



LM385/LM385B

Adjustable Micropower Voltage Reference

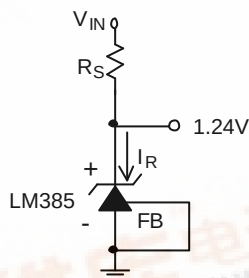
FEATURES

- Adjustable from 1.24V to 5.3V.
- Operating Current from 10 μ A 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.

TYPICAL APPLICATION CIRCUIT



Precision 1.24V Voltage Reference

DESCRIPTION

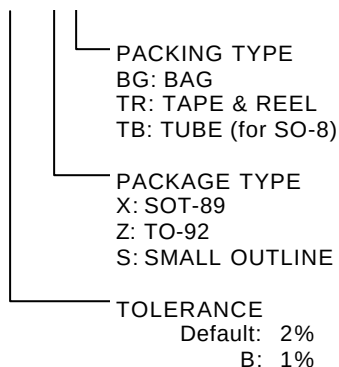
The LM385 is micropower 3-terminal adjustable band-gap voltage reference. Operating from 1.24V to 5.3V and over 10 μ A to 20mA current range. They feature exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to achieve tight voltage tolerance. Since the LM385 band-gap reference uses only transistors and resistors, low noise and good longterm stability result.

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

The extremely low power drain of the LM385 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 part.

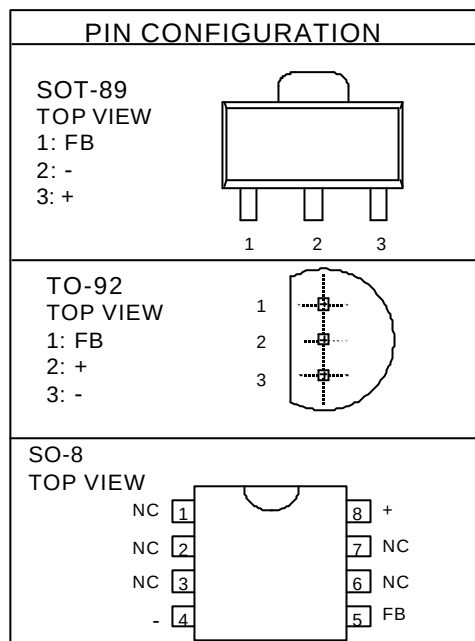
ORDERING INFORMATION

LM385X-CXXX



Example: LM385-CXTR

→ 2% version, in SOT-89 Package & Taping & Reel Packing Type
(CS is not available in BAG packing type.)



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 ($T_A=25^{\circ}\text{C}$, unless otherwise specified.)

PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Reverse Voltage	$I_R=100\mu\text{A}$	LM385B LM385	V_R	1.228 1.215	1.240 1.240	1.252 1.265	V
Reverse Voltage Change with Current	$I_{R\text{MIN}} \leq I_R \leq 1\text{mA}$ $1\text{mA} \leq I_R \leq 20\text{mA}$		ΔV_R		0.2 5	1 15	mV
Minimum Operating Current	$V_{\text{OUT}}=1.24\text{V}$ $V_{\text{OUT}}=5.3\text{V}$		$I_{R\text{MIN}}$		7 35	11 55	μA
Dynamic Output Impedance	$I_R=100\mu\text{A}$, $f=100\text{Hz}$ $I_{AC}=0.1I_R$, $V_{\text{OUT}}=1.24\text{V}$, $V_{\text{OUT}}=5.3\text{V}$		Z_R		0.4 1		Ω
Reference Voltage Change with Output Voltage	$I_R=100\mu\text{A}$				2	5	mV
Feedback Current			I_{FB}		8	20	nA
Output Wideband Noise	$I_R=100\mu\text{A}$, $10\text{Hz} < f < 10\text{KHz}$ $V_{\text{OUT}}=1.24\text{V}$, $V_{\text{OUT}}=5.3\text{V}$		e_N		50 170		μV_{RMS}
Average Temperature Coefficient (Note)	$I_R=100\mu\text{A}$		αV_R		100		ppm/ $^{\circ}\text{C}$
Long Term Stability	$I_R=100\mu\text{A}$, $T=1000\text{Hrs}$, $T_A=25^{\circ}\text{C} \pm 0.1^{\circ}\text{C}$		$\Delta V_R/\Delta t$		20		ppm

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

TYPICAL PERFORMANCE CHARACTERISTICS

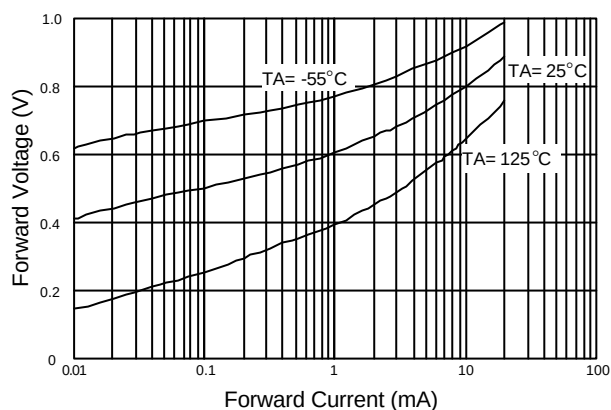


Fig. 1 Forward characteristics

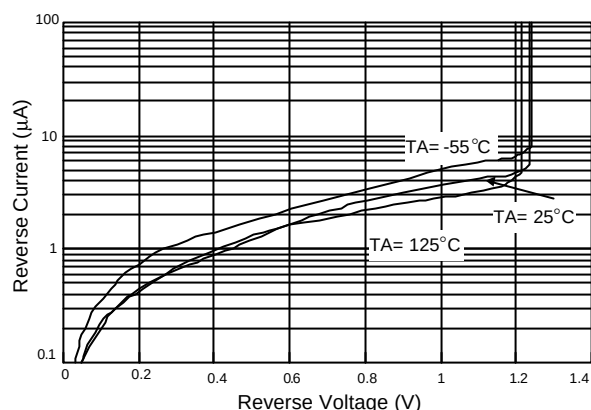


Fig. 2 Reverse Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

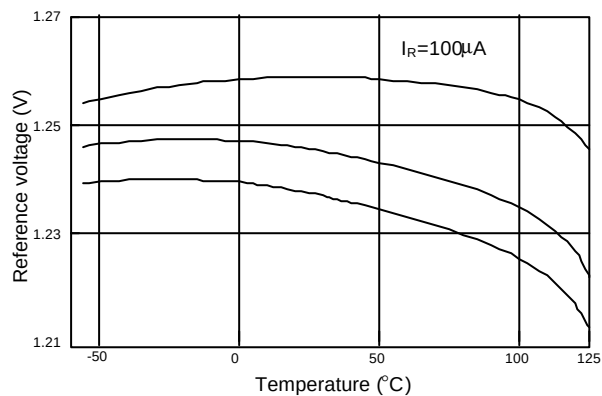


Fig. 3 Temperature Drift of 3 Representative Units

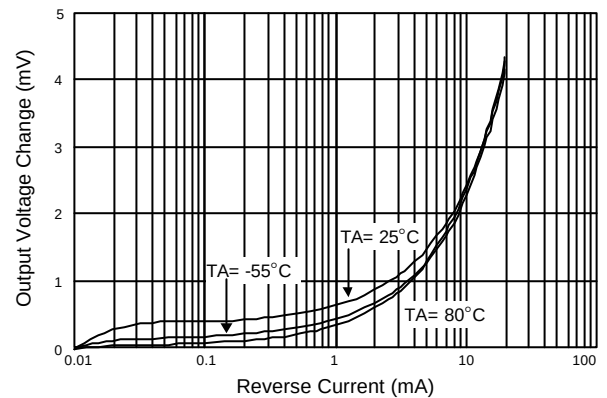


Fig. 4 Reverse Characteristics

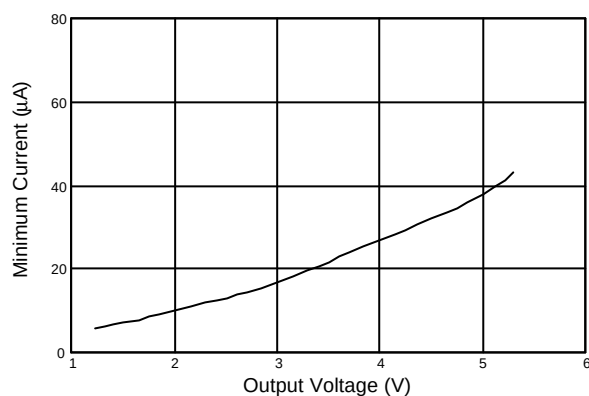


Fig. 5 Minimum Operating Current

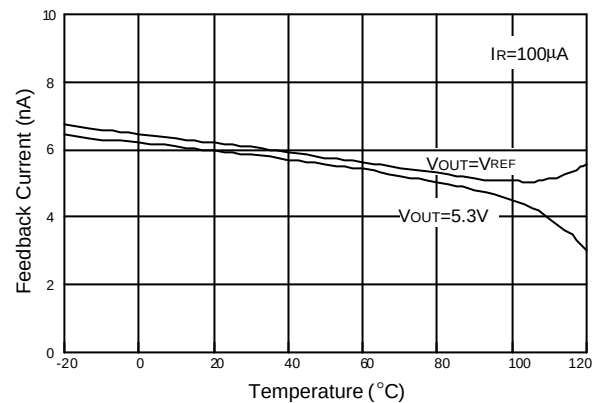


Fig. 6 Feedback Current

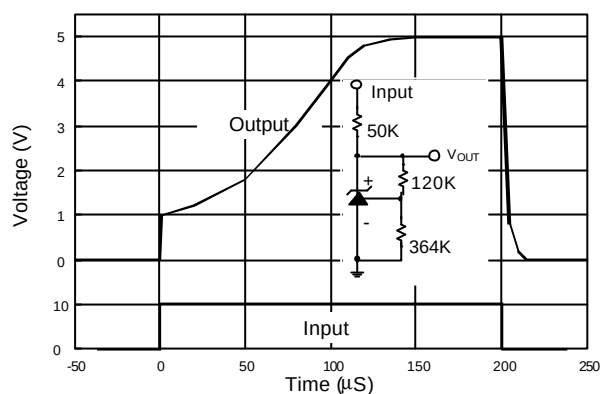


Fig. 7 Response Time

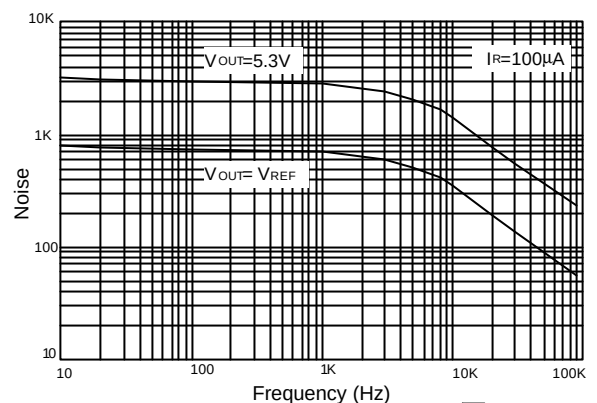
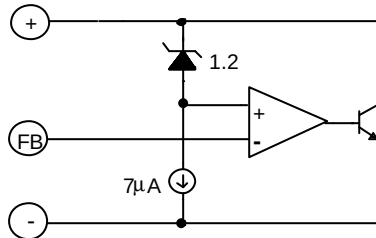
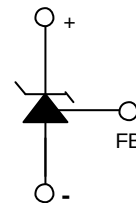


Fig. 8 Output Noise Voltage ($nV/\sqrt{Hz}$)

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

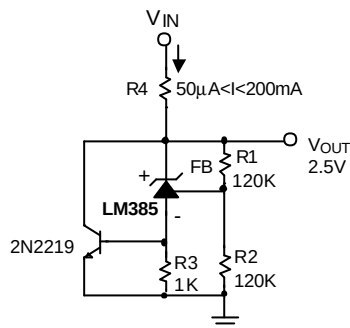


Fig. 9 200mA Shunt Regulator

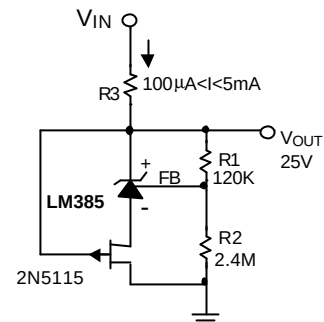


Fig. 10 25V Low Current Shunt Regulator

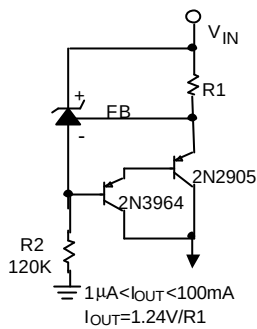


Fig. 11 Current Source

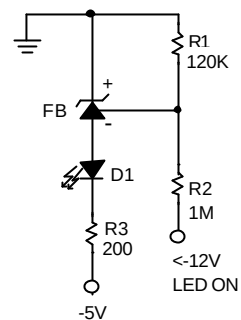


Fig. 12 Voltage Level Detector

APPLICATION EXAMPLES (Continued)

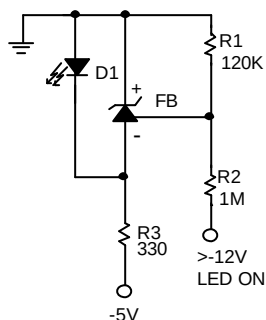
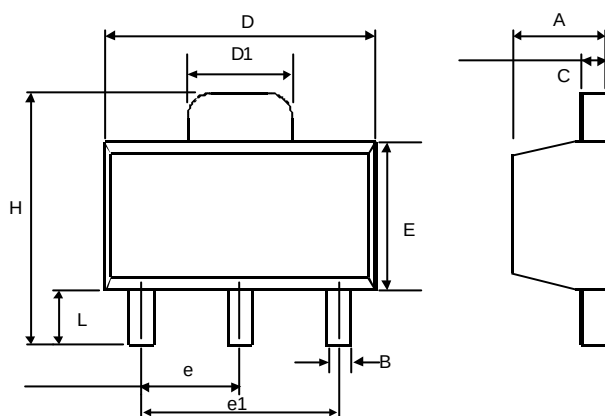


Fig. 13 Voltage Level Detector

PHYSICAL DIMENSIONS

SOT-89 (unit: mm)

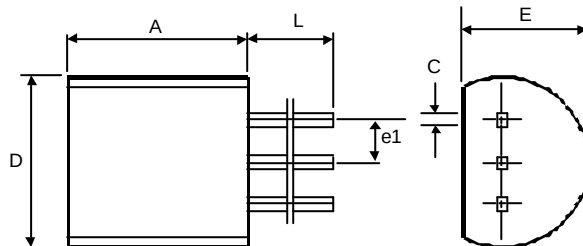


SYMBOL	MIN	MAX
A	1.40	1.60
B	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.62	1.83
E	2.29	2.60
e	1.50 (TYP.)	
e1	3.00 (TYP.)	
H	3.94	4.25
L	0.89	1.20

SOT-89 Marking

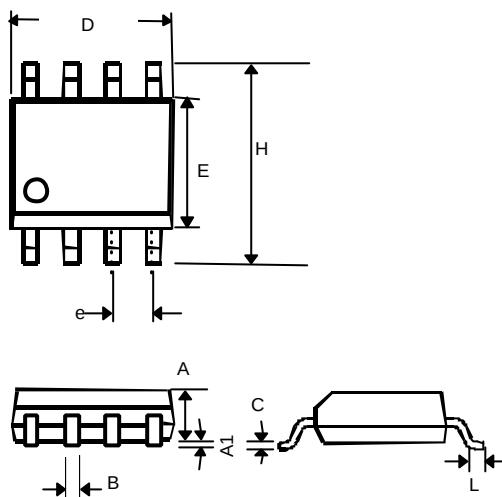
Part No.	Marking
LM385CX	AI01
LM385BCX	AIB01

● 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 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