LM385-2.5/LM385B-2.5

Micropower Voltage Reference

FEATURES

- Operating Current from 20μA to 20mA.
- Low Temperature Coefficient.
- 1% and 2% Initial Tolerance.
- Low Dynamic Impedance.

APPLICATIONS

- Portable, Battery-Powered Equipment.
- Instrumentation.
- Process Control.
- Energy Management.
- Product Testing.
- Automotive.
- Precision Audio Components.

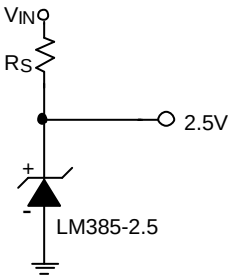
DESCRIPTION

The LM385-2.5 is a micropower 2-terminal bandgap voltage reference, which can operate in a 20μA to 20mA current range, they feature exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to achieve tight voltage tolerance. Since the LM385-2.5 bandgap reference uses only transistors and resistors, low noise and good long-term stability result.

Careful design of the LM385-2.5 has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows for its use with widely varying supplies with excellent regulation.

The extremely low power drain of the LM385-2.5 makes it useful for micropower circuitry. This voltage reference can be used to make portable meters, regulators, or general purpose analog circuitry with battery life approaching shelf life. Further, the wide operating current allows it to replace older references with a tighter tolerance.

TYPICAL APPLICATION CIRCUIT



Precision 2.500V Voltage Reference

ORDERING INFORMATION

LM385X-2.5CXXX

PACKING TYPE
BG: BAG
TB: TUBE (for SO-8)
TR: TAPE & REEL

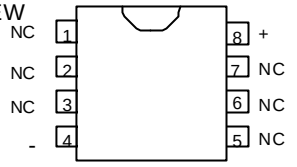
PACKAGE TYPE
S: SMALL OUTLINE
U: SOT-23
X: SOT-89
Z: TO-92

TOLERANCE
Default: 2%
B: 1%

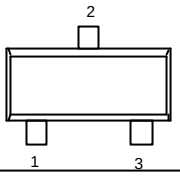
Example: LM385-2.5CSTR
→ 2% version, in SO-8 Package & Taping & Reel Packing Type
(CS is not available in BAG packing type.)

PIN CONFIGURATION

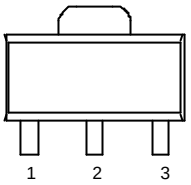
SO-8
TOP VIEW



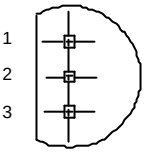
SOT-23
TOP VIEW
1: -
2: +
3: NC



SOT-89
TOP VIEW
1: NC
2: -
3: +



TO-92
TOP VIEW
1: NC
2: +
3: -



ABSOLUTE MAXIMUM RATINGS

Reverse Current 30mA

Forward Current 10mA

Operating Temperature Range. ..... 0°C to 70°C

Storage Temperature ..... -65°C to 150°C

Lead Temperature

TO-92 Package Soldering (10 seconds) ..... 260°C

SO Package Vapor phase (60 seconds) ..... 215°C

TEST CIRCUIT

Refer to TYPICAL APPLICATION CIRCUIT.

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified.)

PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Reverse Breakdown Voltage	I_R=100μA	LM385B-2.5 LM385-2.5	V_R	2.475 2.450	2.500 2.500	2.525 2.550	V
Reverse Breakdown Voltage Change with Current	20μA≤I_R ≤1mA		ΔV_R			2	mV
	1mA≤I_R ≤20mA		ΔV_R			20	mV
Reverse Dynamic Impedance	I_R=100μA, f=20Hz		Z_R		1		Ω
Minimum Operating Current			I_{RMIN}		13	20	μA
Wideband Noise (rms)	I_R=100μA, 10Hz≤ f ≤10KHz		e_N		120		μVrms
Average Temperature Coefficient (Note)	I_R=100μA		αV_R		100		ppm/°C
Long Term Stability	I_R=100μA, T=1000Hrs, T_A=25°C		$\Delta V_R / \Delta t$		20		ppm

Note : The average temperature coefficient is defined as the maximum deviation of reverse breakdown voltage at all measured temperatures from T_{MIN} to T_{MAX}, divided by T_{MAX} - T_{MIN}. The measured temperatures are 0°C, 25°C, 50°C and 70°C.

TYPICAL PERFORMANCE CHARACTERISTICS

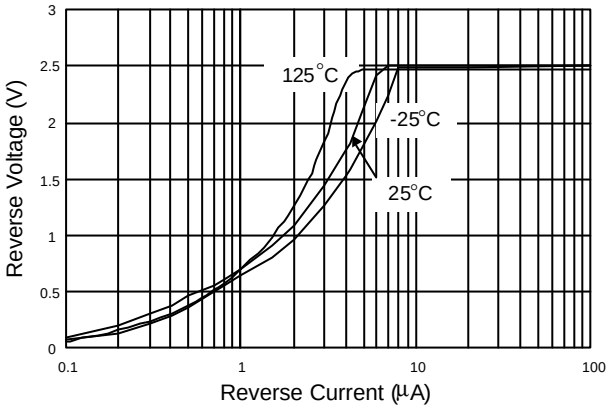


Fig. 1 Reverse Characteristics

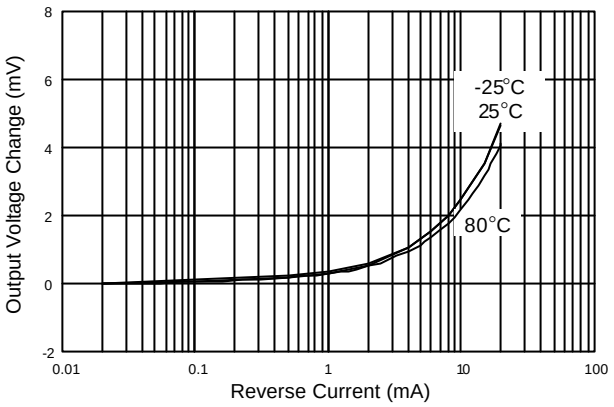


Fig. 2 Reverse Characteristics

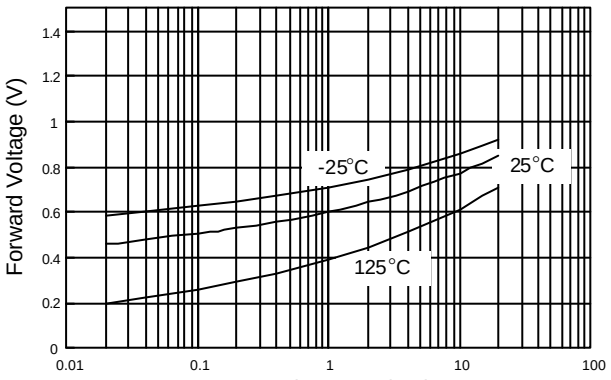


Fig. 3 Forward Characteristics

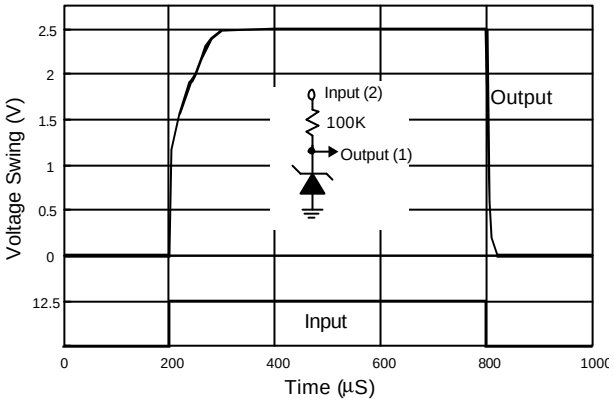


Fig. 4 Response Time

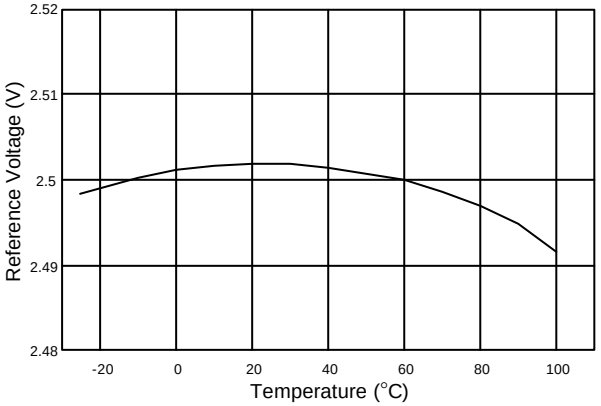


Fig. 5 Temperature Drift

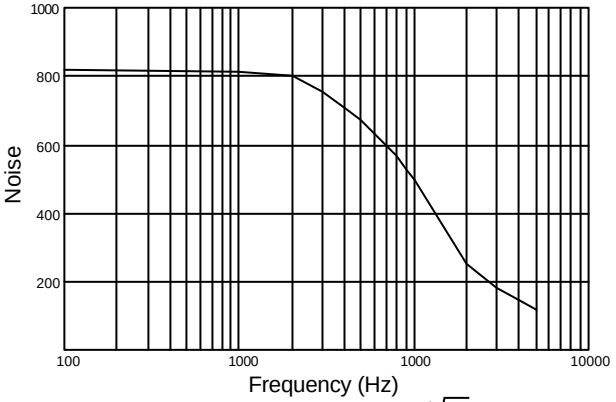
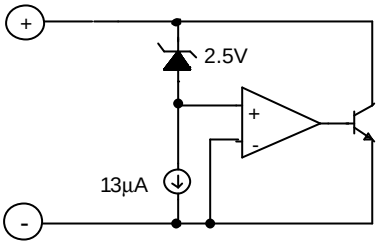


Fig. 6 Noise Voltage ($^{nV}/\sqrt{Hz}$)

BLOCK DIAGRAM



SYMBOL



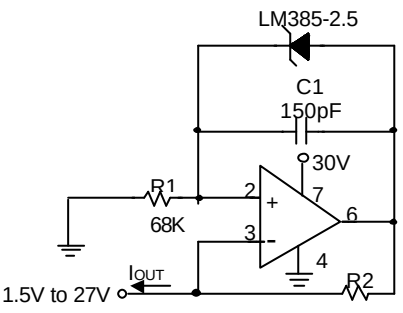
PIN DESCRIPTIONS

PIN + - sinks current with a range from 20μA to 20mA for normal applications. And a stable positive voltage, relative to Pin-, occurs on Pin+.

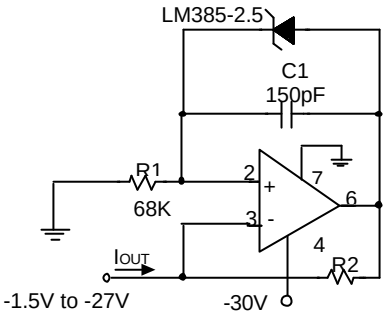
PIN - - Pin- sources current for normal application. The current value is the same as Pin+.

PIN NC - Not connected.

APPLICATION EXAMPLES



$$I_{OUT} = \frac{2.5V}{R2}$$

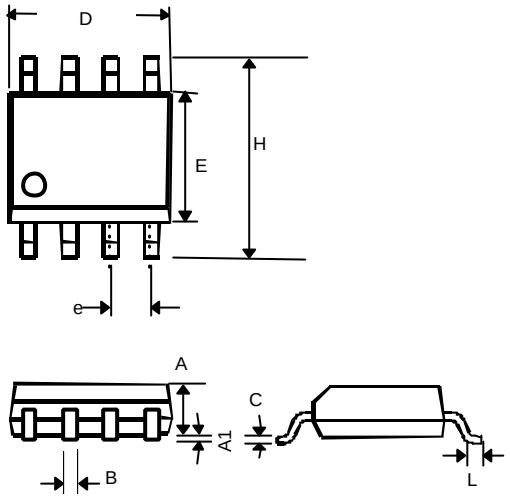


$$I_{OUT} = \frac{2.5V}{R2}$$

Fig. 7 Precision 1mA to 1mA Current Source

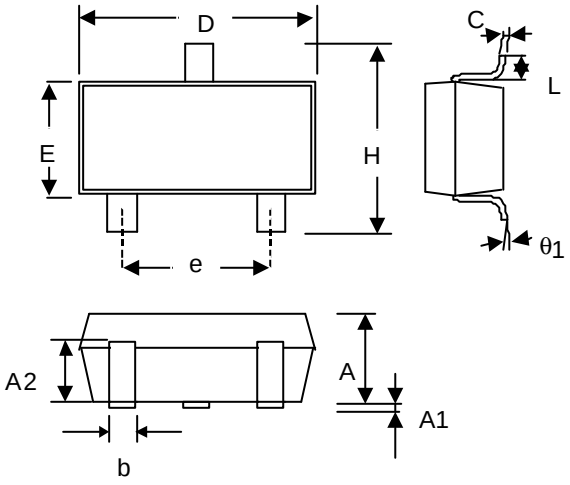
PHYSICAL DIMENSIONS

- **8 LEAD PLASTIC SO (unit: mm)**



SYMBOL	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27(TYP)	
H	5.80	6.20
L	0.40	1.27

- **SOT-23 (unit: mm)**

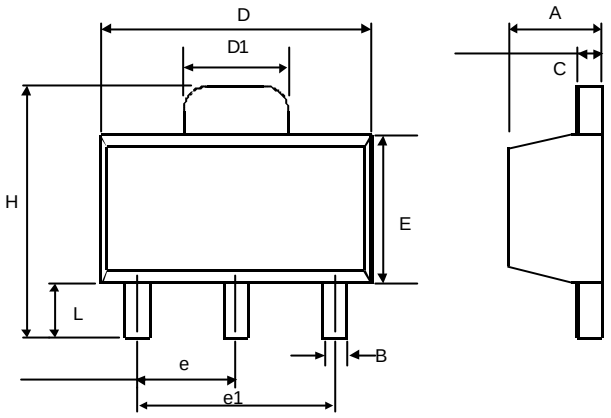


SYMBOL	MIN	MAX
A	1.00	1.30
A1	—	0.10
A2	0.70	0.90
b	0.35	0.50
C	0.10	0.25
D	2.70	3.10
E	1.40	1.80
e	1.90 (TYP)	
H	2.60	3.00
L	0.37	—
θ1	1°	9°

- **SOT-23 MARKING**

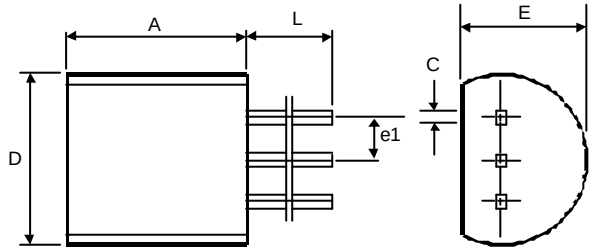
Part No.	Marking
LM385-25CU	AIA2
LM385B-25CU	AIB2

- **SOT-89 (unit: mm)**



SYMBOL	MIN	MAX
A	1.40	1.60
B	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.62	1.83
E	2.29	2.60
e	1.50 (TYP.)	
e1	3.00 (TYP.)	
H	3.94	4.25
L	0.89	1.20

- **TO-92 (unit: mm)**



SYMBOL	MIN	MAX
A	4.32	5.33
C	0.38 (TYP.)	
D	4.40	5.20
E	3.17	4.20
e1	1.27 (TYP.)	
L	12.7	-