

## 3-Terminal Adjustable Regulator

### General Description

The LM317L is an adjustable 3-terminal positive voltage regulator capable of supplying 100mA 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. Also, the LM317L is available packaged in a standard TO-92 transistor package which is easy to use.

In addition to higher performance than fixed regulators, the LM317L offers full overload protection. 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 LM317L 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.

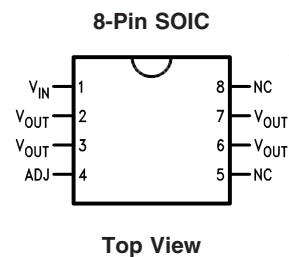
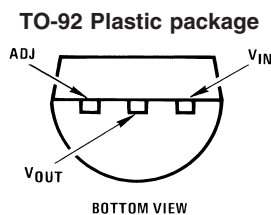
Also, it makes an especially simple adjustable switching regulator, a programmable output regulator, or by connecting a fixed resistor between the adjustment and output, the LM317L can be used as a precision current regulator. Supplies with electronic shutdown can be achieved by clamping the adjustment terminal to ground which programs the output to 1.2V where most loads draw little current.

The LM317L is available in a standard TO-92 transistor package, the SO-8 package, and 6-Bump micro SMD package. The LM317L is rated for operation over a  $-25^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  range.

### Features

- Adjustable output down to 1.2V
- Guaranteed 100mA 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
- Standard 3-lead transistor package
- 80dB ripple rejection
- Available in TO-92, SO-8 package
- Output is short circuit protected
- See AN-1112 for micro SMD considerations

### Connection Diagrams



**Absolute Maximum Ratings** (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Power Dissipation	Internally Limited	Storage Temperature	-55°C to +150°C
Input-Output Voltage Differential	40V	Lead Temperature (Soldering, 4 seconds)	260°C
Operating Junction Temperature Range	-40°C to +125°C	Output is Short Circuit Protected	
		ESD Susceptibility Human Body Model (Note 5)	2kV

**Electrical Characteristics** (Note 2)

Parameter	Conditions	Min	Typ	Max	Units
Line Regulation	$T_J = 25^\circ\text{C}$ , $3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$ , $I_L \leq 20\text{mA}$ (Note 3)		0.01	0.04	%/V
Load Regulation	$T_J = 25^\circ\text{C}$ , $5\text{mA} \leq I_{OUT} \leq I_{MAX}$ , (Note 3)		0.1	0.5	%
Thermal Regulation	$T_J = 25^\circ\text{C}$ , 10ms Pulse		0.04	0.2	%/W
Adjustment Pin Current			50	100	$\mu\text{A}$
Adjustment Pin Current Change	$5\text{mA} \leq I_L \leq 100\text{mA}$ $3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$ , $P \leq 625\text{mW}$		0.2	5	$\mu\text{A}$
Reference Voltage	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$ , (Note 4) $5\text{mA} \leq I_{OUT} \leq 100\text{mA}$ , $P \leq 625\text{mW}$	1.20	1.25	1.30	V
Line Regulation	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$ , $I_L \leq 20\text{mA}$ (Note 3)		0.02	0.07	%/V
Load Regulation	$5\text{mA} \leq I_{OUT} \leq 100\text{mA}$ , (Note 3)		0.3	1.5	%
Temperature Stability	$T_{MIN} \leq T_J \leq T_{MAX}$		0.65		%
Minimum Load Current	$(V_{IN} - V_{OUT}) \leq 40\text{V}$ $3\text{V} \leq (V_{IN} - V_{OUT}) \leq 15\text{V}$		3.5 1.5	5 2.5	mA
Current Limit	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 13\text{V}$ $(V_{IN} - V_{OUT}) = 40\text{V}$	100 25	200 50	300 150	mA mA
Rms Output Noise, % of $V_{OUT}$	$T_J = 25^\circ\text{C}$ , $10\text{Hz} \leq f \leq 10\text{kHz}$		0.003		%
Ripple Rejection Ratio	$V_{OUT} = 10\text{V}$ , $f = 120\text{Hz}$ , $C_{ADJ} = 0$ $C_{ADJ} = 10\mu\text{F}$	66	65 80		dB dB
Long-Term Stability	$T_J = 125^\circ\text{C}$ , 1000 Hours		0.3	1	%
Thermal Resistance Junction to Ambient	Z Package 0.4" Leads Z Package 0.125 Leads SO-8 Package 6-Bump micro SMD		180 160 165 290		$^\circ\text{C}/\text{W}$ $^\circ\text{C}/\text{W}$ $^\circ\text{C}/\text{W}$ $^\circ\text{C}/\text{W}$

**Note 1:** "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.

**Note 2:** Unless otherwise noted, these specifications apply:  $-25^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$  for the LM317L;  $V_{IN} - V_{OUT} = 5\text{V}$  and  $I_{OUT} = 40\text{mA}$ . Although power dissipation is internally limited, these specifications are applicable for power dissipations up to 625mW.  $I_{MAX}$  is 100mA.

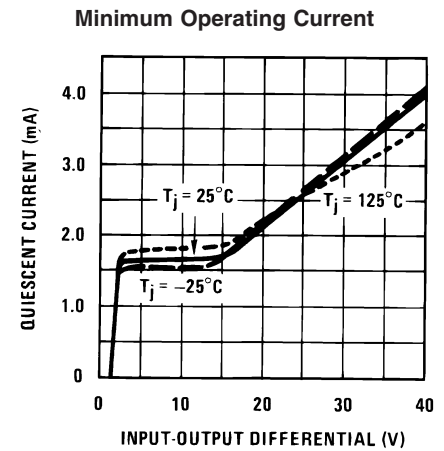
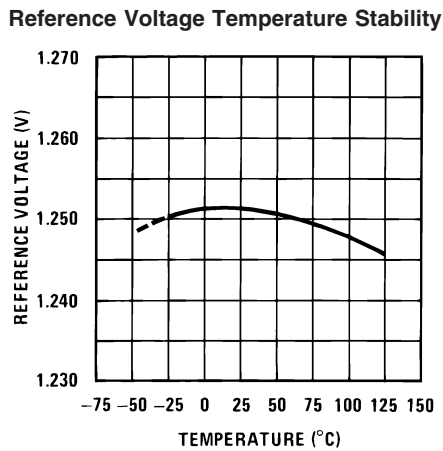
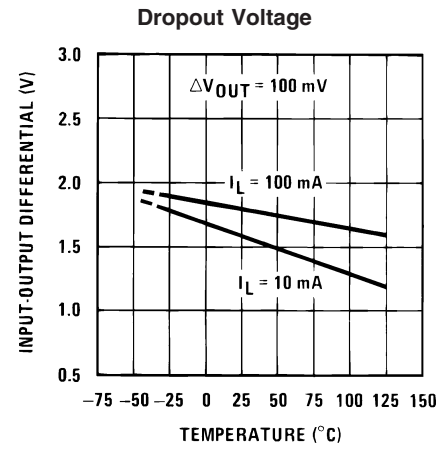
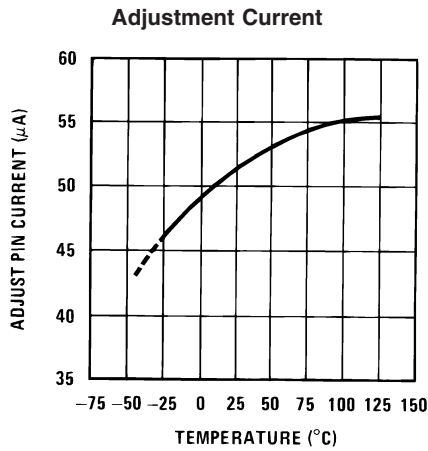
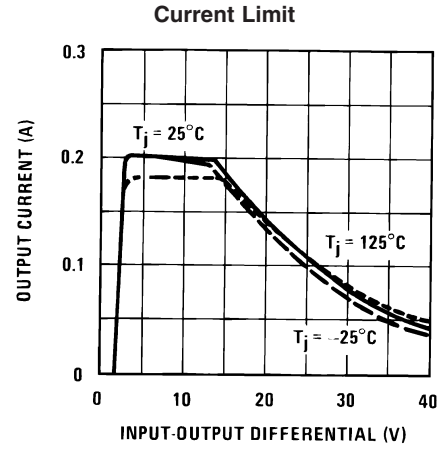
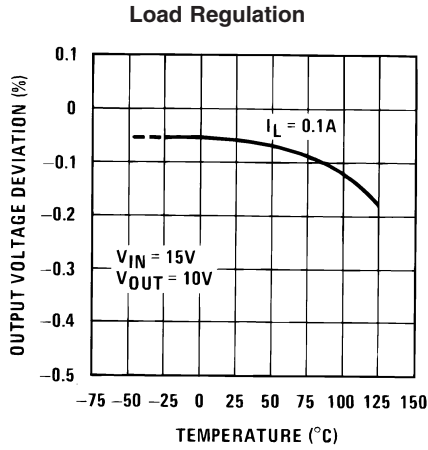
**Note 3:** Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.

**Note 4:** Thermal resistance of the TO-92 package is 180°C/W junction to ambient with 0.4" leads from a PC board and 160°C/W junction to ambient with 0.125" lead length to PC board.

**Note 5:** The human body model is a 100pF capacitor discharged through a 1.5k $\Omega$  resistor into each pin.

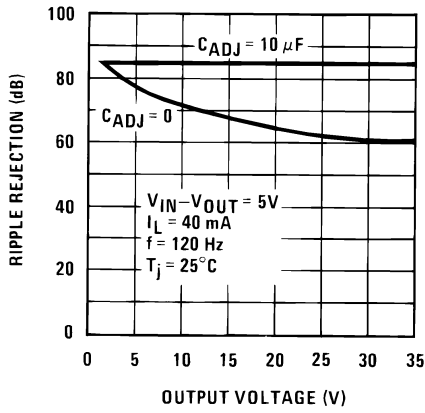
**Typical Performance Characteristics**

(Output capacitor = 0 $\mu$ F unless otherwise noted.)

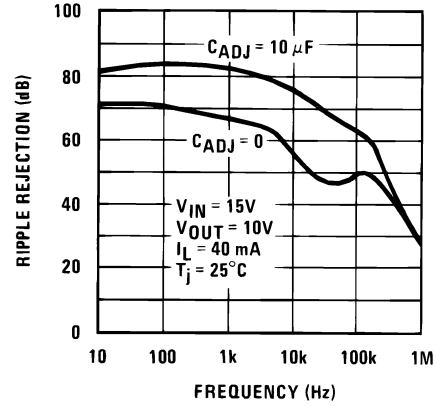


**Typical Performance Characteristics** (Output capacitor = 0 $\mu$ F unless otherwise noted.) (Continued)

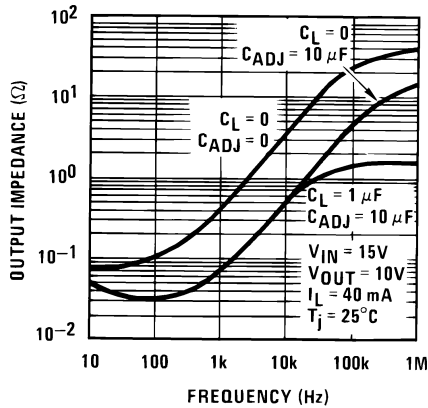
**Ripple Rejection**



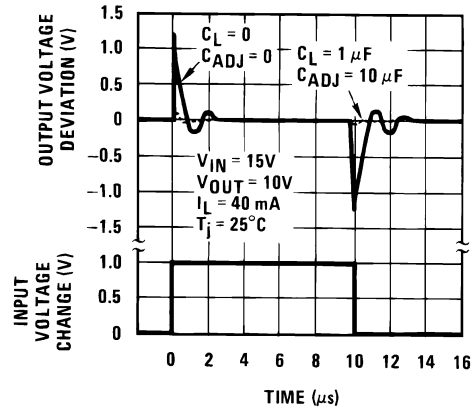
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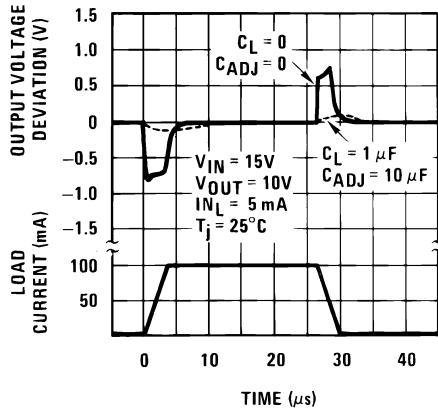
**Output Impedance**



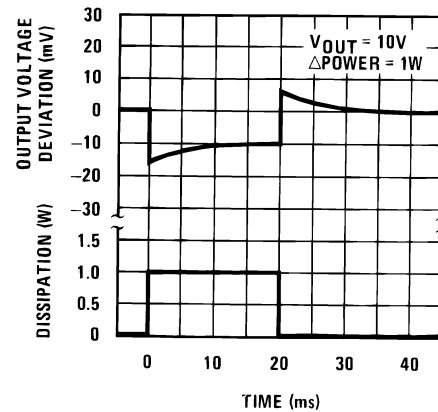
**Line Transient Response**



**Load Transient Response**



**Thermal Regulation**



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