National Semiconductor

MICROCIRCUIT DATA SHEET

MNLM185-1.2-X REV 2A3

Original Creation Date: 08/15/95
Last Update Date: 12/12/02
Last Major Revision Date: 11/20/02

1.2V MICROPOWER VOLTAGE REFERENCE DIODE

General Description

The LM185-1.2 is a micropower 2-terminal band-gap voltage regulator diode. Operating 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 LM185-1.2 band-gap reference uses only transistors and resistors, low noise and good long term stability result.

Careful design of the LM185-1.2 has made the device exceptionally 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 LM185-1.2 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

LM185

Prime Die

LM185

Controlling Document

SEE FEATURES SECTION

NS Part Numbers

LM185E-1.2/883
LM185H-1.2-SMD
LM185H-1.2/883
LM185WG-1.2-QV
LM185WG-1.2/883

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

- Operating current of 10 uA to 20 uA
- 1.0 Ohms max dynamic impedance (Typical)
- Low temperature coefficient
- Low voltage reference-1.235V
- CONTROLLING DOCUMENT:

LM185E-1.2/883	5962-87594012A
LM185H-1.2-SMD	5962-8759401XA
LM185WG-1.2-QV	5962-8759401VYA
LM185WG-1.2/883	5962-8759401YA

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LM185

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Controlling Document

SEE FEATURES SECTION

NS Part Numbers

LM185E-1.2/883
LM185H-1.2-SMD
LM185H-1.2/883
LM185WG-1.2-QV
LM185WG-1.2/883

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

- Operating current of 10 uA to 20 uA
- 1.0 Ohms max dynamic impedance (Typical)
- Low temperature coefficient
- Low voltage reference-1.235V
- CONTROLLING DOCUMENT:

LM185E-1.2/883	5962-87594012A
LM185H-1.2-SMD	5962-8759401XA
LM185WG-1.2-QV	5962-8759401VYA
LM185WG-1.2/883	5962-8759401YA

(Absolute Maximum Ratings)

(Note 1)

Reverse Current		30mA
Forward Current		10mA
Operating Temperature Range		-55 C ≤ Ta ≤ +125 C
Maximum Junction Temperature (Note 2)		150 C
Storage Temperature		-55 C ≤ Ta ≤ +150 C
Lead Temperature (Soldering, 10 seconds)		
Metal Can		300 C
20 Lead LCC		300 C
CERAMIC SOIC		260 C
Thermal Resistance		
ThetaJA		
Metal Can	(Still Air)	300 C/W
	(500LF/Min Air Flow)	139 C/W
20 Lead LCC	(Still Air)	100 C/W
	(500LF/Min Air Flow)	73 C/W
CERAMIC SOIC	(Still Air)	194 C/W
	(500LF/Min Air Flow)	128 C/W
ThetaJC		
Metal Can		57 C/W
20 Lead LCC		25 C/W
CERAMIC SOIC		23 C/W
Package Weight (Typcial)		
Metal Can		TBD
20 Lead LCC		TBD
CERAMIC SOIC		210mg
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 Pdmax = (Tjmax - TA) /ThetaJA 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
Vref	Reverse Breakdown Voltage	Ir = 10uA			1.223	1.247	V	1
		Ir = 20uA			1.205	1.26	V	2, 3
		Ir = 1mA			1.223	1.247	V	1
					1.205	1.26	V	2, 3
		Ir = 20mA			1.223	1.247	V	1
					1.205	1.26	V	2, 3
Delta Vref/Delta Ir	Reverse Breakdown Voltage Change with Current	10uA ≤ Ir ≤ 1mA			-1.0	1.0	mV	1
		20uA ≤ Ir ≤ 1mA			-1.5	1.5	mV	2, 3
		1mA ≤ Ir ≤ 20mA			-10.0	10.0	mV	1
					-20.0	20.0	mV	2, 3
Vf	Forward Bias Voltage	If = 2mA			-1.0	-0.4	V	1

DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: "Delta Calculations performed after Burn-In and Group B-5, unless otherwise specified on IPI"

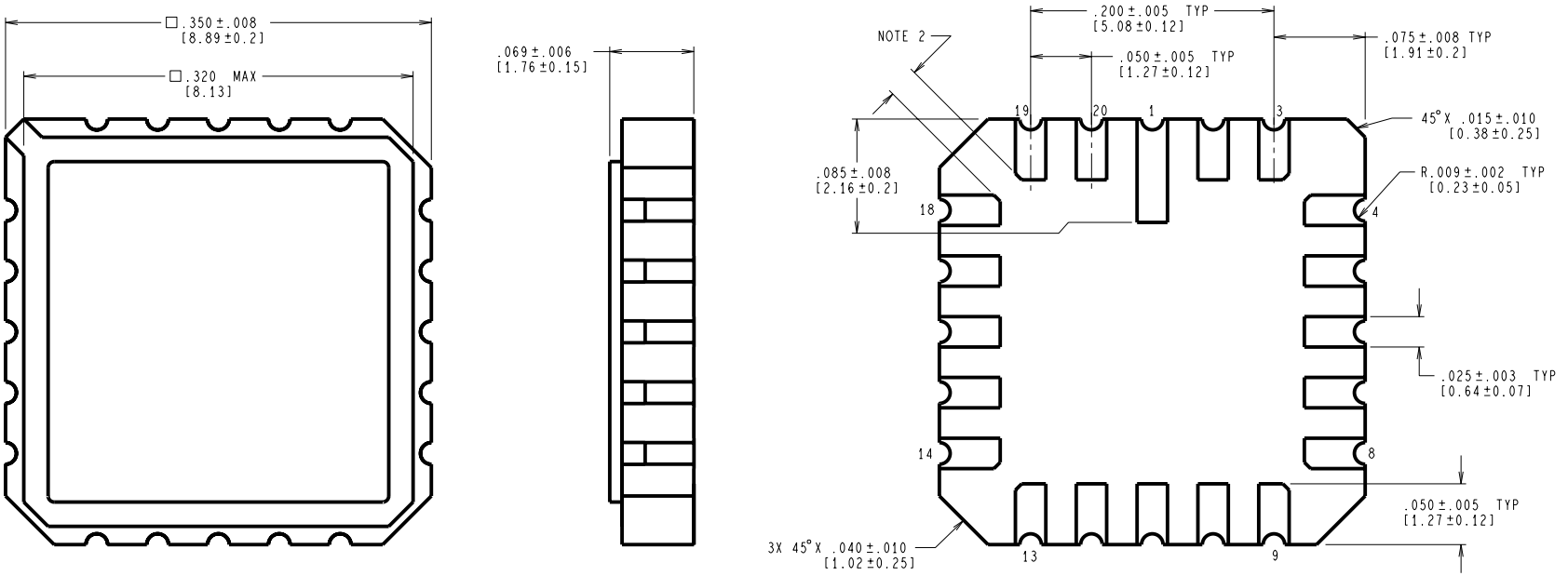
Vr	Reverse Breakdown Voltage	Ir = 10uA			-0.01	0.01	V	1
		Ir = 20mA			-0.01	0.01	V	1

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
05886HRB2	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (B/I CKT)
06175HRB2	LCC (E), TYPE C, 20 TERMINAL (B/I CKT)
06331HRA4	CERAMIC SOIC (WG), 10 LEAD (B/I CKT)
E20ARE	LCC (E), TYPE C, 20 TERMINAL(P/P DWG)
H02ARE	METAL CAN, TO-46,2LD, .100 DIA P.C. (P/P DWG)
P000123C	CERAMIC SOIC (WG), 10 LEAD (PINOUT)
P000329B	LCC (E), TYPE C, 20 TERMINAL (PINOUT)
P000363B	METAL CAN (H-1.2), TO-46, 2 LEAD (PINOUT)
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
E	REVISE AND REDRAW.	10005	02/10/94	DEG/



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

NOTES: UNLESS OTHERWISE SPECIFIED.

1. LEAD FINISH TO BE ONE OF THE FOLLOWING:

   a. 50 MICROINCHES/12.7 MICROMETERS MINIMUM GOLD PLATING OVER 50-350 MICROINCHES/1.27-8.89 MICROMETERS NICKEL.

   b. SOLDER DIP.
   SOLDER THICKNESS PER LATEST REVISION OF MIL-STD-1835.

2. CORNER PADS MAY HAVE A 45°X.020IN/0.51mm MAXIMUM CHAMFER TO ACCOMPLISH THE .015IN/0.38mm DIMENSION.

4. REFERENCE JEDEC REGISTRATION MS-004, VARIATION CB, DATED 7/90.

MIL/AERO
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN: Dwayne Grady	02/10/94
DFTG. CHK.	
ENGR. CHK.	
APPROVAL	

PROJECTION INCH [MM]

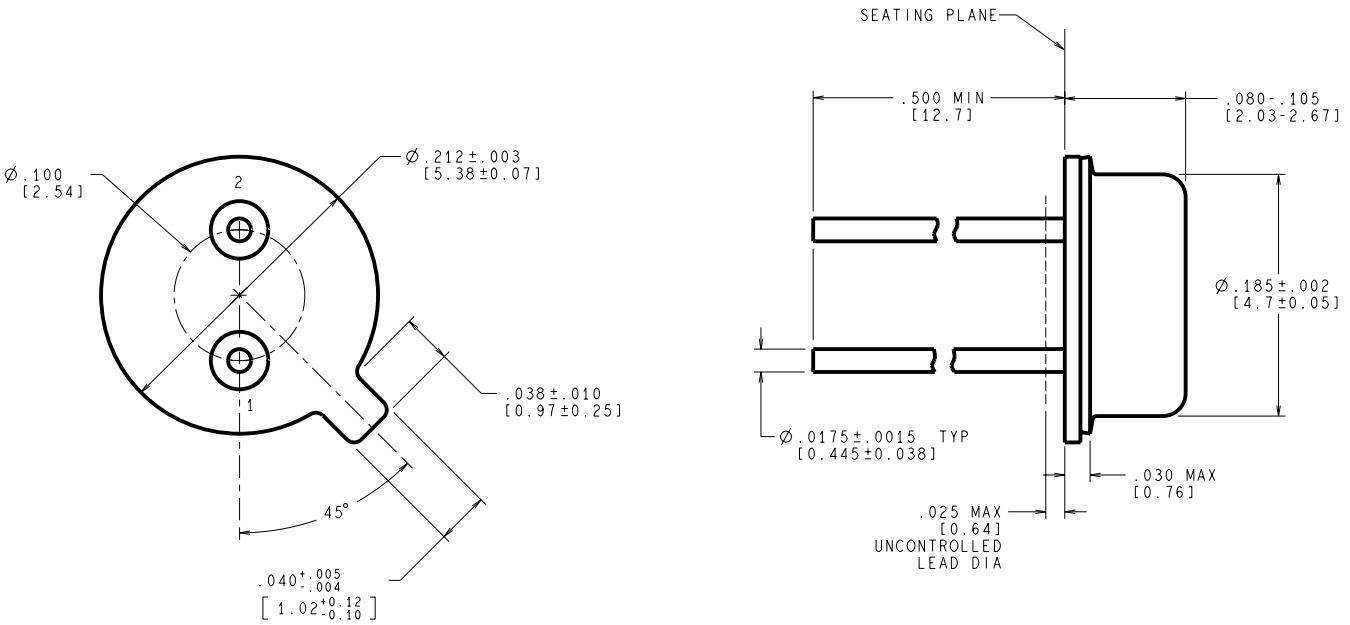
NATIONAL SEMICONDUCTOR CORPORATION
2900 Semiconductor Drive, Santa Clara, CA 95052-8090

LEADLESS CHIP CARRIER, TYPE C, 20 TERMINAL

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-E20A	E

DO NOT SCALE DRAWING | SHEET 1 of 1

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

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-PRF-38535
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN T. LEQUANG	05/04/1994
DFTG. CHK.	
ENGR. CHK.	

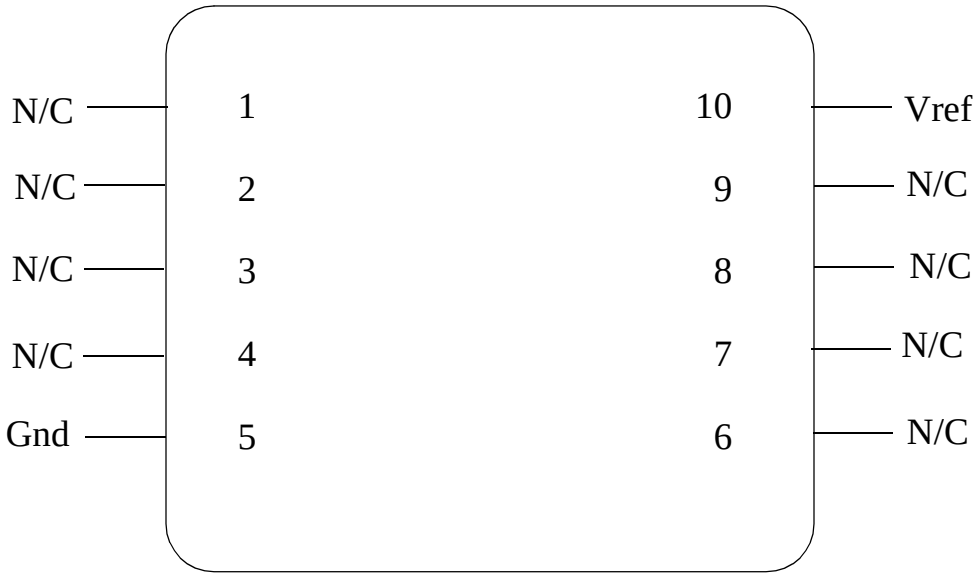
PROJECTION INCH [MM]

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

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

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	(SC)MKT-H02A	E

DO NOT SCALE DRAWING | SHEET 1 of 1



LM185WG-1.2

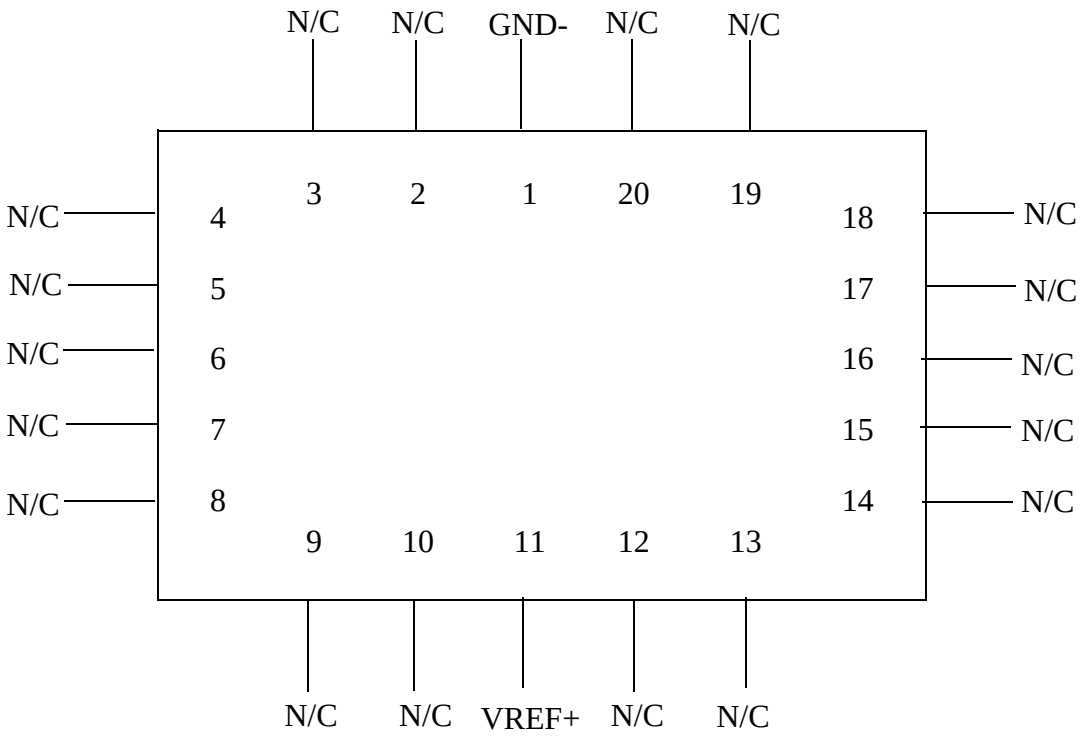
10 - LEAD CERPACK SOIC

CONNECTION DIAGRAM

TOP VIEW

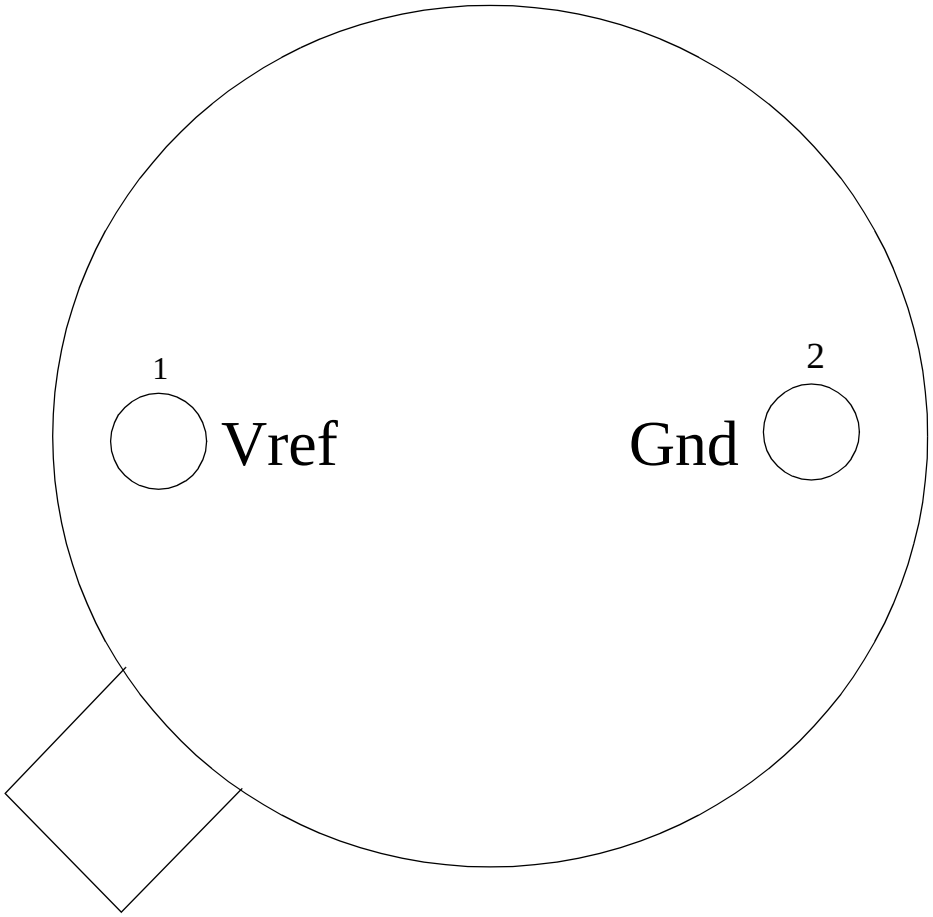
P000123C

NationalSemiconductor
MIL/AEROSPACE OPERATIONS
2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050



LM185E-1.2
20 - LEAD LCC
CONNECTION DIAGRAM
TOP VIEW
P000329B

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



LM185H-1.2

2 - LEAD TO-46

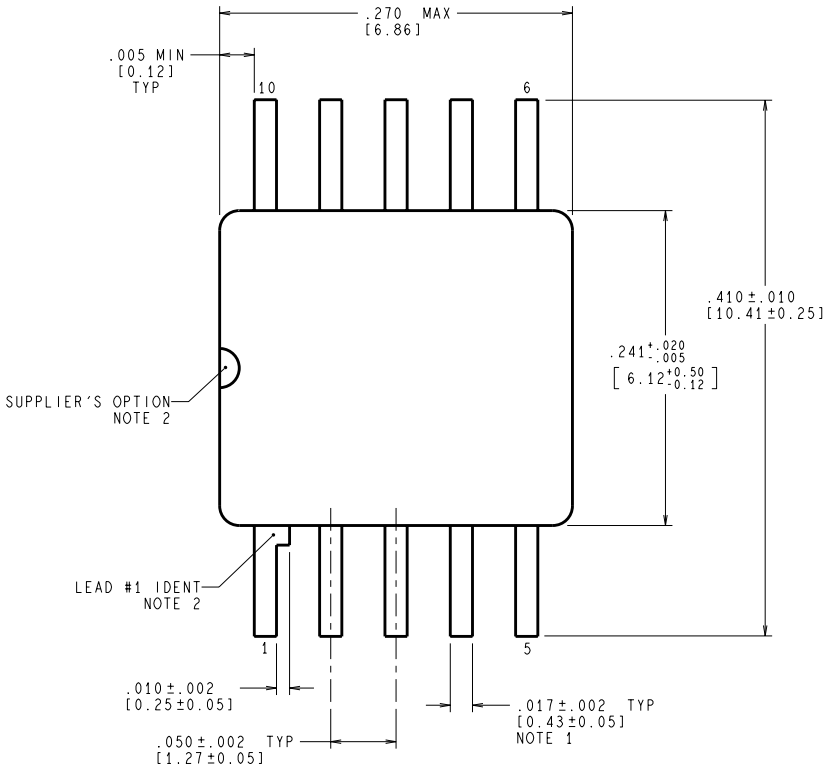
CONNECTION DIAGRAM

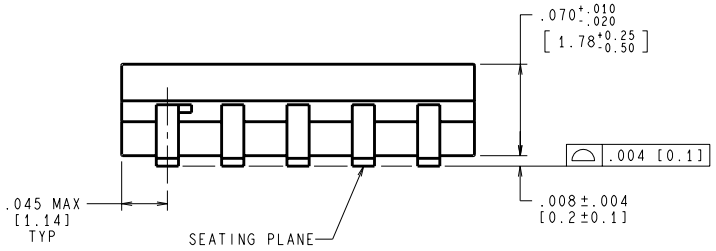
BOTTOM VIEW

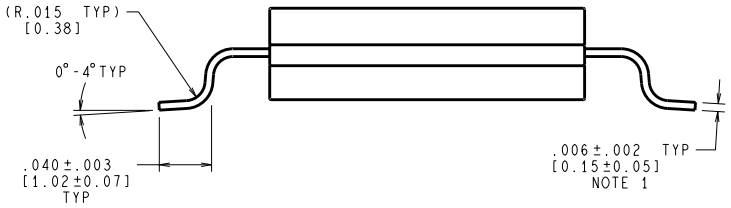
P000363B

NationalSemiconductor
MIL/AEROSPACE OPERATIONS
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/







NOTES: UNLESS OTHERWISE SPECIFIED

1. LEAD FINISH: SOLDER DIPPED WITH Sn60 OR Sn63 SOLDER CONFORMING TO MIL-PRF-38535 TO A MINIMUM THICKNESS OF 200 MICROINCHES/ 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.
2. LEAD 1 IDENTIFICATION SHALL BE:
   a) A NOTCH OR OTHER MARK WITHIN THIS AREA
   b) A TAB ON LEAD 1, EITHER SIDE
3. NO JEDEC REGISTRATION AS OF FEBRUARY 1996.

CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN: MARTA SUCHY	02/29/96
DFTG. CHK.	
ENGR. CHK.	

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

CERPACK, 10 LEAD, GULL WING

PROJECTION
INCH [MM]

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	(SC)MKT-WG10A	C

DO NOT SCALE DRAWING | SHEET 1 of 1