



# Linear Voltage Regulator – LM317

Positive Adjustable 1.5A output Voltage Regulator in bare die form

Rev 1.0  
03/03/18

## Description

The LM317 is a wide  $V_{IN}$  adjustable 3-terminal voltage regulator with guaranteed 1.5A output current and equipped with internal limiting + thermal shutdown features for overload immunity. Output voltage is set by two external resistors. Additional to standard regulator function, the device can be used as a simple adjustable switching regulator; a programmable output regulator; or by connecting a fixed resistor between adjustment pin and output, can be used as a precision current regulator. A shutdown mechanism can be introduced by clamping the adjust terminal to ground which programs output to 1.2V where most loads draw little current.

## Features:

- Output current in excess of 1.5A
- Adjustable output between 1.2V – 37V
- Internal short circuit current limit
- Internal thermal overload protection
- Output transistor Safe-Area Compensation
- Floating operation for high voltage applications
- 0.01% Line & 0.1% Load Regulation
- Negative Voltage complement is LM337

## Ordering Information

The following part suffixes apply:

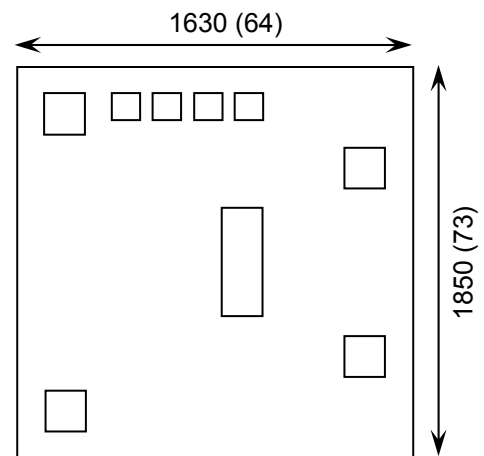
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "H" - MIL-STD-883 /2010B Visual Inspection + MIL-PRF-38534 Class H LAT
- "K" - MIL-STD-883 /2010A Visual Inspection (Space) + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

[www.siliconsupplies.com/quality/bare-die-lot-qualification](http://www.siliconsupplies.com/quality/bare-die-lot-qualification)

## Die Dimensions in $\mu\text{m}$ (mils)



## Supply Formats:

- Default – Die in Waffle Pack (100 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Tape & Reel – On request
- In Metal or Ceramic package – On request

## Mechanical Specification

Die Size (Unsawn)	1630 x 1850 64 x 73	$\mu\text{m}$ mils
Minimum Bond Pad Size	140 x 140 5.51 x 5.51	$\mu\text{m}$ mils
Die Thickness	350 ( $\pm 20$ ) 13.78 ( $\pm 0.79$ )	$\mu\text{m}$ mils
Top Metal Composition	Al 1%Si 2.2 $\mu\text{m}$	
Back Metal Composition	Ti/Ni/Ag 1.2 $\mu\text{m}$	

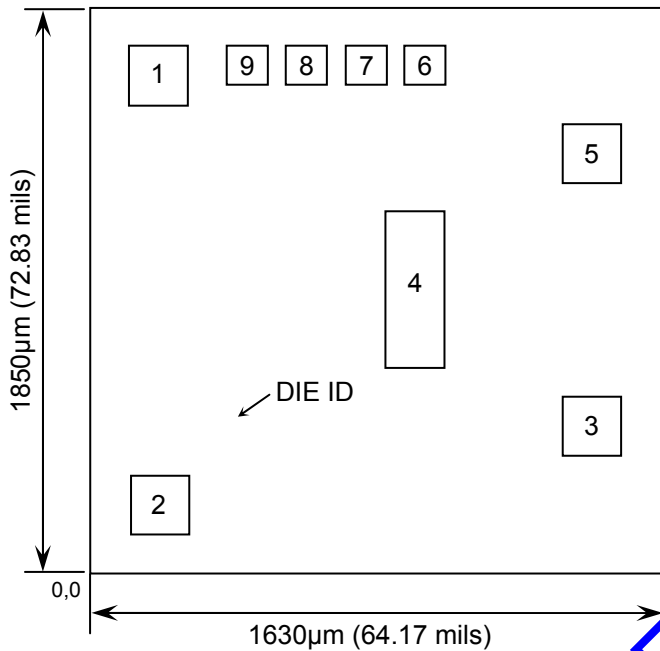




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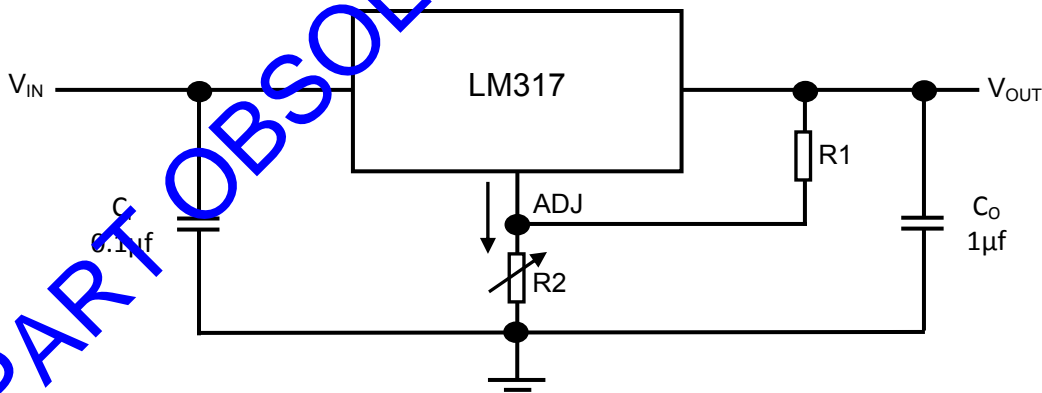
## Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	V <sub>OUT</sub>	0.073	1.637
2	ADJ	0.073	0.073
3	V <sub>OUT</sub>	1.400	0.331
4	V <sub>IN</sub> (X2 wire)	0.773	0.714
5	V <sub>OUT</sub>	1.400	1.402
6	NC	0.641	1.715
7	NC	0.512	1.715
8	NC	0.383	1.715
9	NC	0.254	1.715

NC = NO CONNECT  
CONNECT CHIP BACK TO V<sub>OUT</sub>

## Typical Application



1.2V–25V Adjustable Regulator

$$V_{OUT} = 1.25V \left(1 + \frac{R_2}{R_1}\right) + I_{ADJ} * R_2$$

I<sub>ADJ</sub> tolerance <100µA

C<sub>1</sub> is required if the regulator is located an appreciable distance from power supply filter. C<sub>0</sub> is not required for stability; however it does improve transient response. For optimum stability and transient response locate C<sub>1</sub> C<sub>0</sub> as close as possible to the regulator.





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## Absolute Maximum Ratings<sup>1</sup>

PARAMETER	SYMBOL	VALUE	UNIT
Input–Output Voltage differential	$V_{IN} - V_{OUT}$	40	V
Power Dissipation	$P_D$	Internally Limited	
Operating Junction Temperature	$T_J$	150	°C
Storage Temperature	$T_{STG}$	-65 to 150	°C

## Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNIT
Output Voltage	$V_{OUT}$	1.25	37	V
Input–Output Voltage differential	$V_{IN} - V_{OUT}$	4	40	V
Output Current	$I_{OUT}$	0.01	1.5	A
Operating Junction Temperature Range	$T_J$	0 to 125		°C

## DC Electrical Characteristics, $V_{IN} - V_{OUT} = 5V$ , $I_{OUT} = 0.5A$ , $I_{MAX} = 1.5A$ , $T_J = 0^\circ C$ to $+125^\circ C$ (unless noted otherwise)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Reference Voltage	$V_{REF}$	$3V \leq  V_{IN} - V_{OUT}  \leq 40V$ , $10mA \leq I_{OUT} \leq I_{MAX}$	1.2	1.25	1.30	V
Line Regulation <sup>2</sup>	$\Delta V_{OUT}$	$3V \leq  V_{IN} - V_{OUT}  \leq 40V$ , $T_J = 25^\circ C$	-	0.01	0.04	% / $V_{OUT}$
		$3V \leq  V_{IN} - V_{OUT}  \leq 40V$	-	0.02	0.07	
Load Regulation <sup>2</sup>	$\Delta V_{OUT}$	$V_{IN} \leq 5V$ , $10mA \leq I_{OUT} \leq I_{MAX}$ , $T_J = 25^\circ C$	-	5	25	mV
		$V_{IN} \geq 3V$ , $10mA \leq I_{OUT} \leq I_{MAX}$ , $T_J = 25^\circ C$	-	0.1	0.5	% / $V_{OUT}$
		$V_{IN} \leq 5V$ , $10mA \leq I_{OUT} \leq I_{MAX}$	-	20	70	mV
		$V_{IN} \geq 5V$ , $10mA \leq I_{OUT} \leq I_{MAX}$	-	0.3	1.5	% / $V_{OUT}$
Thermal Regulation		20ms pulse, $T_J = 25^\circ C$	-	0.03	0.07	% / W
Adjustment Pin Current	$I_{ADJ}$		-	50	100	$\mu A$
Adjustment Pin Current Change	$\Delta I_{ADJ}$	$2.5V \leq  V_{IN} - V_{OUT}  \leq 40V$ , $10mA \leq I_L \leq I_{MAX}$ , $P_D \leq P_{MAX}$	-	0.2	5.0	$\mu A$
Temperature Stability	-	$T_{LOW} \leq T_J \leq T_{HIGH}$	-	1	-	%
Minimum Load Current	$I_L$	$ V_{IN} - V_{OUT}  = 40V$	-	3.5	10	mA
Output Current Limit <sup>3</sup>	$I_{MAX}$	$ V_{IN} - V_{OUT}  \leq 15V$ , $P \leq 20W$	1.5	2.2	-	A
		$ V_{IN} - V_{OUT}  = 40V$ , $P \leq 20W$ , $T_J = 25^\circ C$	0.15	0.40	-	

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

2. Regulation is measured at a constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specifications for thermal regulation.





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PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
RMS Output Noise, % of $V_{OUT}$	eN	$10\text{ Hz} \leq f \leq 10\text{ kHz}$ , $T_J = 25^\circ C$	-	0.003	-	%
Ripple Rejection Ratio	RR	$V_{OUT} = 10V$ , $f = 120\text{ Hz}$ , $C_{ADJ} = 0\mu F$	-	65	-	dB
		$V_{OUT} = 10V$ , $f = 120\text{ Hz}$ , $C_{ADJ} = 10\mu F$	66	80	-	
Long Term Stability	-	$T_A = 125^\circ C$ , 1000 hrs	-	0.3	1	%
Thermal Resistance <sup>3</sup>	$R\theta_{JC}$	$T_{LOW} \leq T_J \leq T_{HIGH}$	-	2	-	$^\circ C/W$

3. Assembled in TO-3 package. Die performance is dependent on die attach, substrate choice & assembly method.

Typical Electrical Characteristics,  $T_J = 25^\circ C$  (unless noted otherwise)

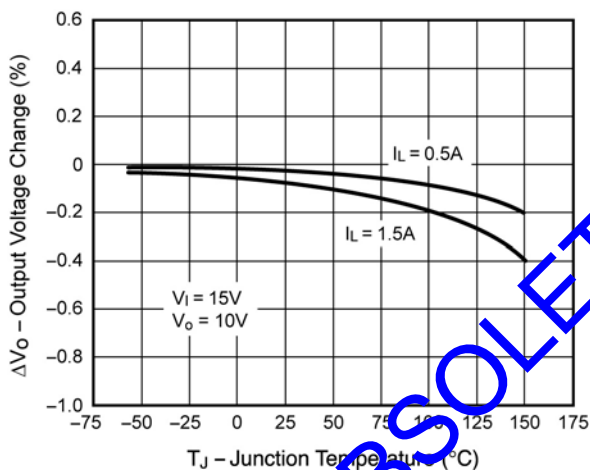


Figure 1 – Load Regulation

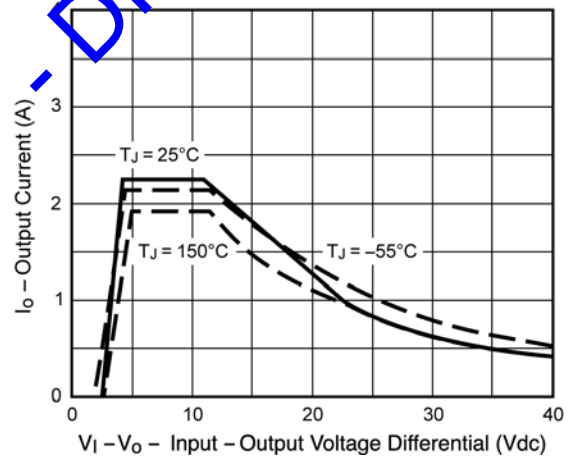


Figure 2 – Current Limit

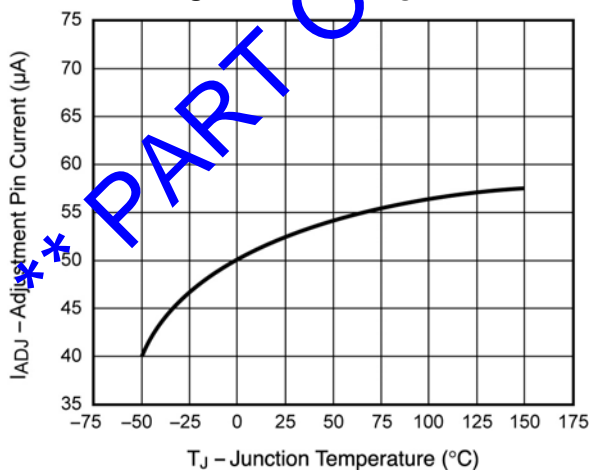


Figure 3 – Adjustment Pin Current

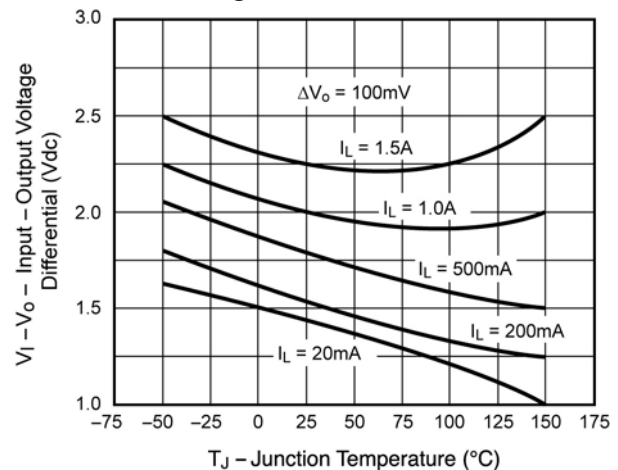


Figure 4 – Dropout Voltage





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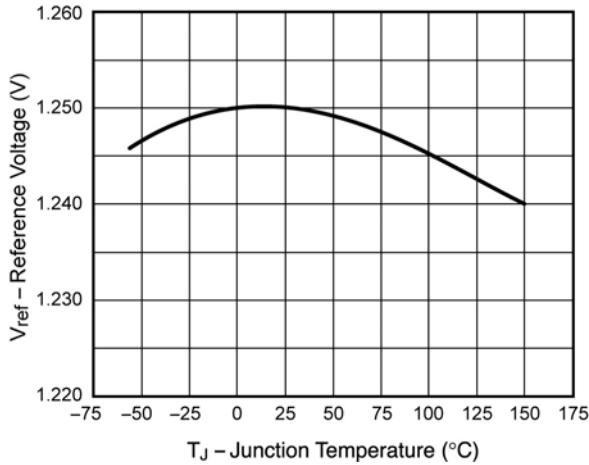


Figure 5 – Temperature Stability

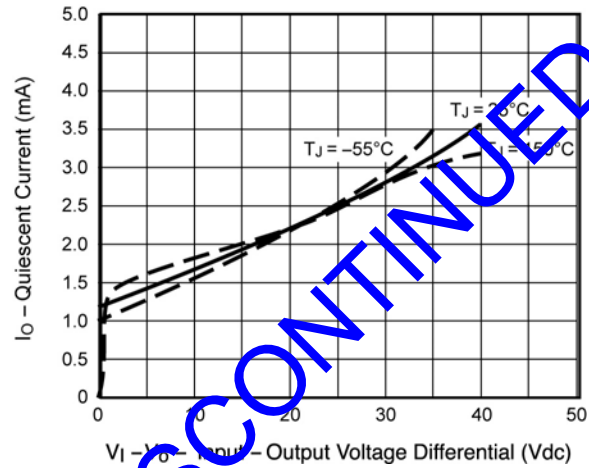


Figure 6 – Minimum Operating Current

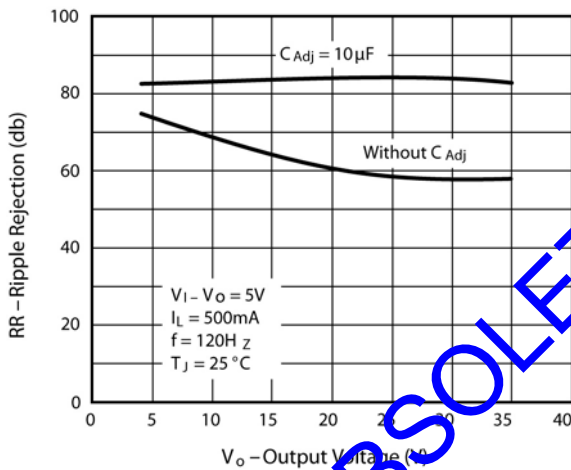


Figure 7 – Ripple Rejection versus Output Voltage

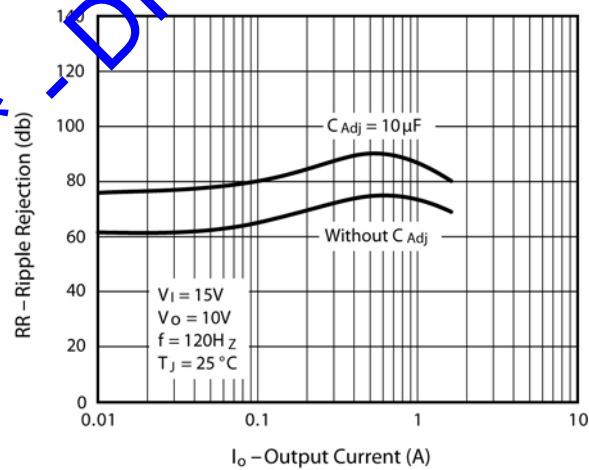


Figure 8 – Ripple Rejection versus Output Current

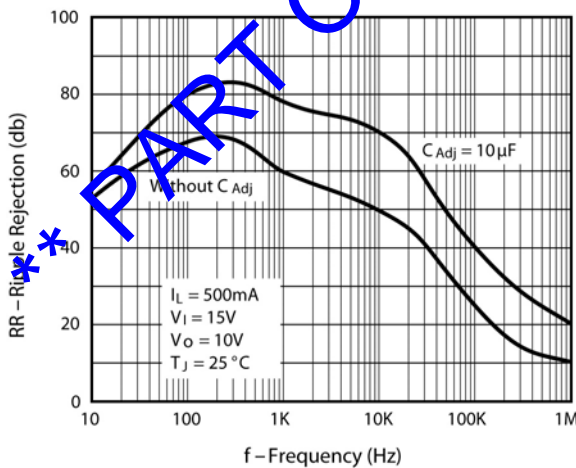


Figure 9 – Ripple Rejection versus Frequency

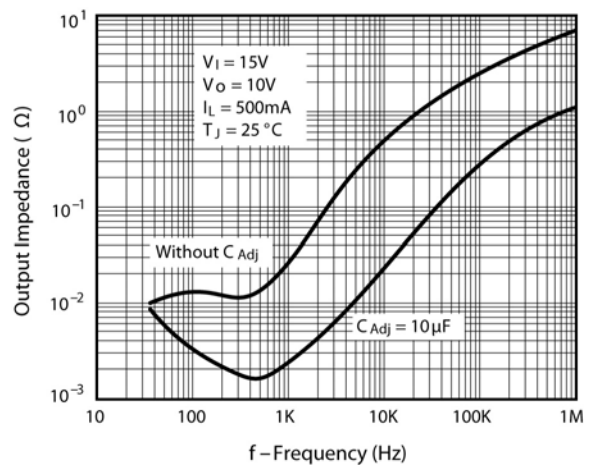


Figure 10 – Output Impedance





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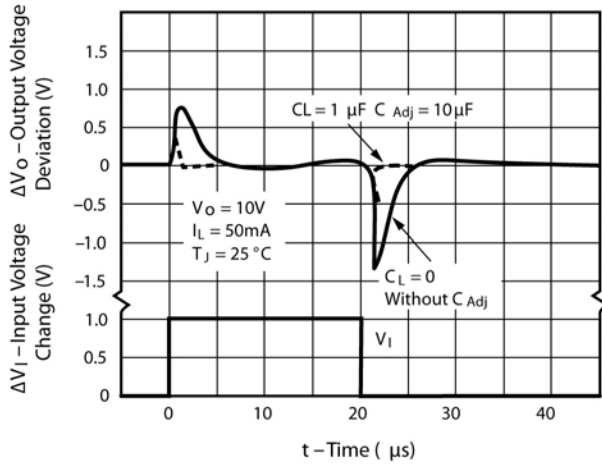


Figure 11– Line Transient Response

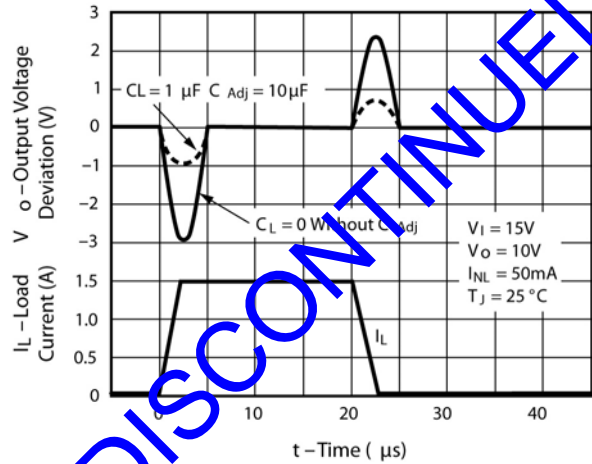


Figure 12– Load Transient Response

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