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LM136A-5.0QML
LM136-5.0QML

October 27, 2010

5.0V Reference Diode

General Description

The LM136A-5.0QML/LM136-5.0QML integrated circuits are precision 5.0V shunt regulator diodes. These monolithic IC voltage references operate as a low temperature coefficient 5.0V zener with 0.6Ω dynamic impedance. A third terminal on the LM136-5.0 allows the reference voltage and temperature coefficient to be trimmed easily.

The LM136-5.0 series is useful as a precision 5.0V low voltage reference for digital voltmeters, power supplies or op amp circuitry. The 5.0V makes it convenient to obtain a stable reference from low voltage supplies. Further, since the LM136-5.0 operates as a shunt regulator, it can be used as either a positive or negative voltage reference.

Features

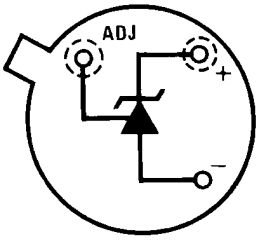
- Adjustable 4V to 6V
- Low temperature coefficient
- Wide operating current of 600 µA to 10 mA
- 0.6Ω dynamic impedance
- Guaranteed temperature stability
- Easily trimmed for minimum temperature drift
- Fast turn-on
- Three lead transistor package

Ordering Information

NS Part Number	SMD Part Number	NS Package Number	Package Description
LM136H-5.0/883		H03H	T0-46, 3LD Metal Can
LM136AH-5.0/883		H03H	T0-46, 3LD Metal Can
LM136AH-5.0-SMD	8418002XA	H03H	T0-46, 3LD Metal Can

Connection Diagram

TO-46
Metal Can Package



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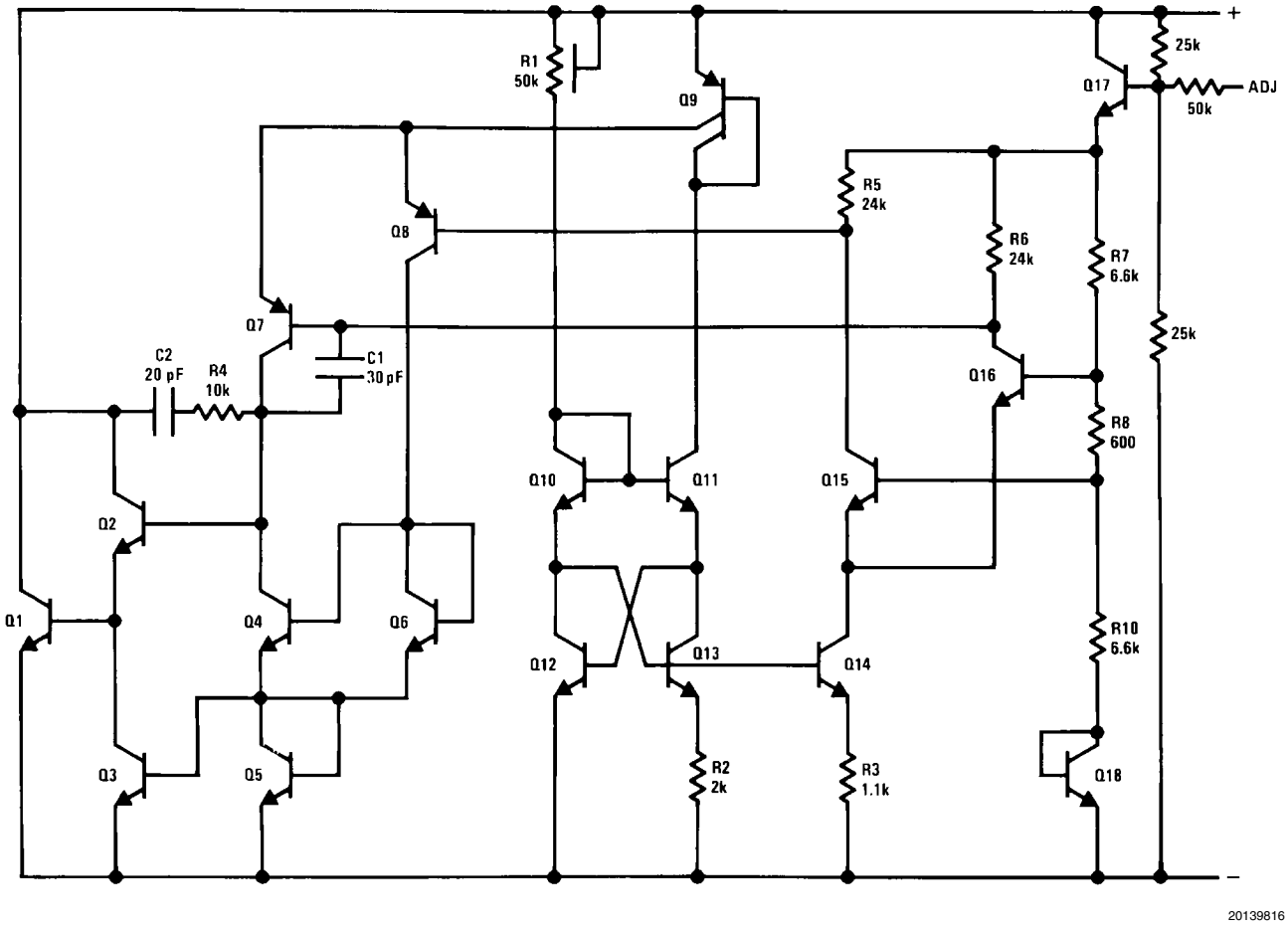
Bottom View
See NS Package Number H03H

Schematic Diagram



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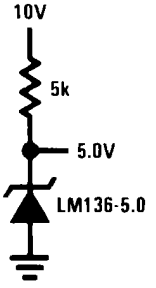
Typical Applications

5.0V Reference



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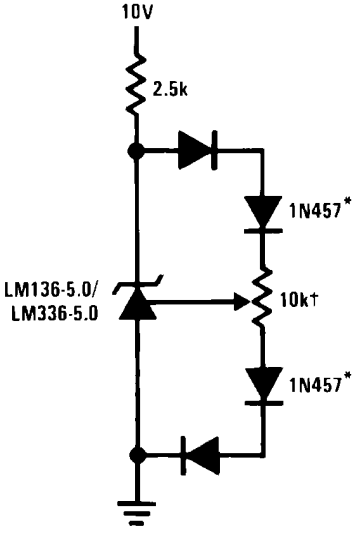
5.0V Reference with Minimum Temperature Coefficient



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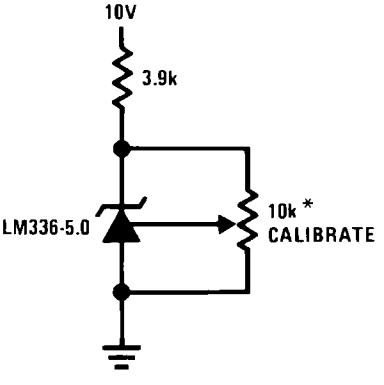
† Adjust to 5.00V

* Any silicon signal diode

Trimmed 4V to 6V Reference with Temperature Coefficient Independent of Breakdown Voltage



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* Does not affect temperature coefficient

Absolute Maximum Ratings (*Note 1*)

Reverse Current	15mA
Forward Current	15mA
Storage Temperature	$-60°C \le T_A \le +150°C$
Operating Temperature Range (*Note 2*)	$-55°C \le T_A \le +125°C$
Soldering Information (10 Seconds)	300°C
Maximum Junction Temperature (T_{Jmax})	150°C
Thermal Resistance	
θ_{JA}	
Still Air Flow	354°C/W
500LF/Min Air Flow	77°C/W
θ_{JC}	46°C/W
ESD Rating (*Note 3*)	1,000 V

Quality Conformance Inspection

Mil-Std-883, Method 5005 - Group A

Subgroup	Description	Temp°C
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	-55

LM136-5.0 Electrical Characteristics

DC Parameters

The following conditions apply, unless otherwise specified. I_R = 1 mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_R	Reverse Breakdown Voltage	V_{Adj} = 2.5V		4.6	5.4	V	1
				4.8	5.6	V	2, 3
		V_{Adj} = 1.5V		5.4	6.6	V	1
				5.6	6.8	V	2, 3
		V_{Adj} = 3.5V		2.4	4.6	V	1
				2.8	4.8	V	2, 3
		V_{Adj} = Open		4.878	5.081	V	1
				4.83	5.13	V	2, 3
I_{Adj}	Adjust Current	V_{Adj} = 2.5V		-260	260	µA	1
		V_{Adj} = 1.5V		-260	260	µA	1
		V_{Adj} = 3.5V		-260	260	µA	1
ΔV_R	Reverse Breakdown Change with Current	0.6mA ≤ I_R ≤ 15 mA		-12	12	mV	1
				-20	20	mV	2, 3
V_F	Foward Voltage	I_R = -10mA		-1.5	-0.49	V	1
V_{Stab}	Temperature Stability	V_R = Adjusted to 5V			36	mV	2, 3
Z_{RD}	Reverse Dynamic Impedance		(*Note 4*)		1.6	Ω	1, 2, 3

LM136A–5.0 Electrical Characteristics

DC Parameters

The following conditions apply, unless otherwise specified. I_R = 1 mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_R	Reverse Breakdown Voltage	V_{Adj} = 2.5V		4.6	5.4	V	1
				4.8	5.6	V	2, 3
		V_{Adj} = 1.5V		5.4	6.6	V	1
				5.6	6.8	V	2, 3
		V_{Adj} = 3.5V		2.4	4.6	V	1
				2.8	4.8	V	2, 3
		V_{Adj} = Open		4.935	5.029	V	1
				4.88	5.08	V	2, 3
I_{Adj}	Adjust Current	V_{Adj} = 2.5V		-260	260	µA	1
		V_{Adj} = 1.5V		-260	260	µA	1
		V_{Adj} = 3.5V		-260	260	µA	1
ΔV_R	Reverse Breakdown Change with Current	0.6mA ≤ I_R ≤ 15 mA		-12	12	mV	1
				-20	20	mV	2, 3
V_F	Foward Voltage	I_R = -10mA		-1.5	-0.49	V	1
V_{Stab}	Temperature Stability	V_R = Adjusted to 5V			36	mV	2, 3
Z_{RD}	Reverse Dynamic Impedance		(*Note 4*)		1.6	Ω	1, 2, 3

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

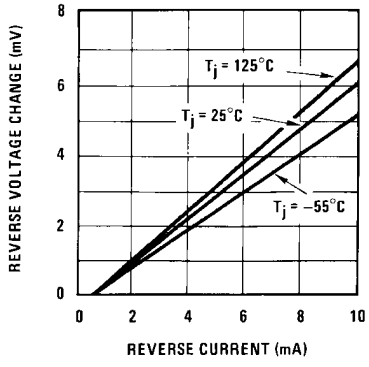
Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

Note 3: Human body model, 100pF discharged through 1.5KΩ

Note 4: Guaranteed, not tested.

Typical Performance Characteristics

Reverse Voltage Change



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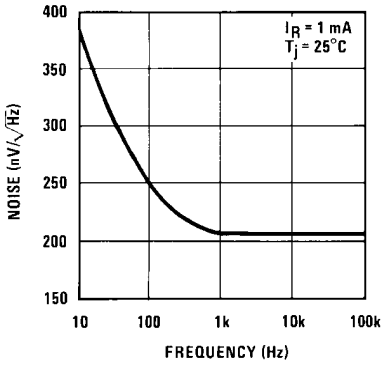
Zener Noise Voltage



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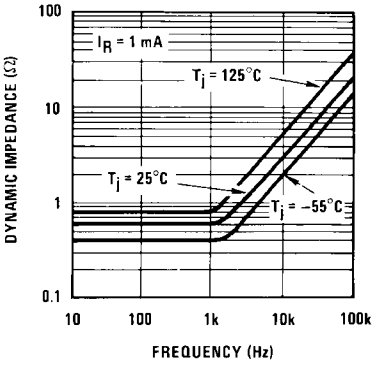
Dynamic Impedance



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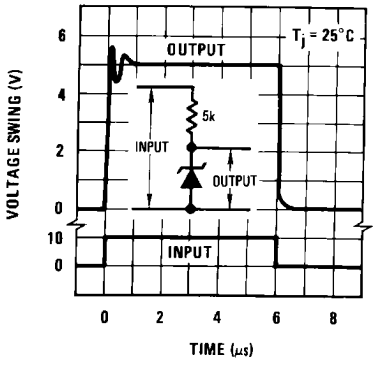
Response Time



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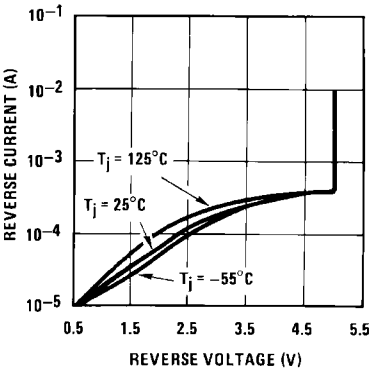
Reverse Characteristics



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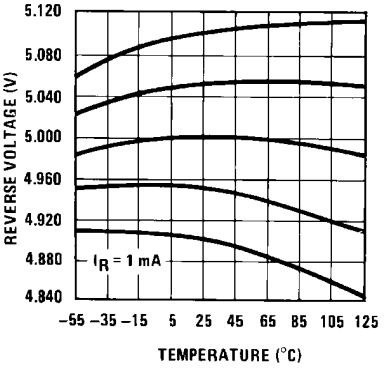
Temperature Drift



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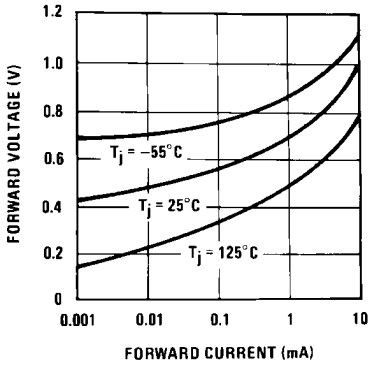
Forward Characteristics



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Application Hints

The LM136-5.0 series voltage references are much easier to use than ordinary zener diodes. Their low impedance and wide operating current range simplify biasing in almost any circuit. Further, either the breakdown voltage or the temperature coefficient can be adjusted to optimize circuit performance.

Figure 1 shows an LM136-5.0 with a 10k potentiometer for adjusting the reverse breakdown voltage. With the addition of R1 the breakdown voltage can be adjusted without affecting the temperature coefficient of the device. The adjustment range is usually sufficient to adjust for both the initial device tolerance and inaccuracies in buffer circuitry.

If minimum temperature coefficient is desired, four diodes can be added in series with the adjustment potentiometer as shown in *Figure 2*. When the device is adjusted to 5.00V the temperature coefficient is minimized. Almost any silicon signal diode can be used for this purpose such as a 1N914, 1N4148 or a 1N457. For proper temperature compensation the diodes should be in the same thermal environment as the LM136-5.0. It is usually sufficient to mount the diodes near the LM136-5.0 on the printed circuit board. The absolute resistance of the network is not critical and any value from 2k to 20k will work. Because of the wide adjustment range, fixed resistors should be connected in series with the pot to make pot setting less critical.

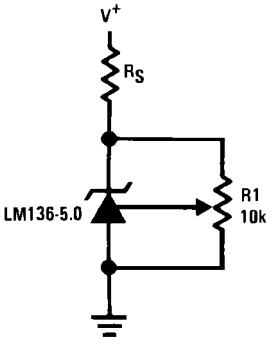

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FIGURE 1. LM136-5.0 with Pot for Adjustment of Breakdown Voltage (Trim Range = ±1.0V Typical)

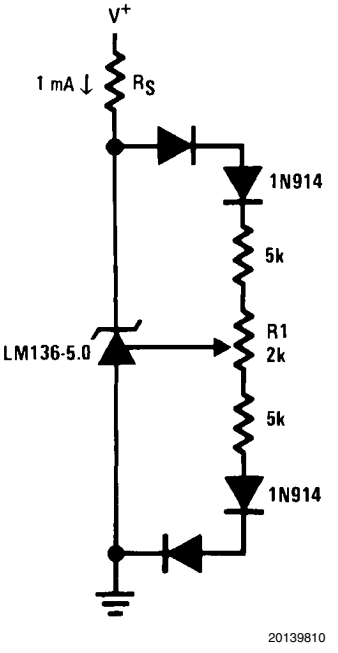

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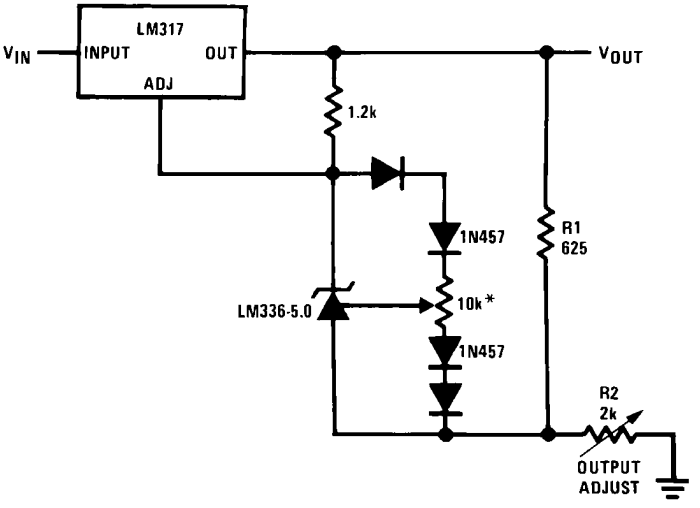
FIGURE 2. Temperature Coefficient Adjustment (Trim Range = ±0.5V Typical)

Typical Applications

Precision Power Regulator with Low Temperature Coefficient



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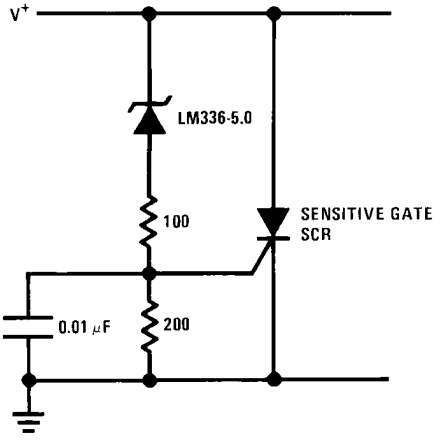
* Adjust for 6.25V across R1

5V Crowbar



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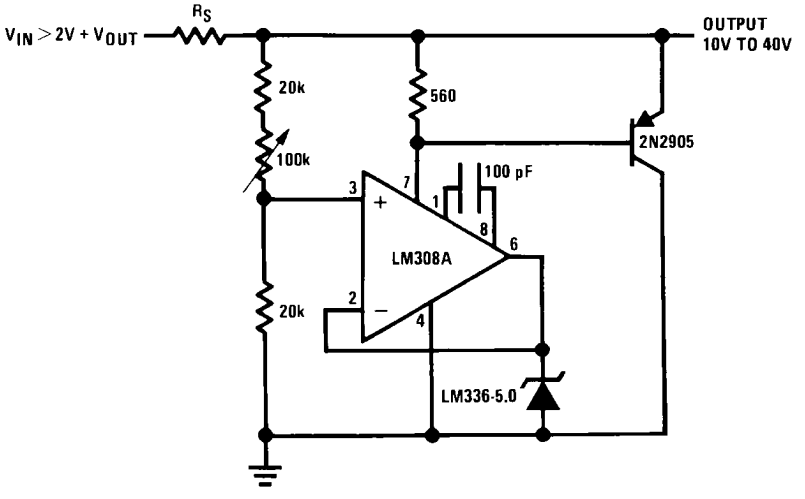
Adjustable Shunt Regulator



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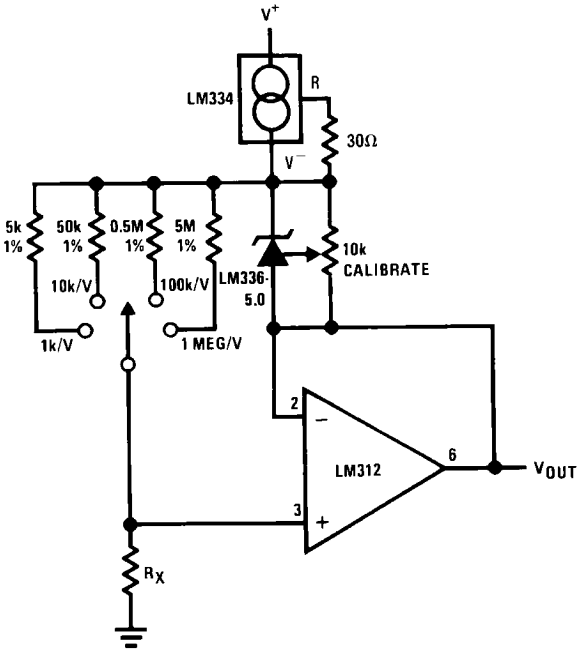
Linear Ohmmeter



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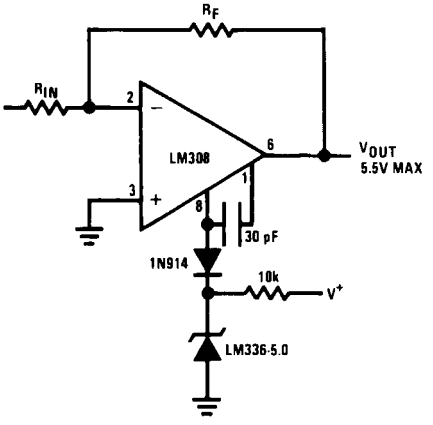
Op Amp with Output Clamped



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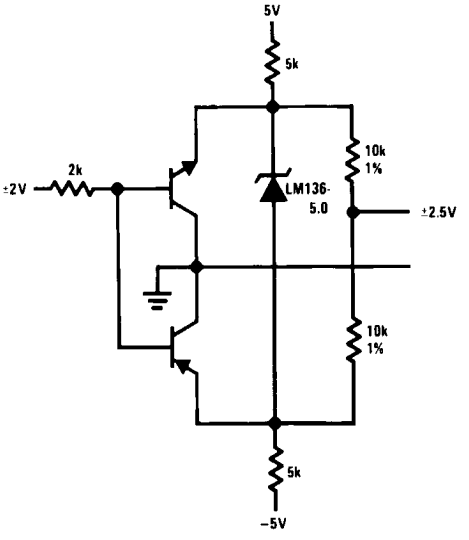
Bipolar Output Reference



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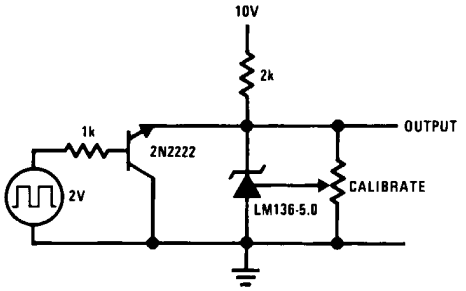
5.0V Square Wave Calibrator



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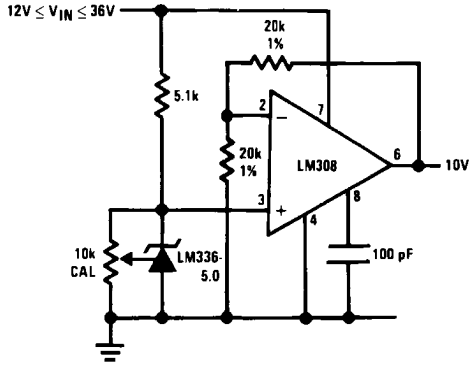
10V Buffered Reference



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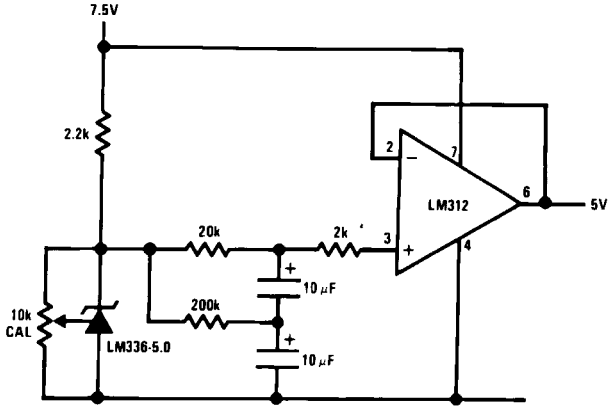
Low Noise Buffered Reference



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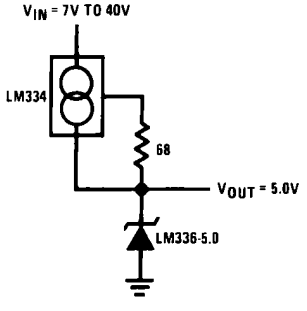
Wide Input Range Reference

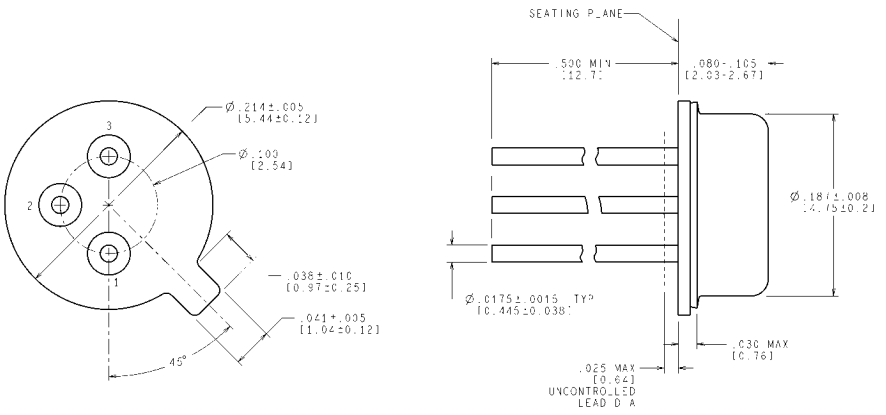


20139829

Revision History

Date Released	Revision	Section	Changes
04/10/08	A	New Release, Corporate format.	2 MDS datasheets were converted into one Corporate datasheet format. MNLM136A-5.0-X Rev 0B0 & LM136-5.0-X Rev 0A0 MDS Data Sheets will be archived.
10/26/2010	B	Data Sheet Title	Changed Title from LM136A-5.0/LM136–5.0QML to LM136A-5.0QML/LM136–5.0QML. Revision A will be Archived.

Physical Dimensions inches (millimeters) unless otherwise noted



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H03H (Rev F)

TO-46 Metal Can Package (H)
NS Package Number H03H

Notes

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