National Semiconductor

LM136-2.5/LM236-2.5/LM336-2.5V Reference Diode

General Description

The LM136-2.5/LM236-2.5 and LM336-2.5 integrated circuits are precision 2.5V shunt regulator diodes. These monolithic IC voltage references operate as a low-temperature-coefficient 2.5V zener with 0.2Ω dynamic impedance. A third terminal on the LM136-2.5 allows the reference voltage and temperature coefficient to be trimmed easily.

The LM136-2.5 series is useful as a precision 2.5V low voltage reference for digital voltmeters, power supplies or op amp circuitry. The 2.5V make it convenient to obtain a stable reference from 5V logic supplies. Further, since the LM136-2.5 operates as a shunt regulator, it can be used as either a positive or negative voltage reference.

The LM136-2.5 is rated for operation over −55˚C to +125˚C while the LM236-2.5 is rated over a −25˚C to +85˚C temperature range.

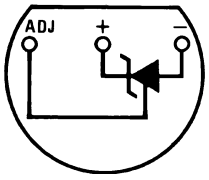
The LM336-2.5 is rated for operation over a 0˚C to +70˚C temperature range. See the connection diagrams for available packages.

Features

- Low temperature coefficient
- Wide operating current of 400 µA to 10 mA
- 0.2Ω dynamic impedance
- ±1% initial tolerance available
- Guaranteed temperature stability
- Easily trimmed for minimum temperature drift
- Fast turn-on

Connection Diagrams

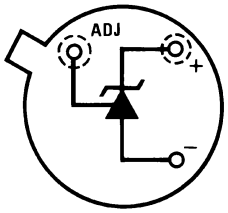
TO-92
Plastic Package



00571508

Bottom View
Order Number LM336Z-2.5 or LM336BZ-2.5
See NS Package Number Z03A

TO-46
Metal Can Package



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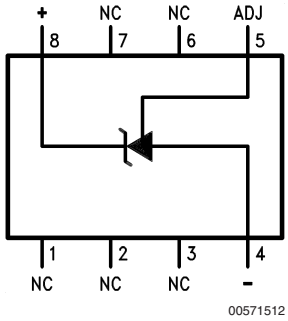
Bottom View
Order Number LM136H-2.5, LM136H-2.5/883, LM236H-2.5, or LM236AH-2.5
See NS Package Number H03H

SO Package



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Top View
Order Number LM236M-2.5, LM236AM-2.5, LM336M-2.5 or LM336BM-2.5
See NS Package Number M08A

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

Reverse Current	15 mA
Forward Current	10 mA
Storage Temperature	−60˚C to +150˚C
Operating Temperature Range (Note 2)	
LM136	−55˚C to +150˚C
LM236	−25˚C to +85˚C
LM336	0˚C to +70˚C
Soldering Information	
TO-92 Package (10 sec.)	260˚C
TO-46 Package (10 sec.)	300˚C
SO Package	
Vapor Phase (60 sec.)	215˚C
Infrared (15 sec.)	220˚C

See AN-450 “Surface Mounting Methods and Their Effect on Product Reliability” (Appendix D) for other methods of soldering surface mount devices.

Electrical Characteristics (Note 3)

Parameter	Conditions	LM136A-2.5/LM236A-2.5 LM136-2.5/LM236-2.5			LM336B-2.5 LM336-2.5			Units
		Min	Typ	Max	Min	Typ	Max	
Reverse Breakdown Voltage	T_A=25˚C, I_R=1 mA							
	LM136, LM236, LM336	2.440	2.490	2.540	2.390	2.490	2.590	V
	LM136A, LM236A, LM336B	2.465	2.490	2.515	2.440	2.490	2.540	V
Reverse Breakdown Change With Current	T_A=25˚C, 400 µA≤I_R≤10 mA		2.6	6		2.6	10	mV
Reverse Dynamic Impedance	T_A=25˚C, I_R=1 mA, f = 100 Hz		0.2	0.6		0.2	1	Ω
Temperature Stability (Note 4)	V_R Adjusted to 2.490V, I_R=1 mA, *Figure 2*							
	0˚C≤T_A≤70˚C (LM336)					1.8	6	mV
	−25˚C≤T_A≤+85˚C (LM236H, LM236Z)		3.5	9				mV
	−25˚C ≤ T_A ≤ +85˚C (LM236M)		7.5	18				mV
	−55˚C≤T_A≤+125˚C (LM136)		12	18				mV
Reverse Breakdown Change With Current	400 µA≤I_R≤10 mA		3	10		3	12	mV
Reverse Dynamic Impedance	I_R=1 mA		0.4	1		0.4	1.4	Ω
Long Term Stability	T_A=25˚C ±0.1˚C, I_R=1 mA, t = 1000 hrs		20			20		ppm

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Electrical specifications do not apply when operating the device beyond its specified operating conditions.

Note 2: For elevated temperature operation, T_j max is:

LM136	150˚C
LM236	125˚C
LM336	100˚C

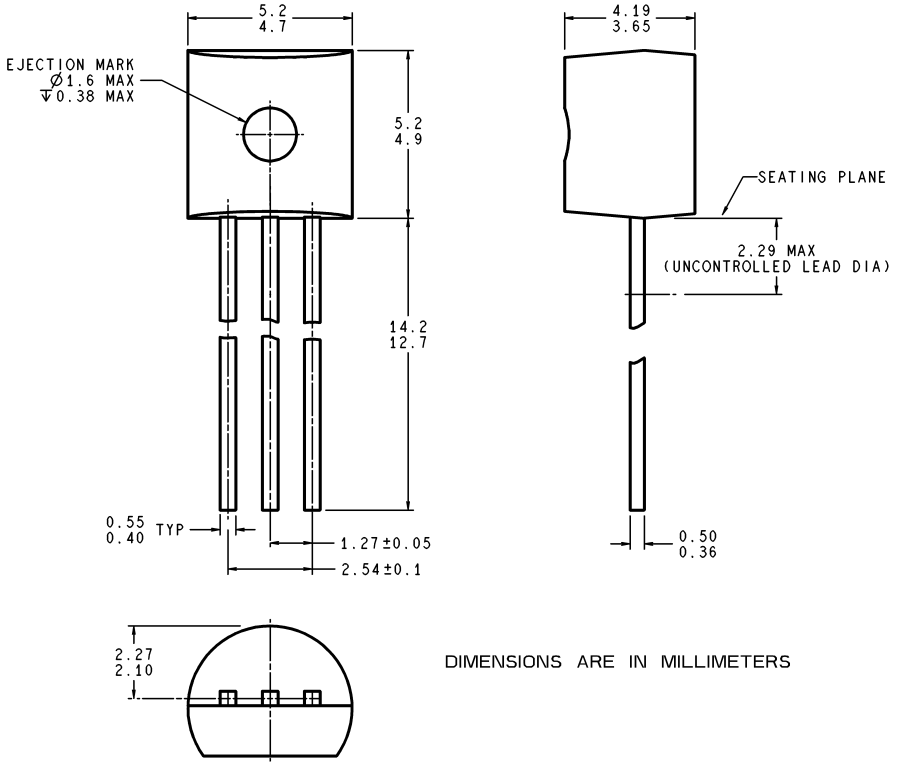
Thermal Resistance	TO-92	TO-46	SO-8
θ_{ja} (Junction to Ambient)	180˚C/W (0.4" leads) 170˚C/W (0.125" lead)	440˚C/W	165˚C/W
θ_{ja} (Junction to Case)	n/a	80˚C/W	n/a

Electrical Characteristics (Note 3) (Continued)

Note 3: Unless otherwise specified, the LM136-2.5 is specified from $-55^{\circ}C \le T_A \le +125^{\circ}C$, the LM236-2.5 from $-25^{\circ}C \le T_A \le +85^{\circ}C$ and the LM336-2.5 from $0^{\circ}C \le T_A \le +70^{\circ}C$.

Note 4: Temperature stability for the LM336 and LM236 family is guaranteed by design. Design limits are guaranteed (but not 100% production tested) over the indicated temperature and supply voltage ranges. These limits are not used to calculate outgoing quality levels. Stability is defined as the maximum change in V_{ref} from 25˚C to T_A (min) or T_A (max).

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



TO-92 Plastic Package (Z)
Order Number LM336Z-2.5 or LM336BZ-2.5
NS Package Number Z03A