National
Semiconductor

MICROCIRCUIT DATA SHEET

MNLM137-X REV 0B1

Original Creation Date: 09/12/00
Last Update Date: 11/03/00
Last Major Revision Date:

3 TERMINAL ADJUSTABLE NEGATIVE REGULATOR

General Description

The LM137H is an adjustable 3-terminal negative voltage regulator capable of supplying in excess of -0.5A over an output voltage range of -1.2V to -37V. This regulator is exceptionally easy to apply, requiring only 2 external resistors to set the output voltage and 1 output capacitor for frequency compensation. The circuit design has been optimized for excellent regulation and low thermal transients. Futher, the LM137H features internal current limiting, thermal shutdown and safe-area compensation, making it virtually blowout-proof against overloads.

The LM137H serves a wide variety of applications including local on-card regulation, programmable-output voltage regulation or precision current regulation. The LM137H is an ideal complement to the LM117H adjustable positive regulator.

Industry Part Number

LM137

NS Part Numbers

LM137H/883
LM137WG/883

Prime Die

LM137

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

- Output voltage adjustable from -1.2V to -37V
- 0.5A output current guaranteed, -55 C to +150 C
- Line regulation typically 0.01%/V
- Load regulation typically 0.3%
- Excellent thermal regulation, 0.002%/W
- 50 ppm/ C temperature coefficient
- Temperature-independent current limit
- Internal thermal overload protection
- Stantard 3-lead transistor package
- Output short circuit protected

(Absolute Maximum Ratings)

(Note 1)

Power Dissipation	Internally Limited
Input-Output Voltage Differential	40V
Operating Temperature	-55 C $\leq$ Ta $\leq$ +125 C
Maximum Junction Temperature (Note 2)	150 C
Storage Temperature	-65 C to +150 C
Lead Temperature	
(Soldering, 10 seconds)	300 C
Thermal Resistance	
ThetaJA	
Metal Can	
(Still Air @ 0.5W)	174 C/W
(500LF/Min Air flow @ 0.5W)	64 C/W
CERAMIC SOIC	
(Still Air @ 0.5W)	108 C/W
(500LF/Min Air flow @ 0.5W)	65 C/W
ThetaJC	
Metal Can (@ 1.0W)	15 C/W
CERAMCI SOIC (@ 1.0W)	2.7 C/W
(Note 3, 4)	
Package Weight	
(Typical)	
Metal Can	995mg
CERAMIC SOIC	370mg
ESD Rating (Note 5)	4000V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Rating 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: For the CERAMIC SOIC device to function properly, the "Output" and "Output/Sense" pins must be connected on the users printed circuit board.

Note 4: The package material for these devices allows much improved heat transfer over our standard ceramic packages. In order to take full advantage of this improved heat transfer, heat sinking must be provided between the package base (directly beneath the die), and either metal traces on, or thermal vias through, the printed circuit board. Without this additional heat sinking, device power dissipation must be calculated using junction-to-ambient, rather than junction-to-case, thermal resistance. It must not be assumed that the device leads will provide substantial heat transfer out of the package, since the thermal resistance of the leadframe materical is very poor, relatvie to the materical of the package base. The stated junction-to-case thermal resistance is for the package material only, and does not account for the additional thermal resistance between the package base and the printed circuit board. The user must determine the value of the additional thermal resistance and must combine this with the stated value for the package, to calculate the total allowed power dissipation for the device.

Note 5: Human body model, 100pF discharged through 1.5K Ohms.

Recommended Operating Conditions

Ta	-55 C to +125 C
Input Voltage Range	-41.25V to -4.25V

Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vin=-4.25V, Il=8mA, Vout=Vref

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vref	Reference Voltage				-1.275	-1.225	V	1
					-1.3	-1.2	V	2, 3
		Vin= -42V			-1.275	-1.225	V	1
		Vin= -41.3V			-1.3	-1.2	V	2, 3
Iq	Minimum Load Current	Vout= -1.7V				3	mA	1, 2, 3
		Vout= -1.7V, Vin= -11.75V				3	mA	1, 2, 3
		Vout= -1.7V, Vin= -42V				5	mA	1
		Vout= -1.7V, Vin= -41.3V				5	mA	2, 3
Rline	Line Regulation	-42V ≤ Vin ≤ -4.25V			-9	9	mV	1
		-41.3V ≤ Vin ≤ -4.25V			-23	23	mV	2, 3
Rload	Load Regulation	5mA ≤ Il ≤ 500mA, Vin=-6.25V			-25	25	mV	1, 2, 3
		5mA ≤ Il ≤ 500mA, Vin=-14.5V			-25	25	mV	1
		5mA ≤ Il ≤ 150mA, Vin=-40V			-25	25	mV	1, 2, 3
Iadj	Adjustment Pin Current	Il = 5 mA				100	uA	1, 2, 3
		Vin = -42V				100	uA	1
		Vin = -41.3V				100	uA	2, 3
Delta Iadj/ (line)	Change vs Line Voltage	-42V ≤ Vin ≤ -4.25V, Il=5 mA			-5	5	uA	1
		-41.3V ≤ Vin ≤ -4.25V, Il=5 mA			-5	5	uA	2, 3
Delta Iadj/ (load)	Change vs Load Current	5 mA ≤ Il ≤ 500 mA, Vin= -6.5V			-5	5	uA	1, 2, 3
Theta R	Thermal Regulation	Vin= -14.5V, Il=500mA, t=10mS			-5	5	mV	1
		Vin= -14.5V, Il=5mA, t=10mS			-5	5	mV	1
Theta JC	Thermal Resistance		1			15	Deg C/W	1
Icl	Current Limit	Vin= -5V			-1.8	-0.5	A	1, 2, 3
		Vin= -40V			-0.65	-0.15	A	1, 2, 3
Vout	Output Voltage				-1.28	-1.22	V	1
					-1.3	-1.2	V	2, 3

Electrical Characteristics

AC PARAMETERS

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Rr	Ripple Rejection Ratio	Vin= -6.25V, Vout=Vref, Il=125mA, ei=1Vrms, F=120Hz	2, 3		66		dB	4, 5, 6

DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vin = -4.25V, Il = 8mA, Vout=Vref. "Deltas not required on B-Level product. Deltas required for S-Level product ONLY as specified on Internal Processing Instructions (IPI)."

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vref	Reference Voltage				-0.01	0.01	V	1
Rline	Line Regulation	$-42V \le Vin \le -4.25V$			-4	4	mV	1
Iadj	Adjustment Pin Current	Il = 5mA			-10	10	uA	1

Note 1: Guaranteed parameter, not tested.
Note 2: Tested at +25 C; guaranteed but not tested at +125 C and -55 C.
Note 3: Bench test refer to (SG) RPI-3-362.

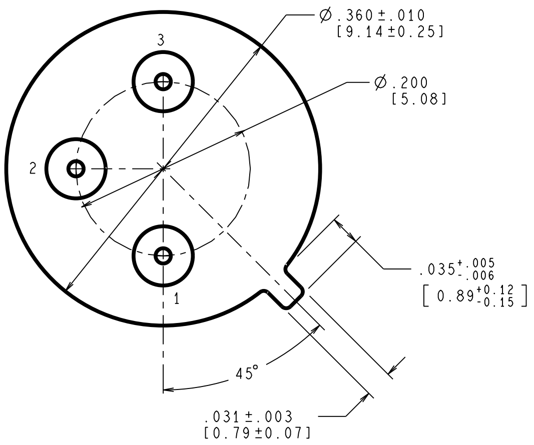
Graphics and Diagrams

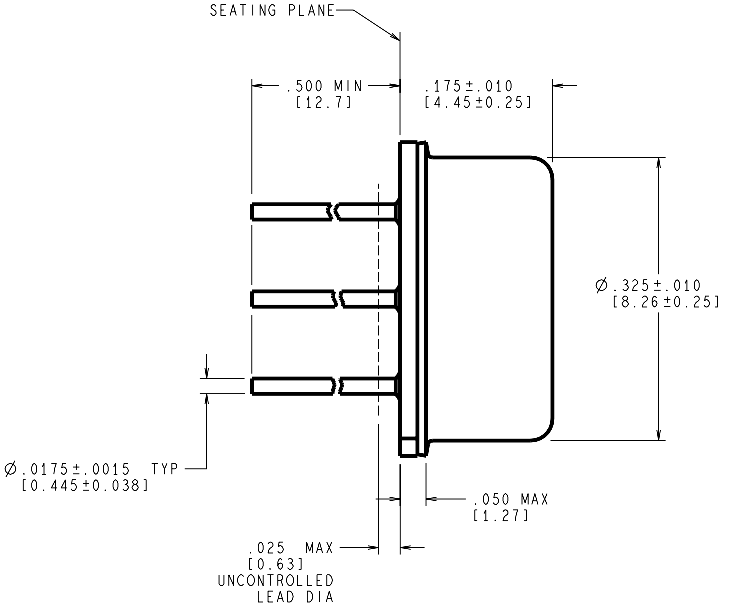
GRAPHICS#	DESCRIPTION
05192HRC1	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (P/P DWG)
06367HRA1	CERAMIC SOIC (WG), 16 LEAD (B/I CKT)
H03ARD	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (P/P DWG)
P000199A	METAL CAN (H), TO-39, 3LD, .200 DIA P.C. (PINOUT)
P000463A	CERAMIC SOIC (WG), 16 LEAD (PINOUT)
WG16ARC	CERAMIC SOIC (WG), 16 LEAD (P/P DWG)

See attached graphics following this page.

REVISIONS

LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
C	REVISE & REDRAW PER NEW STANDARD	10403	05/24/94	TL/GM
D	UPDATE MILAERO STAMP; Ø.325 WAS Ø.326; REVISE TOLERANCES	10798	02/28/95	TL/





CONTROLLING DIMENSION IS INCH

VALUES IN [] ARE MILLIMETERS

MIL-I-38535
CONFIGURATION CONTROL

NOTES: UNLESS OTHERWISE SPECIFIED

1. LEADS TO BE LOCATED WITHIN .010 IN/ 0.25 mm OF THEIR TRUE POSITIONS RELATIVE TO A MAXIMUM WIDTH TAB.
2. STANDARD METAL CAN TYPE: SOLID BASE, KOVAR.
3. APPLIES TO MIL-AERO AND LINEAR PRODUCTS.
4. REFERENCE JEDEC REGISTRATION TO-39, JEDEC PUBLICATION No. 95.

APPROVALS	DATE
DRAWN T. LEQUANG	05/24/94
DFTG. CHK.	
ENGR. CHK.	

PROJECTION
INCH
[MM]

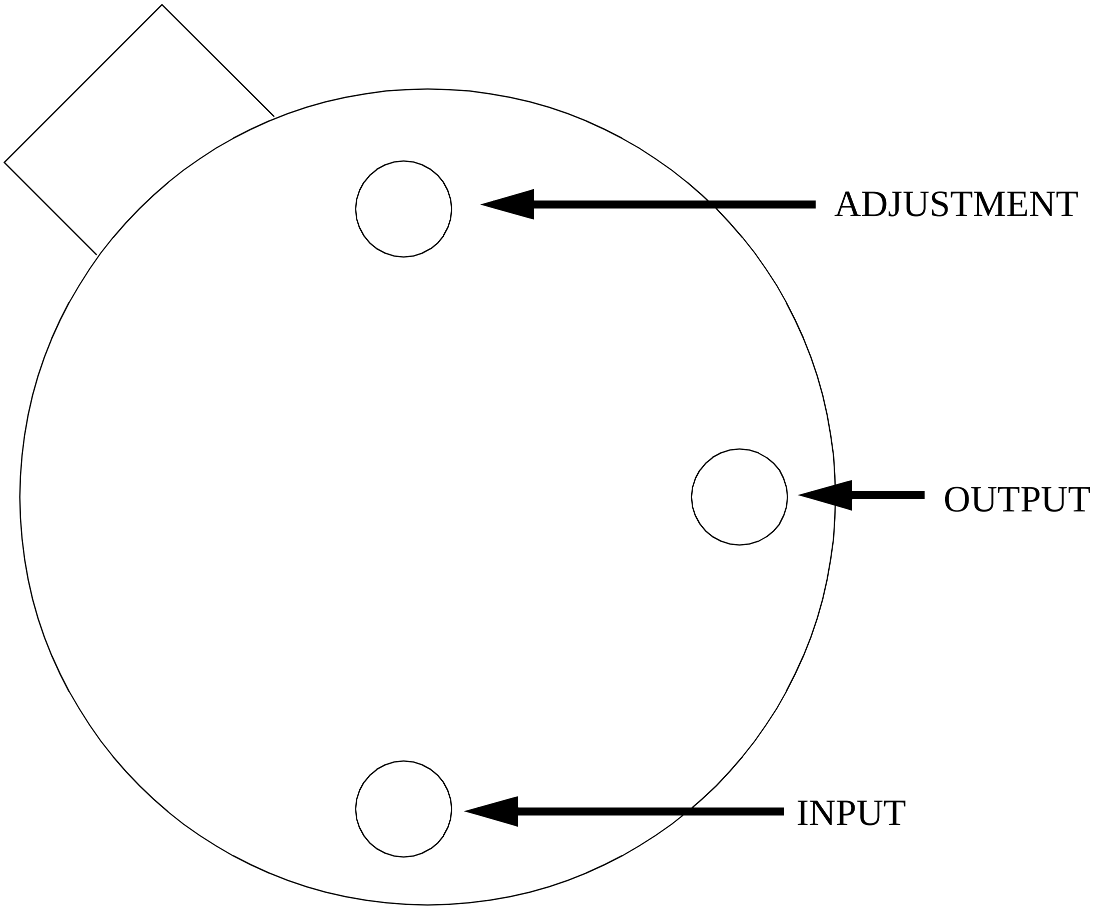
National Semiconductor
2900 Semiconductor dr, Santa Clara, CA 95052-8090

**METAL CAN,
TO-39, 3 LEAD,
.200 DIA P.C.**

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-H03A	D

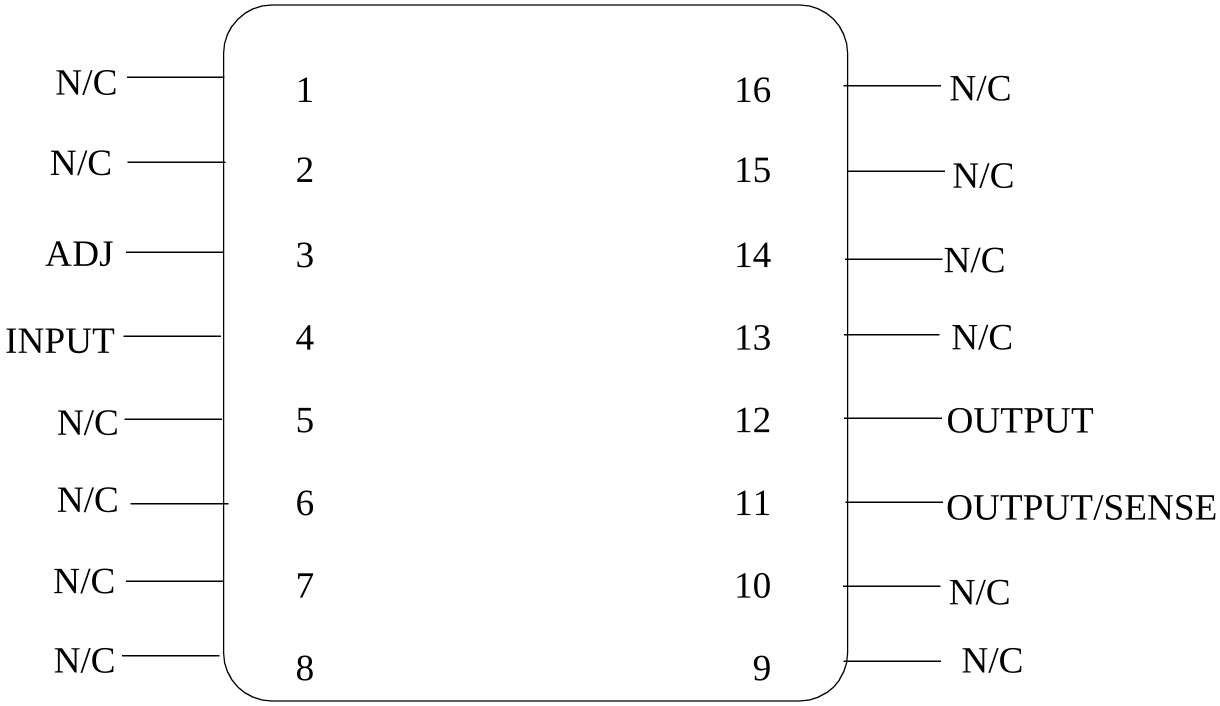
DO NOT SCALE DRAWING

SHEET 1 of 1



LM137H, LM137HVH
3 - LEAD TO-39
CONNECTION DIAGRAM
BOTTOM VIEW
P000199A

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



LM137WG

16 - LEAD CERAMIC SOIC

CONNECTION DIAGRAM

TOP VIEW

P000463A

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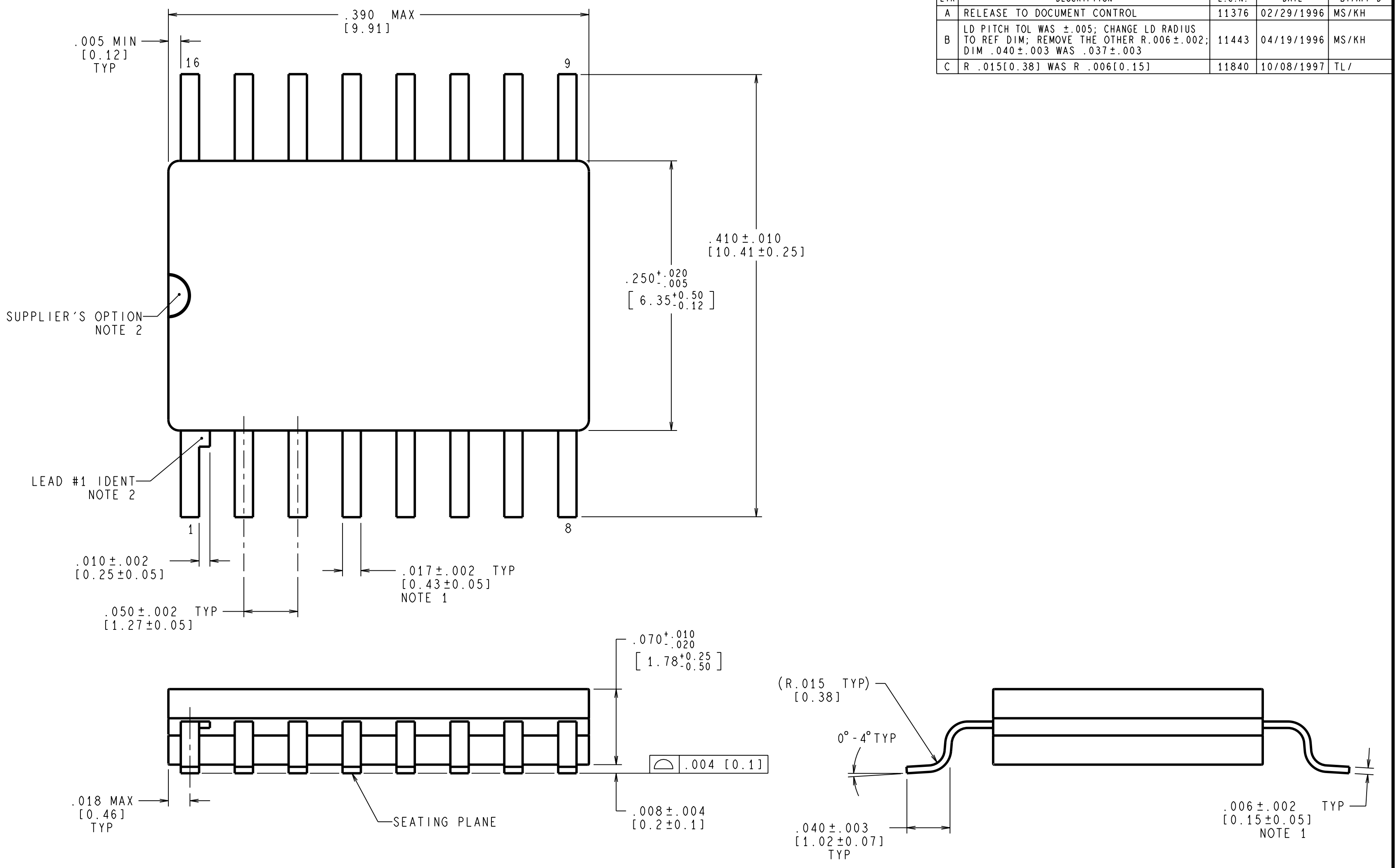
2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050

REVISIONS

LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
A	RELEASE TO DOCUMENT CONTROL	11376	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	11443	04/19/1996	MS/KH
C	R .015[0.38] WAS R .006[0.15]	11840	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,
16 LEAD,
GULL WING

PROJECTION
INCH
[MM]

SCALE	SIZE	DRAWING NUMBER	REV
N/A	**C**	**(SC)MKT-WG16A**	**C**

DO NOT SCALE DRAWING | SHEET 1 of 1

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0A0	M0003391	11/03/00	Rose Malone	Initial MDS Release: MNLM137-X, Rev. 0A0. Replaced MNLM137-H, Rev. 0BL.
0B1	M0003763	11/03/00	Rose Malone	Update MDS: MNLM137-X, Rev. 0A0 to MNLM137-X, Rev. 0B1. Added Package Weight for CERAMIC SOIC in Absolute Section. Revision update to burn-in ckt from 05192HRB2 to 05192HRC1.

National Semiconductor was acquired by Texas Instruments.

http://www.ti.com/corp/docs/investor_relations/pr_09_23_2011_national_semiconductor.html

This file is the datasheet for the following electronic components:

5962P9951701VXA - http://www.ti.com/product/5962p9951701vxa?HQS=TI-null-null-dscatalog-df-pf-null-wwe

JM38510/11804BYA - http://www.ti.com/product/jm38510/11804bya?HQS=TI-null-null-dscatalog-df-pf-null-wwe

5962P9951701VZA - http://www.ti.com/product/5962p9951701vza?HQS=TI-null-null-dscatalog-df-pf-null-wwe

5962P9951702VYA - http://www.ti.com/product/5962p9951702vya?HQS=TI-null-null-dscatalog-df-pf-null-wwe

JM38510/11803BXA - http://www.ti.com/product/jm38510/11803bxa?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137AH/883 - http://www.ti.com/product/lm137ah/883?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137K/883 - http://www.ti.com/product/lm137k/883?HQS=TI-null-null-dscatalog-df-pf-null-wwe

JM38510/11803SXA - http://www.ti.com/product/jm38510/11803sxa?HQS=TI-null-null-dscatalog-df-pf-null-wwe

7703403YA - http://www.ti.com/product/7703403ya?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137H - http://www.ti.com/product/lm137h?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137KG MWA - http://www.ti.com/product/lm137kg mwa?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137WG/883 - http://www.ti.com/product/lm137wg/883?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137H/883 - http://www.ti.com/product/lm137h/883?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137KG MDA - http://www.ti.com/product/lm137kg mda?HQS=TI-null-null-dscatalog-df-pf-null-wwe

7703403XA - http://www.ti.com/product/7703403xa?HQS=TI-null-null-dscatalog-df-pf-null-wwe

JM38510/11804SYA - http://www.ti.com/product/jm38510/11804sya?HQS=TI-null-null-dscatalog-df-pf-null-wwe

5962-9951701VZA - http://www.ti.com/product/5962-9951701vza?HQS=TI-null-null-dscatalog-df-pf-null-wwe

LM137H MDS - http://www.ti.com/product/lm137h mds?HQS=TI-null-null-dscatalog-df-pf-null-wwe