

## FEATURES

- *Guaranteed* Temperature Stability
- Maximum 0.6Ω Dynamic Impedance
- Adjustable for Minimum Temperature Coefficient
- Wide Operating Current Range

## 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 LM136-2.5 is a general purpose shunt regulator diode designed to operate over a wide current range while maintaining good stability with time and temperature. The third terminal allows either the temperature coefficient to be minimized or the reference voltage to be adjusted without changing the temperature coefficient. Because it operates as a shunt regulator it can be used equally well as a positive or negative reference.

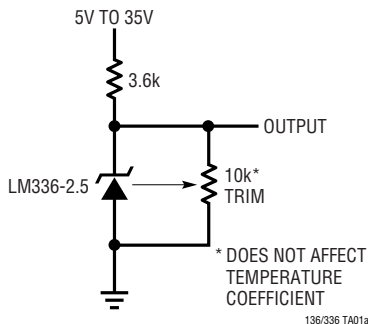
The LM136-2.5 is available with initial tolerances as low as 1% in either a TO-46 metal can for hermetic requirements or a low cost TO-92 plastic package.

Linear's advanced design, test and process techniques have optimized the LM136-2.5 to achieve superior performance and reliability over previous designs. For more demanding precision reference applications requiring very low initial tolerance and temperature coefficients, consult the LT1009 data sheet. A typical 2.5V reference with trim is shown below.

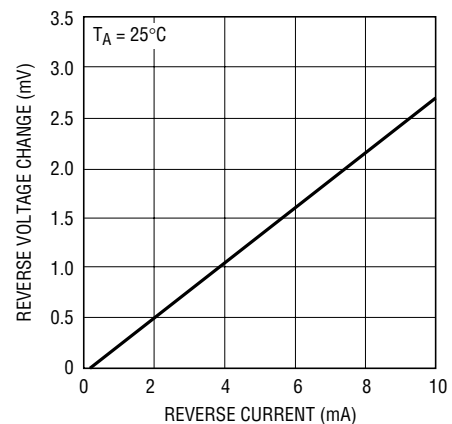
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## TYPICAL APPLICATION

**2.5V Reference**



**Reverse Voltage Change**

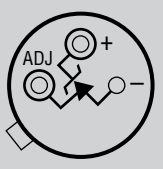
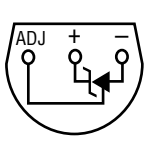


# LM136-2.5/LM336-2.5

## ABSOLUTE MAXIMUM RATINGS (Note 1)

Operating Temperature Range	LM136-2.5 (OBSOLETE) ..... -55°C to 125°C	LM336-2.5 ..... 0°C to 70°C	Storage Temperature Range ..... -65°C to 150°C	Lead Temperature (Soldering, 10 sec)..... 300°C	Reverse Current ..... 15mA	Forward Current ..... 10mA
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## PACKAGE/ORDER INFORMATION

 <p>BOTTOM VIEW</p> <p>H PACKAGE 3-LEAD TO-46 METAL CAN T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 440°C/W (NOTE 2)</p> <p><b>OBSOLETE PACKAGE</b> Consider the Z Packages for Alternate Source</p>	ORDER PART NUMBER	 <p>BOTTOM VIEW</p> <p>Z PACKAGE 3-LEAD PLASTIC TO-92 T<sub>JMAX</sub> = 150°C, θ<sub>JA</sub> = 160°C/W (NOTE 2)</p>	ORDER PART NUMBER
	LM136H-2.5 LM136AH-2.5 LM336H-2.5 LM336AH-2.5		LM336Z-2.5 LM336BZ-2.5

Consult LTC Marketing for parts specified with wider operating temperature ranges.

## ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at T<sub>A</sub> = 25°C. (Note 2)

SYMBOL	PARAMETER	CONDITIONS	LM136/LM136A			LM336/LM336B			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
V <sub>Z</sub>	Reverse Breakdown Voltage	T <sub>A</sub> = 25°C, I <sub>R</sub> = 1mA LM136/LM336 LM136A/LM336B	2.440	2.490	2.540	2.390	2.490	2.590	V
$\frac{\Delta V_Z}{\Delta I_R}$	Reverse Breakdown Change with Current	400µA ≤ I <sub>R</sub> ≤ 10mA T <sub>A</sub> = 25°C T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>		2.6	6		2.6	10	mV
r <sub>Z</sub>	Reverse Dynamic Impedance	I <sub>R</sub> = 1mA T <sub>A</sub> = 25°C T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>		0.2	0.6		0.2	1.0	Ω
$\frac{\Delta V_Z}{\Delta \text{Temp}}$	Temperature Stability	V <sub>R</sub> Adjusted to 2.490V, I <sub>R</sub> = 1mA, T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub> (See Figure 1)		12	18		1.8	6	mV
$\frac{\Delta V_Z}{\Delta \text{Time}}$	Long Term Stability	T <sub>A</sub> = 25°C ± 0.1°C, I <sub>R</sub> = 1mA		20			20		ppm/kHr

**Note 1:** Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

**Note 2:** The LT1009 is an improved, low cost, pin for pin replacement for the "A" and "B" versions. For further information consult the LT1009 data sheet.

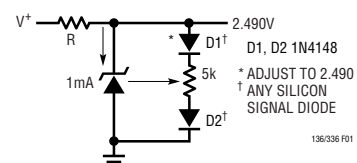
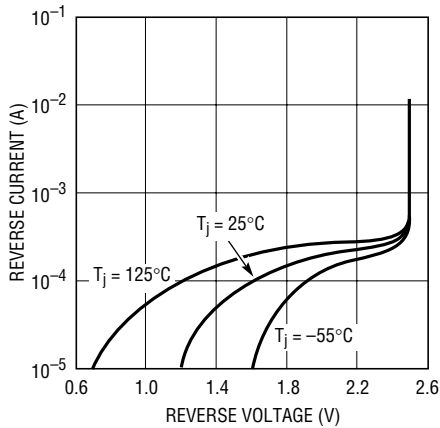


Figure 1. Adjusting the LM336 for Minimum Temperature Coefficient

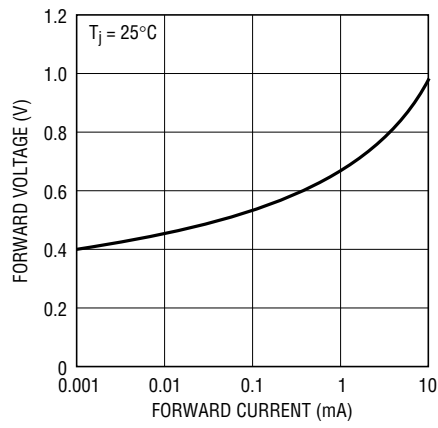
# TYPICAL PERFORMANCE CHARACTERISTICS

Reverse Characteristics



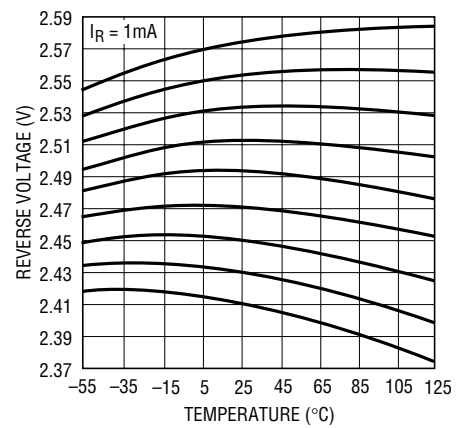
136/336 G01

Forward Characteristics



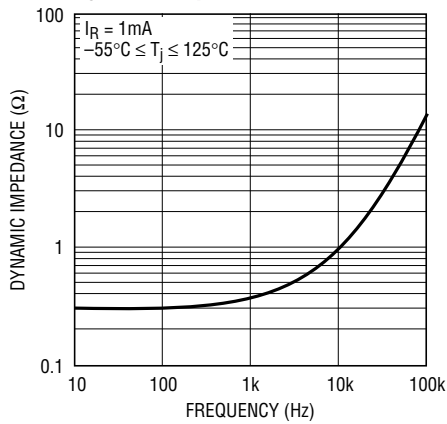
136/336 G02

Temperature Drift



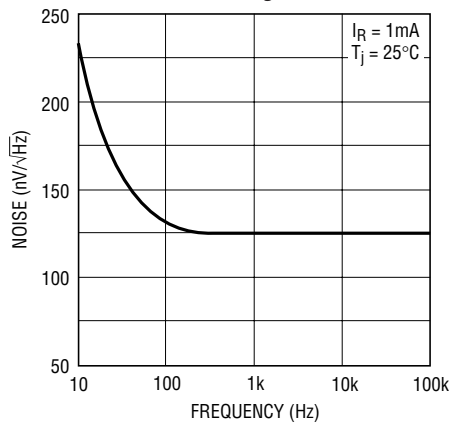
136/336 G03

Dynamic Impedance



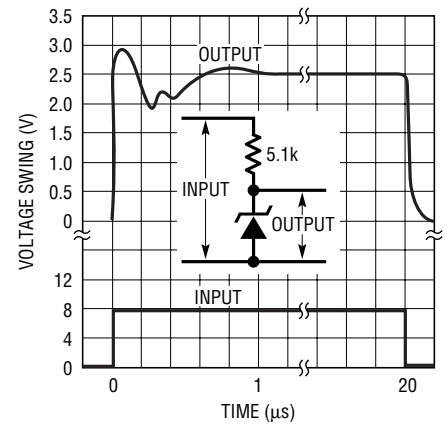
136/336 G04

Zener Noise Voltage



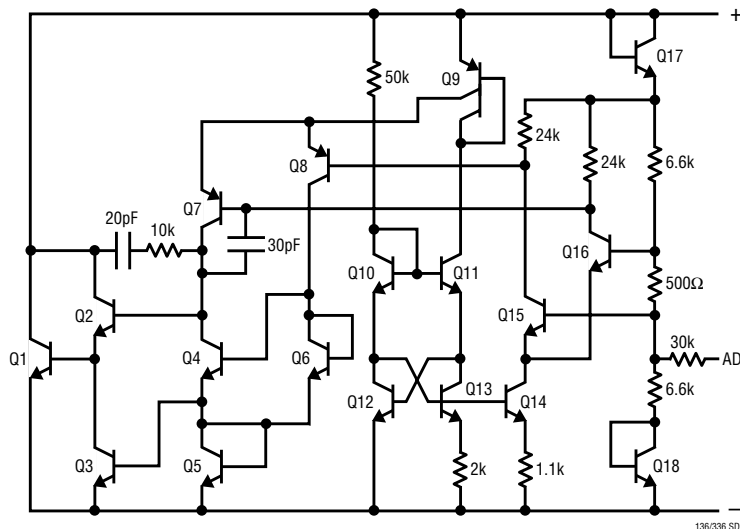
136/336 G05

Response Time



136/336 G06

# SCHEMATIC DIAGRAM

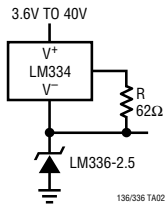


136/336 SD

# LM136-2.5/LM336-2.5

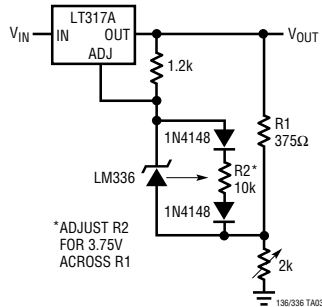
## TYPICAL APPLICATIONS

### Wide Supply Range, Reference



136/336 TA02

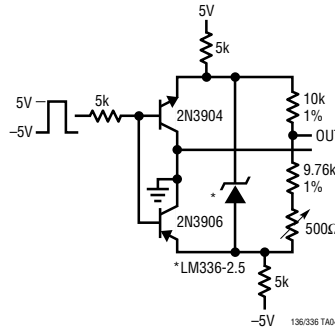
### Low Temperature Coefficient Power Regulator



\*ADJUST R2 FOR 3.75V ACROSS R1

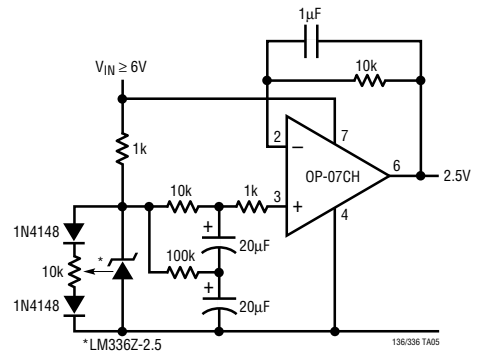
136/336 TA03

### Switchable $\pm 1.25V$ Bipolar Reference



136/336 TA04

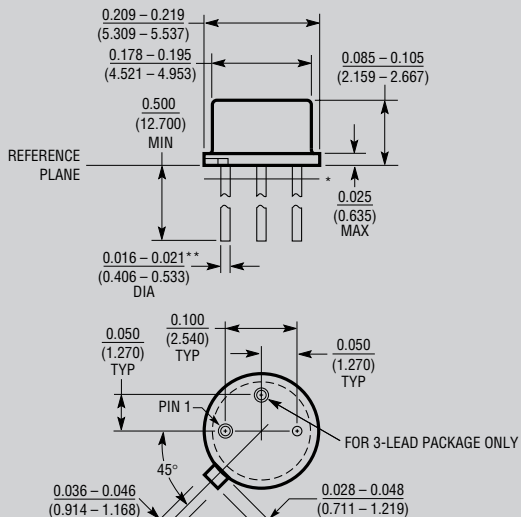
### Low Noise 2.5V Buffered Reference



136/336 TA05

## PACKAGE DESCRIPTION

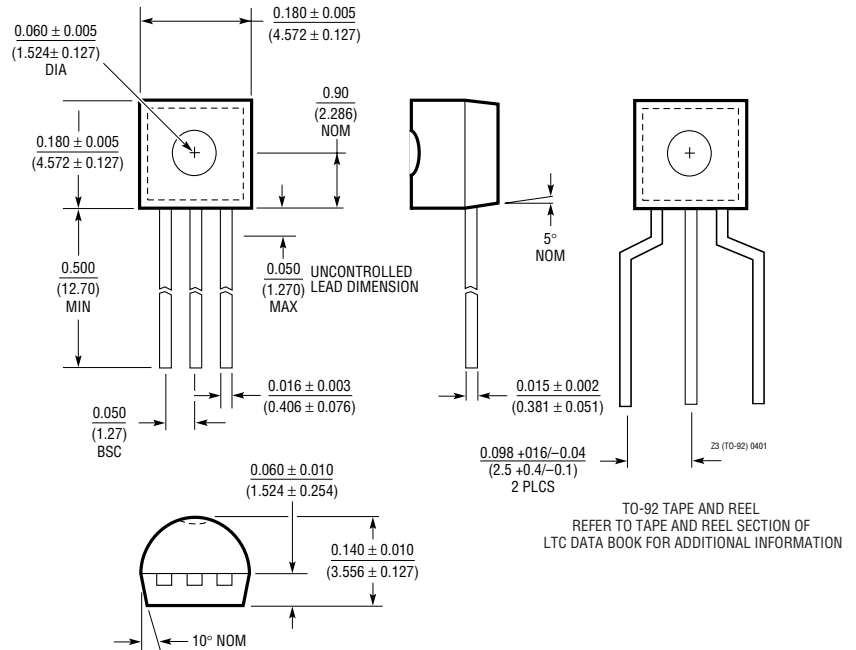
### H Package 2-Lead and 3-Lead TO-46 Metal Can (Reference LTC DWG # 05-08-1340)



\*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**

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



TO-92 TAPE AND REEL  
REFER TO TAPE AND REEL SECTION OF  
LTC DATA BOOK FOR ADDITIONAL INFORMATION

## RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LT1009	Precision 2.5V Shunt Reference	0.2% Max Initial Tolerance