

LM236-2.5, LM336-2.5, LM336B-2.5 2.5-V INTEGRATED REFERENCE CIRCUITS

SLVS063C – NOVEMBER 1988 – REVISED AUGUST 2000

- Low Temperature Coefficient
- Wide Operating Current . . . 400 μ A to 10 mA
- 0.27- Ω Dynamic Impedance
- $\pm 1\%$ Tolerance Available
- Specified Temperature Stability
- Easily Trimmed for Minimum Temperature Drift
- Fast Turnon
- Three-Lead Transistor Package

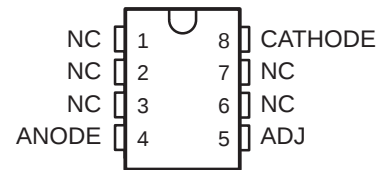
description

The LM236-2.5, LM336-2.5, and LM336B-2.5 integrated circuits are precision 2.5-V shunt regulator diodes. These reference circuits operate as low-temperature-coefficient 2.5-V zeners with a 0.2- Ω dynamic impedance. A third terminal provided on the circuit allows the reference voltage and temperature coefficient to be trimmed easily.

The series is useful as precision 2.5-V low-voltage references (V_Z) for digital voltmeters, power supplies, or operational-amplifier circuitry. The 2.5-V voltage reference makes it convenient to obtain a stable reference from 5-V logic supplies. Devices in this series operate as shunt regulators, and can be used as either positive or negative voltage references.

The LM236-2.5 is characterized for operation from -25°C to 85°C . The LM336-2.5 and LM336B-2.5 are characterized for operation from 0°C to 70°C .

D PACKAGE
(TOP VIEW)



NC-No internal connection

LP PACKAGE
(TOP VIEW)



symbol



AVAILABLE OPTIONS

T_A	PACKAGED DEVICES	
	SMALL OUTLINE (D)	PLASTIC (LP)
0°C to 70°C	LM336D-2.5	LM336LP-2.5
	LM336BD-2.5	LM336BLP-2.5
-25°C to 85°C	LM236D-2.5	LM236LP-2.5

The D and LP packages also are available taped and reeled. Add the suffix R to the device type (e.g., LM336DR-2.5). Chip forms are tested at 25°C .



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

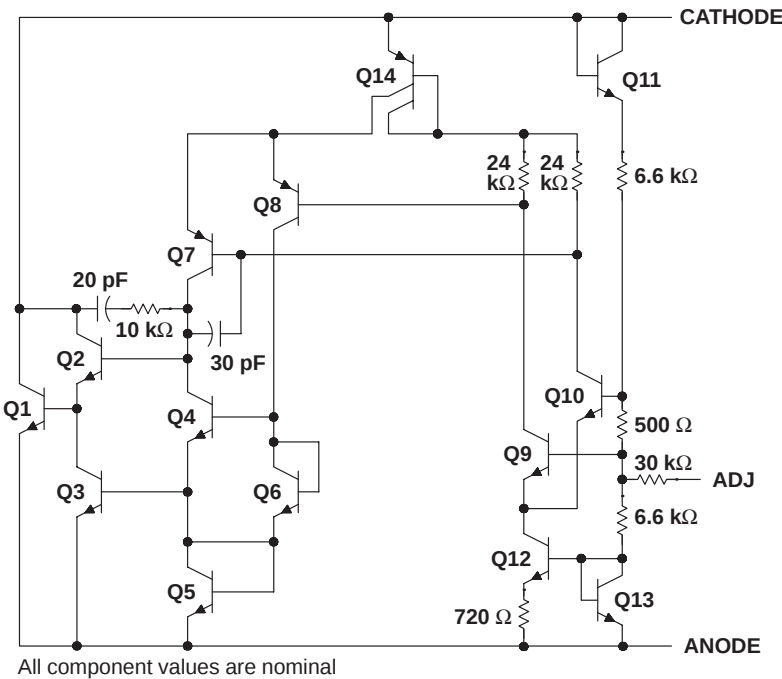
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schematic diagram



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	156°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or LP package	260°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 $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. Operating 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.

recommended operating conditions

		MIN	MAX	UNIT
Operating free-air temperature, T_A	LM236-2.5	–25	85	°C
	LM336-2.5, LM336B-2.5	0	70	

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SLVS063C – NOVEMBER 1988 – REVISED AUGUST 2000

electrical characteristics at specified free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	LM236-2.5			LM336-2.5			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_Z Reference voltage	$I_Z = 1 \text{ mA}$	25°C	LM236, LM336			2.44	2.49	2.54	V
			LM336B			2.39	2.49	2.59	
$\Delta V_Z(\Delta T)$ Change in reference voltage with temperature	V_Z adjusted to 2.490 V, $I_Z = 1 \text{ mA}$	Full range		3.5	9		1.8	6	mV
$\Delta V_Z(\Delta I)$ Change in reference voltage with current	$I_Z = 400 \mu\text{A}$ to 10 mA	25°C		2.6	6		2.6	10	mV
		Full range		3	10		3	12	
$\Delta V_Z(\Delta t)$ Long-term change in reference voltage	$I_Z = 1 \text{ mA}$	25°C		20			20		ppm/khr
z_z Reference impedance	$I_Z = 1 \text{ mA}$, $f = 1 \text{ kHz}$	25°C		0.2	0.6		0.2	1	W
		Full range		0.4	1		0.4	1.4	

† Full range is –25°C to 85°C for the LM236-2.5 and 0°C to 70°C for the LM336-2.5 and LM336B-2.5.

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SLVS063C – NOVEMBER 1988 – REVISED AUGUST 2000

TYPICAL CHARACTERISTICS

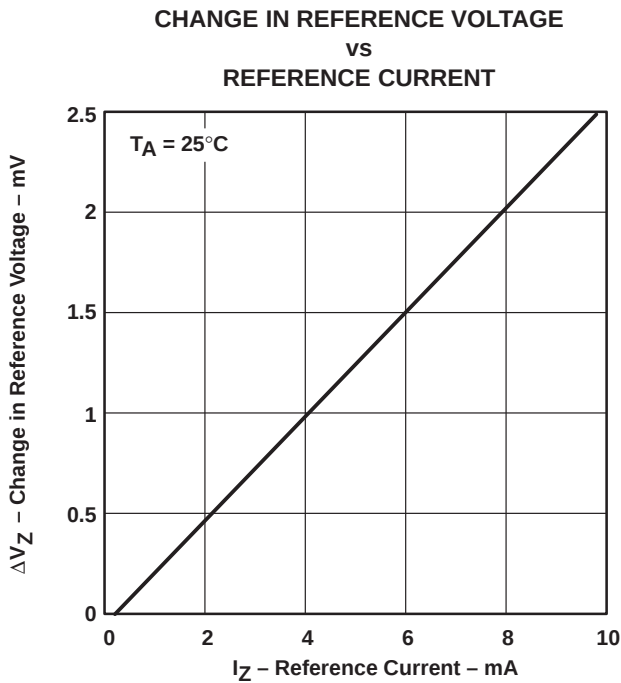


Figure 1

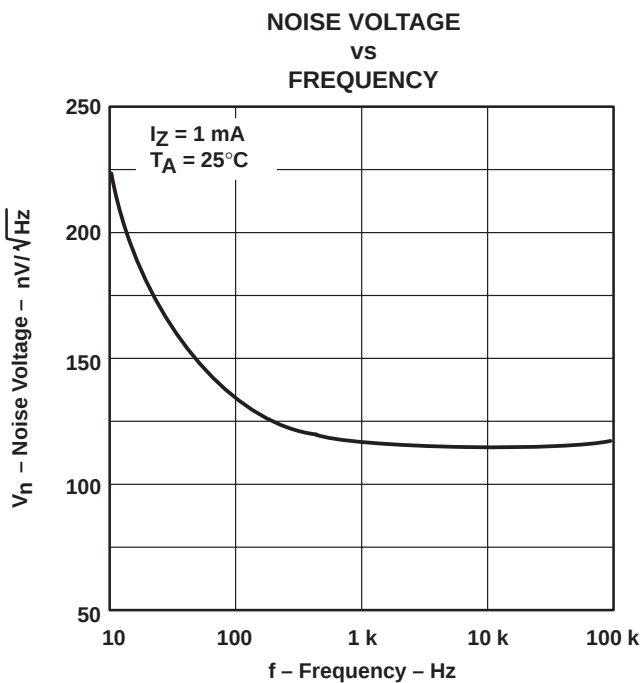


Figure 2

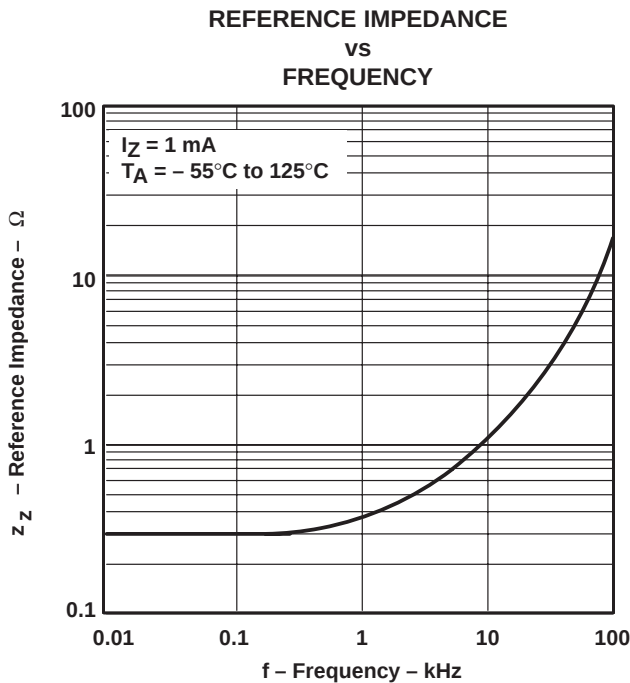


Figure 3

APPLICATION INFORMATION

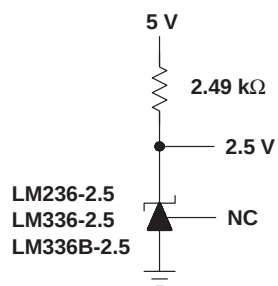


Figure 4. 2.5-V Reference

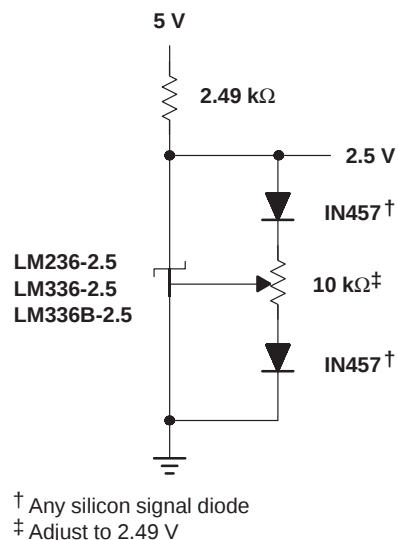


Figure 5. 2.5-V Reference With Minimum Temperature Coefficient

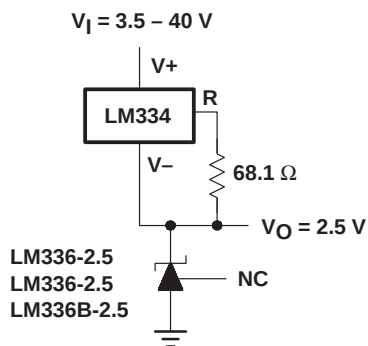


Figure 6. Wide-Input-Range Reference

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