

LM236-LM336

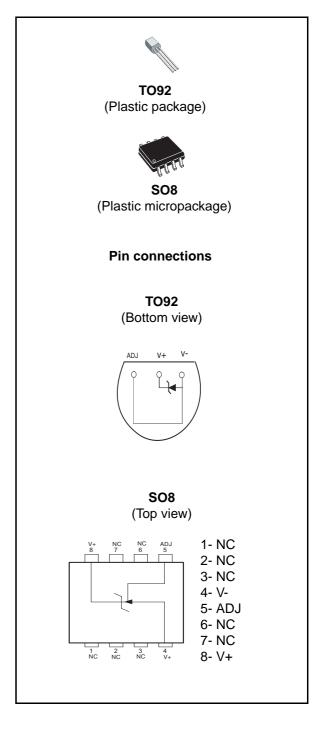
2.5V voltage references

Features

- Low temperature coefficient
- Wide operating current of 400µA to 10mA
- 0.2Ω dynamic impedance
- Guaranteed temperature stability
- Fast turn-on

Description

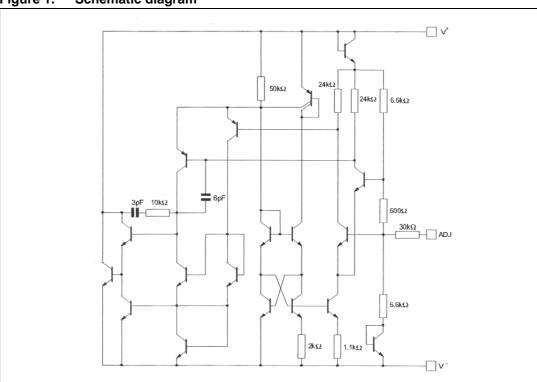
The LM236 and LM336 are precision 2.5V regulator diodes. These voltage reference monolithic ICs operate like 2.5V Zener diodes with a low temperature coefficient and a dynamic impedance of 0.2Ω A third pin enables adjusting the reference voltage and the temperature coefficient.



Schematic diagram LM236-LM336

1 Schematic diagram

Figure 1. Schematic diagram



2 Absolute maximum ratings

Table 1. Absolute maximum ratings (AMR)

Symbol	Parameter	LM236	LM336,B	Unit
I _R	Current Reverse Forward		5 0	mA
T _{oper}	Operating free-air temperature range	-25 to +85 0 to +70		°C
T _{stg}	Storage temperature range	-65 to +150		°C

3 Electrical characteristics

Table 2. Electrical characteristics

Symbol	Parameter		LM236			LM336,B		
Symbol			Тур.	Max.	Min.	Тур.	Max.	Unit
V _R	Reference breakdown voltage T _{amb} = +25°C, I _R = 1mA LM236, LM336 LM336B	2.44	2.49	2.54	2.39 2.44	2.49 2.49	2.59 2.54	V
ΔV _R	Reverse breakdown voltage change with current $400\mu A \le I_R \le 10mA$ $T_{amb} = +25^{\circ}C$ $T_{min} \le T_{amb} \le T_{max}$		2.6 3	6 10		2.6 3	10 12	mV
Z _D	Reverse dynamic impedance ($I_R = 1mA$) $T_{amb} = +25^{\circ}C$ $T_{min} \le T_{amb} \le T_{max}$		0.2 0.4	0.6 1		0.2 0.4	1 1.4	Ω
K _{VT}	Temperature stability ($V_R = 2.49V$, $I_R = 1mA$)		3.5	9		1.8	6	mV
K _{VH}	Long term stability ($T_{amb} = +25^{\circ}C \pm 0.1^{\circ}C$, $I_{R} = 1mA$)		20			20		ppm

Figure 2. Reverse voltage change

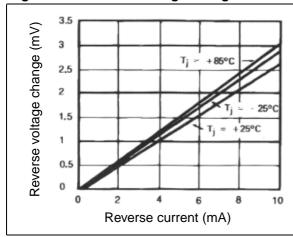
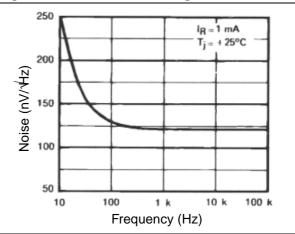


Figure 3. Zener noise voltage



Electrical characteristics LM236-LM336

Figure 4. Dynamic impedance

Figure 5. Response time

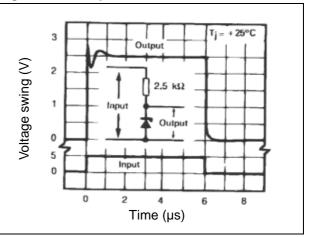


Figure 6. Reverse characteristics

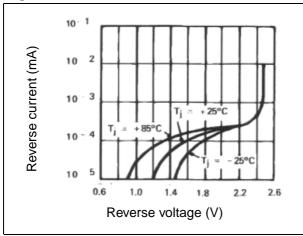


Figure 7. Forward characteristics

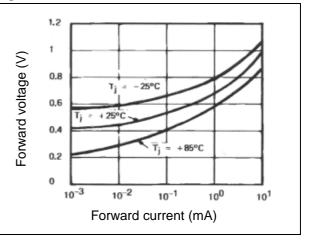
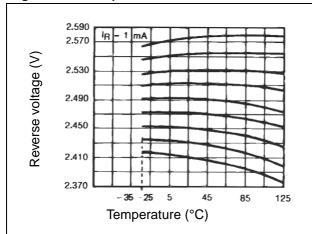


Figure 8. Temperature drift



4 Application information

The LM236, LM336 voltage references are easier to use than zener diodes. Their low impedance and wide current range facilitate biasing in any circuits. Besides, the breakdown voltage or the temperature coefficient can be adjusted so as to optimize the performance of the circuit.

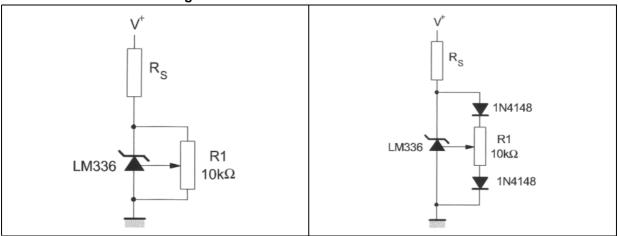
Figure 9 represents a LM336 with a $10k\Omega$ potentiometer to adjust the reverse breakdown voltage which can be adjusted without altering the temperature coefficient of the circuit. The adjustment range is generally sufficient to adjust the initial tolerance of the circuit and the inaccuracy of the amplifier circuit.

To obtain a lower temperature coefficient two diodes can be connected in series as indicated in *Figure 10*.

When the circuit is adjusted to 2.49V the temperature coefficient is minimized.

For a correct temperature coefficient, the diodes should be at the same ambient temperature as the LM336. The value of R1 is not critical (2-20k Ω).

Figure 9. LM336 with pot for adjustment of Figure 10. Temperature coefficient adjustment breakdown voltage



Typical applications

Figure 11. 2.5V reference

Figure 12. Wide input range reference

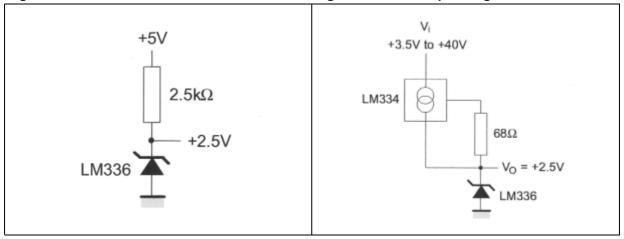


Figure 13. Precision power regulator with low temperature coefficient

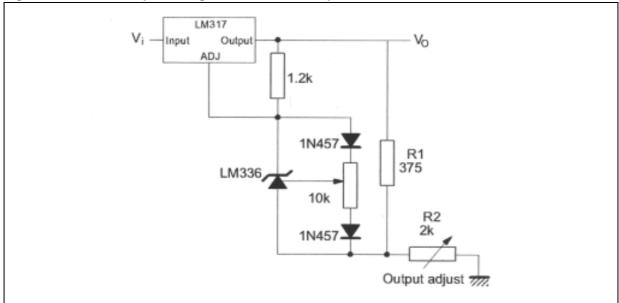


Figure 14. Adjustable shunt regulator

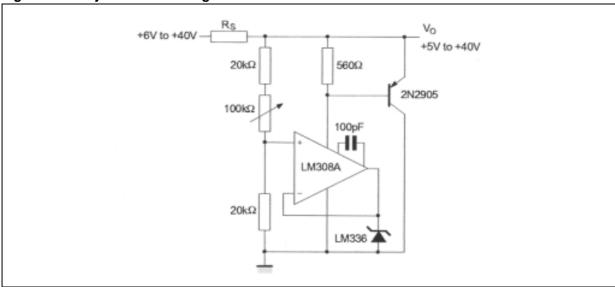


Figure 15. Linear ohmmeter

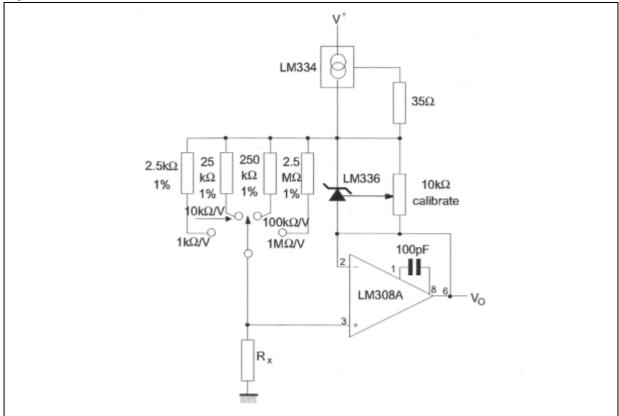


Figure 16. Bipolar output reference

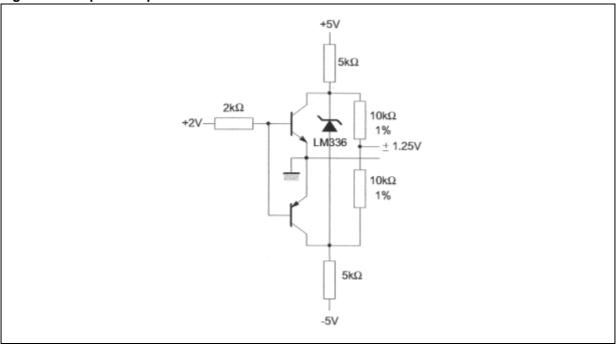


Figure 17. 5V buffered reference

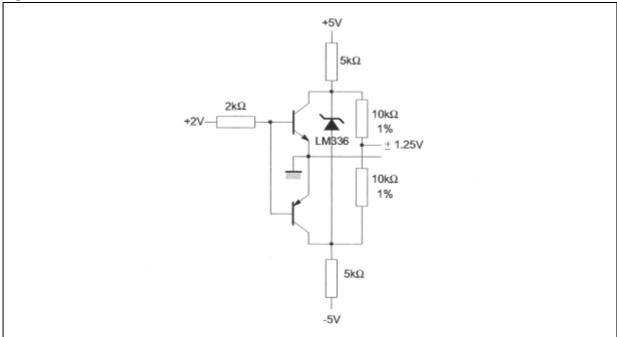
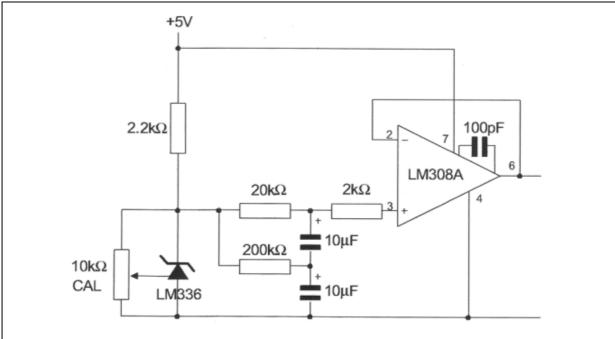


Figure 18. Low noise buffered reference



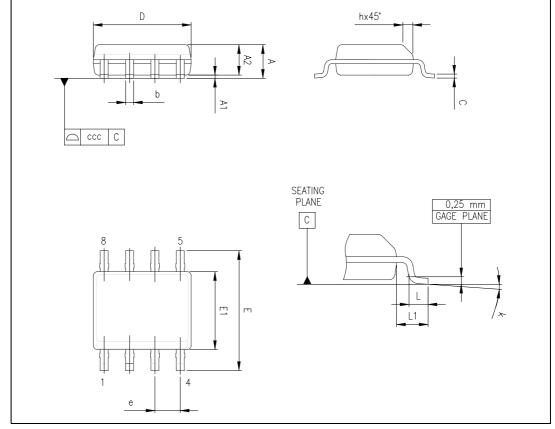
Package information LM236-LM336

5 Package information

In order to meet environmental requirements, STMicroelectronics offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an STMicroelectronics trademark. ECOPACK specifications are available at: www.st.com.

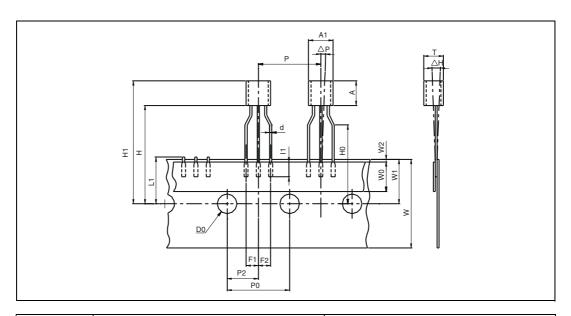
5.1 SO-8 package mechanical data

	Dimensions							
Ref.	Millimeters			Inches				
	Min.	Тур.	Max.	Min.	Тур.	Max.		
Α			1.75			0.069		
A1	0.10		0.25	0.004		0.010		
A2	1.25			0.049				
b	0.28		0.48	0.011		0.019		
С	0.17		0.23	0.007		0.010		
D	4.80	4.90	5.00	0.189	0.193	0.197		
Н	5.80	6.00	6.20	0.228	0.236	0.244		
E1	3.80	3.90	4.00	0.150	0.154	0.157		
е		1.27			0.050			
h	0.25		0.50	0.010		0.020		
L	0.40		1.27	0.016		0.050		
k	1°		8°	1°		8°		
CCC			0.10			0.004		



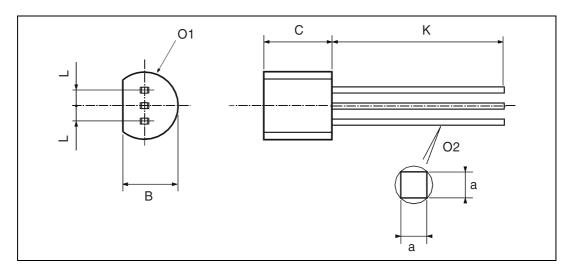
Package information LM236-LM336

5.2 TO-92 ammopack and tape & reel package mechanical data



Dim.	Millimeters			Inches			
Dim.	Min.	Тур.	Max.	Min.	Тур.	Max.	
AL			5.0			0.197	
А			5.0			0.197	
Т			4.0			0.157	
d		0.45			0.018		
I1	2.5			0.098			
Р	11.7	12.7	13.7	0.461	0.500	0.539	
PO	12.4	12.7	13	0.488	0.500	0.512	
P2	5.95	6.35	6.75	0.234	0.250	0.266	
F1/F2	2.4	2.5	2.8	0.094	0.098	0.110	
Δh	-1	0	1	-0.039	0	0.039	
ΔΡ	-1	0	1	-0.039	0	0.039	
W	17.5	18.0	19.0	0.689	0.709	0.748	
W0	5.7	6	6.3	0.224	0.236	0.248	
W1	8.5	9	9.75	0.335	0.354	0.384	
W2			0.5			0.020	
Н			20			0.787	
H0	15.5	16	16.5	0.610	0.630	0.650	
H1			25			0.984	
DO	3.8	4.0	4.2	0.150	0.157	0.165	
L1			11			0.433	

5.3 TO-92 bulk package mechanical data



Dim.	Millimeters			Inches		
Dilli.	Min.	Тур.	Max.	Min.	Тур.	Max.
L		1.27			0.05	
В	3.2	3.7	4.2	0.126	0.1457	0.1654
01	4.45	5.00	5.2	0.1752	0.1969	0.2047
С	4.58	5.03	5.33	0.1803	0.198	0.2098
K	12.7			0.5		
O2	0.407	0.5	0.508	0.016	0.0197	0.02
а	0.35			0.0138		

Ordering information LM236-LM336

6 Ordering information

Table 3. Order codes

Part number	Temperature range	Package	Packing	Marking
LM236D/DT	-25°C to +85°C	SO-8	Tube or Tape & reel	LM236
LM236Z/ZT/AP	-25°C to +85°C	TO-92	Bulk or Tape & reel or Ammopack	LM236
LM336D/DT	-25°C to +85°C	SO-8	Tube or Tape & reel	LM336
LM336Z/ZT/AP	-25°C to +85°C	TO-92	Bulk or Tape & reel or Ammopack	LM336
LM336BD/BDT	0°C to 70°C	SO-8	Tube or Tape & reel	LM336B
LM336BZ/BZT/BAP	0°C to 70°C	TO-92	Bulk or Tape & reel or Ammopack	LM336B

7 Revision history

Date Revision		Changes
2-May-1997	1	Initial release.
24-May-2003	2	Caption of pinout diagram for TO-92 package changed to indicate top view.
29-May-2007	3	Corrected caption of pinout diagram for TO-92 package on cover page (previous version is wrong, should be bottom view). Updated Section 5: Package information and Table 3: Order codes.

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