

**MNLM113-X REV 1B1**

 Original Creation Date: 06/30/95  
 Last Update Date: 04/18/00  
 Last Major Revision Date: 11/07/96

**REFERENCE DIODE**
**General Description**

The LM113 is a temperature compensated, low voltage reference diode. It features extremely-tight regulation over a wide range of operating currents in addition to an unusually-low breakdown voltage and good temperature stability.

The diode is synthesized using transistors and resistors in a monolithic integrated circuit. As such, it has the same low noise and long term stability as modern IC op amps. Further, output voltage of the reference depends only on highly-predictable properties of components in the IC; so they can be manufactured and supplied to tight tolerances.

The characteristics of this reference recommend it for use in bias-regulation circuitry, in low-voltage power supplies or in battery powered equipment. The fact that the breakdown voltage is equal to a physical property of silicon—the energy-band gap voltage—makes it useful for many temperature-compensation and temperature-measurement functions.

**Industry Part Number**

LM113

**Prime Die**

LM113

**NS Part Numbers**

 LM113H-QMLV  
 LM113H-SMD  
 LM113H/883  
 LM113WG-QMLV  
 LM113WG-SMD

**Controlling Document**

SEE FEATURES SECTION

**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**

- Low breakdown voltage: 1.220V
- Dynamic impedance of 0.3 Ohms from 500uA to 20mA
- Temperature stability typically 1% over -55 C to 125 C range

CONTROLLING DOCUMENTS:

LM113H-QMLV	5962-9684301VXA
LM113H-SMD	5962-8671101XA
LM113WG-QMLV	5962-9684301VZA
LM113WG-SMD	5962-8671101ZA

**(Absolute Maximum Ratings)**

(Note 1)

Power Dissipation (Note 2)		100mW
Reverse Current		50mA
Forward Current		50mA
Storage Temperature Range		-65 C to +150 C
Lead Temperature (Soldering, 10 seconds)		300 C
Operating Temperature Range		-55 C to + 125C
Maximum Junction Temperature		+150 C
Thermal Resistance		
ThetaJA		
Metal Can	(Still Air)	440 C/W
	(500LF/Min Air Flow)	TBD
CERAMIC SOIC	(Still Air)	218 C/W
	(500LF/Min Air Flow)	140 C/W
ThetaJC		
Metal Can		80 C/W
CERAMIC SOIC		27 C/W
ESD Tolerance (Note 3)		4000V

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.

Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by Tjmax (maximum junction temperature), ThetaJA (package junction to ambient thermal resistance), and TA (ambient temperature). The maximum allowable power dissipation at any temperature is  $P_{dmax} = (T_{jmax} - TA)/\Theta_{JA}$  or the number given in the Absolute Maximum Ratings, whichever is lower.

Note 3: Human body model, 1.5K Ohms in series with 100pF.

## Electrical Characteristics

### DC PARAMETERS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vzr	Zener Voltage	Ir = 1 mA			1.16	1.28	V	1
					1.157	1.283	V	2, 3
Delta Vzr	Delta Zener Voltage	0.5mA <= Ir <= 20mA				15	mV	1
		0.5mA <= Ir <= 10mA				15	mV	2, 3
Vf	Forward Voltage Drop	If = 1mA				1	V	1, 2, 3
Rr	Reverse Dynamic Impedance	Ir = 1mA	1			1	Ohm	4
		Ir = 10mA	1			0.8	Ohm	4

### DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)  
 DC: Delta calculations performed on JAN S and QMLV devices at Group B, Subgroup 5 "ONLY".

Vzr	Zener Voltage	Ir = 1mA			-0.02	0.02	V	1
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Note 1: Guaranteed parameter not tested.

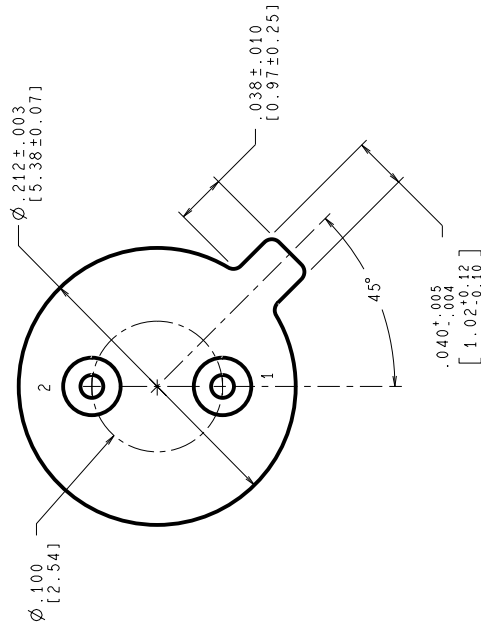
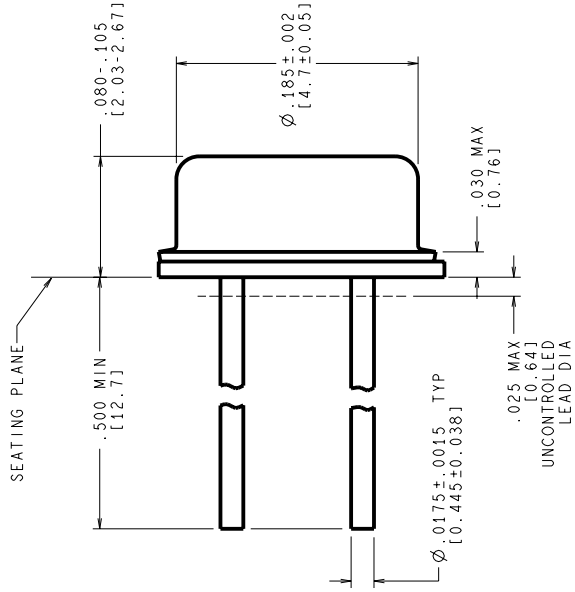
## Graphics and Diagrams

GRAPHICS#	DESCRIPTION
06331HRA6	CERAMIC SOIC (WG), 10 LEAD (B/I CKT)
09385HRA1	METAL CAN, TO-46,2LD, .100 DIA P.C. (B/I CKT)
H02ARE	METAL CAN, TO-46,2LD, .100 DIA P.C. (P/P DWG)
P000472A	CERAMIC SOIC (WG), 10 LEAD (PIN OUT)
P000475A	METAL CAN, TO-46,2LD, .100 DIA P.C. (PIN OUT)
WG10ARC	CERAMIC SOIC (WG), 10 LEAD (P/P DWG)

See attached graphics following this page.

REVISIONS

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



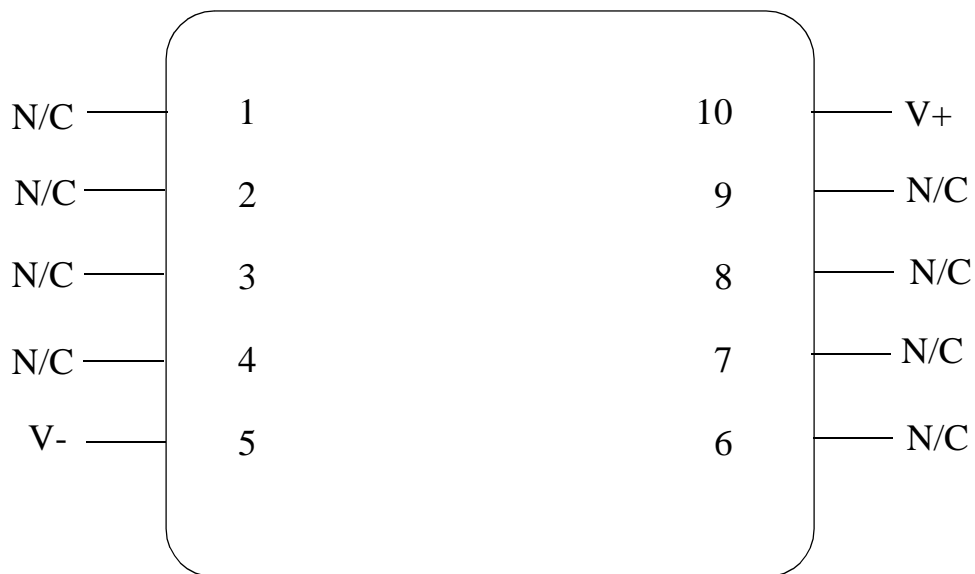
**CONTROLLING DIMENSION IS INCH  
VALUES IN ( ) ARE MILLIMETERS**

**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.

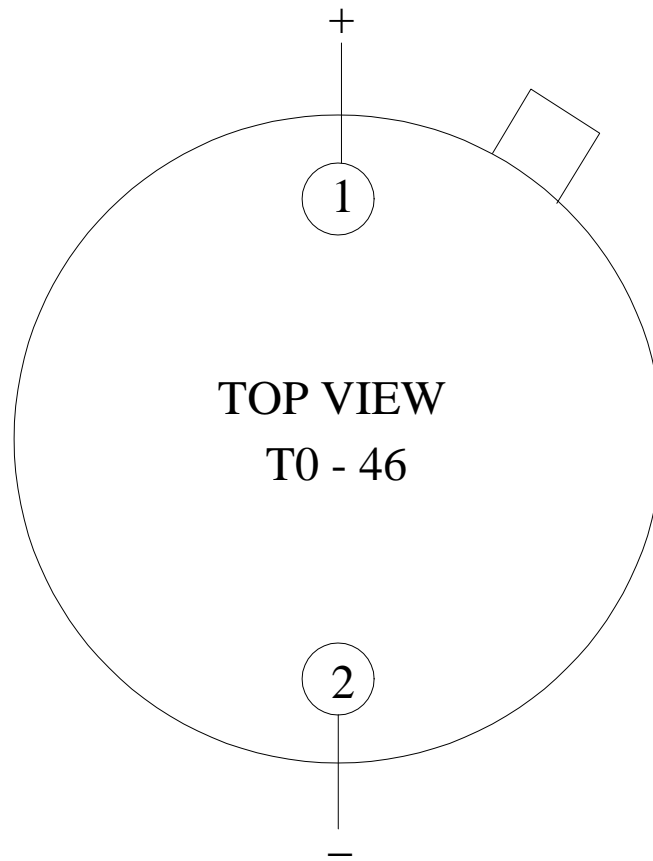
APPROVALS	DATE	SCALE	SIZE	DRAWING NUMBER	REV
DRW'G: T. LEQUANG	05/04/1994	N/A	C	(SC)MKT-H02A	E
DATE: 05/04/1994					
ENGR. CHK.					
PROJECTION					
DO NOT SCALE DRAWING					
National Semiconductor 2800 Semiconductor dr., Santa Clara, CA 95052-8090					
METAL CAN TO-46, 2 LEAD, .100 DIA P.C.					



**LM113WG**  
**10 - LEAD CERPACK SOIC**  
**CONNECTION DIAGRAM**  
**TOP VIEW**  
**P000472A**



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



LM103H, LM113H, LM129H  
2 - LEAD TO-46  
CONNECTION DIAGRAM  
TOP VIEW  
P000475A

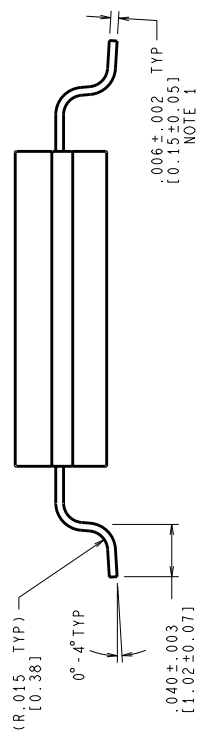
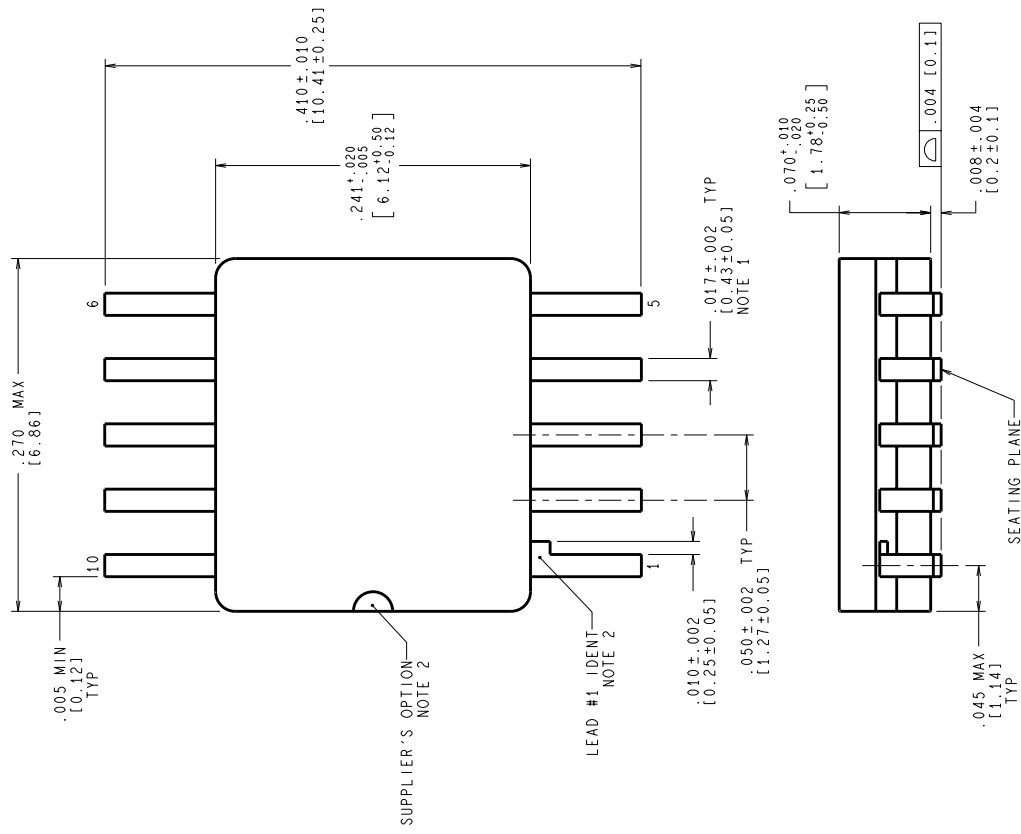


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2900 SEMICONDUCTOR DRIVE  
SANTA CLARA, CA 95050



REVISIONS

LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
A	RELEASE TO DOCUMENT CONTROL	11374	02/29/1996	MS/KH
B	LD PITCH TOL WAS ±.005; CHANGE LD RADIUS TO REF DIM; REMOVE THE OTHER R.006±.002 DIM. .040±.003 WAS .037±.003	11441	04/19/1996	MS/KH
C	R .015(0.38) WAS R .006(0.15)	11838	10/08/1997	TL/



CONTROLLING DIMENSION IS INCH  
VALUES IN | ARE MILLIMETERS

MIL-PRF-38535  
CONFIGURATION CONTROL

NOTES: UNLESS OTHERWISE SPECIFIED

- LEAD FINISH: SOLDER DIPPED WITH Sn60 OR Sn63 SOLDER CONFORMING TO MIL-PRF-38535 TO A MINIMUM THICKNESS OF 200 MICRONS/ 5.08 MICROMETERS. SOLDER MAY BE APPLIED OVER LEAD BASIS METAL OR Sn PLATE. MAXIMUM LIMIT MAY BE INCREASED BY .003 IN/ 0.08mm AFTER LEAD FINISH APPLIED.
- LEAD 1 IDENTIFICATION SHALL BE:
  - A NOTCH OR OTHER MARK WITHIN THIS AREA
  - A TAB ON LEAD 1, EITHER SIDE
- NO JEDEC REGISTRATION AS OF FEBRUARY 1996.

APPROVALS	DATE	SCALE	SIZE	DRAWING NUMBER	REV
DRN: MARYA SUCHY	02/29/96	N/A	C	(SC)MKT-WG10A	C
DATE: 02/29/96					
ENGR. CHK.					
NATIONAL SEMICONDUCTOR 2800 Semiconductor Dr., Santa Clara, CA 95052-8090					
CERPACK, 10 LEAD, GULL WING					
DO NOT SCALE DRAWING SHEET 1 of 1					

**Revision History**

<b>Rev</b>	<b>ECN #</b>	<b>Rel Date</b>	<b>Originator</b>	<b>Changes</b>
1B1	M0003665	04/18/00	Rose Malone	Update MDS: MNLM113-X, Rev. 1A0 to MNLM113-X, Rev. 1B1. Added reference to WG pkg and graphics to graphics section. Updated Absolute Section.