

MNLM185B-X REV 0A0

Original Creation Date: 08/15/95

Last Update Date: 02/03/99

Last Major Revision Date: 08/15/95

ADJUSTABLE MICROPOWER VOLTAGE REFERENCE

General Description

The LM185B is a micropower 3-terminal adjustable band-gap voltage reference diode. Operating from 1.24 to 5.3V and over a 10 uA to 20 mA current range, it features exceptionally low dynamic impedance and good temperature stability. On-chip trimming is used to provide tight voltage tolerance. Since the LM185B band-gap reference uses only transistors and resistors, low noise and good long-term stability result.

Careful design of the LM185B 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 LM185B 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.

Industry Part Number

LM185B

NS Part Numbers

LM185BE/883

LM185BH/883

Prime Die

LM185

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (°C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

Features

- Adjustable from 1.24V to 5.30V.
- Operating current of 10 uA to 20 mA.
- 1% and 2% initial tolerance.
- 1 Ohm dynamic impedance.
- Low temperature coefficient.

(Absolute Maximum Ratings)

(Note 1)

Reverse Current	30mA
Forward Current	10mA
Operating Temperature Range	-55 C to +125 C
Maximum Junction Temperature	150 C
Storage Temperature	-55 C to +150 C
Lead Temperature (Soldering, 10 seconds)	300 C
Thermal Resistance	
ThetaJA	
E-Pkg (Still Air)	100 C/W
E-Pkg (500LF/Min Air flow)	73 C/W
H-Pkg (Still Air)	300 C/W
H-Pkg (500LF/Min Air flow)	139 C/W
ThetaJC	
E-Pkg	25 C/W
H-Pkg	57 C/W
Package Weight (Typical)	

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Electrical Characteristics

DC PARAMETERS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vref	Reference Voltage	Ir = 100uA			1.228	1.252	V	1
					1.215	1.255	V	2, 3
		Ir = 9uA			1.228	1.252	V	1
					1.215	1.255	V	2, 3
		Ir = 1mA			1.228	1.252	V	1
					1.215	1.255	V	2, 3
		Ir = 20mA			1.228	1.252	V	1
					1.215	1.255	V	2, 3
		Vr = 5.3V, Ir = 100uA			1.228	1.252	V	1
					1.215	1.255	V	2, 3
		Vr = 5.3V, Ir = 45uA			1.288	1.252	V	1
		Vr = 5.3V, Ir = 50uA			1.215	1.255	V	2, 3
		Vr = 5.3V, Ir = 1.0mA			1.288	1.252	V	1
					1.215	1.255	V	2, 3
		Vr = 5.3V, Ir = 20mA			1.288	1.252	V	1
					1.215	1.255	V	2, 3
Delta Vref/Delta Ir	Reference Voltage Change with Current	9uA ≤ Ir ≤ 1mA				1	mV	1
		10uA ≤ Ir ≤ 1mA				1.5	mV	2, 3
		1mA ≤ Ir ≤ 20mA				10	mV	1
		1mA ≤ Ir ≤ 20mA				20	mV	2, 3
		Vr = 5.3V, 45uA ≤ Ir ≤ 1mA				1	mV	1
		Vr = 5.3V, 50uA ≤ Ir ≤ 1mA				1.5	mV	2, 3
		Vr = 5.3V, 1mA ≤ Ir ≤ 20mA				10	mV	1
		Vr = 5.3V, 1mA ≤ Ir ≤ 20mA				20	mV	2, 3
Delta Vref/Delta Vo	Reference Voltage Change with Output Voltage	Vr = 5.3V, Ir = 100uA				3	mV	1
						6	mV	2, 3

Electrical Characteristics

DC PARAMETERS(Continued)

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
If	Feedback Current	Ir = 9uA				20	nA	1
		Ir = 10uA				25	nA	2, 3
		Ir = 20mA				20	nA	1
						25	nA	2, 3
		Vr = 5.3V, Ir = 45uA				20	nA	1
		Vr = 5.3V, Ir = 50uA				25	nA	2, 3
		Vr = 5.3V, Ir = 20mA				20	nA	1
						25	nA	2, 3
Ic	Minimum Operating Current	Vr = Vref	1		9		uA	1
			1		10		uA	2, 3
		Vr = 5.3V	1		45		uA	1
			1		50		uA	2, 3

Note 1: Functional Test.

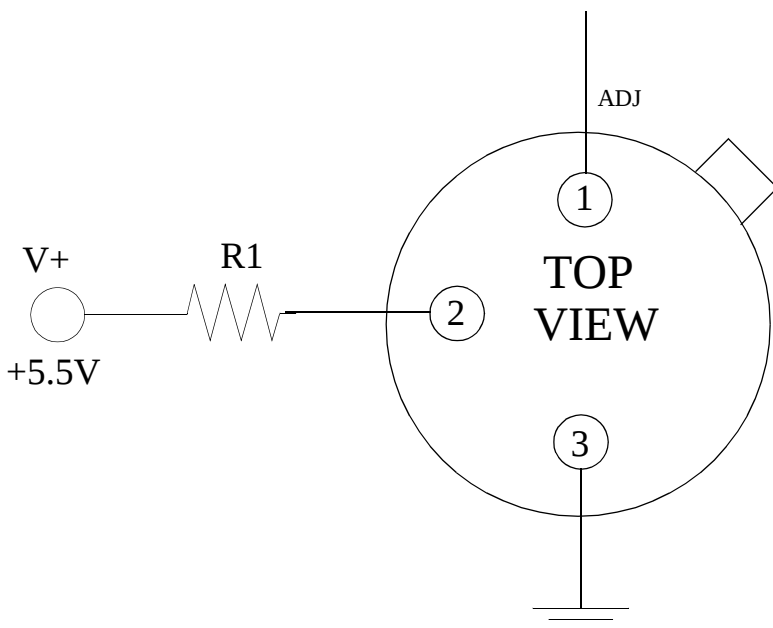
Graphics and Diagrams

GRAPHICS#	DESCRIPTION
05886HRB2	METAL CAN, T0-46, 2LD, .100 DIA P.C. (H) (B/I CKT)
06175HRB2	LCC (E), TYPE C, 20 TERMINAL (B/I CKT)
E20ARE	LCC (E), TYPE C, 20 TERMINAL (P/P DWG)
H02ARE	METAL CAN, T0-46, 2LD, .100 DIA P.C. (H) (P/P DWG)
P000188A	METAL CAN (H), T0-46, 3 LEAD (PINOUT)
P000366B	LCC (E), 20 LEAD (PINOUT)

See attached graphics following this page.

1. GENERIC - INDUSTRY TYPE DEVICES THAT MAY BE USED WITH THIS CIRCUIT SHALL BE AS SPECIFIED IN NSC BURN-IN CIRCUIT LIST R512B-04.
2. ALL 1/4 AND 1/2 WATT RESISTORS SHALL BE METAL FILM. ALL 1, 2, AND 3 WATT RESISTORS SHALL BE WIRE WOUND. TOLERANCE SHALL BE +/-5% UNLESS OTHERWISE SPECIFIED.
3. ALL VOLTAGES SPECIFIED SHALL BE MEASURED AT THE "DEVICE UNDER TEST" PIN AND SHALL BE MINIMUM VALUES UNLESS OTHERWISE SPECIFIED.
4. WHEN APPLICABLE, CLOCK PULSES SPECIFIED SHALL HAVE 50% DUTY CYCLE.
5. THIS DRAWING COMPLIES WITH MIL-PRF-38535, WHEN APPLICABLE.

ECN	REV	APPROVALS	DATE
	A1	R Wallace	10/21/87
	B1	P.Reid	2/13/92
	B2	J. GOMEZ	10/27/98

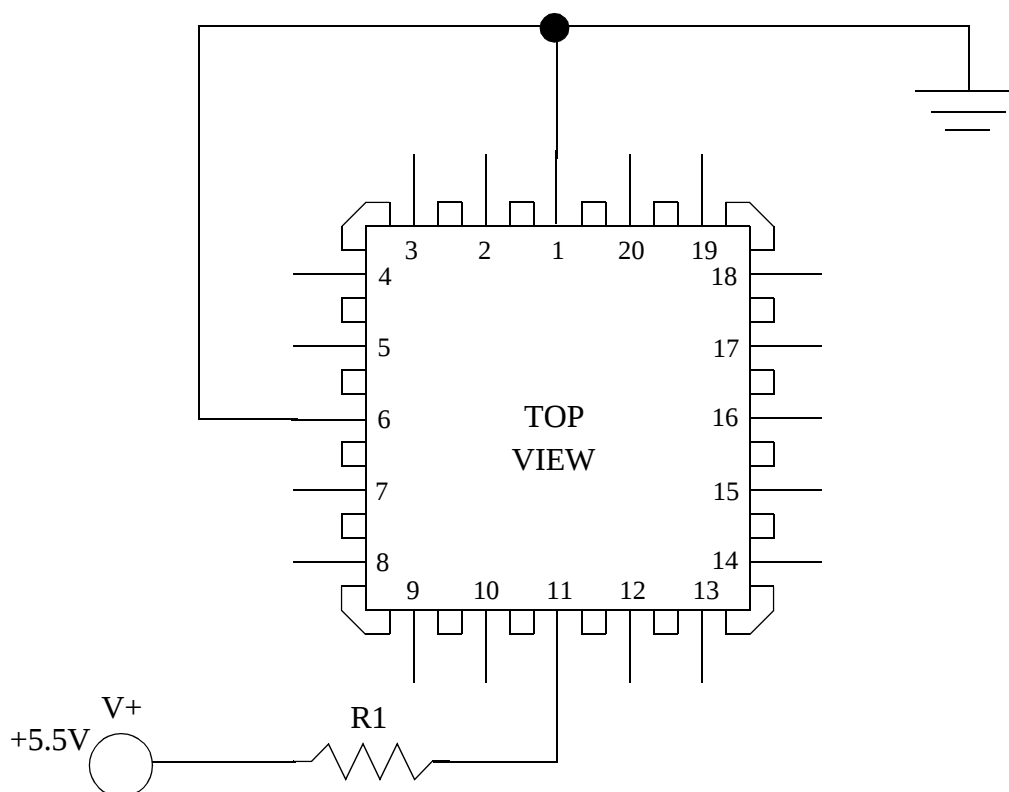
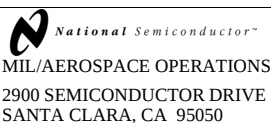
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 *National Semiconductor™*
MIL/AEROSPACE OPERATIONS
2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050

CUSTOMER			PACKAGE TYPE H03		MIL	NSC NOTE 7	TEST CONDITION C
ORIGINATOR J.GOMEZ	DATE 10/27/98	CHECKED BY	DATE	DRAWING NUMBER 05886HR		REV B2	

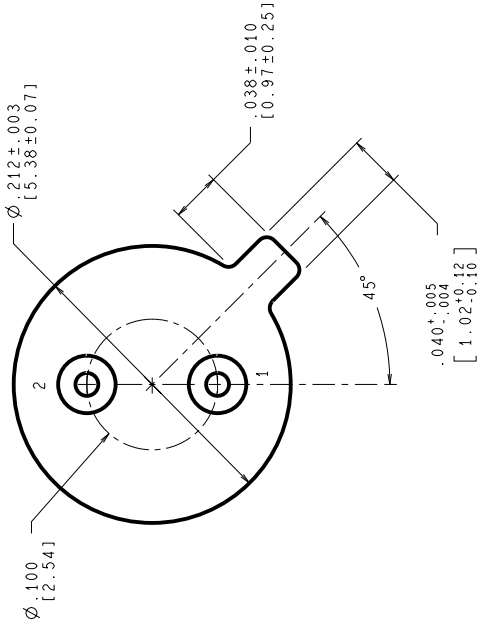
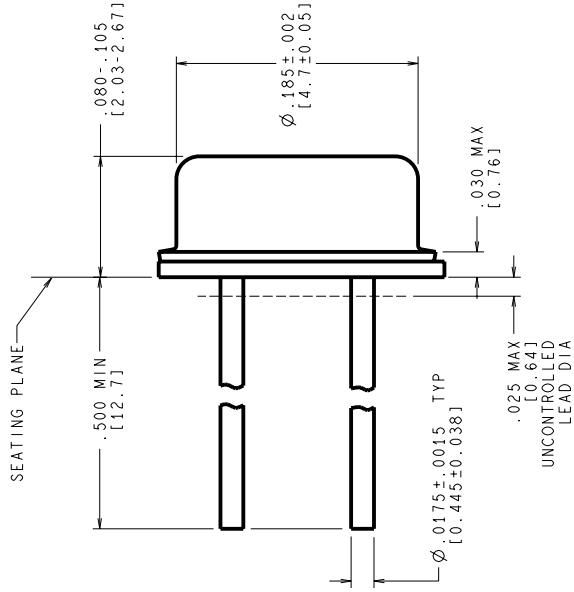
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ECN	REV	APPROVALS	DATE
<u>04192</u>	A1	RWALLACE	8/29/90
	B1	RWALLACE	10/10/90
	B2	J. GOMEZ	10/22/98

[illegible]

BURN-IN CIRCUIT							SH	OF	
CUSTOMER		PACKAGE TYPE	E20	MIL	NSC	NOTE 7	TEST CONDITION		C
ORIGINATOR	DATE	CHECKED BY	DATE	DRAWING NUMBER		REV			
J.GOMEZ	10/22/98			06175HR		B2			

REVISIONS			
LTR	DESCRIPTION	E.C.N.	DATE
D	REVISE & REDRAW PER NEW STANDARD	10402	05/04/1994
E	UPDATE TITLE & MIL/AERO STAMP;		TL/GY
E	CHANGE DWG SIZE FORMAT FROM B TO C.	12131	11/17/1998
			MS/



CONTROLLING DIMENSION IS INCH
VALUES IN () ARE MILLIMETERS

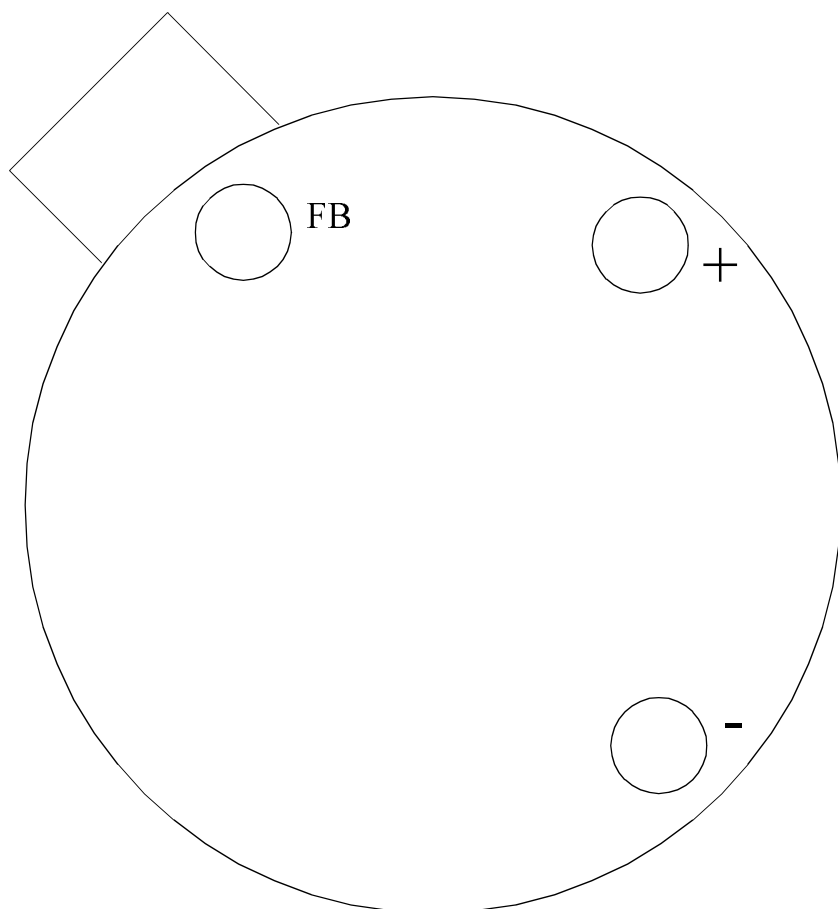
MIL-PRF-38535
CONFIGURATION CONTROL

- NOTES: UNLESS OTHERWISE SPECIFIED
- LEADS TO BE LOCATED WITHIN .007 IN/ 0.18 mm OF THEIR TRUE POSITIONS RELATIVE TO A MAXIMUM WIDTH TAB.
 - STANDARD METAL CAN TYPE: SOLID BASE.
 - APPLIES TO MIL-AERO AND LINEAR PRODUCTS.
 - REFERENCE JEDEC REGISTRATION TO-46, JEDEC PUBLICATION No. 95.

APPROVALS	DATE	<i>National Semiconductor</i>			
DESIGN T. LEUANG	05/04/1994	2900 Semiconductor dr., Santa Clara, CA 95052-8000			
ESTG. CHK.		METAL CAN, TO-46, 2 LEAD, .100 DIA P.C.			
ENGR. CHK.					
PROJECTION		SCALE	SIZE	DRAWING NUMBER	REV
		N/A	C	(SC)MKT-H02A	E
DO NOT SCALE DRAWING					
SHEET 1 of 1					

National Semiconductor
2500 Semiconductor dr., Santa Clara, CA 95052-8000

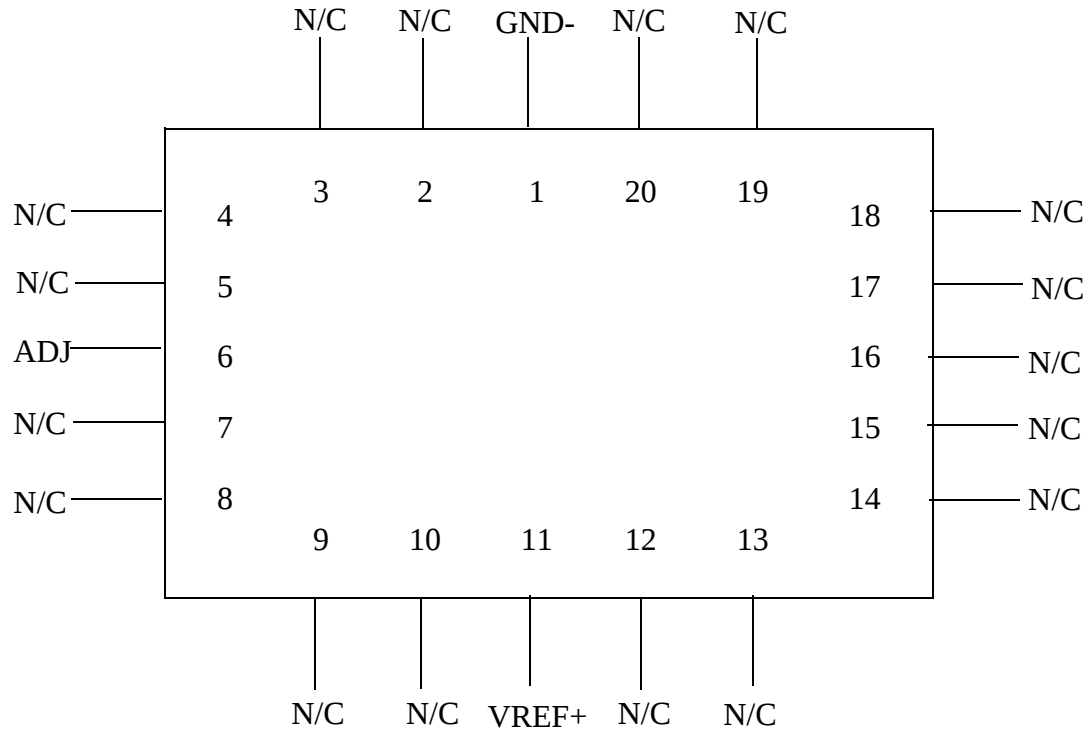
METAL CAN,
TO-46, 2 LEAD,
.100 DIA P.C.



LM185H
3 - LEAD TO-46
CONNECTION DIAGRAM
BOTTOM VIEW
P000188A



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LM185E
 20 - LEAD LCC
 CONNECTION DIAGRAM
 TOP VIEW
 P000366B



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 2900 SEMICONDUCTOR DRIVE
 SANTA CLARA, CA 95050

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0A0	M0003059	02/03/99	Rose Malone	Archive RETS185BX, Rev. 0A. Update MDS: MNLM185B-X, Rev. 0AL to MNLM185B-X, Rev. 0A0, Fully Released MDS. Updated Discription, Features and Absolute section. Verified NSID.