

Micropower Voltage Reference

FEATURES

- Low Output Voltage 1.235V
- Dynamic Impedance..... 1Ω max
- Low Temperature Coefficient.....30ppm/ $^{\circ}\text{C}$ (typ)
- Operating Current..... $10\mu\text{A}$ to 20mA
- Extended Temperature Range .. -40°C to $+85^{\circ}\text{C}$
- Initial Tolerance.....1% and 2%
- Pin Compatible with LM185/285/385, 1.23V

APPLICATIONS

- Portable Meter Reference
- Portable Test Instruments
- Battery Operated Systems
- Panel Meters

DESCRIPTION

The SPX385-1.2 is a micropower 2-terminal band-gap voltage reference with a very wide operating current range from $10\mu\text{A}$ to 20mA that provides a stable voltage. The high stability of this device is primarily the result of the low temperature coefficient Thin Film Resistor process and Laser Trimming of the output voltage at the wafer level.

The SPX385-1.2 is available in a TO-92, SOIC-8 and SOT-89 package with an operating temperature range of -40°C to 85°C . A 2.5 volt device is also available - SPX385-2.5.

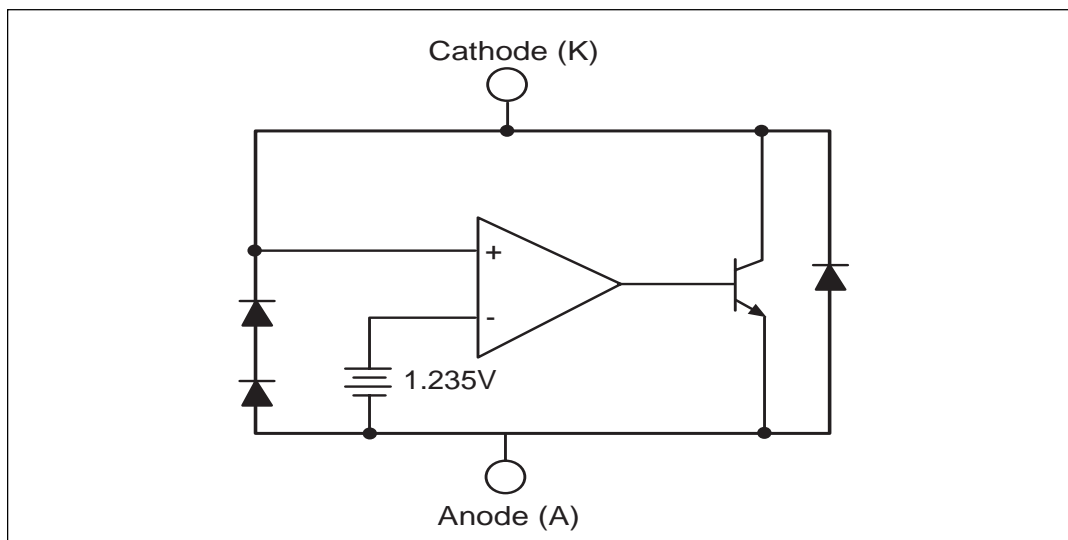


Figure 1: Block Diagram

ABSOLUTE MAXIMUM RATINGS

Reverse Current (I_{KA})	30mA
Forward Current (I_{AK})	10mA
Operating Temperature Range (T_A)	-40 to +85°C
Continuous Power Dissipation at 25°C (P_D)	
TO-92	775mW
SOIC-8	750mW
SOT-89	1000mW
Junction Temperature (T_J)	150°C
Storage Temperature (T_{STG})	- 65 to 150°C
Lead Temperature (Soldering 10 sec.), T_L	300°C

Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

TYPICAL THERMAL RESISTANCES

PACKAGE	θ_{JA}	θ_{JA}	TYPICAL DERATING
TO-92	160°C/W	80°C/W	6.3 mW/°C
SOIC-8	175°C/W	45°C/W	5.7mW/°C
SOT-89	110°C/W	8°C/W	9.1mW/°C

ELECTRICAL CHARACTERISTICS

$I_{IN} = 100\mu A$, $T_A = 25^\circ C$, unless otherwise specified.

PARAMETER	CONDITIONS	SPX385A-1.2			SPX385-1.2			UNIT
		MIN.	TYP.	MAX	MIN.	TYP.	MAX.	
Reference Voltage		1.223	1.235	1.247	1.205	1.235	1.260	V
Dynamic Output Impedance	$F = 20\text{Hz}$ $I_R = 100\mu A$		0.6	1.0		0.6	1.0	Ω
Reference Voltage Change with I_R	$10\mu A \leq I_R \leq 20\text{mA}$		10	20		10	20	mV
Temperature Coefficient	Note 1		30	50		30	50	ppm/°C
Minimum Operating Current			8	10		8	10	μA
Output Wideband Noise	$10\text{Hz} \leq f \leq 10\text{kHz}$		60			60		μV_{rms}
Operating Temperature		-40		+85	-40		+85	°C

Note 1. Three-point measurement guarantees the error band over the specified temperature range.

*CALCULATING AVERAGE TEMPERATURE COEFFICIENT (TC)

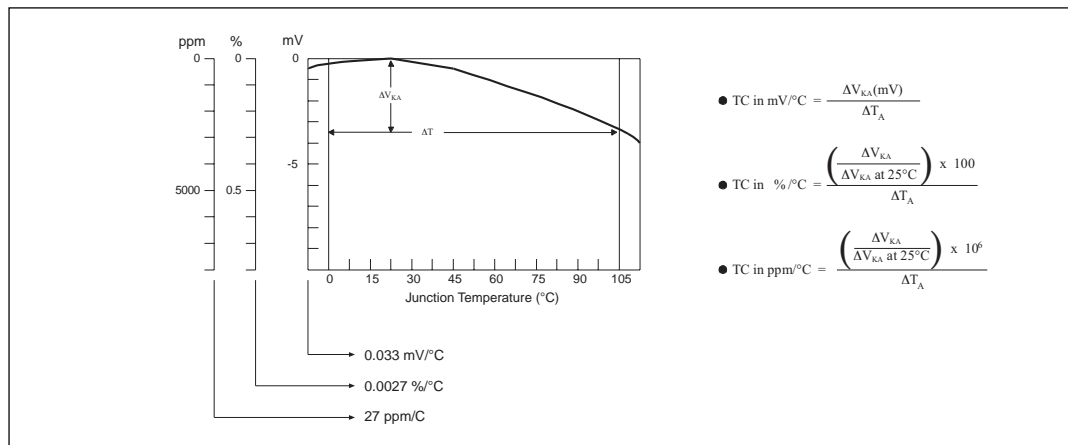


Figure 2. V_{REF} vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS

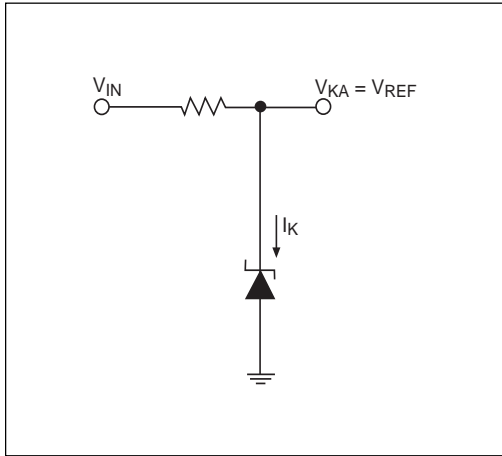


Figure 3. Test Circuit for $V_{KA} = V_{REF}$

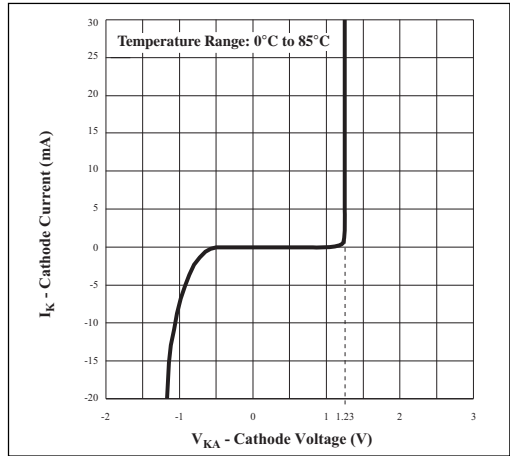


Figure 4. High Current Operating Characteristics

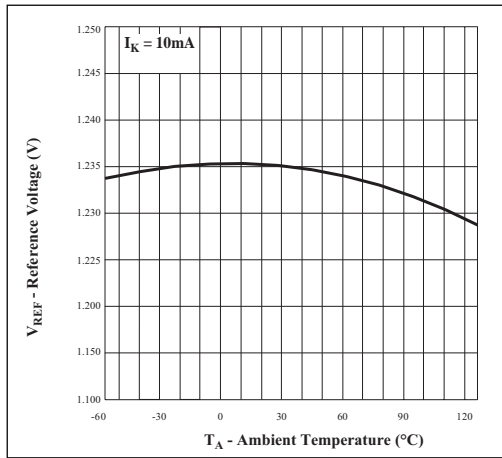


Figure 5. Reference Voltage vs. Ambient Temperature

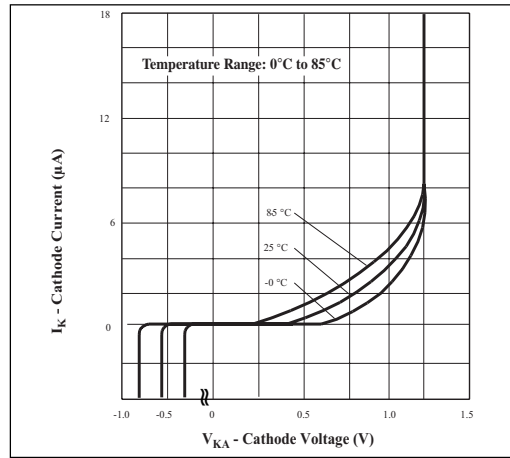


Figure 6. Low Current Operating Characteristics

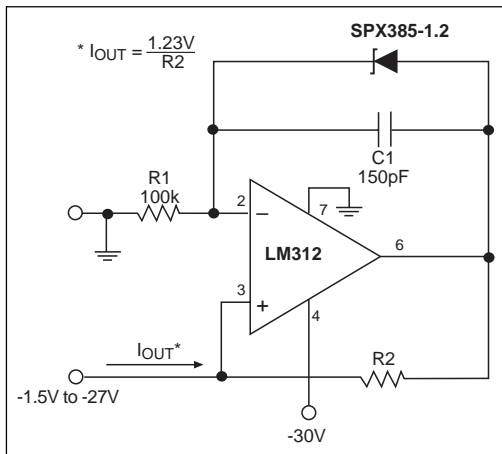


Figure 7a. Precision $1\mu\text{A}$ to 1mA Current Sink

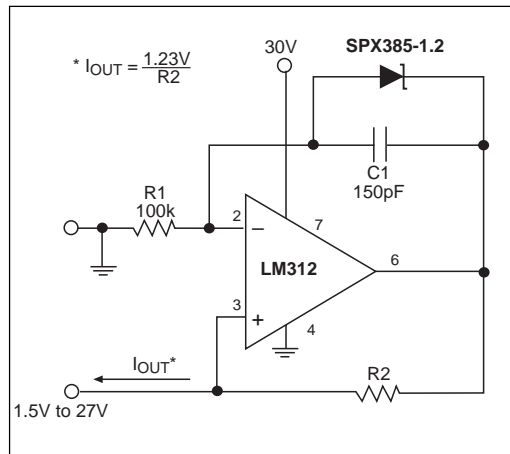


Figure 7b. Precision $1\mu\text{A}$ to 1mA Current Source

TYPICAL PERFORMANCE CHARACTERISTICS

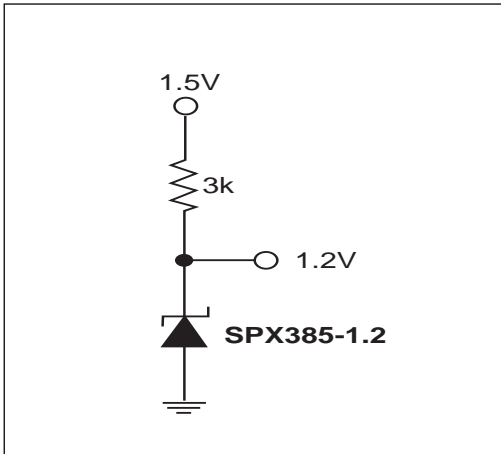


Figure 8. Reference from 1.5V Battery

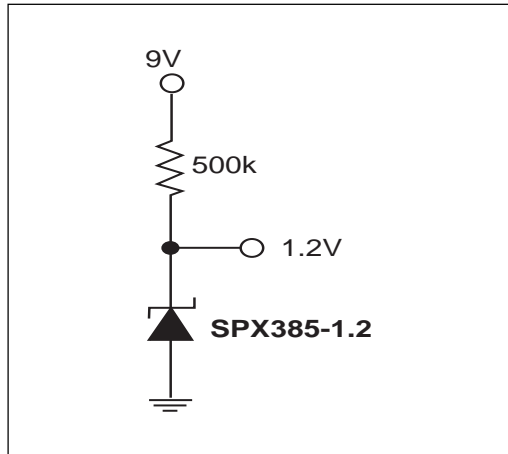


Figure 9. Micropower Reference from 9V Battery

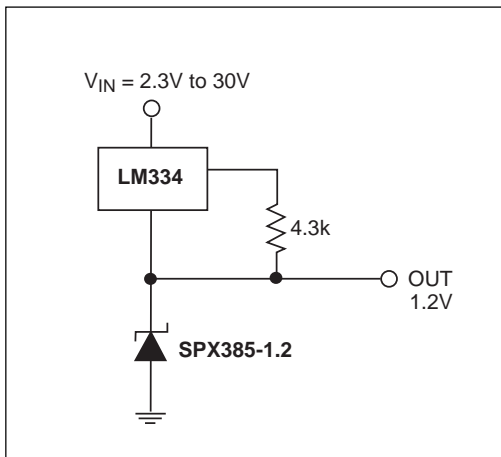


Figure 10. Wide Input Range Reference

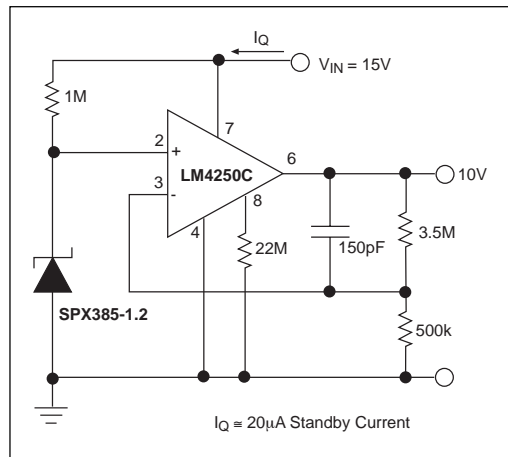
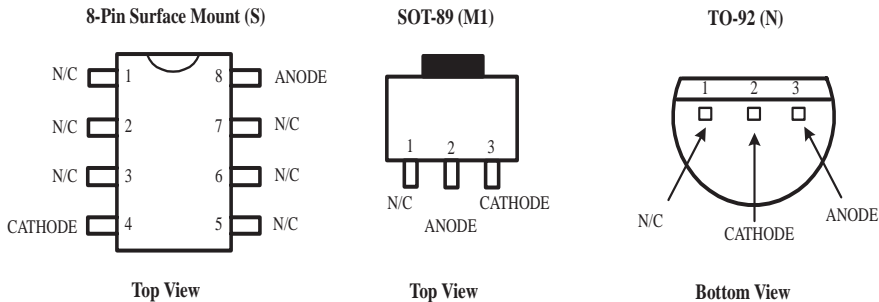


Figure 11. Precision Micropower 10V Reference

PACKAGES



ORDERING INFORMATION

Part Number	Accuracy	Output Voltage	Package Type
SPX385AM1-1.2	1.0%	1.235V	3-Pin SOT-89
SPX385AS-1.2	1.0%	1.235V	8-Pin SOIC
SPX385AN-1.2	1.0%	1.235V	3-Pin TO-92
SPX385M1-1.2	2.0%	1.235V	3-Pin SOT-89
SPX385S-1.2	2.0%	1.235V	8-Pin SOIC
SPX385N-1.2	2.0%	1.235V	3-Pin TO-92



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Sipex Corporation

Headquarters and Sales Office:
 233 Hillview Dr
 Milpitas, CA 95035
 TEL: (408) 934-7500
 FAX: (408) 935-7600

Sales Office:
 22 Linnell Circle
 Billerica, MA 01821
 TEL: (978) 667-8700
 FAX: (978) 670-9001

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