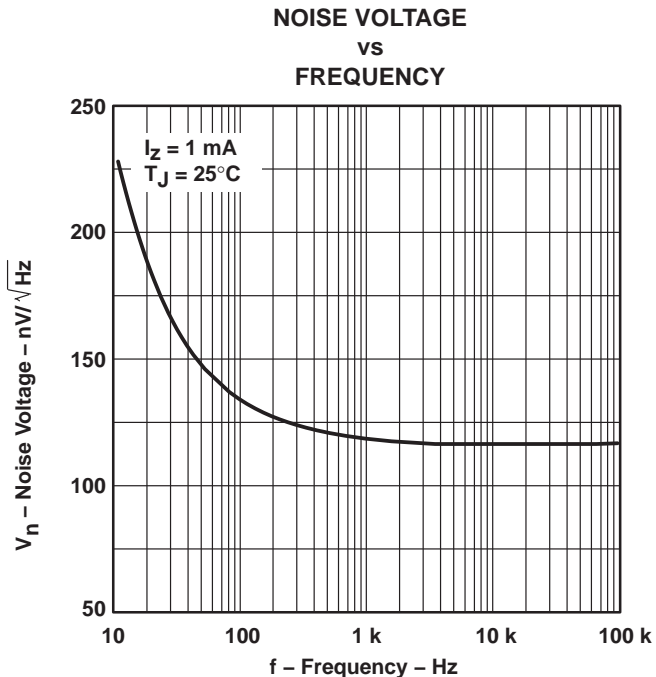


Figure 6

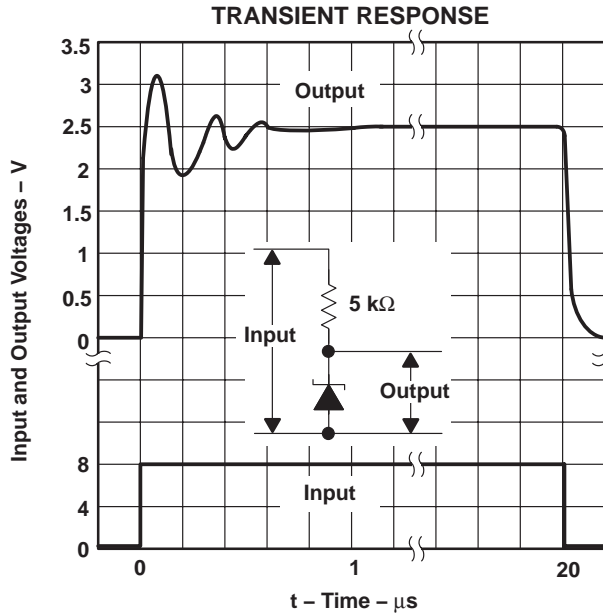


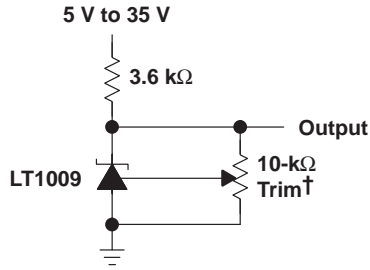
Figure 7

LT1009

2.5-V INTEGRATED REFERENCE CIRCUIT

SLVS013J – MAY 1987 – REVISED SEPTEMBER 2003

APPLICATION INFORMATION



†This does not affect temperature coefficient. It provides $\pm 5\%$ trim range.

Figure 8. 2.5-V Reference

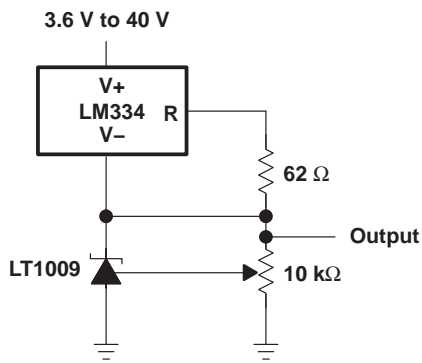


Figure 9. Adjustable Reference With Wide Supply Range

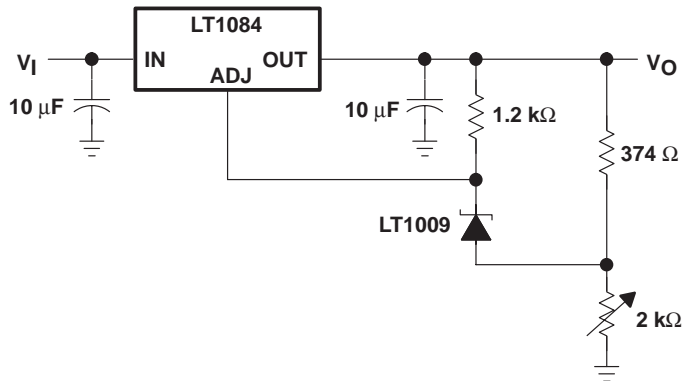


Figure 10. Power Regulator With Low Temperature Coefficient

APPLICATION INFORMATION

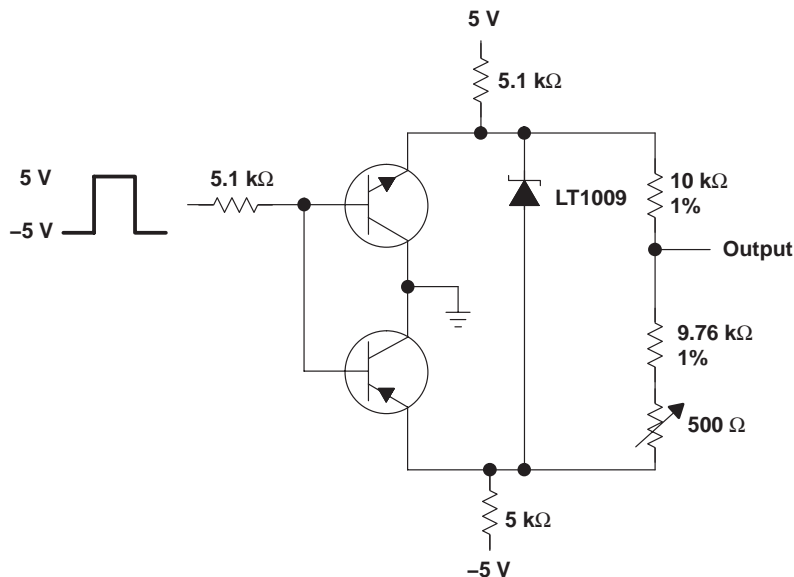


Figure 11. Switchable ± 1.25 -V Bipolar Reference

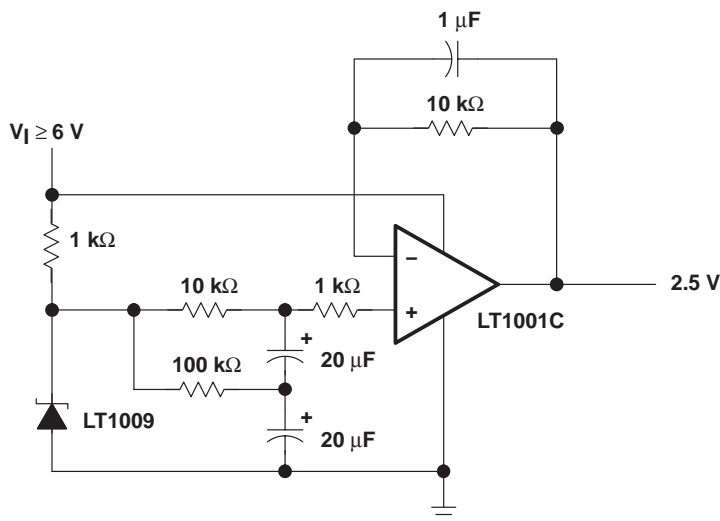
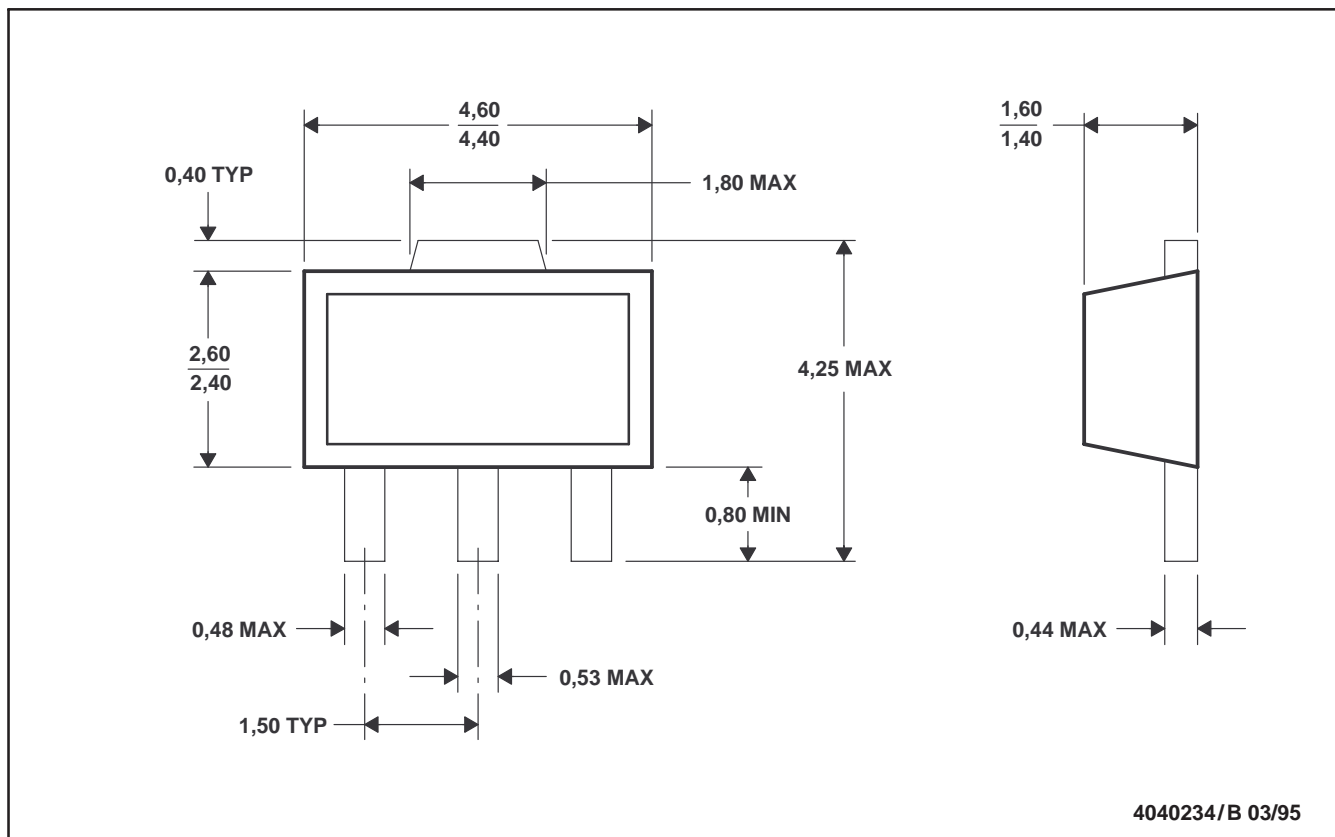


Figure 12. Low-Noise 2.5-V Buffered Reference

PK (R-PSSO-F3)

PLASTIC SINGLE-IN-LINE PACKAGE



4040234/B 03/95

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. The center lead is in electrical contact with the tab.

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN

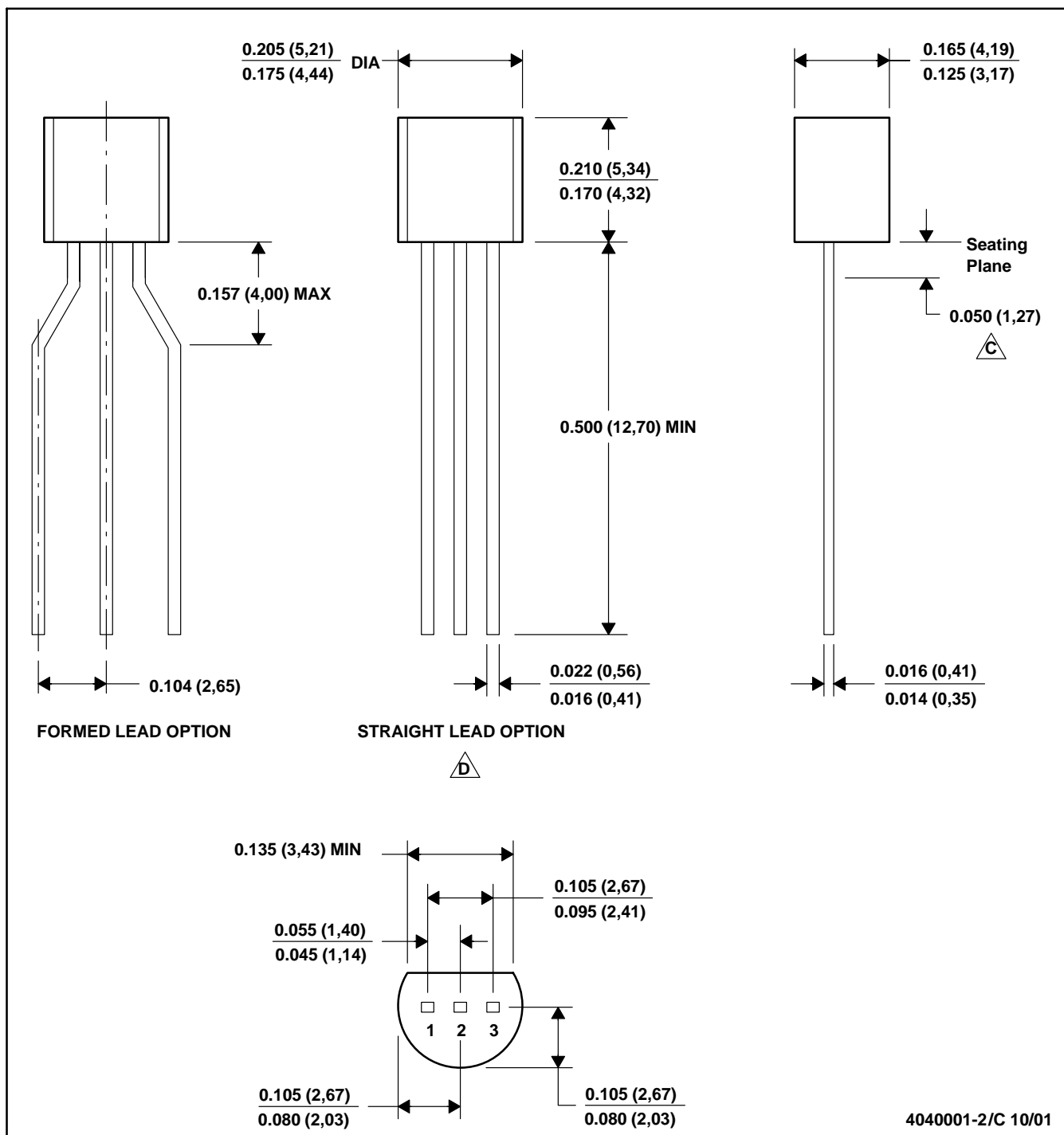


4040047/E 09/01

- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 D. Falls within JEDEC MS-012

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



4040001-2/C 10/01

- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
C Lead dimensions are not controlled within this area
D Falls within JEDEC TO -226 Variation AA (TO-226 replaces TO-92)
 E. Shipping Method:
 Straight lead option available in bulk pack only.
 Formed lead option available in tape & reel or ammo pack.

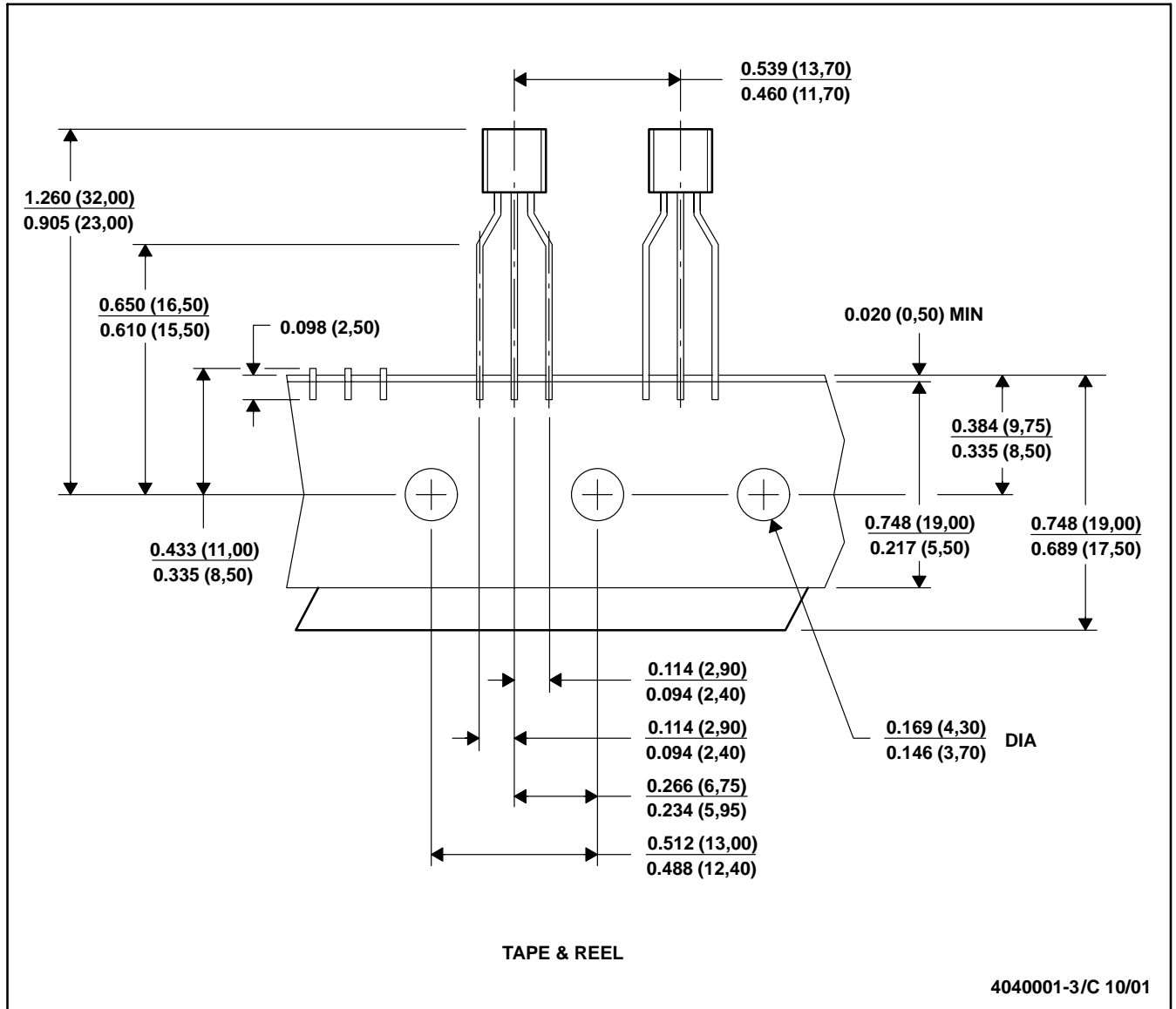


MECHANICAL DATA

MSOT002A – OCTOBER 1994 – REVISED NOVEMBER 2001

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Tape and Reel information for the Format Lead Option package.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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