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:

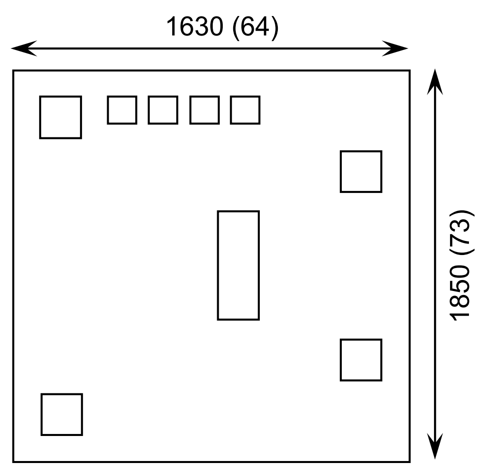
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "**H**" - MIL-STD-883 /2010B Visual Inspection
  + MIL-PRF-38534 Class H LAT
- "**K**" - MIL-STD-883 /2010A Visual Inspection (Space)
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

Die Dimensions in µm (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	µm mils
Minimum Bond Pad Size	140 x 140 5.51 x 5.51	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 2.2µm	
Back Metal Composition	Ti/Ni/Ag 1.2 µm	

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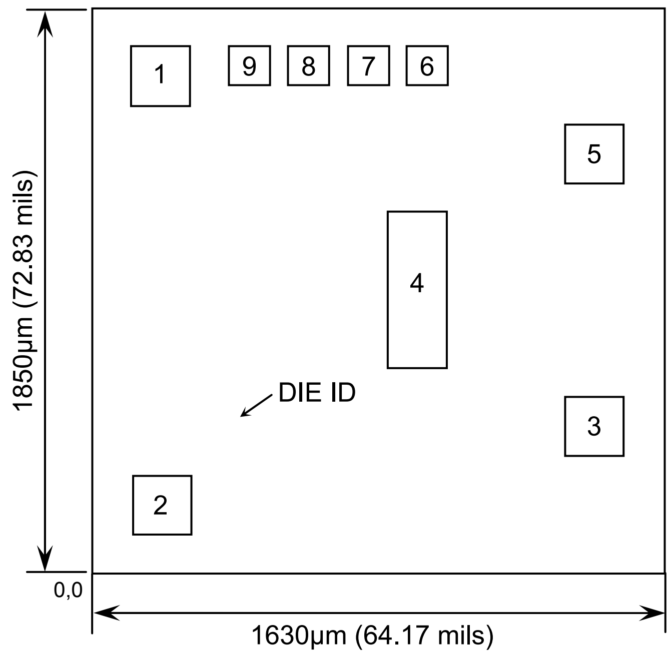
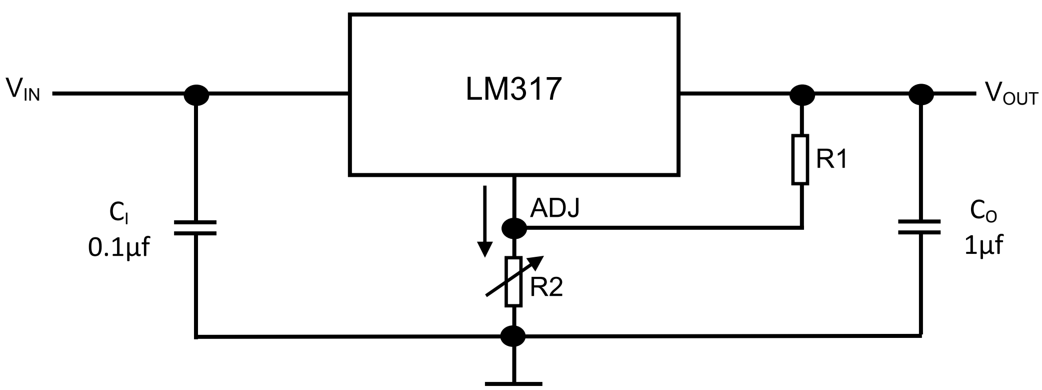
Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	V_{OUT}	0.073	1.637
2	ADJ	0.073	0.073
3	V_{OUT}	1.400	0.331
4	V_{IN} (x2 wire)	0.773	0.714
5	V_{OUT}	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_{OUT}			

Typical Application



1.2V–25V Adjustable Regulator

$V_{OUT} = 1.25V\,(1 + \frac{R2}{R1}) + I_{ADJ} * R2$

I_{ADJ} tolerance <100µA

C_I is required if the regulator is located an appreciable distance from power supply filter. C_O is not required for stability; however it does improve transient response. For optimum stability and transient response locate C_I C_O as close as possible to the regulator.

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Absolute Maximum Ratings[1]

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°C to +125°C(unless noted otherwise)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Reference Voltage	V_{REF}	3V ≤ |V_{IN} -V_{OUT}| ≤ 40V, 10mA ≤ I_{OUT} ≤ I_{MAX}	1.2	1.25	1.30	V
Line Regulation[2]	ΔV_{OUT}	3V ≤ |V_{IN} - V_{OUT}| ≤ 40V, T_J = 25°C	-	0.01	0.04	% / V_{OUT}
		3V ≤ |V_{IN} - V_{OUT}| ≤ 40V		0.02	0.07	
Load Regulation[2]	ΔV_{OUT}	V_{IN} ≤ 5V,10mA ≤ I_{OUT} ≤ I_{MAX}, T_J =25°C	-	5	25	mV
		V_{IN} ≥ 5V,10mA ≤ I_{OUT} ≤ I_{MAX}, T_J =25°C	-	0.1	0.5	% / V_{OUT}
		V_{IN} ≤ 5V,10mA ≤ I_{OUT} ≤ I_{MAX}	-	20	70	mV
		V_{IN} ≥ 5V,10mA ≤ I_{OUT} ≤ I_{MAX}	-	0.3	1.5	% / V_{OUT}
Thermal Regulation	-	20ms pulse, T_J = 25°C	-	0.03	0.07	% / W
Adjustment Pin Current	I_{ADJ}		-	50	100	μA
Adjustment Pin Current Change	ΔI_{ADJ}	2.5V ≤ |V_{IN} - V_{OUT}| ≤ 40V, 10mA ≤ I_L ≤ I_{MAX}, P_D ≤ P_{MAX}	-	0.2	5.0	μA
Temperature Stability	-	T_{LOW} ≤ T_J ≤ T_{HIGH}	-	1	-	%
Minimum Load Current	I_L	|V_{IN} – V_{OUT}| = 40V	-	3.5	10	mA
Output Current Limit[3]	I_{MAX}	|V_{IN} – V_{OUT}| ≤ 15V, P ≤ 20W	1.5	2.2	-	A
		|V_{IN} – V_{OUT}| = 40V, P ≤ 20W,T_J = 25°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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DC Electrical Characteristics, V_{IN} -V_{OUT}=5V, I_{OUT}=0.5A, I_{MAX} = 1.5A, T_J = 0°C to +125°C(unless noted otherwise)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
RMS Output Noise, % of V_{OUT}	eN	10 Hz ≤ f ≤ 10 kHz, T_J = 25°C	-	0.003	-	%
Ripple Rejection Ratio	RR	V_{OUT} = 10V, f = 120 Hz, C_{ADJ} = 0µF	-	65	-	dB
		V_{OUT} = 10V,f = 120 Hz, C_{ADJ} =10µF	66	80	-	
Long Term Stability	-	T_A = 125°C, 1000 hrs	-	0.3	1	%
Thermal Resistance[3]	$R\theta_{JC}$	T_{LOW} ≤ T_J ≤ T_{HIGH}	-	2	-	°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°C (unless noted otherwise)

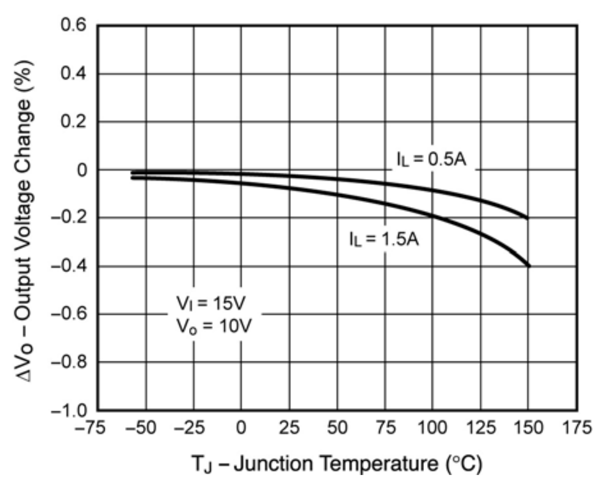

Figure 1 – Load Regulation

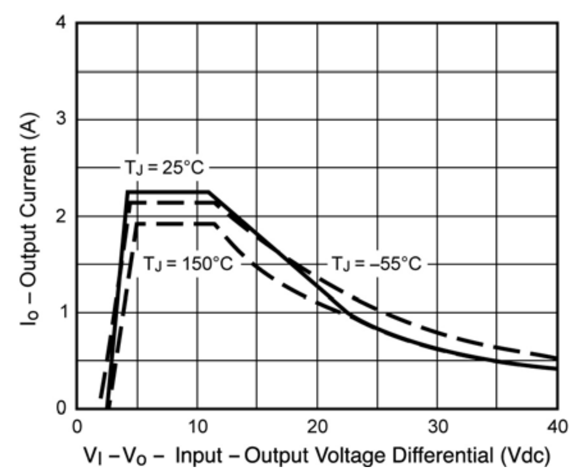

Figure 2 – Current Limit

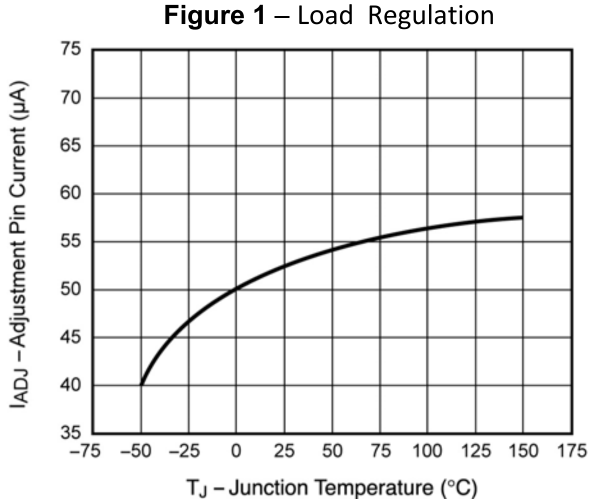

Figure 3 – Adjustment Pin Current

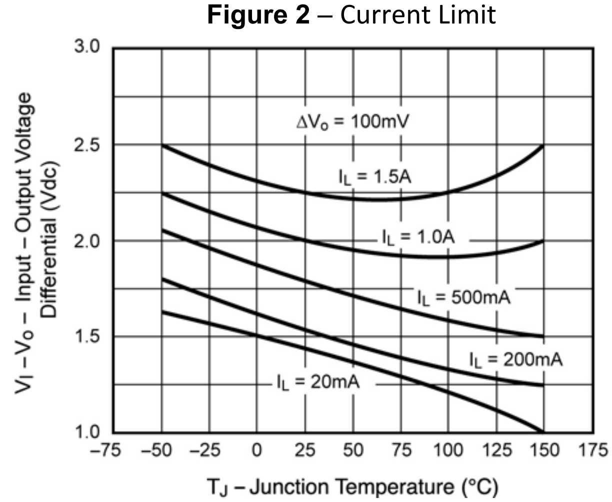

Figure 4 – Dropout Voltage

Typical Electrical Characteristics, T_J = 25°C (unless noted otherwise)

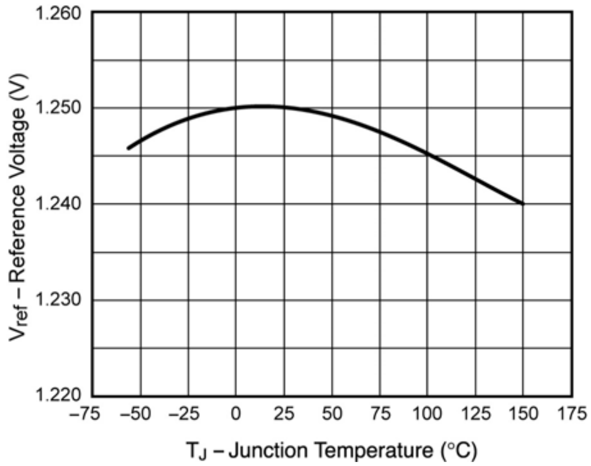

Figure 5 – Temperature Stability

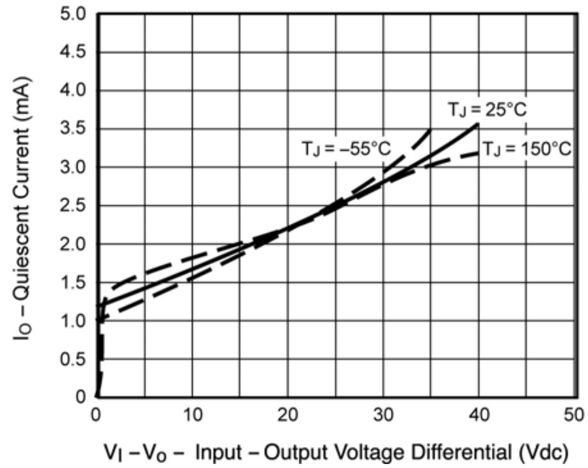

Figure 6 – Minimum Operating Current

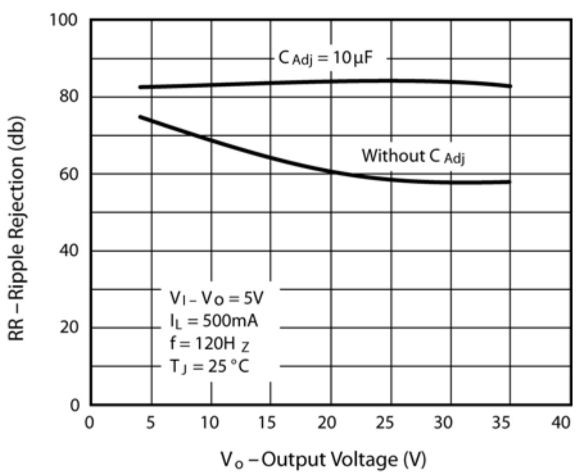

Figure 7 – Ripple Rejection versus Output Voltage

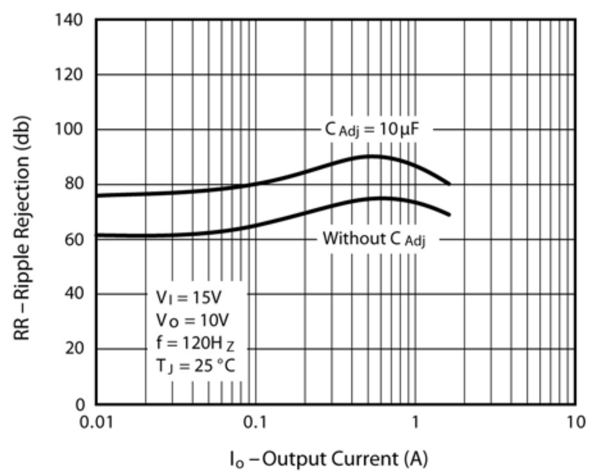

Figure 8 – Ripple Rejection versus Output Current

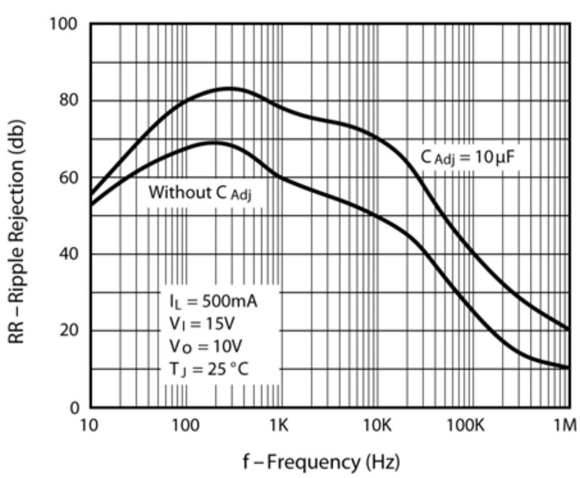

Figure 9 – Ripple Rejection versus Frequency

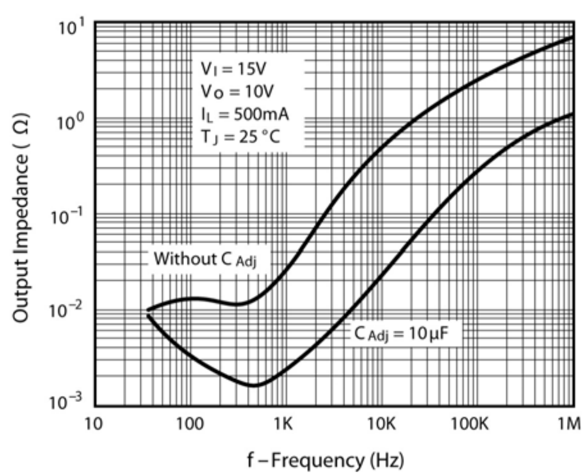

Figure 10 – Output Impedance

Typical Electrical Characteristics, T_J = 25°C (unless noted otherwise)

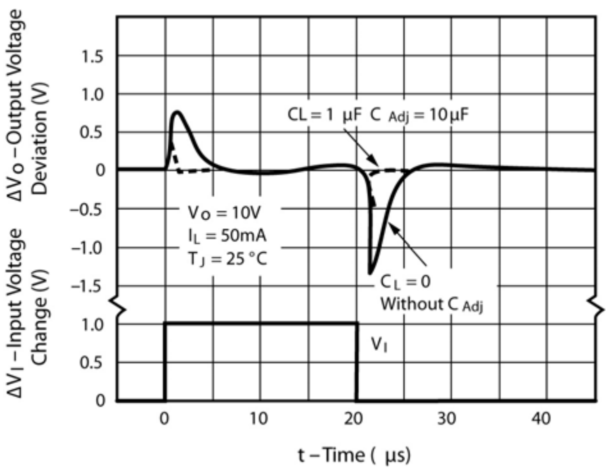

Figure 11– Line Transient Response

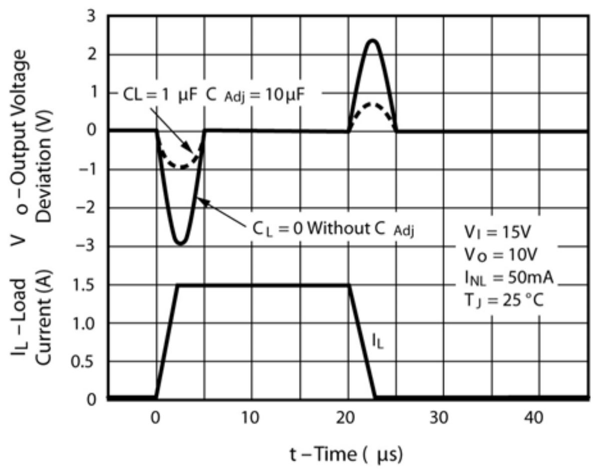

Figure 12– Load Transient Response