National Semiconductor

MICROCIRCUIT DATA SHEET

MDLM117HV-H REV 0A0

Original Creation Date: 06/27/95
Last Update Date: 09/18/95
Last Major Revision Date: 06/27/95

POSITIVE THREE TERMINAL HIGH VOLTAGE ADJUSTABLE REGULATOR

General Description

The LM117HV adjustable 3-terminal positive voltage regulator is capable of supplying in excess of 0.5A over a 1.2V to 57V output range. It is exceptionally easy to use and requires only two external resistors to set the output voltage. Further, both line and load regulation are are better than standard fixed regulators.

In addition to higher performance than fixed regulators, the LM117HV offers full overload protection available only in IC's. Included on the chip are current limit, thermal overload protection and safe area protection. All overload protection circuitry remains fully functional even if the adjustment terminal is disconnected.

Normally, no capacitors are needed unless the device is situated more than 6 inches from the input filter capacitors in which case an input bypass is needed. An optional output capacitor can be added to improve transient response. The adjustment terminal can be bypassed to achieve very high ripple rejection ratios which are difficult to achieve with standard 3-terminal regulators.

Besides replacing fixed regulators, the LM117HV is useful in a wide variety of other applications. Since the regulator is "floating" and sees only the input-to-output differential voltage, supplies of several hundred volts can be regulated as long as the maximum input to output differential is not exceeded, (i.e. do not short the output to ground).

Also, it makes an especially simple adjustable switching regulator, a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the LM117HV can be used as a precision current regulator. Supplies with electronic shutdown can be achieved by clamping the adjustment terminal to ground which programs the output to 1.2V where most loads draw little current.

Industry Part Number

LM117HVH

NS Part Numbers

LM117HVH-SMD

Prime Die

LM117HVH

Controlling Document

DESC.# 7703402XA

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

- Adjustable output down to 1.2V.
- Guaranteed 0.5A output current.
- Line regulation typically 0.01%/V.
- Load regulation typically 0.1%.
- Current limit constant with temperature.
- Eliminates the need to stock many voltages.
- 80 dB ripple rejection.
- Output is short-circuit protected.

(Absolute Maximum Ratings)
(Note 1)

Power Dissipation	Internally Limited
Input-Output Voltage Differential	+60V, -0.3V
Maximum Junction Temperature	150 C
Storage Temperature Range	-65 C to +150 C
Lead Temperature (Soldering, 10 seconds)	300 C
Thermal Resistance	
ThetaJA	
(Still Air)	186 C/W
(500LF/Min Air flow)	64 C/W
ThetaJC	21 C/W
ESD Tolerance (Note 2)	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 intended to be 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.
Note 2: Human body model, 1.5K Ohms 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: Il = 8mA

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vref	Reference Voltage	Vdiff = 3V			1.2	1.3	V	1
		Vdiff = 40V			1.2	1.3	V	1, 2, 3
		Vdiff = 60V			1.2	1.3	V	1, 2, 3
		Vdiff = 3.3V			1.2	1.3	V	2, 3
Rline	Line Regulation	3V ≤ Vdiff ≤ 40V, Vout = Vref			-9	9	mV	1
		40V ≤ Vdiff ≤ 60V, Vout = Vref			-5	5	mV	1
		40V ≤ Vdiff ≤ 60V, Vout = Vref			-10	10	mV	2, 3
		3V ≤ Vdiff ≤ 60V			-14	14	mV	1
		3V ≤ Vdiff ≤ 60V			-33	33	mV	2, 3
		3.3V ≤ Vdiff ≤ 40V, Vout = Vref			-23	23	mV	2, 3
Rload	Load Regulation	Vdiff = 3V, 10mA ≤ Il ≤ 500mA			-15	15	mV	1
		Vdiff = 40V, 10mA ≤ Il ≤ 150mA			-15	15	mV	1
		Vdiff = 60V, 10mA ≤ Il ≤ 20mA			-15	15	mV	1, 2, 3
		Vdiff = 3.3V, 10mA ≤ Il ≤ 500mA			-15	15	mV	2, 3
		Vdiff = 40V, 10mA ≤ Il ≤ 100mA			-15	15	mV	2, 3
Vrth	Thermal Regulation	Vin = 14.6V, Il = 300mA, Pd = 4W, t = 20mS			-3.1	3.1	mV	1
Iadj	Adjustment Pin Current	Vdiff = 3V				100	uA	1
		Vdiff = 40V				100	uA	1, 2, 3
		Vdiff = 60V				100	uA	1, 2, 3
		Vdiff = 3.3V				100	uA	2, 3
Delta Iadj	Adjustment Pin Current Change	Vdiff = 3V, 10mA ≤ Il ≤ 500mA			-5	5	uA	1
		Vdiff = 40V, 10mA ≤ Il ≤ 150mA			-5	5	uA	1
		3V ≤ Vdiff ≤ 40V			-5	5	uA	1
		3.3V ≤ Vdiff ≤ 60V			-5	5	uA	1, 2, 3
		Vdiff = 3.3V, 10mA ≤ Il ≤ 500mA			-5	5	uA	2, 3
		Vdiff = 40V, 10mA ≤ Il ≤ 100mA			-5	5	uA	2, 3
		3.3V ≤ Vdiff ≤ 40V			-5	5	uA	2, 3

Electrical Characteristics

DC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Il = 8mA

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Ilmin	Minimum Load Current	Vdiff = 3V, Vout = 1.4V (forced)				5	mA	1
		Vdiff = 40V, Vout = 1.4V (forced)				5	mA	1, 2, 3
		Vdiff = 60V, Vout = 1.4V (forced)				7	mA	1, 2, 3
		Vdiff = 3.3V, Vout = 1.4V (forced)				5	mA	2, 3
Icl	Current Limit	Vdiff = 5V			.5	1.65	A	1, 2, 3
		Vdiff = 40V			.15	.65	A	1
		Vdiff = 60V			.02	.28	A	1

AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: Il = 8mA

Rn	Ripple Rejection	f = 120Hz, Vout = Vref, Cadj = 10uF, Iout = 100mA	1		66		dB	4, 5, 6

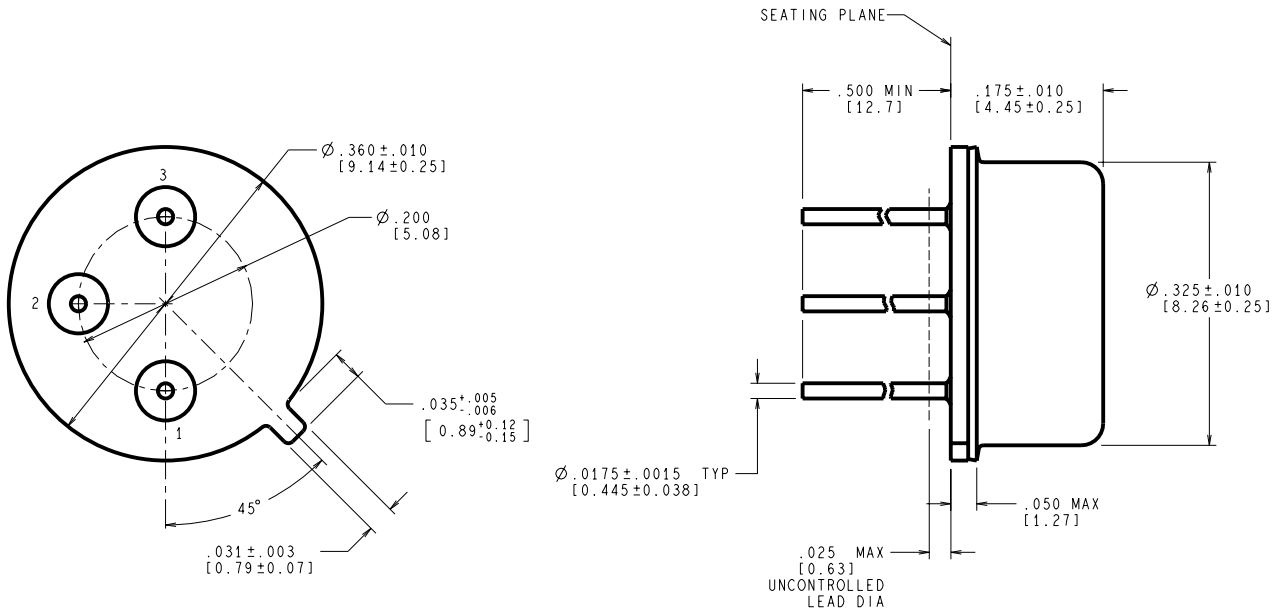
Note 1: Group "A" sample only, test at all temperature.

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
9784HRB1	3LD .200 DIA P.C. METAL CAN PKG (B/I CKT)
H03ARD	3LD .200 DIA P.C. METAL CAN PKG (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

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.

MIL-I-38535
CONFIGURATION CONTROL

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

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

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

PROJECTION
INCH [MM]

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

DO NOT SCALE DRAWING | SHEET 1 of 1