National Semiconductor

MICROCIRCUIT DATA SHEET

MDLM117-K REV 0A0

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

POSITIVE THREE TERMINAL ADJUSTABLE VOLTAGE REGULATOR

General Description

The LM117 adjustable 3-terminal positive voltage regulator is capable of supplying in excess of 1.5A over a 1.2V to 37V 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 better than standard fixed regulators.

In addition to higher performance than fixed regulators, the LM117 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 LM117 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., avoid short-circuiting the output).

Also, it makes an especially simple adjustable switching regulator, a programmable output regulator, or by connecting a fixed resistor between the adjustment pin and output, the LM117 can be used a 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.

For applications requiring greater output current, see LM150 (3A) and LM138 (5A) data sheets. For the negative complement, see LM137 data sheet.

Industry Part Number

LM117K

NS Part Numbers

LM117K-SMD

Prime Die

LM117K

Controlling Document

DESC.# 7703401YA

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

- Guaranteed 1.5A output current.
- Adjustable output down to 1.2V.
- Current limit constant with temperature.
- 80 dB ripple rejection.
- Output is short-circuit protected.

(Absolute Maximum Ratings)
(Note 1)

Power Dissipation	Internally Limited
Input-Output Voltage Differential	+40V, -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)	38 C/W
(500LF/Min Air flow)	TBD
ThetaJC	3 C/W
ESD Tolerance (Note 2)	3kV

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
		Vin = 40V			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
		3.3V ≤ Vdiff ≤ 40V, Vout = Vref			-23	23	mV	2, 3
Rload	Load Regulation	Vdiff = 3V, 10mA ≤ Il ≤ 1.5A			-15	15	mV	1
		Vdiff = 40V, 10mA ≤ Il ≤ 300mA			-15	15	mV	1
		Vdiff = 3.3V, 10mA ≤ Il ≤ 1.5A			-15	15	mV	2, 3
		Vdiff = 40V, 10mA ≤ Il ≤ 195mA			-15	15	mV	2, 3
Vrth	Thermal Regulation	Vin = 14.6V, Il = 1.5A, Pd = 20W, t = 20mS			-16	16	mV	1
Iadj	Adjustment Pin Current	Vdiff = 3V				100	uA	1
		Vdiff = 40V				100	uA	1, 2, 3
		Vdiff = 3.3V				100	uA	2, 3
Delta Iadj	Adjustment Pin Current Change	Vdiff = 3V, 10mA ≤ Il ≤ 1.5A			-5	5	uA	1
		Vdiff = 40V, 10mA ≤ Il ≤ 300mA			-5	5	uA	1
		3V ≤ Vdiff ≤ 40V			-5	5	uA	1
		Vdiff = 3.3V, 10mA ≤ Il ≤ 1.5A			-5	5	uA	2, 3
		Vdiff = 40V, 10mA ≤ Il ≤ 195mA			-5	5	uA	2, 3
		3.3V ≤ Vdiff ≤ 40V			-5	5	uA	2, 3
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 = 3.3V, Vout = 1.4V, (forced)				5	mA	2, 3
Icl	Current Limit	Vdiff = 15V			1.5	3.5	A	1, 2, 3
		Vdiff = 40V			.18	1.5	A	1

AC PARAMETERS

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

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

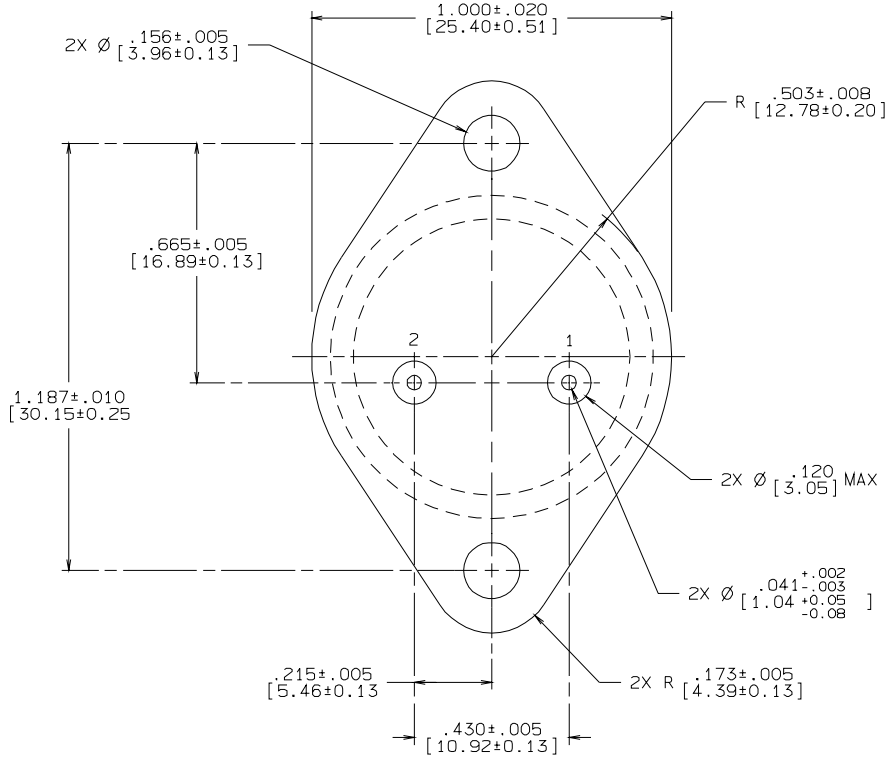
Note 1: Group "A" sample only, test at all temp.

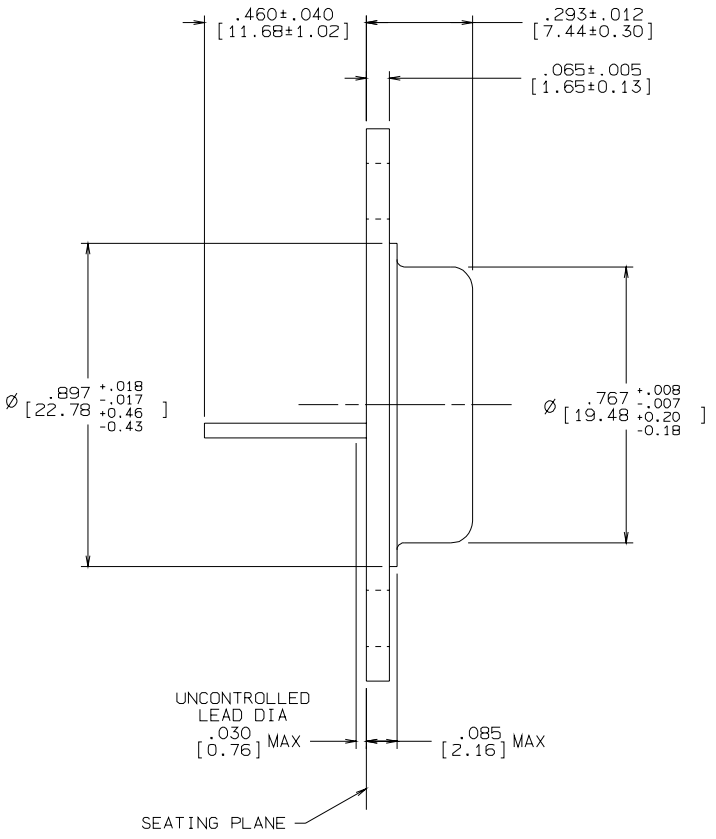
Graphics and Diagrams

GRAPHICS#	DESCRIPTION
9757HRE2	METAL CAN (KA), TO-3, 2LD, LOW PROFILE (B/I CKT)
K02CRD	METAL CAN (KA), TO-3, 2LD,LOW PROFILE (P/P DWG)

See attached graphics following this page.

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
B	REV & REDRAW PER STD FORMAT; ADD NOTE 4; .420-.500 WAS .450 ±.030	08827	10/25/91	TL/FL
C	REVISE AND REDRAW PER ECN.	10487	08/17/94	DEG/GY
D	DIM .293±.012 [7.44±0.30] WAS .295±.010 [7.49±0.25]; REPLACE MIL/AERO STAMPS WITH MIL-I-38535 CONFIG. CONTROL STAMP; REV NOTE 2	10852	02/27/95	MS/





CONTROLLING DIMENSION: INCH

NOTES: UNLESS OTHERWISE SPECIFIED

1. STANDARD HEADER TYPE SOLID BASE.
2. STANDARD LEAD FINISH:
   PER MIL-I-38535 TYPE X OR EQUIVALENT.
3. LEAD NOT BENT GREATER THAN 15°.
4. DIMENSIONS BASED ON JEDEC STANDARD TO-3
   PUBLICATION 95, PAGE 98.

MIL-I-38535
CONFIGURATION CONTROL

APPROVALS	DATE
DRAWN T. LEQUANG	10/25/91
DFTG. CHK.	
ENGR. CHK.	

PROJECTION
INCH
[MM]

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

METAL CAN, TO-3,
2 LEAD, LOW PROFILE

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-K02C	D

DO NOT SCALE DRAWING | SHEET 1 OF 1