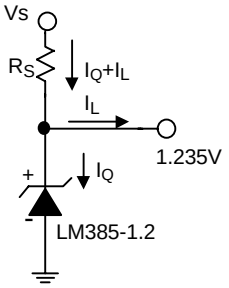
FEATURES

- Operating Current of 10μA to 20mA.
- Low Temperature Coefficient.
- Low Voltage Reference……..1.235V.
- 1% and 2% Initial Tolerance.

APPLICATIONS

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

TYPICAL APPLICATION CIRCUITS



Precision 1.235V Voltage Reference

DESCRIPTION

The LM385-1.2 is a micropower 2-terminal bandgap voltage regulator diode. Operating over a 10μA to 20mA current range, it features exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to achieve tight voltage tolerance. Since the LM385-1.2 bandgap reference uses only bipolar transistors and resistors, low noise and good long term stability result.

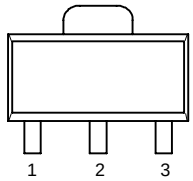
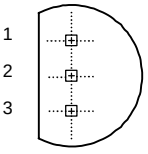
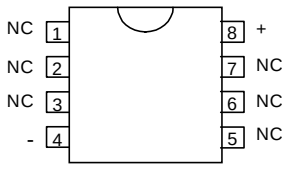
Careful design of the LM385-1.2 has made the device exceptionally tolerant of capacitive loading, making it easy to use in almost any reference application. The wide dynamic operating range allows for its use with widely varying supplies with excellent regulation.

The extremely low power drain of the LM385-1.2 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.

ORDERING INFORMATION

LM385X-1.2XX

- PACKAGE TYPE
  - X: SOT-89
  - Z: TO-92
  - S: 8-LEAD SMALL OUTLINE
- TEMPERATURE RANGE
  - C=0°C~+70°C
- TOLERANCE
  - B: 1%
  - Default: 2%

ORDER NUMBER	PIN CONFIGURATION
LM385B-1.2CX LM385 -1.2CX (SOT-89)	FRONT VIEW 1: NC 2: - 3: + 
LM385B-1.2CZ LM385 -1.2CZ (TO-92)	TOP VIEW 1: NC 2: + 3: - 
LM385B-1.2CS LM385 -1.2CS (PLASTIC SO)	TOP VIEW 

■ 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 (Ta=25°C, unless otherwise specified.)

PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Reverse Breakdown Voltage	I_R=100μA	LM385B-1.2 LM385-1.2	V_R	1.222 1.210	1.235 1.235	1.248 1.260	V
Reverse Breakdown Voltage Change with Current	10μA≤I_R ≤1mA		ΔV_R			1	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}		8	15	μA
Wideband Noise (rms)	I_R=100μA, 10Hz≤ f ≤10KHz		e_N		60		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

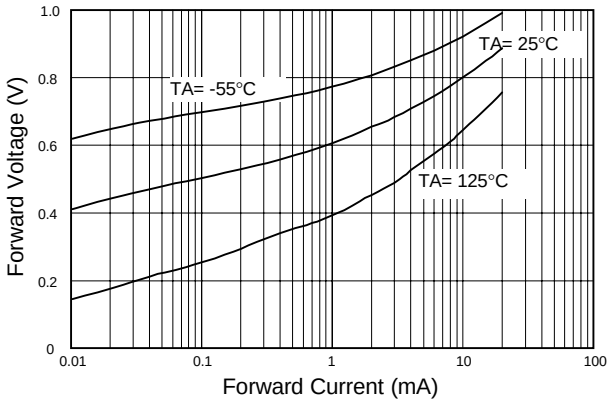
Note : The average temperature coefficient is defined as the maximum deviation of reverse breakdown voltage at all measured temperatures from T_{MIN} to T_{MAX}, divided by T_{MAX} - T_{MIN}. The measured temperature are 0°C, 25°C, 50°C and 70°C.

The total over temperature tolerance for the different grades follows:

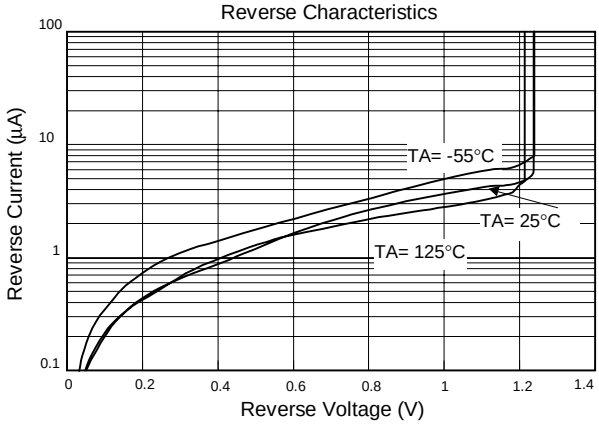
LM385B-1.2: ±1.70% = ±1.0% ± 100ppm/°C x 70°C
LM385-1.2: ±2.7% = ±2.0% ± 100ppm/°C x 70°C

TYPICAL PERFORMANCE CHARACTERISTICS

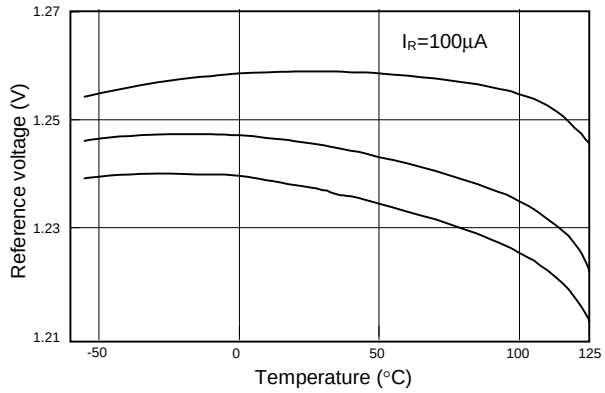
Forward characteristics



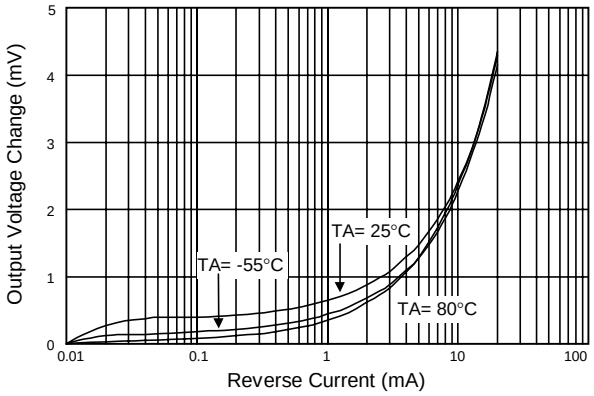
Reverse Characteristics



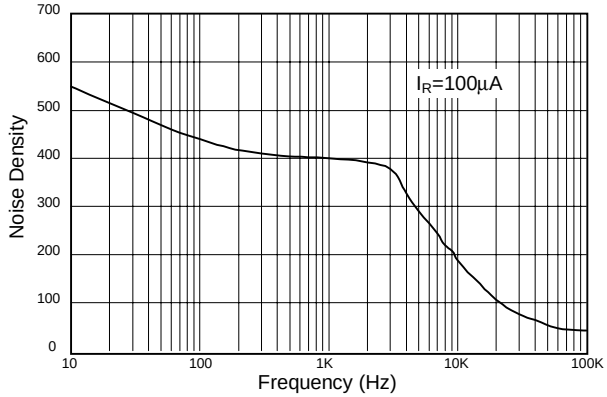
Temperature Drift of 3 Representative Units



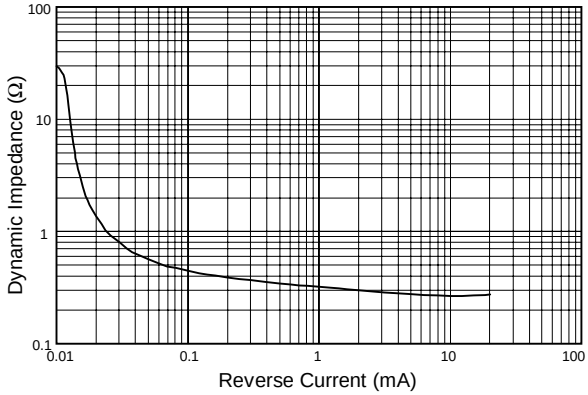
Reverse Characteristics



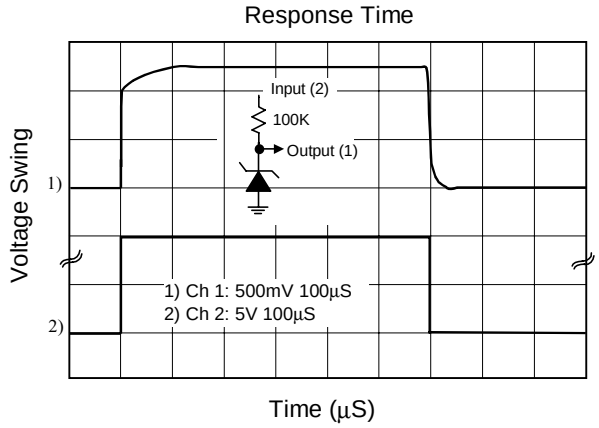
Output Noise Voltage ($nV/\sqrt{Hz}$)



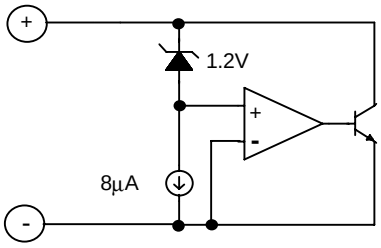
Reverse Characteristics



TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)



BLOCK DIAGRAM



SYMBOL

APPLICATION EXAMPLES

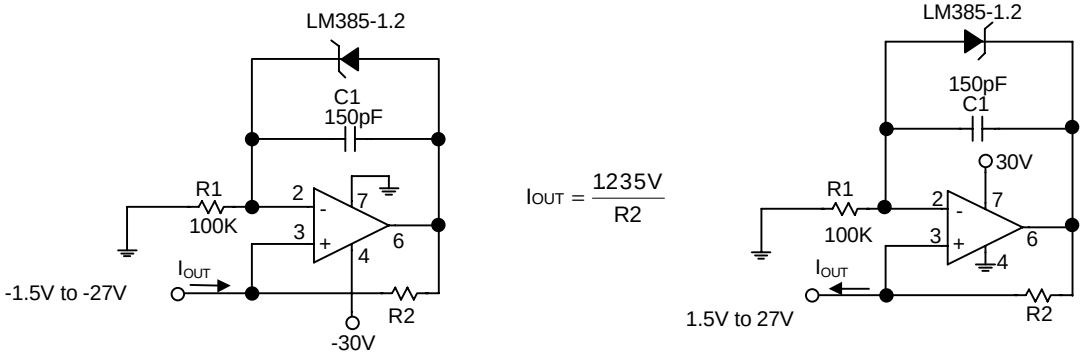


Fig. 1. Precision 1µA to 1mA Current Source

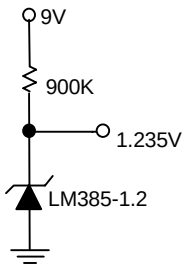


Fig. 2 Micropower Reference from 9V Battery

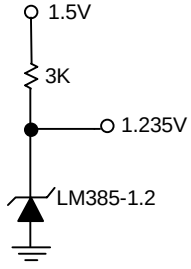


Fig. 3 Reference from 1.5V Battery

APPLICATION EXAMPLES (Continued)

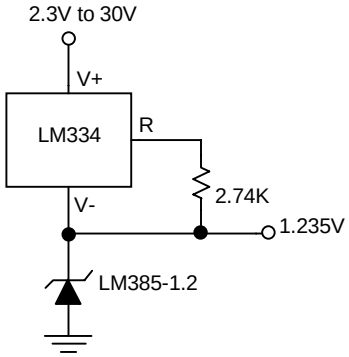


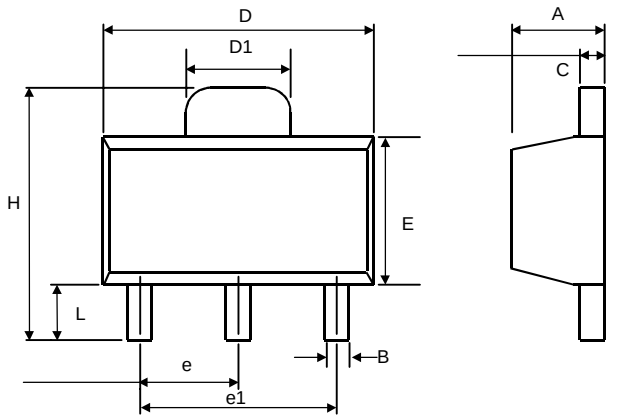
Fig. 4 Operation over a wide Supply Range

SOT-89 Marking

Part No.	Marking
LM385-12CX	AI12
LM385B-12CX	AIB12

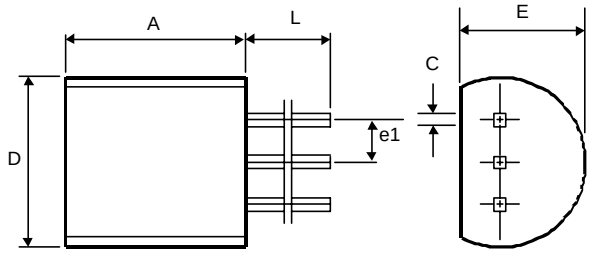
PHYSICAL DIMENSIONS

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



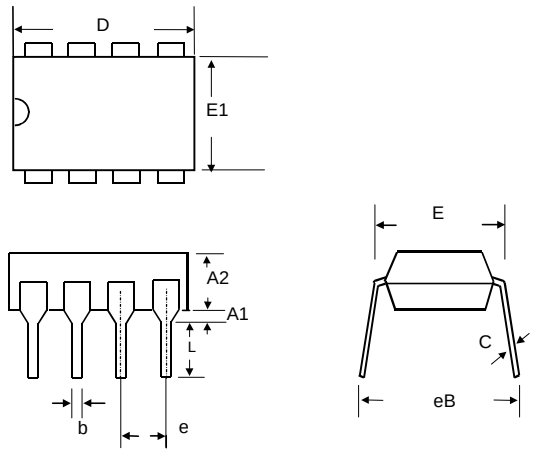
SYMBOL	MIN	MAX
A	1.40	1.60
B	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.62	1.83
E	2.29	2.60
e	1.50 (TYP.)	
e1	3.00 (TYP.)	
H	3.94	4.25
L	0.89	1.20

- **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	-

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



SYMBOL	MIN	MAX
A1	0.381	—
A2	2.92	4.96
b	0.35	0.56
C	0.20	0.36
D	9.01	10.16
E	7.62	8.26
E1	6.09	7.12
e	2.54 (TYP)	
eB	—	10.92
L	2.92	3.81