

MNLM117-E 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 0.5A 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, or by connecting a fixed resistor between the adjustment pin and output, the LM117 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

LM117E

NS Part Numbers

LM117E/883

Prime Die

LM117H

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

- Guaranteed 0.5A 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)	260 C
Thermal Resistance	
ThetaJA	
(Still Air)	90 C/W
(500LF/Min Air flow)	63 C/W
ThetaJC	47 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 ≤ TA ≤ +125 C
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Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
 DC: $V_{diff} = (V_{in} - V_{out})$, $I_L = 8mA$, $P_d \leq 1.5W$

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Iadj	Adjustment Pin Current	$V_{diff} = 3V$				100	uA	1
		$V_{diff} = 3.3V$				100	uA	2, 3
		$V_{diff} = 40V$				100	uA	1, 2, 3
Iq	Minimum Load Current	$V_{diff} = 3V$, $V_{out} = 1.7V$				5	mA	1
		$V_{diff} = 3.3V$, $V_{out} = 1.7V$				5	mA	2, 3
		$V_{diff} = 40V$, $V_{out} = 1.7V$				5	mA	1, 2, 3
Vref	Reference Voltage	$V_{diff} = 3V$			1.2	1.3	V	1
		$V_{diff} = 3.3V$			1.2	1.3	V	2, 3
		$V_{diff} = 40V$			1.2	1.3	V	1, 2, 3
Vrline	Line Regulation	$3V \leq V_{diff} \leq 40V$, $V_{out} = 1.2V$			-8.9	8.9	mV	1
		$3.3V \leq V_{diff} \leq 40V$, $V_{out} = 1.2V$			-22.2	22.2	mV	2, 3
Vrload	Load Regulation	$V_{diff} = 3V$, $I_L = 10mA$ to $100mA$			-15	15	mV	1
		$V_{diff} = 3.3V$, $I_L = 10mA$ to $100mA$			-15	15	mV	2, 3
		$V_{diff} = 40V$, $I_L = 10mA$ to $100mA$			-15	15	mV	1, 2
					-25	25	mV	3
		$V_{diff} = 3V$, $I_L = 10mA$ to $500mA$			-15	15	mV	1
		$V_{diff} = 3.3V$, $I_L = 10mA$ to $500mA$			-15	15	mV	2, 3
Delta Iadj	Adjustment Current Change	$V_{diff} = 3V$, $I_L = 10mA$ to $500mA$			-5	5	uA	1
		$V_{diff} = 3.3V$, $I_L = 10mA$ to $500mA$			-5	5	uA	2, 3
		$V_{diff} = 40V$, $I_L = 10mA$ to $100mA$			-5	5	uA	1, 2, 3
		$3V \leq V_{diff} \leq 40V$			-5	5	uA	1
		$3.3V \leq V_{diff} \leq 40V$			-5	5	uA	2, 3
Ios	Short Circuit Current	$V_{diff} = 10V$.45	1.6	A	1
Theta R	Thermal Regulation	$T_A = 25^\circ C$, $t = 20mS$, $V_{diff} = 40V$, $I_L = 75mA$			-6	6	mV	1
Icl	Current Limit	$V_{diff} \leq 15V$	1		0.5		A	1, 2, 3
		$V_{diff} \leq 40V$	1		0.15		A	1

Electrical Characteristics

AC PARAMETERS

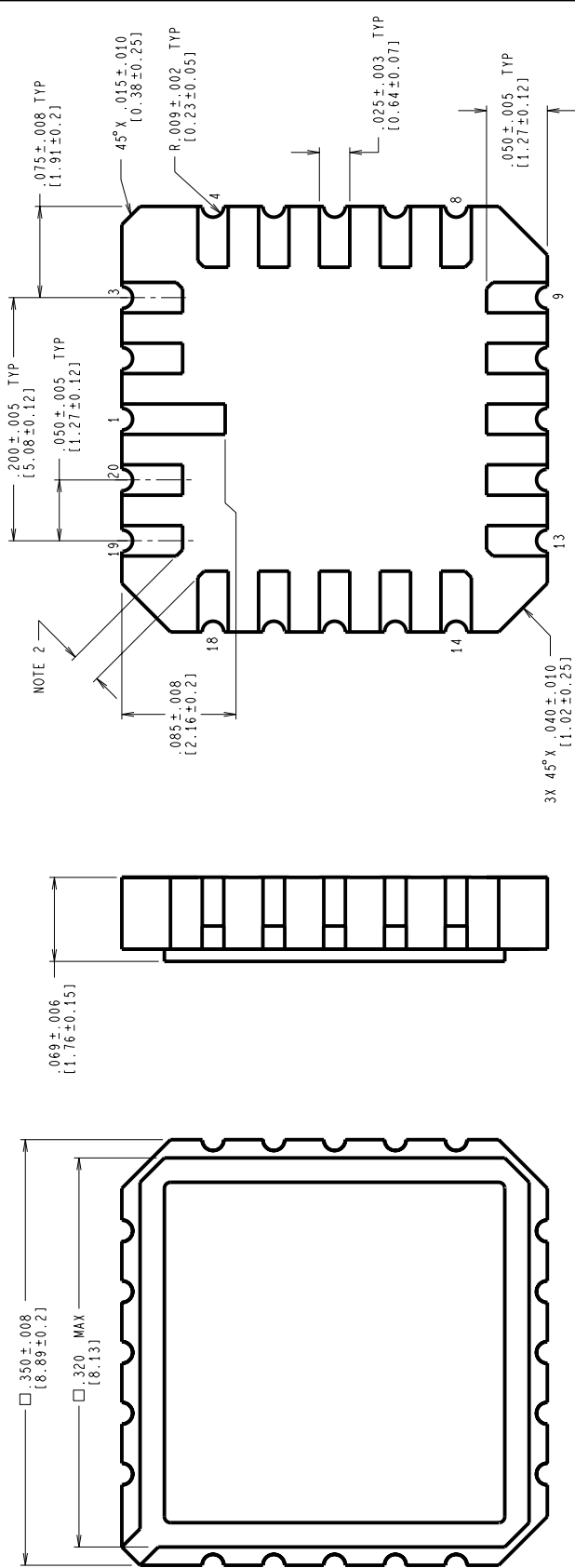
SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Rr	Ripple Rejection	Vin = +6.25V, Vout=Vref, f=120Hz, ei=1Vrms, Il=100mA, Cadj=10uf	2		66		dB	4, 5, 6

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
6145HRA1	LDLESS CHIP CARRIER,TYPE C,20 TERMINAL(B/I CKT)
E20ARE	LDLESS CHIP CARRIER, TYPE C 20 TERMINAL(P/P DWG)

See attached graphics following this page.

REVISIONS			
LTR	DESCRIPTION	E.C.N.	DATE
E	REVISE AND REDRAW	10005	02/10/94 DEG/



CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

- NOTES: UNLESS OTHERWISE SPECIFIED.
- LEAD FINISH TO BE ONE OF THE FOLLOWING:
 - 50 MICRONS/12.7 MICROMETERS MINIMUM GOLD PLATING OVER 50-350 MICRONS/1.27-8.89 MICROMETERS NICKEL.
 - SOLDER DIP.
 - SOLDER THICKNESS PER LATEST REVISION OF MIL-STD-1835.
 - CORNER PADS MAY HAVE A 45° X $.020$ IN/0.51mm MAXIMUM CHAMFER TO ACCOMPLISH THE .015 IN/0.38mm DIMENSION.
 - REFERENCE JEDEC REGISTRATION MS-004, VARIATION CB, DATED 7/90.

MIL/AERO CONFIGURATION CONTROL

APPROVALS		DATE	NATIONAL SEMICONDUCTOR CORPORATION	
DESIGN	Design Grady	02/10/94	2000 Semiconductor Drive, Santa Clara, CA 95052-8000	
ESTG. CHK.			LEADLESS CHIP CARRIER, TYPE C, 20 TERMINAL	
ENGR. CHK.				
APPROVAL				
PROJECTION		SCALE	SIZE	REV
		N/A	C	MKT-E20A
		DO NOT SCALE DRAWING		E
				SHEET 1 of 1