

MNLM1575-15-X REV 0D1

 Original Creation Date: 08/29/95
 Last Update Date: 05/22/00
 Last Major Revision Date: 08/29/95

SIMPLE SWITCHER(TM) 1A STEP-DOWN VOLTAGE REGULATOR
General Description

The LM1575 regulator is a monolithic integrated circuit that provides all the active functions for a step-down (buck) switching regulator, capable of driving a 1A load with excellent line and load regulation.

Requiring a minimum number of external components, this regulator is simple to use and includes internal frequency compensation and a fixed-frequency oscillator.

The LM1575 offers a high-efficiency replacement for popular three-terminal linear regulators. It substantially reduces the size of the heat sink, and in many cases no heat sink is required.

A standard series of inductors optimized for use with the LM1575 are available from several different manufacturers. This feature greatly simplifies the design of switch-mode power supplies.

Other features include a guaranteed $\pm 4\%$ tolerance on output voltage within specified input voltage and output load conditions, and $\pm 10\%$ on the oscillator frequency. External shutdown is included, featuring 50uA (typical) standby current. The output switch includes cycle-by-cycle current limiting, as well as thermal shutdown for full protection under fault conditions.

Industry Part Number

LM1575-15

NS Part Numbers

 LM1575J-15-QML
 LM1575K-15-QML
 LM1575WG-15-QML

Prime Die

LM1575-15

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

- Adjustable version output voltage range, 1.23V to 37V $\pm 4\%$ max over line and load conditions
- Guaranteed 1A output current
- Requires only 4 external components
- 52KHz fixed frequency internal oscillator
- TTL shutdown capability, low power standby mode
- High efficiency
- Uses readily available standard inductors
- Thermal shutdown and current limit protection

CONTROLLING DOCUMENTS:

LM1575J-15-QML	5962-9167401QEA
LM1575K-15-QML	5962-9167401QXA
LM1575WG-15-QML	5962-9167401QZA

Applications

- Simple high-efficiency step-down (buck) regulator
- Efficient pre-regulator for linear regulators
- On-card switching regulators
- Positive to negative converted (Buck-Boost)

(Absolute Maximum Ratings)

(Note 1)

Maximum Supply Voltage	45V
$\overline{\text{ON}}$ /OFF Pin Input Voltage	$-0.3\text{V} \leq V \leq +V_{\text{in}}$
Output Voltage to Ground (Steady State)	-1V
Power Dissipation (Note 2, 3)	Internally Limited
Storage Temperature Range	$-65\text{ C} \leq T_a \leq +150\text{ C}$
Lead Temperature (Soldering, 10 seconds)	
METAL CAN	300 C
CERDIP	260 C
CERAMIC SOIC	260 C
Maximum Junction Temperature	150 C
Thermal Resistance	
ThetaJA	
METAL CAN (Still Air)	45 C/W
(500LF/Min Air Flow)	10 C/W
CERDIP (Still Air)	70 C/W
(500LF/Min Air Flow)	33 C/W
CERAMIC SOIC (Still Air)	121 C/W
(500LF/Min Air Flow)	73 C/W
Theta JC (Note 3)	
METAL CAN	3.3 C/W
CERDIP	2.0 C/W
CERAMIC SOIC	3.0 C/W
Package Weight (Typical)	
METAL CAN	TBD
CERDIP	TBD
CERAMIC SOIC	TBD
ESD Tolerance (Note 4)	3000V

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 $T_{j\text{max}}$ (maximum junction temperature), Θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{\text{dmax}} = (T_{j\text{max}} - T_A)/\Theta_{\text{JA}}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

(Continued)

- Note 3: 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 material is very poor, relative to the material 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 4: Human body model, 1.5k Ohms in series with 100pF.

Recommended Operating Conditions

Temperature Range	-55 C ≤ Ta ≤ +125 C
Supply Voltage	40V

Electrical Characteristics

ELECTRICAL CHARACTERISTICS: SYSTEM PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: $V_{in} = 30V$, and $I_{load} = 200mA$.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vout	Output Voltage		1		14.85	15.15	V	1
		$0.2A \leq I_{load} \leq 1A$, $18V \leq V_{in} \leq 40V$	1		14.55	15.45	V	1
			1		14.40	15.60	V	2, 3

ELECTRICAL CHARACTERISTICS: DEVICE PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: $V_{in} = 30V$, and $I_{load} = 200mA$.

Vsat	Saturation Voltage	$I_{out} = 1A$	2			1.2	V	1
			2			1.4	V	2, 3
Icl	Current Limit	Peak Current, $t_{ON} \leq 3\mu S$	2		1.7	3.0	A	1
			2		1.3	3.2	A	2, 3
Il	Output Leakage Current	$V_{in} = 35V$, Output = 0V	4			2	mA	1
		$V_{in} = 35V$, Output = -1V	4			30	mA	1
Iq	Quiescent Current		4			10	mA	1
			4			12	mA	2, 3
Istby	Standby Quiescent Current	\overline{ON}/OFF Pin = 5V (OFF)				200	uA	1
						500	uA	2, 3

AC ELECTRICAL CHARACTERISTICS: DEVICE PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: $V_{in} = 30V$, and $I_{load} = 200mA$.

fo	Oscillator Frequency				47	58	KHz	4
					43	62	KHz	5, 6
Dc	Max Duty Cycle (ON)		3		93		%	9

Electrical Characteristics

ELECTRICAL CHARACTERISTICS: ON/OFF CONTROL

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: $V_{in} = 30V$, and $I_{load} = 200mA$.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vih	\overline{ON}/OFF Pin Logic Input Level	$V_{out} = 0V$			2.2		V	1
Vih	\overline{ON}/OFF Pin Logic Input Level	$V_{out} = 0V$			2.4		V	2, 3
Vil	\overline{ON}/OFF Pin Logic Input Level	$V_{out} = 15V$				1.0	V	1
Vil	\overline{ON}/OFF Pin Logic Input Level	$V_{out} = 15V$				0.8	V	2, 3
Iih	\overline{ON}/OFF Pin Input Current	\overline{ON}/OFF Pin = 5V (OFF)				30	μA	1
Iil	\overline{ON}/OFF Pin Input Current	\overline{ON}/OFF Pin = 0V (ON)				10	μA	1

Note 1: External components such as the catch diode, inductor, input and output capacitors can affect switching regulator system performance.

Note 2: Output sourcing current. No diode, inductor or capacitor connected to output.

Note 3: Feedback removed from output and connected to 0V.

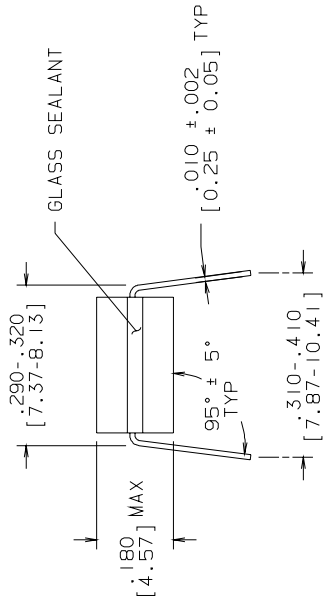
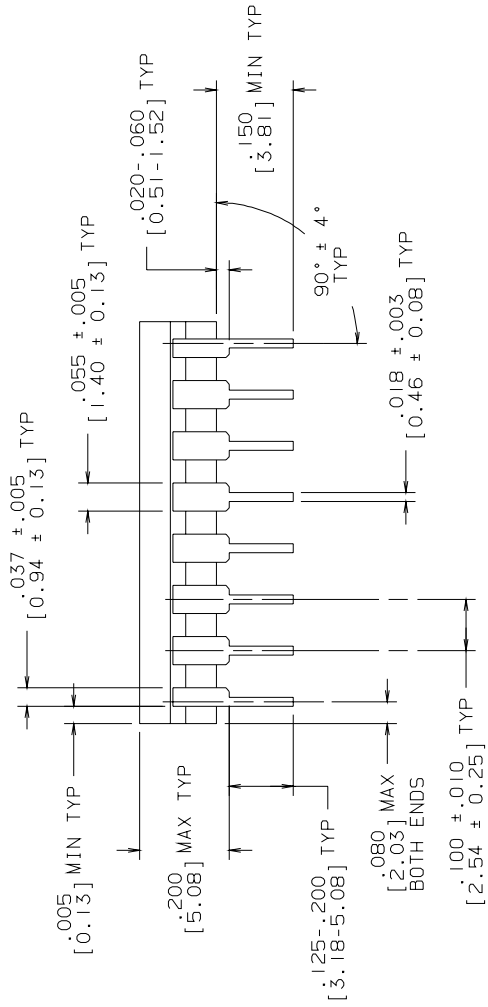
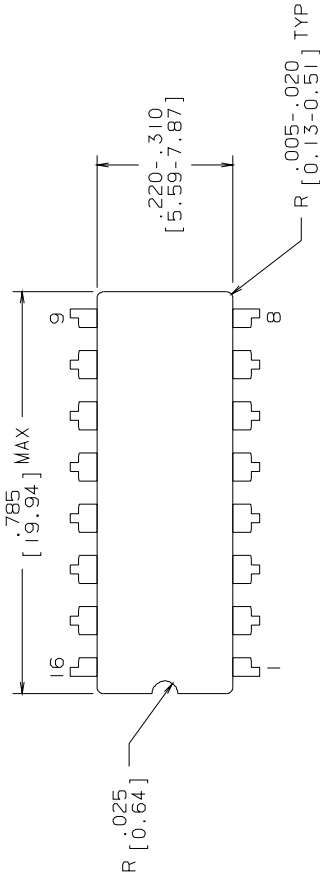
Note 4: Feedback removed from output and connected to 25V to force the output transistor OFF.

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
06153HRA2	METAL CAN (KA), TO-3, 4LD, LOW PROFILE (B/I CKT)
06265HRB2	CERDIP (J), 16 LEAD (B/I CKT)
06379HRA1	CERAMIC SOIC (WG), 16 LEAD (B/I CKT)
J16ARL	CERDIP (J), 16 LEAD (P/P DWG)
KA04BRA	METAL CAN (KA), TO-3, 4 LEAD, LOW PROFILE (P/P DWG)
P000232A	METAL CAN (KA), TO-3, 4LD, LOW PROFILE (PINOUT)
P000371A	CERDIP (J), 16 LEAD (PINOUT)
P000464A	CERAMIC SOIC (WG), 16 LEAD (PIN OUT)
WG16ARC	CERAMIC SOIC (WG), 16 LEAD (P/P DWG)

See attached graphics following this page.

R E V I S I O N S			
LTR	DESCRIPTION	E. C. N.	DATE
L	REVISE PER CURRENT STD; REDRAW	09996	09/15/93
			TL/



MILIAERO
CONFIGURATION CONTROL

MIL-M-38510
CONFIGURATION CONTROL

CONTROLLING DIMENSION: INCH	
APPROVALS	DATE
DRAWN T. LEQUANG	09/15/93
DFTG. CHK.	
ENGR. CHK.	
APPROVAL	
PROJECTION 	
SCALE N/A	SIZE B
DO NOT SCALE DRAWING	DRAWING NUMBER MKT-J16A
	REV L
	SHEET 1 OF 1

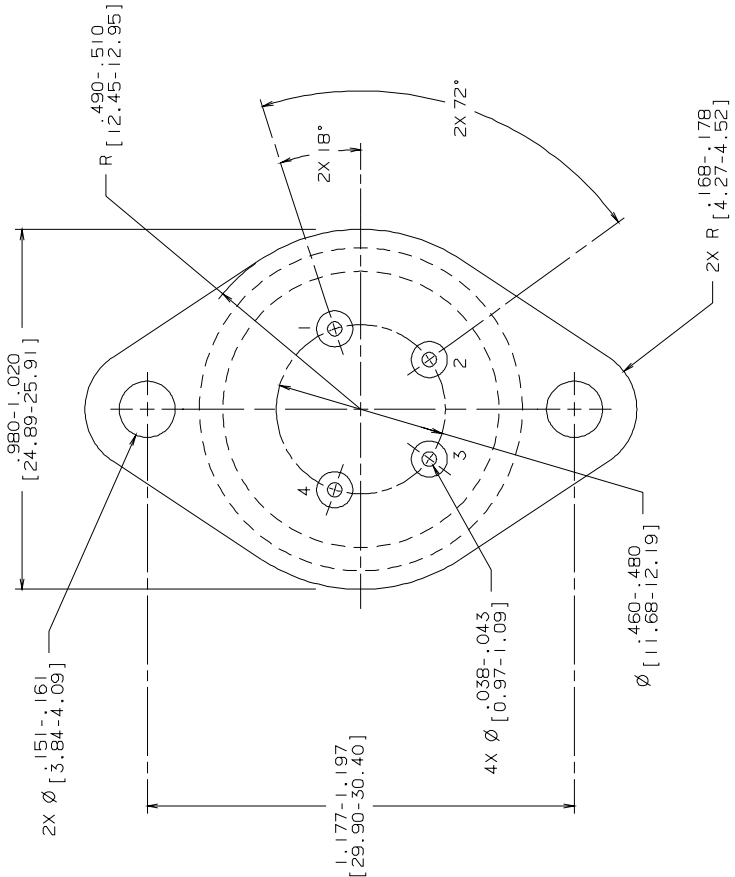
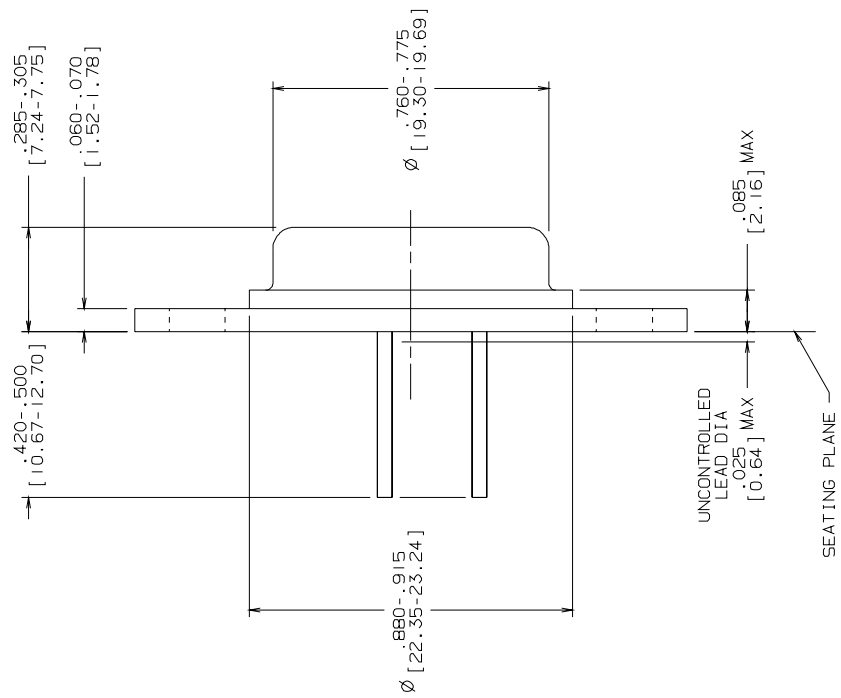
NATIONAL SEMICONDUCTOR CORPORATION
2900 Semiconductor Drive, Santa Clara, CA 95052-8090

CERDIP (J),
16 LEAD

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 AD, DATED 04/1981.

REVISIONS			
LTR	DESCRIPTION	E.C.N.	DATE
A	RELEASE TO DOCUMENT CONTROL	09260	08/14/92 DEG/



NOTES: UNLESS OTHERWISE SPECIFIED

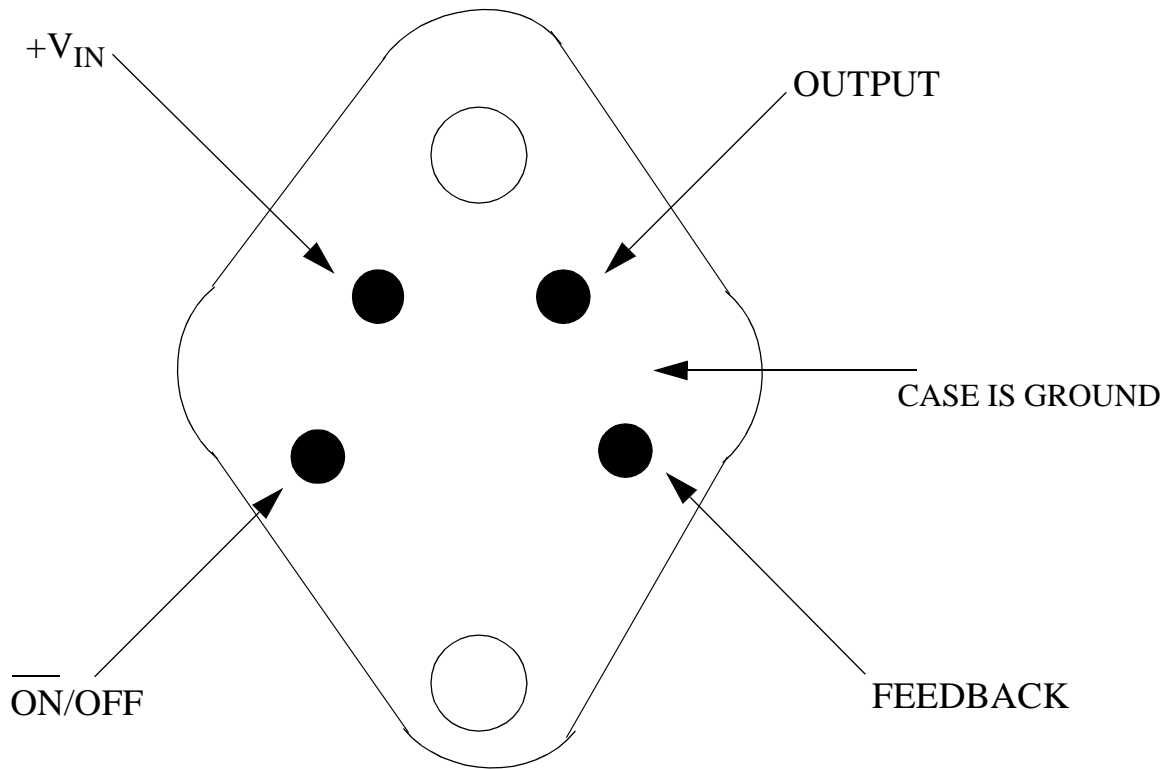
- STANDARD HEADER TYPE SOLID BASE.
- STANDARD LEAD FINISH:
Sn/Pb SOLDER OVER 100 MICRONS/
2.54 MICROMETERS MINIMUM NICKEL PLATED
ON ALLOY 52.
- LEAD TIPS LOCATED WITHIN ±.080 [2.03]
OF LEAD POSITION AT BASE.
- REFERENCE ON JEDEC REGISTRATION TO-3,
PUBLICATION 95, PAGE 98.

MIL/AERO
CONFIGURATION CONTROL

CONTROLLING DIMENSION: INCH	
APPROVALS	DATE
DRAWN: D.E. GRADY	10/28/91
DFG: CHK.	
ENGR. CHK.	
APPROVAL	
SCALE	N/A
SIZE	C
DRAWING NUMBER	MKT-KA04B
REV	A
DO NOT SCALE DRAWING	
SHEET 1 OF 1	

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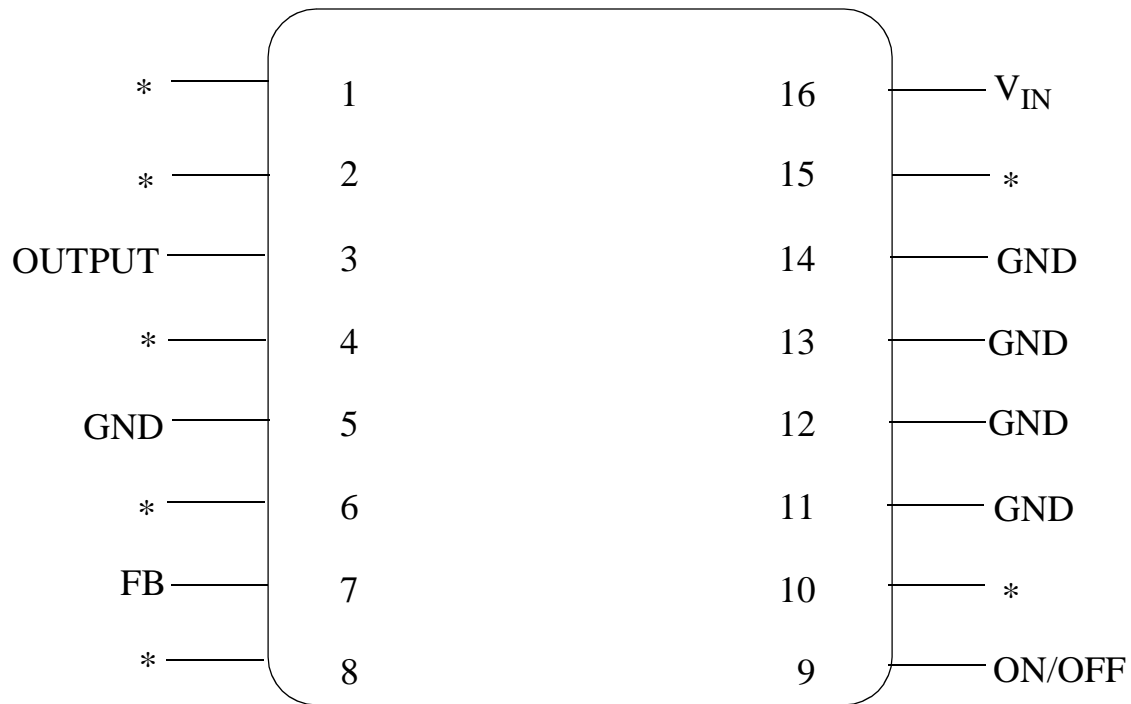
METAL CAN, TO-3
4 LEAD, LOW PROFILE



LM1575K, LM1575HVK
4 - LEAD TO-3
CONNECTION DIAGRAM
BOTTOM VIEW
P000232A



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



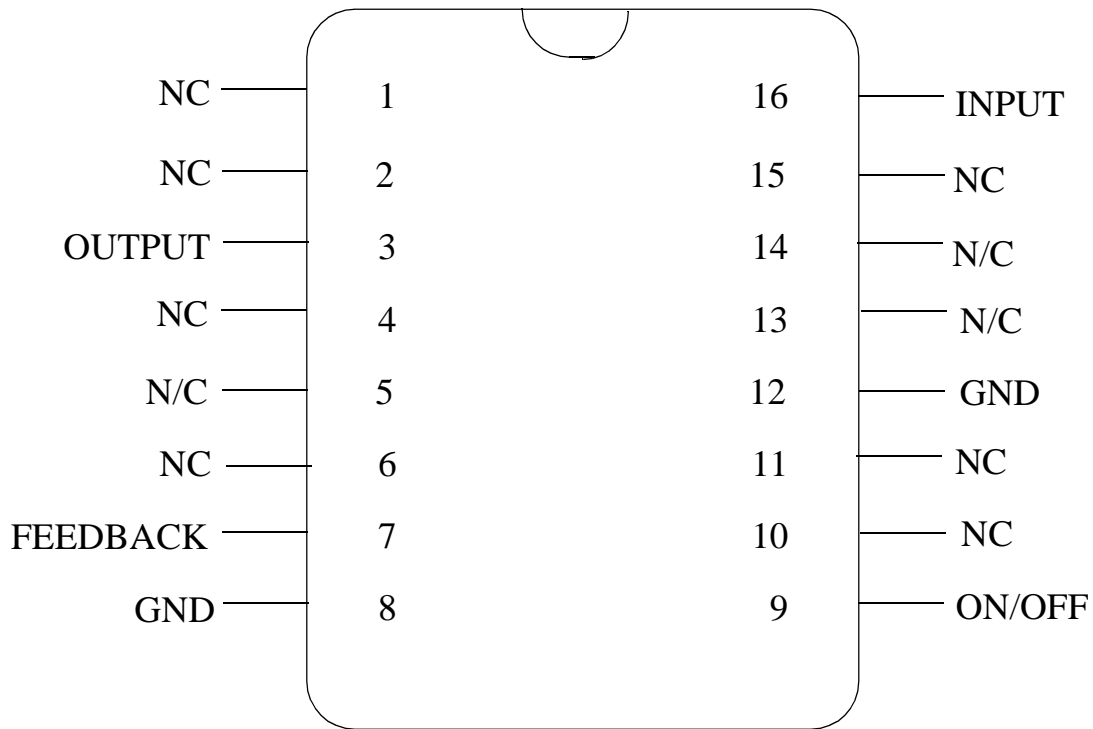
*No Internal Connection

LM1575J
16 - LEAD DIP
CONNECTION DIAGRAM
TOP VIEW
P000371A



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



LM1575WG
16 - LEAD CERAMIC SOIC
CONNECTION DIAGRAM
TOP VIEW
P000464A

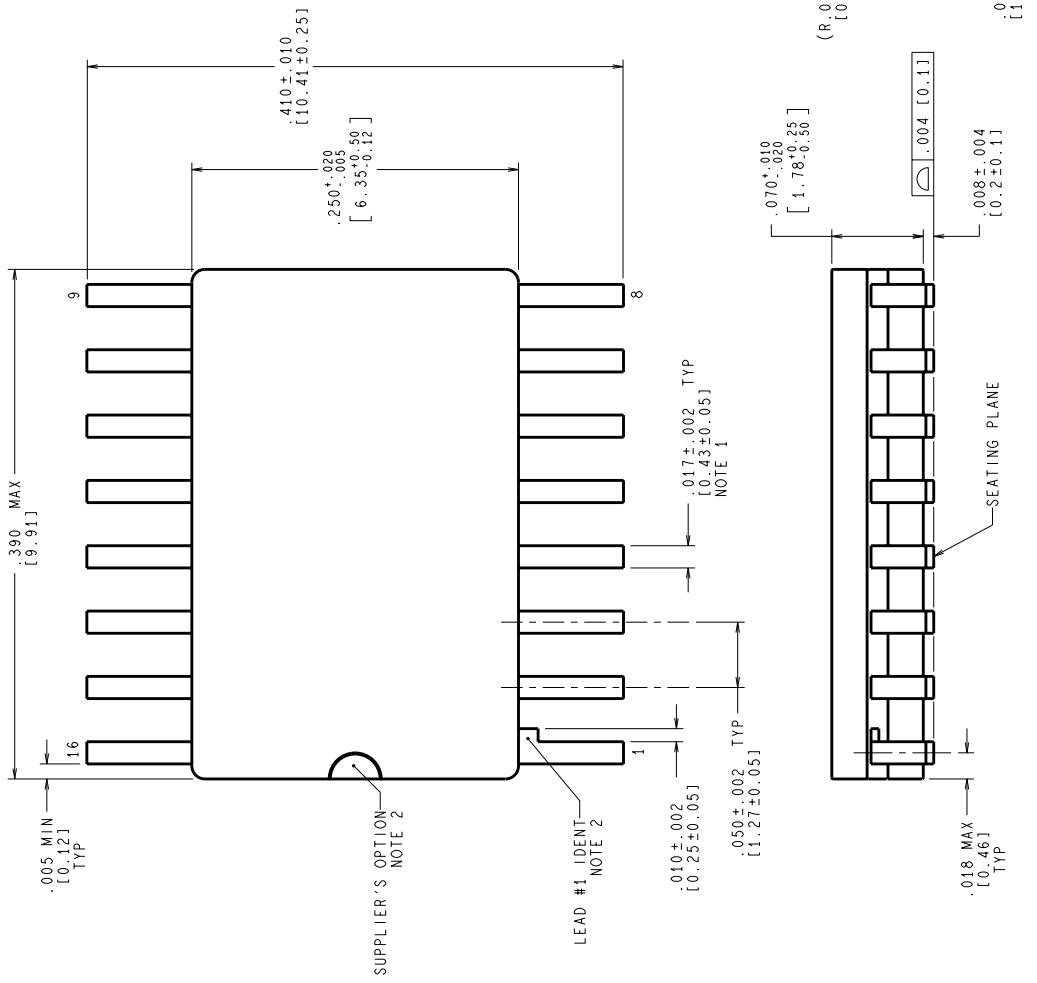


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MIL/AEROSPACE OPERATIONS
 2900 SEMICONDUCTOR DRIVE
 SANTA CLARA, CA 95050

REVISIONS			
LTR	DESCRIPTION	E.C.N.	DATE
A	RELEASE TO DOCUMENT CONTROL	11376	02/29/1996
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
C	R.015(0.38) WAS R.006(0.15)	11840	10/08/1997

APPROVALS	DATE	BY/APP'D
DRN: <i>MARYA SUCHY</i>	02/29/96	MS/KH
ENR. CHK:		MS/KH
PROJECTION		TL/



**MIL-PRF-38535
CONFIGURATION CONTROL**

CONTROLLING DIMENSION IS INCH
VALUES IN | ARE MILLIMETERS

- 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.

 National Semiconductor 2900 Semiconductor Dr., Santa Clara, CA 95052-8090	
DATE	02/29/96
SCALE	N/A
SIZE	C
DRAWING NUMBER	(SC)MKT-WG16A
REV	C
DO NOT SCALE DRAWING	
SHEET 1 of 1	

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0C0	M0001550	05/22/00	Barbara Lopez	Changed: MNL1575-X-15 Rev. 0B0 to MNL1575-15-X Rev. 0C0. Added power dissipation note for Aluminum Nitride package. Changed nomenclature.
0D1	M0003689	05/22/00	Rose Malone	Update MDS: MNL1575-15-X, Rev. 0C0 to MNL1575-15-X, Rev. 0D1. Added reference to WG package to Main Table, Market Dwg., B/I Ckt., Pin Out to Graphics Section and to Absolute Maximum Ratings Section. Moved Controlling Documents (SMD numbers) to Features Section. Corrected typo in Recommended Operating Conditions Section.