

MNLM118-X REV 0A0

 Original Creation Date: 06/30/95
 Last Update Date: 03/23/00
 Last Major Revision Date: 02/29/00

OPERATIONAL AMPLIFIER
General Description

The LM118 is a precision high speed operational amplifier designed for applications requiring wide bandwidth and high slew rate. It features a factor of ten increase in speed over general purpose devices without sacrificing DC performance.

The LM118 has internal unity gain frequency compensation. This considerably simplifies its application since no external components are necessary for operation. However, unlike most internally compensated amplifiers, external frequency compensation may be added for optimum performance. For inverting applications, feedforward compensation will boost the slew rate to over 150V/uS and almost double the bandwidth. Overcompensation can be used with the amplifier for greater stability when maximum bandwidth is not needed. Further, a single capacitor can be added to reduce the 0.1% settling time to under 1uS.

The high speed and fast settling time of these op amps make them useful in A/D converters, oscillators, active filters, sample and hold circuits, or general purpose amplifiers. This device is easy to apply and offers an order of magnitude better AC performance than industry standards such as the LM709.

Industry Part Number

LM118

Prime Die

LM118

NS Part Numbers

 LM118H/883
 LM118J-8/883
 LM118J/883
 LM118WG/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

- 15 MHz small signal bandwidth
- Guaranteed 50V/uS slew rate
- Maximum bias current of 250nA
- Operates from supplies of $\pm 5V$ to $\pm 20V$
- Internal frequency compensation
- Input and output overload protected
- Pin compatible with general purpose op amps

(Absolute Maximum Ratings)

(Note 1)

Supply Voltage		±20V
Power Dissipation (Note 2)		
Metal Can Pkg		750mW
J-8 Pkg		1000mW
J-14 Pkg		1250mW
CERAMIC SOIC		600mW
Differential Input Current (Note 3)		±10mA
Input Voltage (Note 4)		±15V
Output Short-Circuit Duration		Continuous
Operating Temperature Range		-55 C to +125 C
Thermal Resistance		
ThetaJA		
Metal Can Pkg	(Still Air @ 0.5W)	160 C/W
	(500LF/Min Air flow @ 0.5W)	86 C/W
J-8 Pkg	(Still Air @ 0.5W)	120 C/W
	(500LF/Min Air flow @ 0.5W)	66 C/W
J-14 Pkg	(Still Air @ 0.5W)	87 C/w
	(500LF/Min Air flow @ 0.5W)	51 C/W
CERAMIC SOIC	(Still Air @ 0.5W)	198 C/W
	(500LF/Min Air flow @ 0.5W)	124 C/W
ThetaJC		
Metal Can Pkg		48 C/W
J-8 Pkg		17 C/W
J-14 Pkg		17 C/W
CERAMIC SOIC		22 C/W
Storage Temperature Range		-65 C to +150 C
Lead Temperature (Soldering, 10 seconds)		300 C
ESD Tolerance (Note 5)		2000V

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 $P_{dmax} = (T_{jmax} - T_A) / \Theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

Note 3: The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, excessive current will flow if a differential input voltage in excess of 1V is applied between the inputs unless some limiting resistance is used.

Note 4: For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.

Note 5: Human body model, 1.5K Ohms in series with 100pF.

Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: $V_{cc} = \pm 15V$, $V_{cm} = 0$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vio	Input Offset Voltage	$V_{cm} = \pm 11.5V$, $R_s = 50 \text{ Ohms}$			-4	+4	mV	1
					-6	+6	mV	2, 3
		$V_{cc} = \pm 20V$, $R_s = 50 \text{ Ohms}$			-4	+4	mV	1
					-6	+6	mV	2, 3
		$V_{cc} = \pm 20V$, $V_{cm} = \pm 15V$, $R_s = 50 \text{ Ohms}$			-4	+4	mV	1
					-6	+6	mV	2, 3
Iio	Input Offset Current	$V_{cm} = \pm 11.5V$, $R_s = 10K \text{ Ohms}$			-50	+50	nA	1
					-100	+100	nA	2, 3
		$V_{cc} = \pm 20V$, $R_s = 10K \text{ Ohms}$			-50	+50	nA	1
					-100	+100	nA	2, 3
		$V_{cc} = \pm 5V$, $R_s = 10K \text{ Ohms}$			-50	+50	nA	1
					-100	+100	nA	2, 3
Iib	Input Bias Current	$V_{cm} = \pm 11.5V$, $R_s = 10K \text{ Ohms}$			1	250	nA	1
					1	500	nA	2, 3
		$V_{cc} = \pm 20V$, $R_s = 10K \text{ Ohms}$			1	250	nA	1
					1	500	nA	2, 3
		$V_{cc} = \pm 5V$, $R_s = 10K \text{ Ohms}$			1	250	nA	1
					1	500	nA	2, 3
PSRR	Power Supply Rejection Ratio	$+V_{cc} = 20V \text{ to } 5V$, $R_s = 50 \text{ Ohms}$			70		dB	1, 2, 3
		$-V_{cc} = -20V \text{ to } -5V$, $R_s = 50 \text{ Ohms}$			70		dB	1, 2, 3
CMRR	Common Mode Rejection Ratio	$V_{cc} = \pm 15V$, $V_{cm} = \pm 11.5V$, $R_s = 50 \text{ Ohms}$			80		dB	1, 2, 3
Ios+	Short Circuit Current	$t < 25mS$			-65	-5	mA	1, 2, 3
Ios-	Short Circuit Current	$t < 25mS$			5	65	mA	1, 2
					5	80	mA	3

Electrical Characteristics

DC PARAMETERS (Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: $V_{cc} = \pm 15V$, $V_{cm} = 0$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
I _{cc}	Power Supply Current	$V_{cc} = \pm 20V$				8	mA	1
						7	mA	2
						11	mA	3
V _{ioAdj}	Input Offset Voltage Adjust	$V_{cc} = \pm 20V$			4	-4	mV	1
R _{in}	Input Resistance		2		1		MOhms	1
V _{in}	Input Voltage Range	$V_{cc} = \pm 15V$	1		-11.5	+11.5	V	1, 2, 3
A _{vs}	Large Signal Voltage Gain	R _l =2K Ohms, V _o =0 to -10V	3		50		V/mV	4
			3		25		V/mV	5, 6
		R _l =2K Ohms, V _o =0 to +10V	3		50		V/mV	4
			3		25		V/mV	5, 6
V _{out}	Output Voltage Swing	R _l =2K Ohms			+12	-12	V	4, 5, 6

AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: $V_{cc} = \pm 15V$, $V_{cm} = 0$, $R_s = 0$, $R_l = 2K$ Ohms, $C_l = 33pF$

S _r	Slew Rate	$V_{cc} = \pm 20V$, $V_{in} = -5V$ to $+5V$, $A_v=1$	4		50		V/uS	7
		$V_{cc} = \pm 20V$, $V_{in} = +5V$ to $-5V$, $A_v=1$	4		50		V/uS	7

- Note 1: Guaranteed by CMRR.
 Note 2: Guaranteed parameter not tested.
 Note 3: Datalog in K = V/mV
 Note 4: Bench tested use TDN 25256223

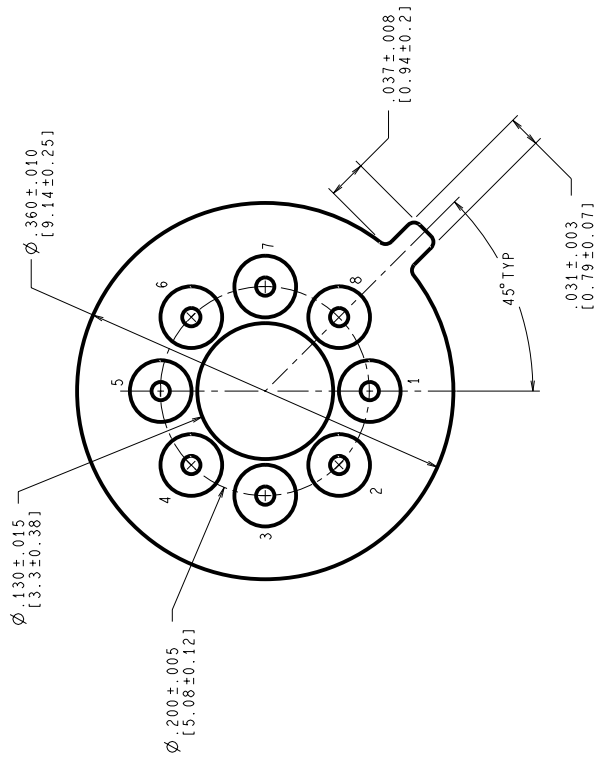
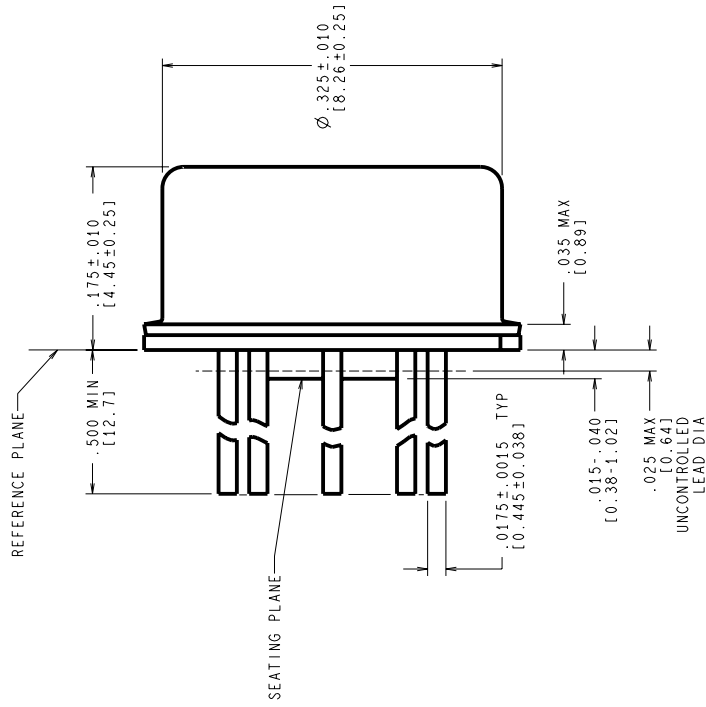
Graphics and Diagrams

GRAPHICS#	DESCRIPTION
05482HRA1	10LD CERPACK, 10LD CERAMIC SOIC (B/I CKT)
09556HR02	CERDIP (J14), CERDIP (J8) (B/I CKT)
09557HRA4	METAL CAN (H), TO-99, 8LD, .200 DIA P.C. (B/I CKT)
H08CRF	METAL CAN (H), TO-99, 8LD, .200 DIA P.C. (P/P DWG)
J08ARL	CERDIP (J), 8 LEAD (P/P DWG)
J14ARH	CERDIP (J), 14 LEAD (P/P DWG)
P000268A	METAL CAN (H), 8 LEAD (PINOUT)
P000315A	CERDIP (J), 8 LEAD (PINOUT)
P000316A	CERDIP (J), 14 LEAD (PINOUT)
P000459A	CERPACK, 10 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
F	REVISE & REDRAW PER CURRENT STANDARD; UPDATE MIL/AERO STAMP & TITLE.	11002	06/22/95	MS/



CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

MIL-I-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 WITH CERAMIC STANDOFF.
- APPLIES TO MIL-AERO AND LINEAR PRODUCTS.
- REFERENCE JEDEC REGISTRATION TO-99, JEDEC PUBLICATION No. 95.

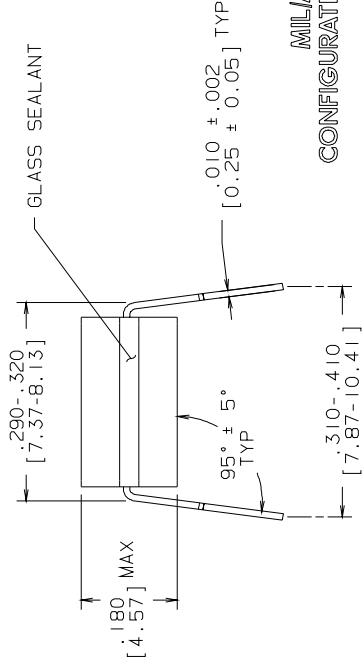
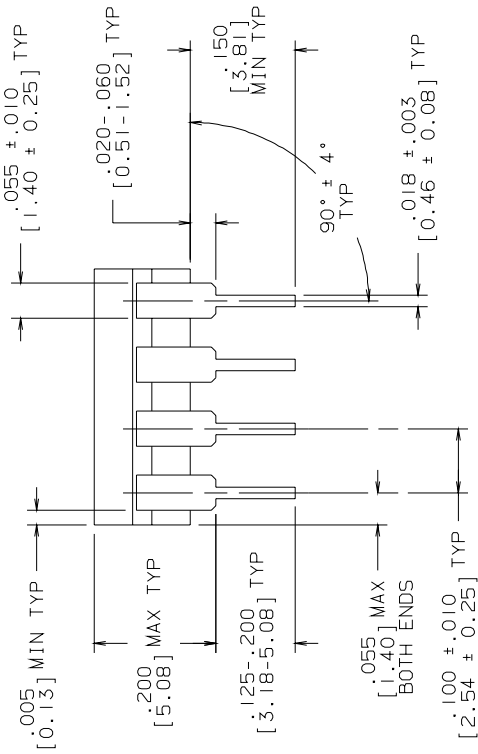
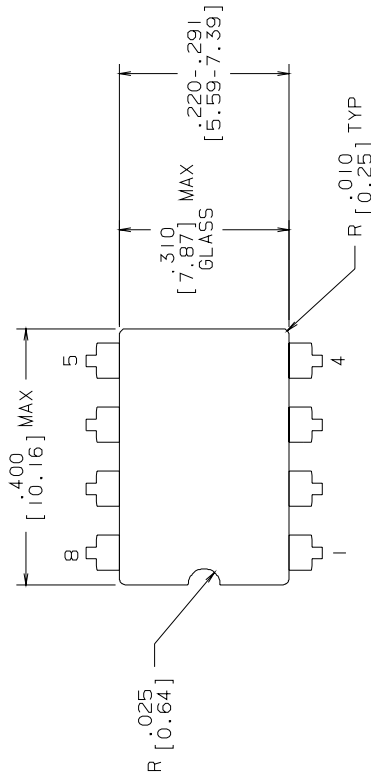
APPROVALS	DATE
DRN: MARTA SUCHY	06/22/95
DWG. CHK.	
ENGR. CHK.	

SCALE	N/A
SIZE	C
DRAWING NUMBER	MKT-H08C
REV	F

National Semiconductor	
2800, Semiconductor dr., Santa Clara, CA 95052-8090	
METAL CAN, 8 LEAD, .200 DIA P.C.	

DO NOT SCALE DRAWING	
SHEET 1 of 1	

R E V I S I O N S			
LTR	DESCRIPTION	E. C. N.	DATE
L	REVISE PER CURRENT STD; REDRAW	10002	09/21/93
			BY/APP'D TL/



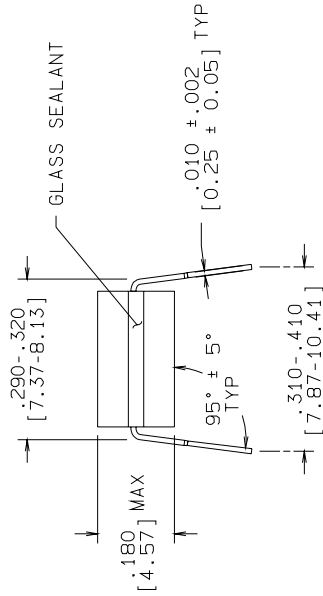
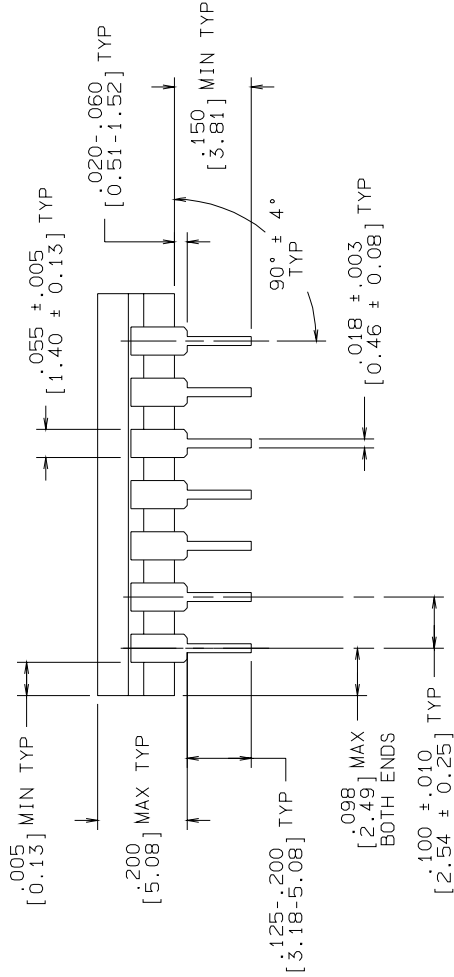
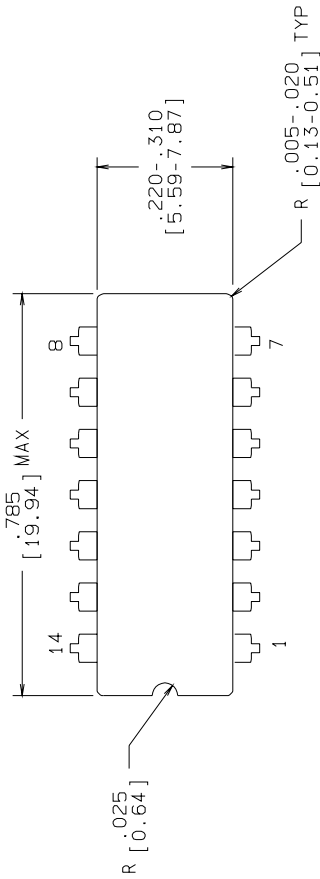
MILAERO
CONFIGURATION CONTROL
MIL-M-38510
CONFIGURATION CONTROL

CONTROLLING DIMENSION: INCH	
APPROVALS	DATE
DRAWN T. LEQUANG	09/21/93
DFTG. CHK.	
ENGR. CHK.	
APPROVAL	
NATIONAL SEMICONDUCTOR CORPORATION 2900 Semiconductor Drive, Santa Clara, CA 95052-8090	
CERDIP (J), 8 LEAD	
SCALE N/A	SIZE B
DO NOT SCALE DRAWING	DRAWING NUMBER MKT-J08A
SHEET 1	OF 1
REV	L

NOTES: UNLESS OTHERWISE SPECIFIED

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

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



CONTROLLING DIMENSION: INCH

NOTES: UNLESS OTHERWISE SPECIFIED

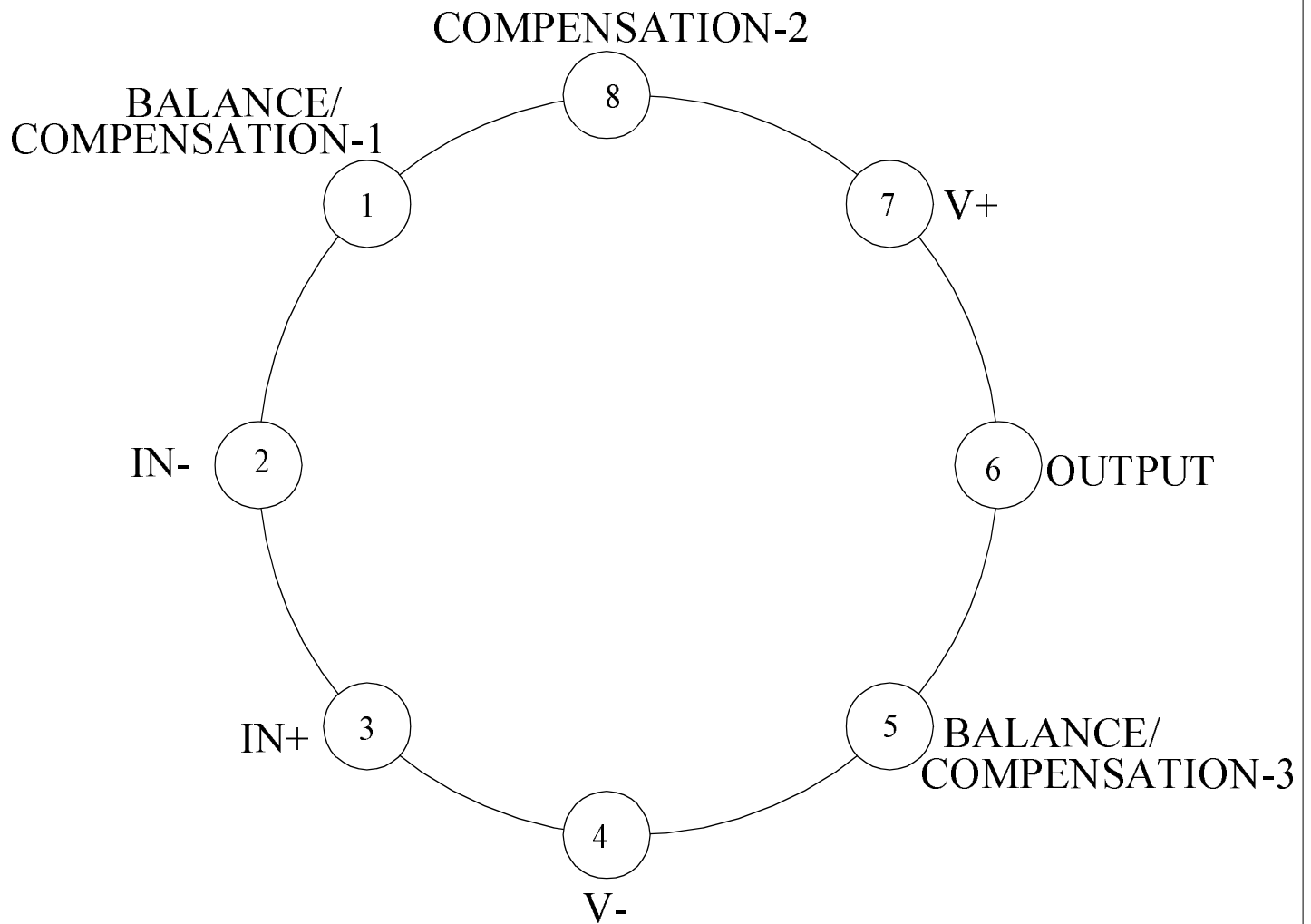
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2. JEDEC REGISTRATION MO-036, VARIATION AB, DATED 04/1981.

MIL/AERO MIL-M-38510
CONFIGURATION CONTROL CONFIGURATION CONTROL

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

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		DO NOT SCALE DRAWING	SHEET	1	OF 1

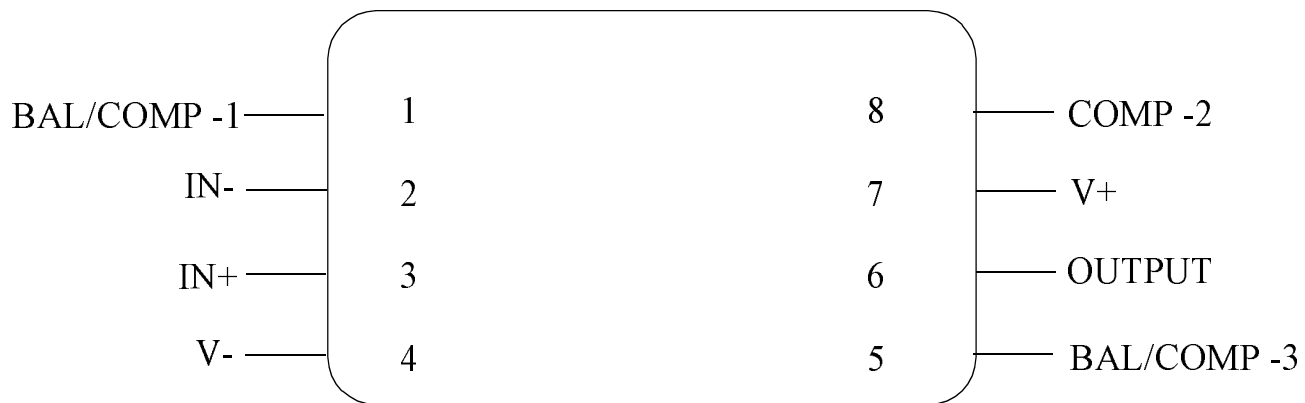
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LM118H
8 - PIN METAL CAN
CONNECTION DIAGRAM
TOP VIEW
P000268A



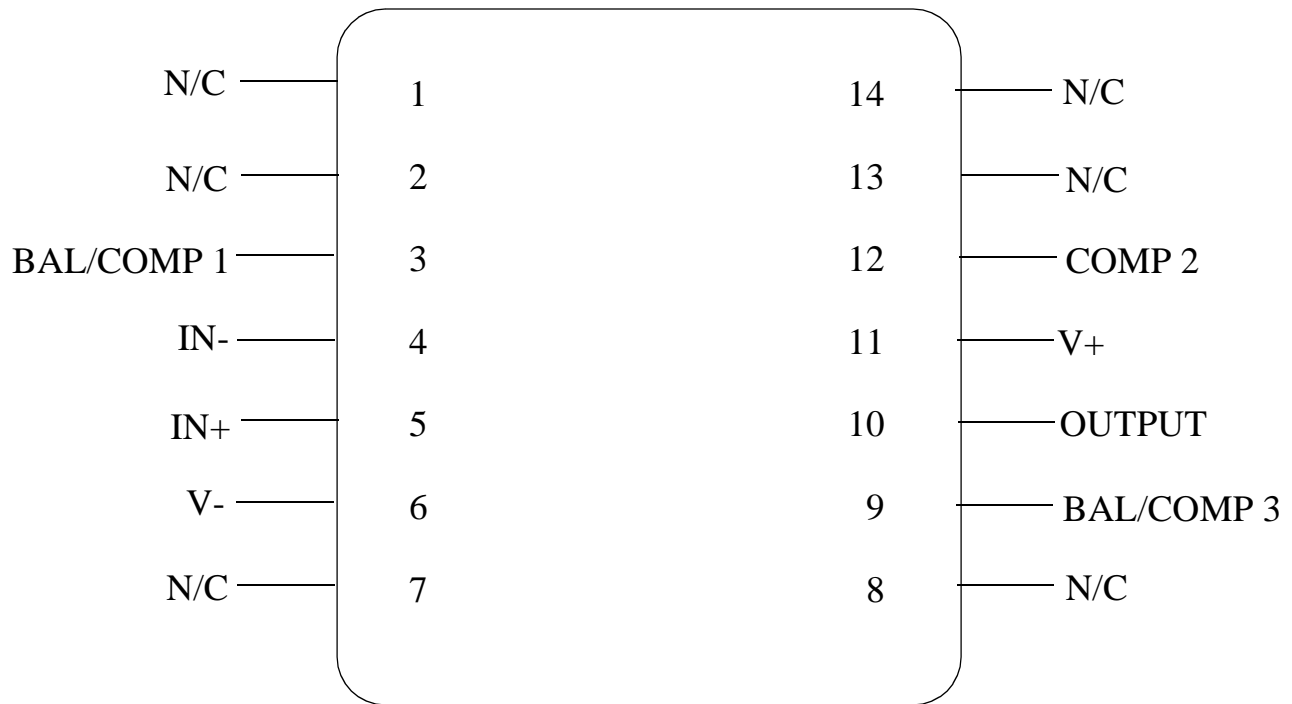
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2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050



LM118J-8
8 - LEAD DIP
CONNECTION DIAGRAM
TOP VIEW
P000315A



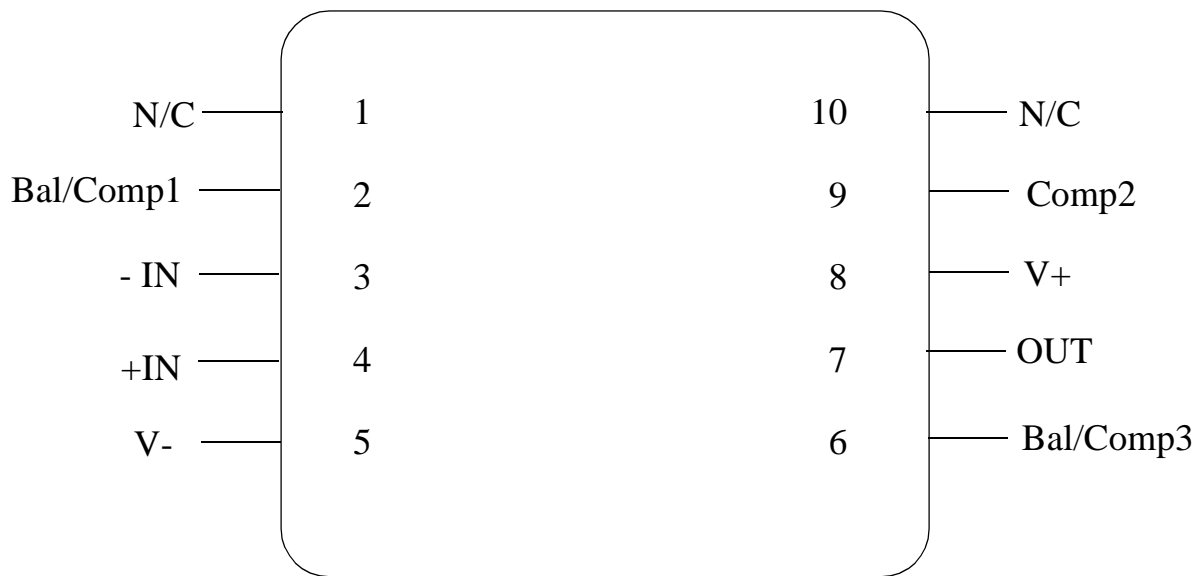
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SANTA CLARA, CA 95050



LM118J
14 - LEAD DIP
CONNECTION DIAGRAM
TOP VIEW
P000316A



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LM118WG
10 - LEAD CERAMIC SOIC
CONNECTION DIAGRAM
TOP VIEW
P000459A

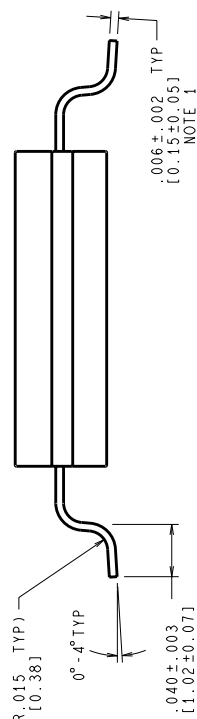
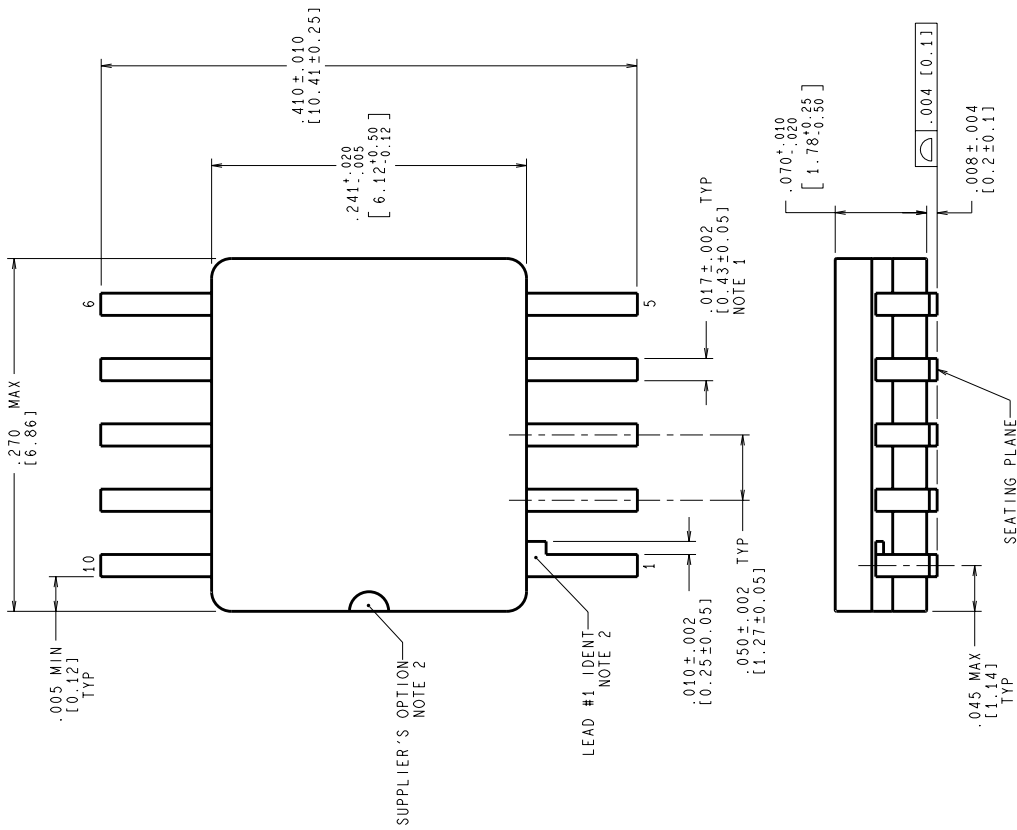


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 2900 SEMICONDUCTOR DRIVE
 SANTA CLARA, CA 95050

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/



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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

Rev	ECN #	Rel Date	Originator	Changes
0A0	M0003641	03/23/00	Rose Malone	Update MDS - MNLM118-X, Rev. 0AL to MNLM118-X, Rev. 0A0 Fully Released MDS. Archive/Obsolete RETS118X, Rev. AA