National Semiconductor

MICROCIRCUIT DATA SHEET

MNLM185BY-X REV 0A0

Original Creation Date: 08/15/95
Last Update Date: 07/30/99
Last Major Revision Date: 07/13/99

ADJUSTABLE MICROPOWER VOLTAGE REFERENCE

General Description

The LM185BY 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 LM185BY band-gap reference uses only transistors and resistors, low noise and good long-term stability result.

Careful design of the LM185BY 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 LM185BY 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

LM185BY

NS Part Numbers

LM185BYH-SMD
LM185BYH/883

Prime Die

LM185

Controlling Document

SEE FEATURES SECTION

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (^{O}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% initial tolerance.
- 1 Ohm dynamic impedance.
- Low temperature coefficient.
- CONTROLLING DOCUMENT
  LM185BYH 5962-9091401MXA

(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	
H-Pkg (Still Air)	300 C/W
H-Pkg (500LF/Min Air flow)	139 C/W
ThetaJC	
H-Pkg	57 C/W
Package Weight (Typcial)	

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
		Ir = 10uA			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
						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
						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
Tc	Temperature Coefficient		2			50	ppm/C	1, 2, 3

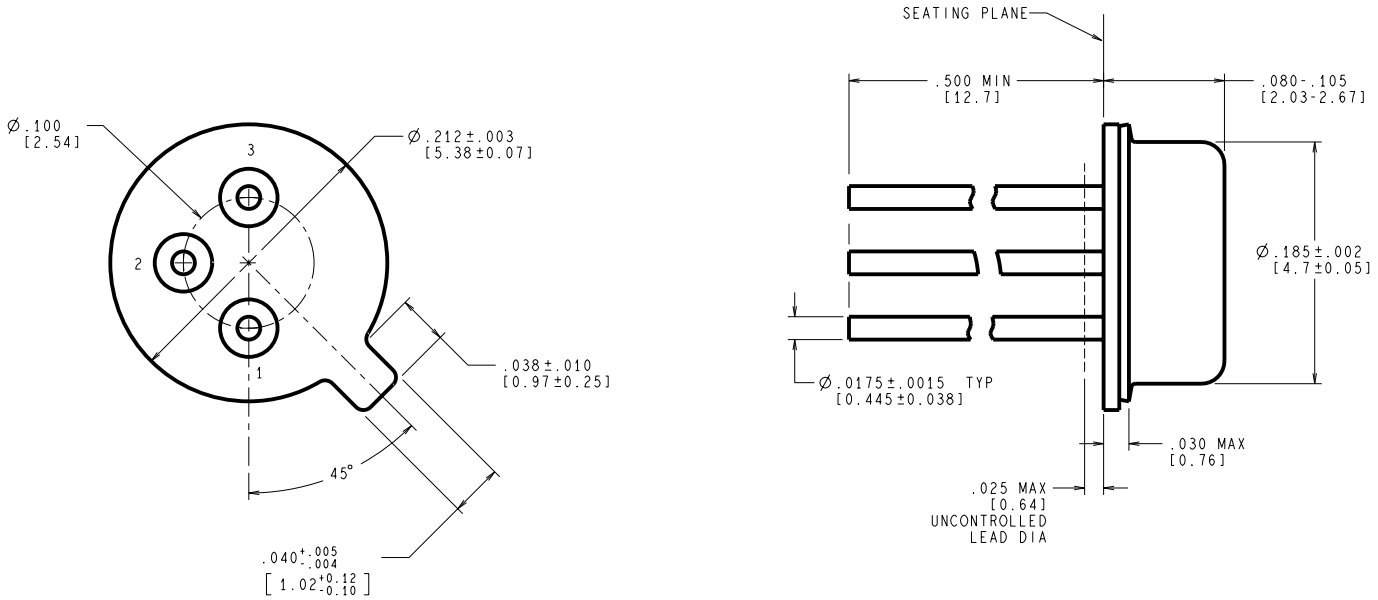
Note 1: Functional Test.
Note 2: The average temperature coefficient is defined as the maximum deviation of reference voltage at all measured temperatures between the operating Tmin and Tmax, divided by Tmax - Tmin. The measured temperatures are -55 C, -40 C, 0 C, 25 C, 70 C, 85 C and 125 C.

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
05886HRB2	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (B/I CKT)
H03HRE	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (P/P DWG)
P000188A	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (PIN OUT)

See attached graphics following this page.

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
D	REVISE & REDRAW PER NEW STANDARD	10404	05/19/94	TL/GY
E	UPDATE MIL/AERO STAMPS	11000	06/19/95	MS/



CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

NOTES: UNLESS OTHERWISE SPECIFIED

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

MIL-I-38535
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN T. LEQUANG	05/19/94
DFTG. CHK.	
ENGR. CHK.	

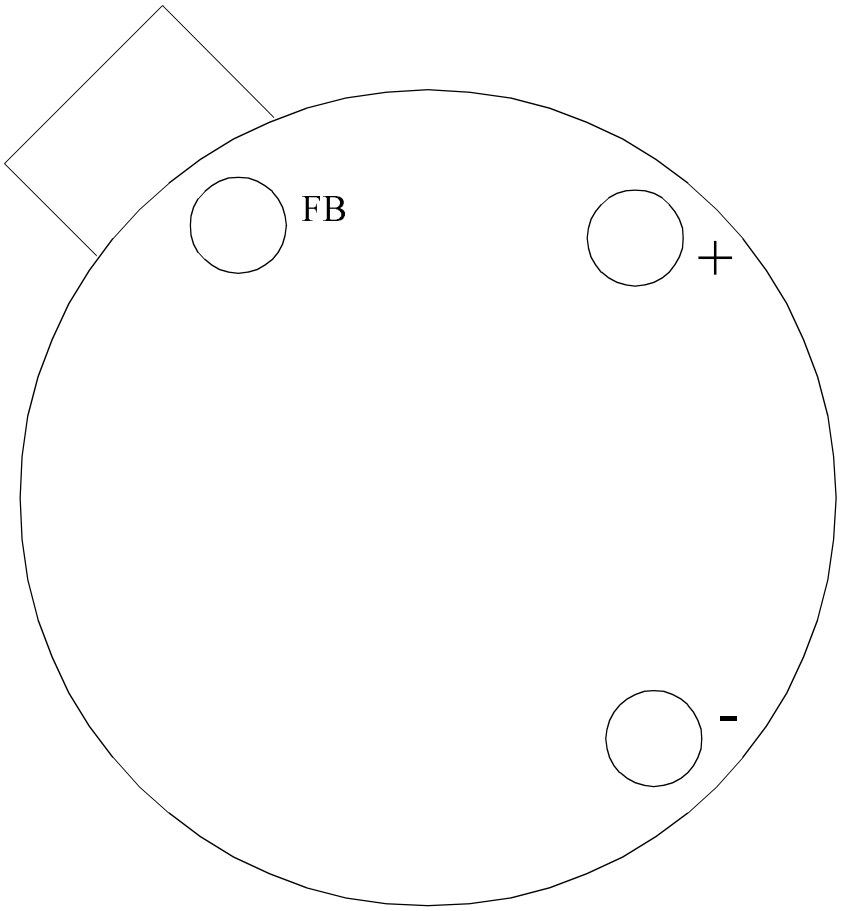
National Semiconductor
2900 Semiconductor dr, Santa Clara, CA 95052-8090

METAL CAN, TO-46, 3 LEAD, .100 DIA P.C.

PROJECTION
INCH [MM]

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-H03H	E

DO NOT SCALE DRAWING | SHEET 1 of 1



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

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

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0A0	M0003465	07/30/99	Rose Malone	Archive RETS185BX, Rev. 0A. Updated MNLM185BY-X, Rev. 0AL to MNLM185BY-X, Rev. 0A0. Fully Released MDS. Updated Discription, Features and Absolute section. Verified NSID.