National Semiconductor

MICROCIRCUIT DATA SHEET

MNLM119-X REV 0F1

Original Creation Date: 08/29/95
Last Update Date: 07/19/02
Last Major Revision Date: 08/29/95

HIGH SPEED DUAL COMPARATOR

General Description

The LM119 precision high speed dual comparator is fabricated on a single monolithic chip. It is designed to operate over a wide range of supply voltages down to a single 5V logic supply and ground. Furthermore it has a higher gain and lower input current than other devices. The uncommitted collector of the output stage makes the LM119 compatible with RTL, DTL and TTL as well as capable of driving lamps and relays at currents up to 25mA.

Industry Part Number

LM119

Prime Die

LM119

NS Part Numbers

LM119E/883
LM119H/883
LM119J/883
LM119W/883
LM119WG/883

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

- Two independent comparators
- Operates from a single 5V supply
- Typically 80nS response time at ±15V
- Minimum fan-out of 2 each side
- Maximum input current of 1uA over temperature
- Inputs and outputs can be isolated from system ground
- High common mode slew rate

Although designed primarily for applications requiring operation from digital logic supplies, the LM119 is fully specified for power supplies up to ±15V. It features faster response than the LM111 at the expense of higher power dissipation. However, the high speed, wide operating voltage range and low package count make the LM119 much more versatile than older devices.

(Absolute Maximum Ratings)

(Note 1)

Total Supply Voltage	36V
Output to Negative Supply Voltage	36V
Ground to Negative Supply Voltage	25V
Ground to Positive Supply Voltage	18V
Differential Input Voltage	±5V
Input Voltage (Note 3)	±15V
Power Dissipation (Note 2)	500mW
Output Short Circuit Duration	10 Sec.
Maximum Junction Temperature	150 C
Storage Temperature Range	-65 C to 150 C
Lead Temperature Soldering, (10 seconds)	260 C
Thermal Resistance	
ThetaJA	
E Pkg (Still Air)	89 C/W
E Pkg (500LF/Min Air flow)	63 C/W
H Pkg (Still Air)	162 C/W
H Pkg (500LF/Min Air flow)	88 C/W
J Pkg (Still Air)	94 C/W
J Pkg (500LF/Min Air flow)	52 C/W
W Pkg (Still Air)	215 C/W
W Pkg (500LF/Min Air flow)	132 C/W
WG Pkg (Still Air)	215 C/W
WG Pkg (500LF/Min Air flow)	132 C/W
ThetaJC	
E Pkg	17.0 C/W
H Pkg	31 C/W
J Pkg	10.9 C/W
W Pkg	12.3 C/W
WG Pkg	12.3 C/W
Package Weight (Typical)	
E Pkg	TBD
H Pkg	TBD
J Pkg	TBD
W Pkg	TBD
WG Pkg	225mg
ESD Tolerance (Note 4)	800V

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: For supply voltages less than $\pm$15V the absolute maximum input voltage is equal to the supply voltage.

Note 4: Human body model, 1.5K Ohm in series with 100pF.

Recommended Operating Conditions

Operating Temperature Range

$-55\ C \leq TA \leq 125\ C$

Electrical Characteristics

DC PARAMETERS:

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vcm = 0V.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Icc+	Positive Supply Current	+Vcc = ±15V, V+ = 5.6V thru 1.4K Ohms, Vout = LOW				11	mA	1
						11.5	mA	2
Icc-	Negative Supply Current	±Vcc = ±15V, V+ = 5.6V thru 1.4K Ohms, Vout = LOW			-4.2		mA	1
					-4.5		mA	2
Ileak	Output Leakage Current	+Vcc = 15V, -Vcc = -1V Vgrd = 0V, Vout = 35V, Vin = 5mV				1.8	uA	1
						9.5	uA	2
						10	uA	3
Iib	Input Bias Current	±Vcc = ±15V				0.475	uA	1
						0.95	uA	2, 3
		V+ = 5V, V- = 0V, Vcm = 1.5V				0.475	uA	1
						0.95	uA	2, 3
Vio	Input Offset Voltage	V+ = 5V, V- = 0V, Vcm = 1V, Rs = 5K Ohms			-3.8	3.8	mV	1
					-6.8	6.8	mV	2, 3
		V+ = 5V, V- = 0V, Vcm = 3V, Rs = 5K Ohms			-3.8	3.8	mV	1
					-6.8	6.8	mV	2, 3
		±Vcc = ±15V, Vcm = 12V, Rs = 5K Ohms			-3.8	3.8	mV	1
					-6.8	6.8	mV	2, 3
		±Vcc = ±15V, Vcm = -12V, Rs = 5K Ohms			-3.8	3.8	mV	1
					-6.8	6.8	mV	2, 3
Iio	Input Offset Current	V+ = 5V, V- = 0V, Vcm = 1V			-75	75	nA	1
					-100	100	nA	2, 3
		V+ = 5V, V- = 0V, Vcm = 3V			-75	75	nA	1
					-100	100	nA	2, 3
		±Vcc = ±15V, Vcm = 12V			-75	75	nA	1
					-100	100	nA	2, 3
		±Vcc = ±15V, Vcm = -12V			-75	75	nA	1
					-100	100	nA	2, 3
Vsat	Output Saturation Voltage	V+ = 5V, V- =0V, Il = 4mA	3			0.4	V	1, 2
			3			0.6	V	3
		Vcc = ±15V, Il = 25mA, Vin = -5mV				1.5	V	1

Electrical Characteristics

DC PARAMETERS:(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vcm = 0V.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Avs	Voltage Gain	±Vcc = ±15V, Delta Vout = 12V, Rl = 1.4K Ohms	1, 4		10.5		V/mV	4
			1, 4		10		V/mV	5, 6
		V+ = 5V, V- = 0V, Delta Vout + 4.5V, Rl = 1.4K Ohms	2, 4		8		V/mV	4
			2, 4		5		V/mV	5
			2, 4		5.8		V/mV	6

DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vcm = 0V. "Deltas not required on B-Level product. Deltas required for S-Level product ONLY as specified on Internal Processing Instructions (IPI)."

Icc+	Positive Supply Current	+Vcc = ±15V, V+ = 5.6V thru 1.4K Ohms, Vout = LOW			-1	1	mA	1
Icc-	Negative Supply Current	+Vcc = ±15V, V+ = 5.6V thru 1.4K Ohms, Vout = LOW			-0.5	0.5	mA	1
Vio	Input Offset Voltage	V+ = 5V, V - = 0V, Vcm = 1V, Rs = 5K Ohms			-0.4	0.4	mV	1

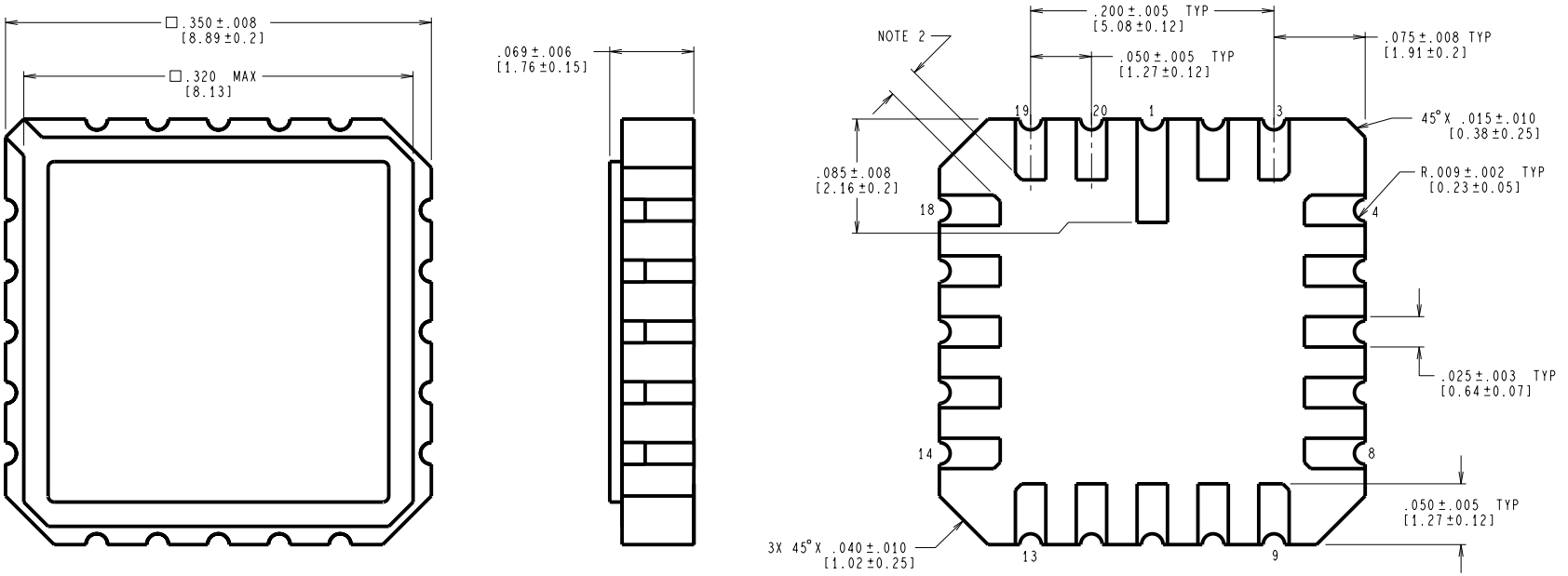
Note 1: Gain is computed with an output swing from +13.5V to +1.5V.
Note 2: Gain is computed with an output swing from +5.0V to +0.5V.
Note 3: Output is monitored by measuring Vin with limits from 0 to 6mV at all temps.
Note 4: Datalog reading in K = V/mV.

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
06142HRA3	LCC (E), TYPE C, 20 TERMINAL (B/I CKT)
08906HRB3	METAL CAN (H), 10 LEAD (B/I CKT)
09078HRB3	CERPACK (W), 10 LEAD (B/I CKT)
09641HRA2	CERDIP (J), 14 LEAD (B/I CKT)
E20ARE	LCC (E), TYPE C, 20 TERMINAL(P/P DWG)
H10CRF	METAL CAN (H), TO-100, 10LD, .230 DIA PC (P/P DWG)
J14ARH	CERDIP (J), 14 LEAD (P/P DWG)
P000182A	CERDIP (J), 14 LEAD (PINOUT)
P000196A	LCC (E), 20 LEAD (PINOUT)
P000197A	METAL CAN (H), TO-100, 10 LD, .230 DIA PC (PINOUT)
P000198A	CERPACK (W), 10 LEAD (PINOUT)
P000237A	CERAMIC SOIC (WG), 10 LEAD (PINOUT)
W10ARG	CERPACK (W), 10 LEAD (P/P DWG)
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]

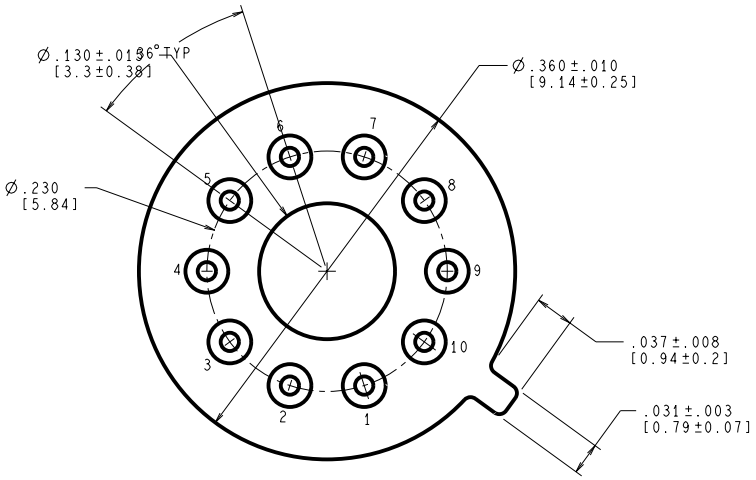
NATIONAL SEMICONDUCTOR CORPORATION
2900 Semiconductor Drive, Santa Clara, CA 95052-8090

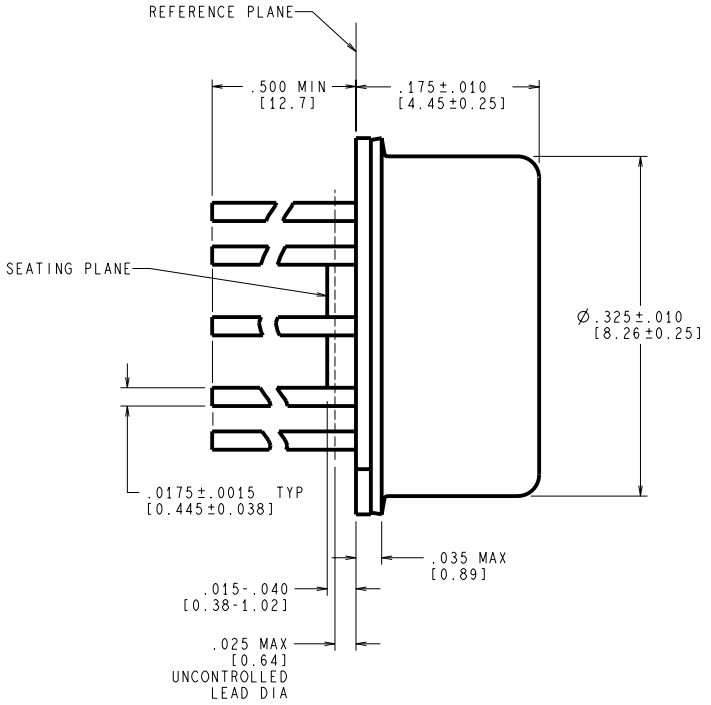
LEADLESS CHIP CARRIER, TYPE C, 20 TERMINAL

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
F	REVISE & REDRAW PER CURRENT STANDARD; UPDATE MIL/AERO STAMP & TITLE.	11003	06/26/95	MS/





CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

MIL-I-38535
CONFIGURATION CONTROL

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 WITH CERAMIC STANDOFF.
3. APPLIES TO MIL-AERO AND LINEAR PRODUCTS.
4. REFERENCE JEDEC REGISTRATION TO-100, JEDEC PUBLICATION No.95.

APPROVALS	DATE
DRAWN: MARTA SUCHY	06/26/95
DFTG. CHK.	
ENGR. CHK.	

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

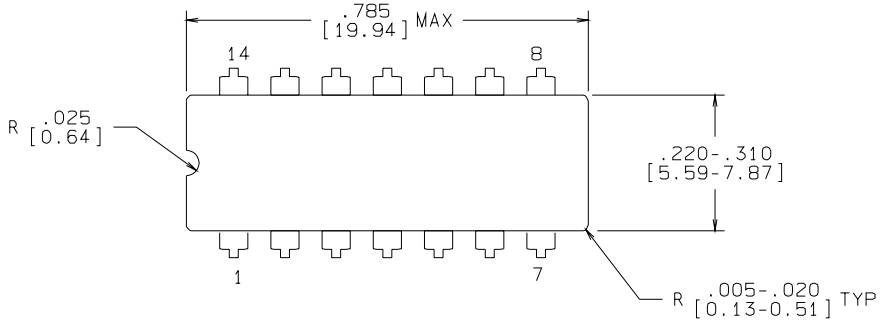
METAL CAN, TO-100, 10 LEAD, .230 DIA P.C.

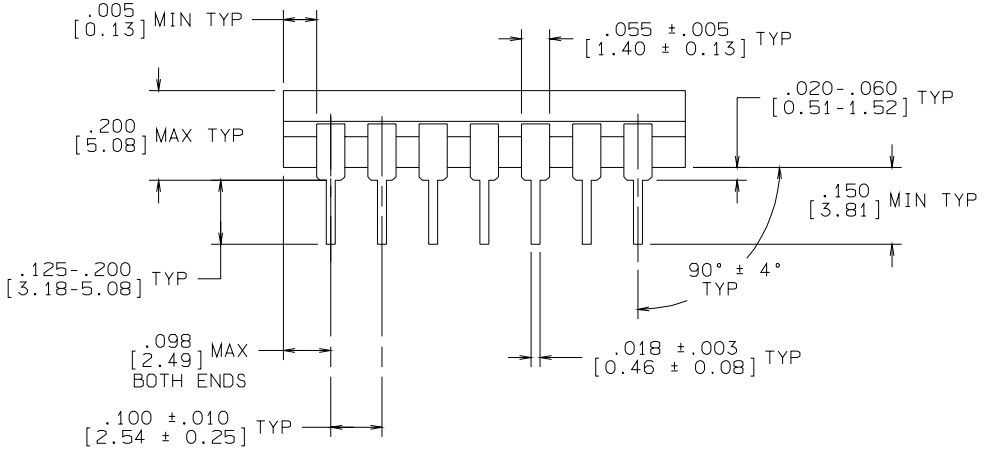
PROJECTION — INCH [MM]

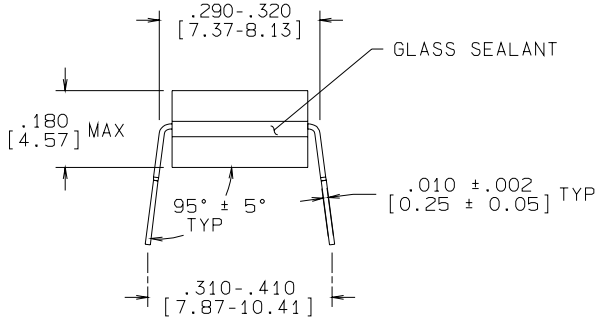
SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-H10C	F

DO NOT SCALE DRAWING — SHEET 1 of 1

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
H	REVISE PER CURRENT STD; REDRAW	10001	09/15/93	TL/







CONTROLLING DIMENSION: INCH

MIL/AERO CONFIGURATION CONTROL

MIL-M-38510 CONFIGURATION CONTROL

NOTES: UNLESS OTHERWISE SPECIFIED

1. LEAD FINISH TO BE 200 MICROINCHES / 5.08 MICROMETERS MINIMUM SOLDER MEASURED AT THE CREST OF THE MAJOR FLATS.
2. JEDEC REGISTRATION MO-036, VARIATION AB, DATED 04/1981.

APPROVALS	DATE
DRAWN T. LEQUANG	09/15/93
DFTG. CHK.	
ENGR. CHK.	
APPROVAL	

PROJECTION

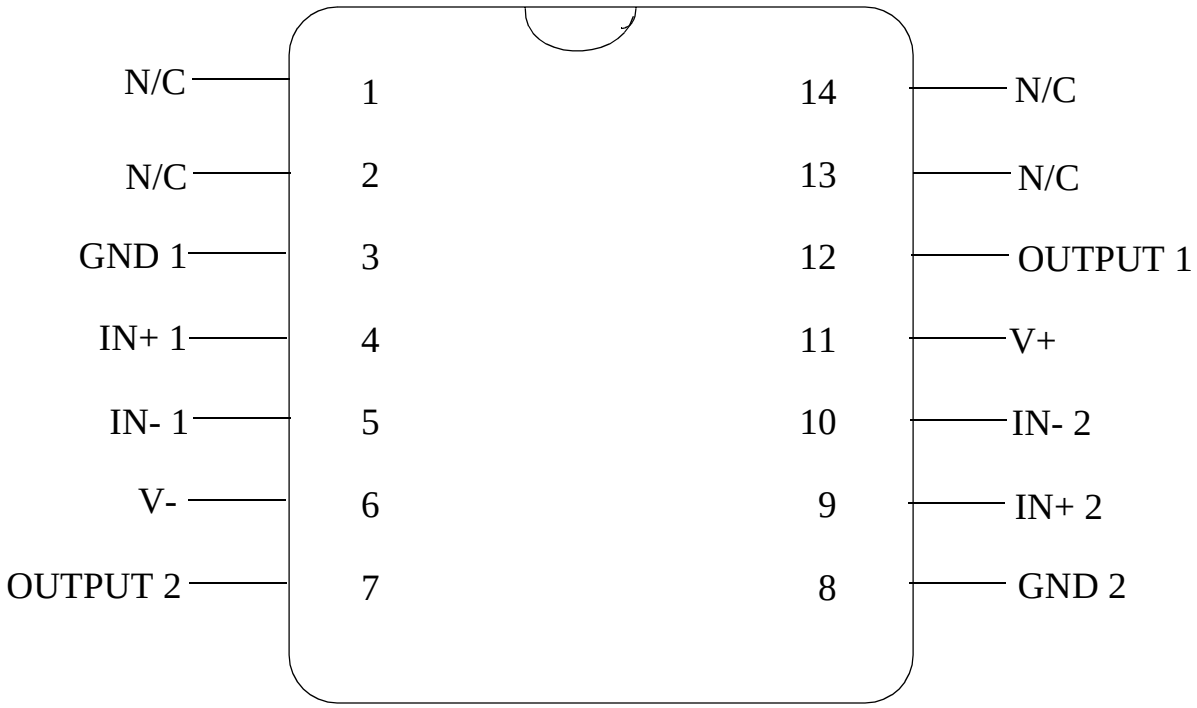
INCH
[MM]

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

CERDIP (J), 14 LEAD,

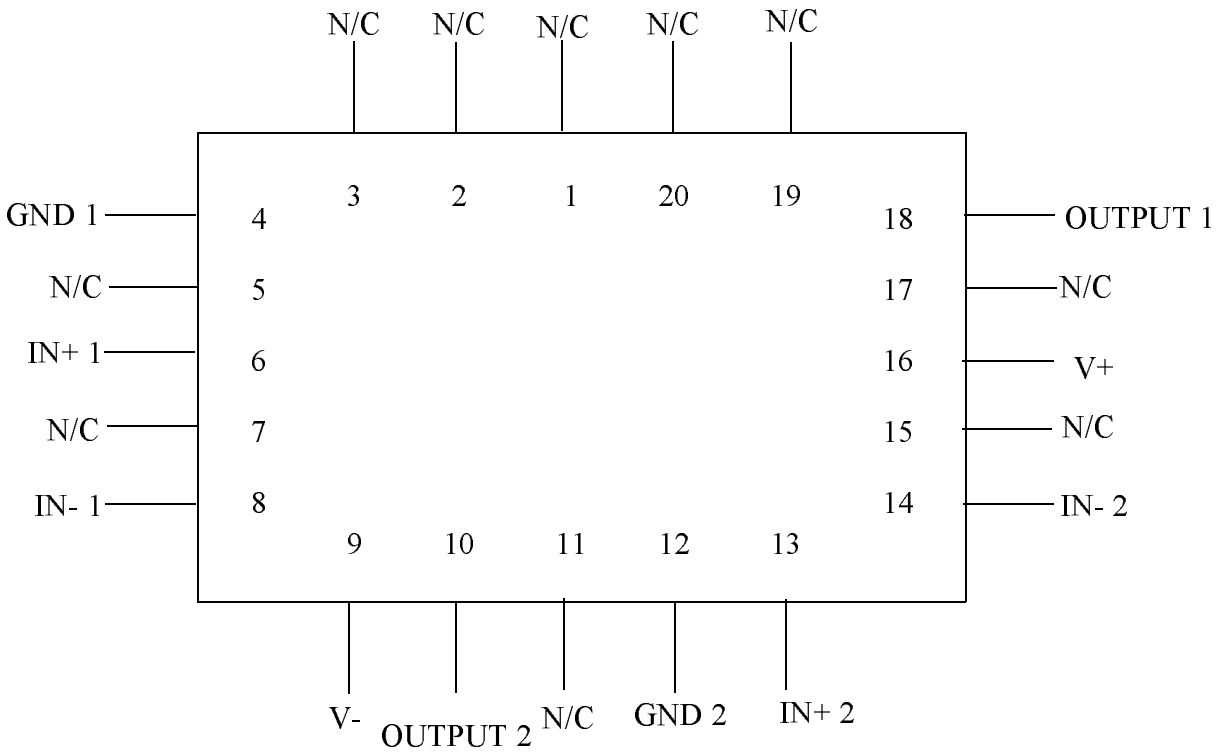
SCALE	SIZE	DRAWING NUMBER	REV
N/A	B	MKT-J14A	H

DO NOT SCALE DRAWING | SHEET 1 OF 1



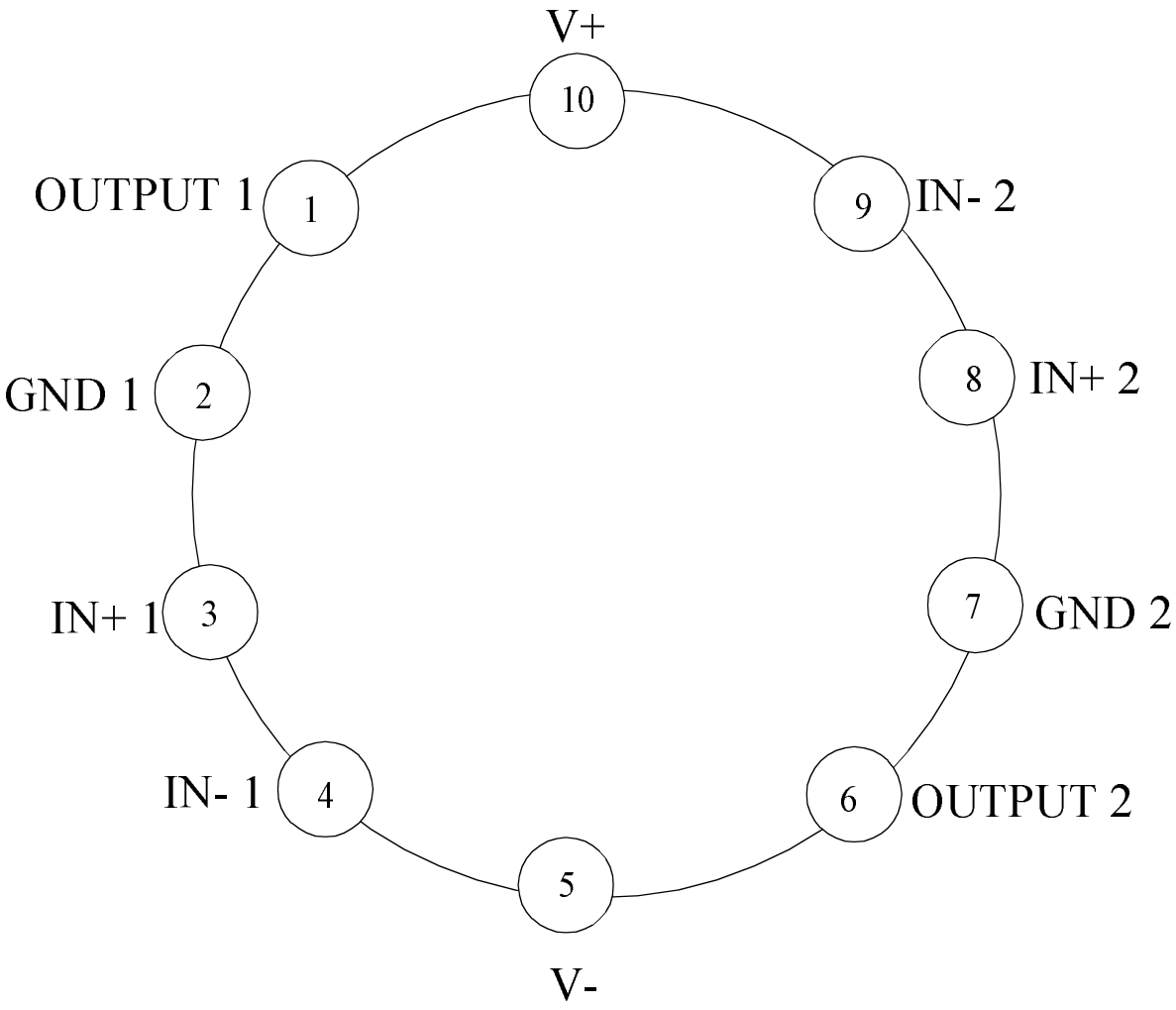
LM119J
14 - LEAD DIP
CONNECTION DIAGRAM
TOP VIEW
P000182A

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



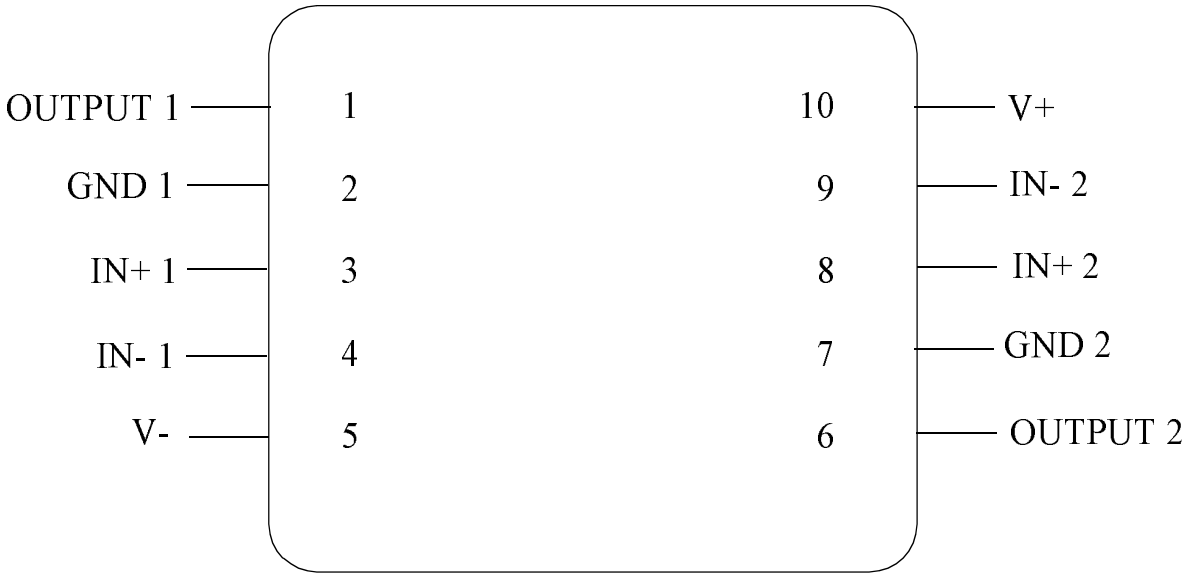
LM119E
20 - LEAD LCC
CONNECTION DIAGRAM
TOP VIEW
P000196A

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



LM119H
10 - PIN METAL CAN
CONNECTION DIAGRAM
TOP VIEW
P000197A

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



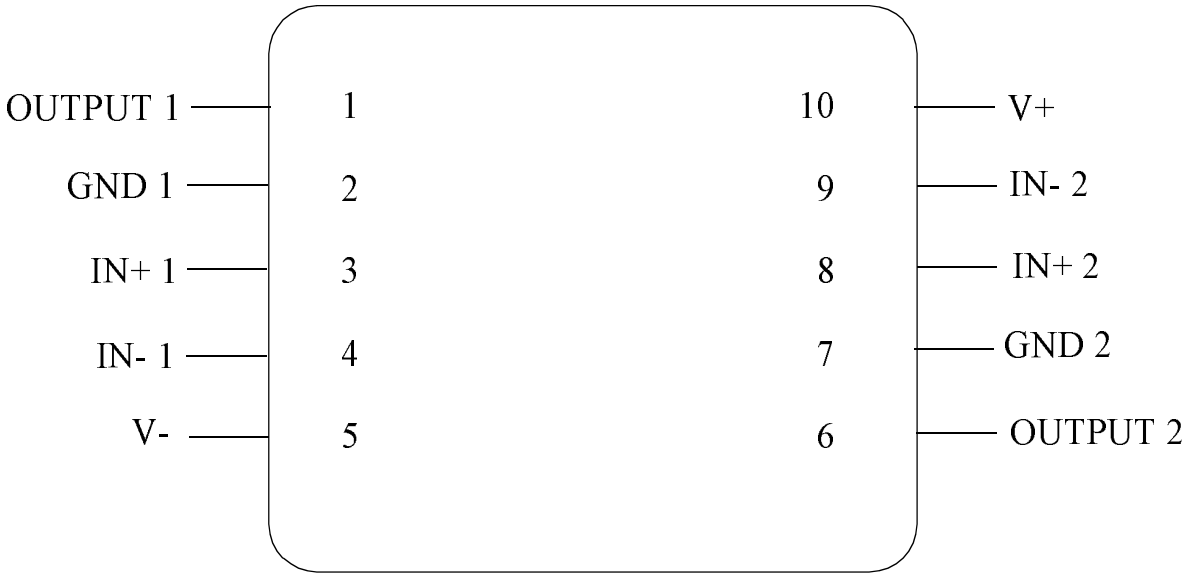
LM119W

10 - LEAD CERPACK

CONNECTION DIAGRAM
TOP VIEW

P000198A

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



LM119WG

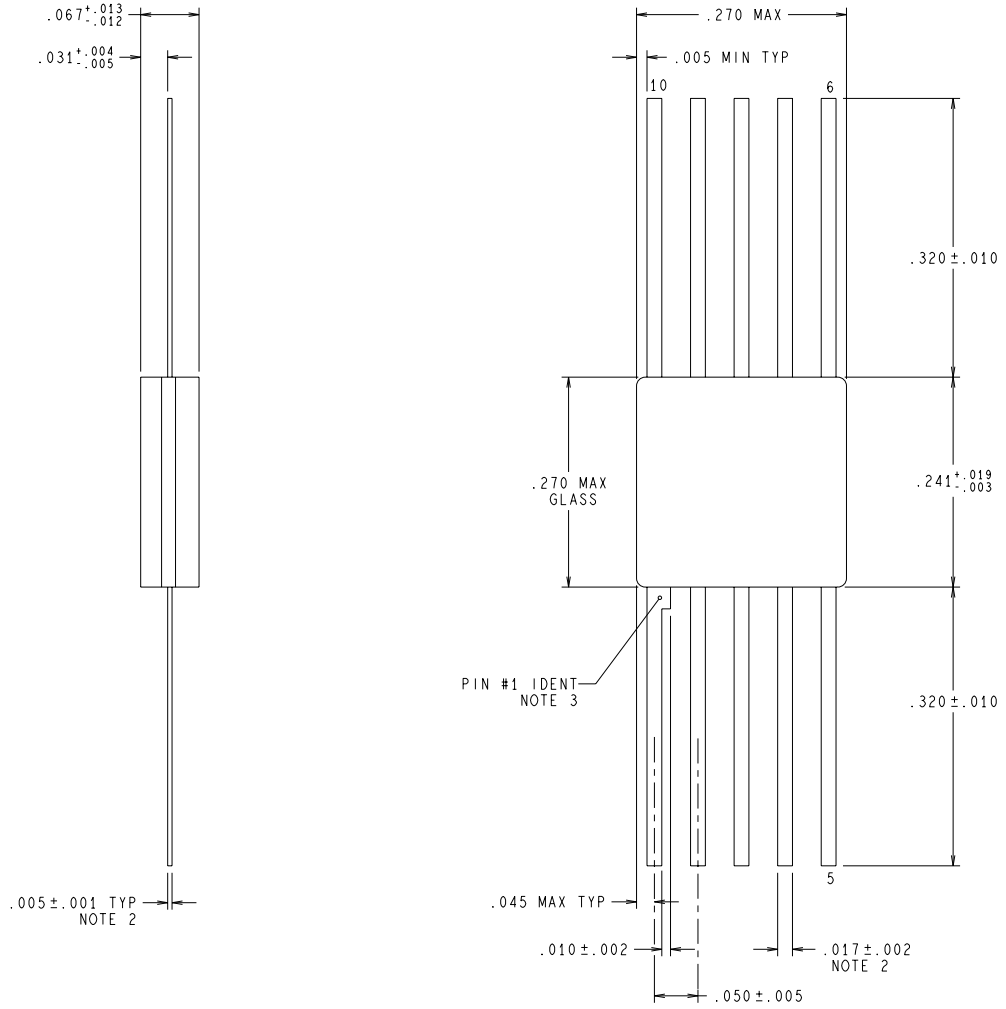
10 - LEAD CERAMIC SOIC

CONNECTION DIAGRAM
TOP VIEW

P000237A

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

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
F	REVISE AND REDRAW PER NEW STANDARD.	10510	07/28/94	DEG/AEP
G	.017±.002 WAS .017±.020.	10654	10/21/94	DEG/



NOTES: UNLESS OTHERWISE SPECIFIED.

1. LEAD FINISH: SOLDER DIPPED WITH Sn60 OR Sn63 SOLDER CONFORMING TO MIL-M-38510 TO A MINIMUM THICKNESS OF 200 MICROINCHES. SOLDER MAY BE APPLIED OVER LEAD BASIS METAL OR Sn PLATE.
2. MAXIMUM LIMIT MAY BE INCREASED BY .003 INCHES AFTER LEAD FINISH APPLIED.
3. LEAD 1 IDENTIFICATION SHALL BE:
   a) A NOTCH OR OTHER MARK WITHIN THIS AREA
   b) A TAB ON LEAD 1, EITHER SIDE
4. REFERENCE JEDEC REGISTRATION MO-003, VARIATION AG, DATED 06/01/76.

MIL/AERO CONFIGURATION CONTROL

MIL-M-38510 CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN: D.E.Grady	07/28/94
DFTG. CHK.	
ENGR. CHK.	

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

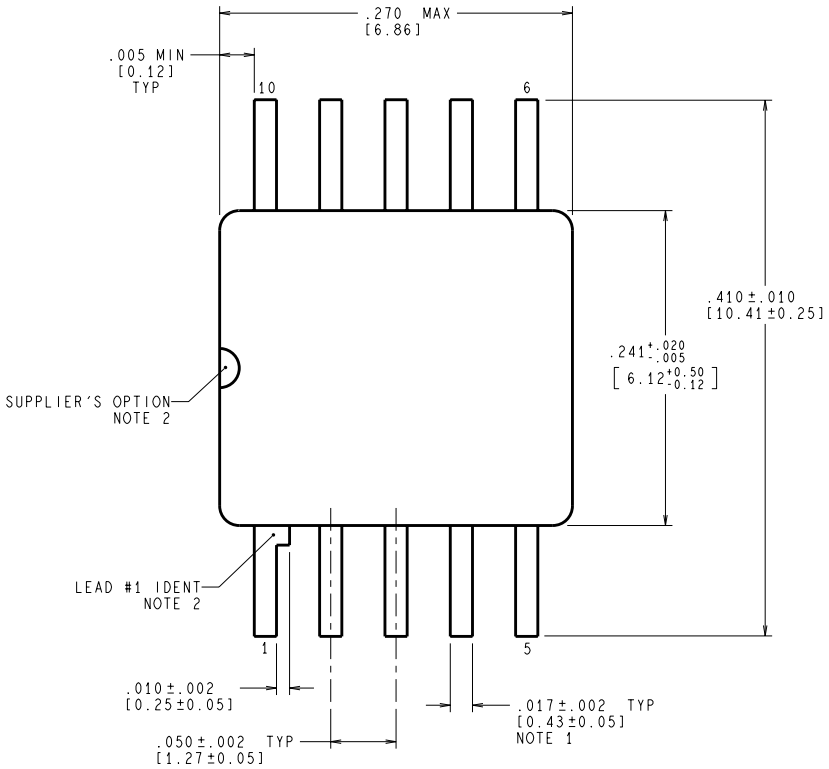
CERPACK, 10 LEAD

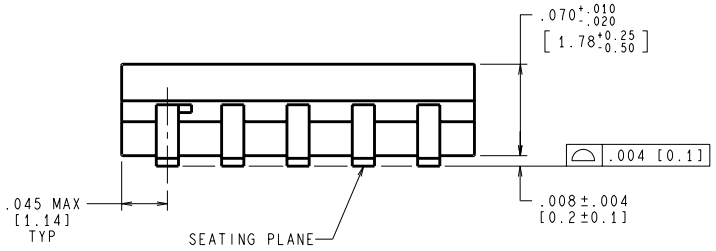
PROJECTION — INCH [MM]

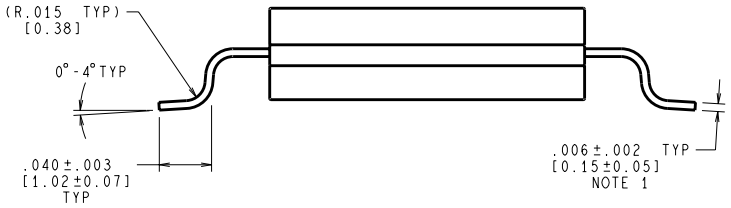
SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-W10A	G

DO NOT SCALE DRAWING — SHEET 1 of 1

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

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0D0	M0001370	05/02/00	Barbara Lopez	Added Power Dissipation - Note 2 in Absolute section. Renumbered all other notes. Archive MDS - MNLM119-X Rev. 0C0. Release MDS - MNLM119-X Rev. 0D0.
0E1	M0003659	07/19/02	Rose Malone	Update MDS: MNLM119-X, Rev. 0D0 to MNLM119-X, Rev. 0E1. Added reference for WG pkg, Package Weight Section and changed ThetaJC E pkg number from 5 C/W to 17.0 C/W in Absolute Maximum Section. Add graphics to graphics section.
0F1	M0004031	07/19/02	Rose Malone	Update MDS: MNLM119-X, Rev. 0E1 to MNLM119-X, Rev. 0F1. Updated Absolute Section, Package Weight for WG package