



### Description

The LM317L is an adjustable 3-terminal positive-voltage regulator capable of supplying 100 mA over an output-voltage range of 1.2 V to 37 V. It is exceptionally easy to use and requires only two external resistors to set the output voltage. In addition, internal current limiting, thermal shutdown, and safe area compensation, making it essentially blow-out proof.

The LM317L serves a wide variety of applications including local, on card regulation. This device can also be used to make 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.

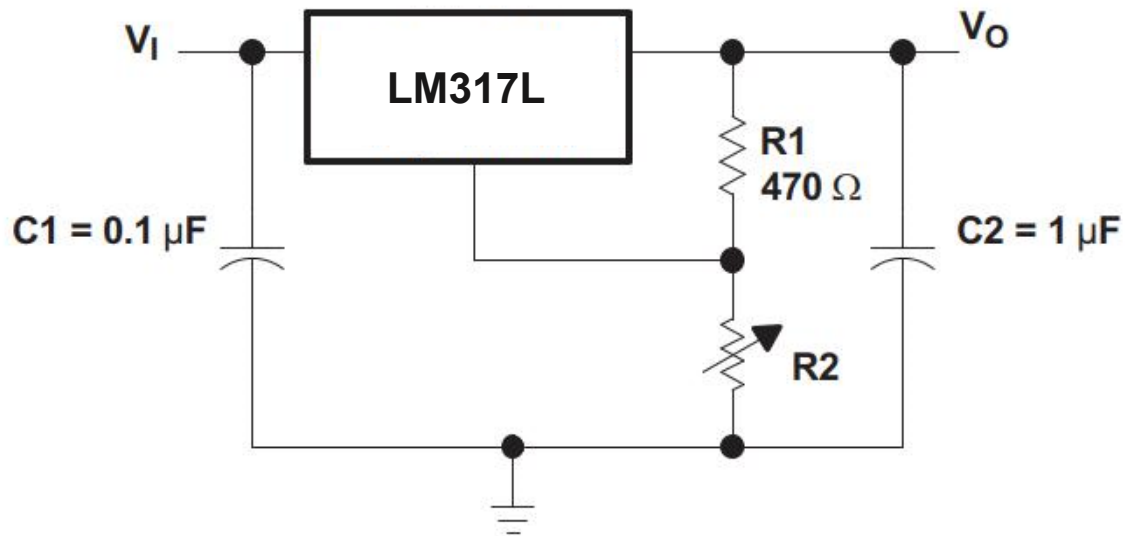
### Features

- Output Current in Excess of 100 mA
- Output Adjustable Between 1.2 V and 37 V
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting Constant with Temperature
- Output Transistor Safe-Area Compensation
- Eliminates Stocking many Fixed Voltages
- Available Packages: SOT-89 and SOP-8

### Applications

- Electronic Points of Sale
- Medical, Health, and Fitness Applications
- Appliances and White Goods
- TV Set-Top Boxes

### Typical Applications



**Note:**

C1 is required if regulator is located an appreciable distance from power supply filter.  
C2 is not needed for stability, however, it does improve transient response.

$$V_{OUT} = 1.25V(1 + R_2/R_1) + I_{Adj} R_2$$

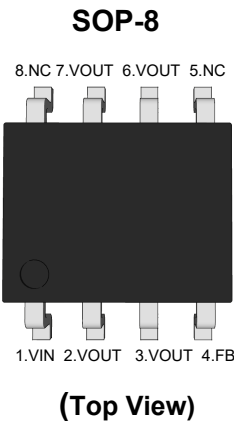
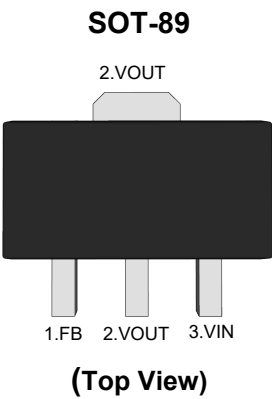
Since  $I_{Adj}$  is controlled to less than 50  $\mu A$ , the error associated with this term is negligible in most applications.



# LM317L

## 3-Terminal Adjustable Voltage Regulators

### Pin Distribution



### Functional Pin Description

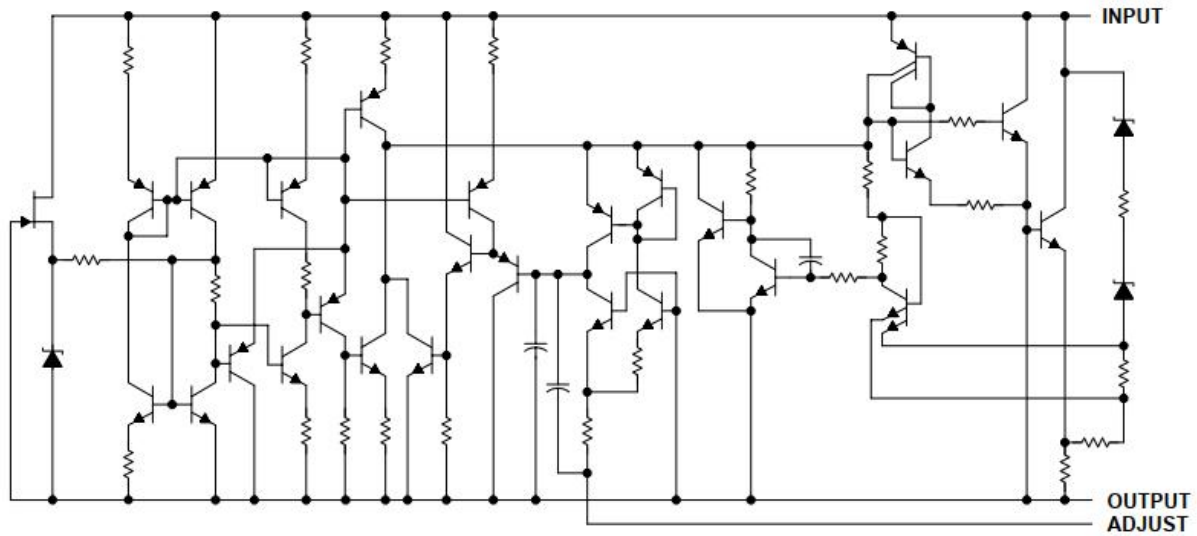
Pin Name	Pin Function
FB	Output Feedback Voltage
VOUT	Output Voltage
VIN	Power Input Voltage
NC	No Connected

### Ordering Information Continue

Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan <sup>Note</sup>	MSL Level	Marking Code
LM317LSQ	SOT-89	7/13	1000/3000	RoHS & Green	MSL1	
LM317LPA	SOP-8	13	4000	RoHS & Green	MSL3	

**Note:**  
RoHS: PJ defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials.  
Green: PJ defines "Green" to mean Halogen-Free and Antimony-Free.

### Function Block Diagram



### Absolute Maximum Ratings

Ratings at 25°C ambient temperature unless otherwise specified.

Parameter		Value	Unit
Input-Output Voltage Differential		-0.3 ~ +40	V
Output Current		Internally limited	--
Power Dissipation	SOT-89	2	W
	SOP-8	1	W
Thermal Resistance, Junction-to-Ambient	SOT-89	51	°C/W
	SOP-8	97	°C/W
Junction temperature		150	°C
Storage temperature range		-40 ~ +150	°C

### Recommended Operating Conditions

Parameter	Min.	Max.	Unit
Input-Output Voltage Differential	2.5	32	V
Output Current	2.5	100	mA
Operating Ambient Temperature	0	125	°C



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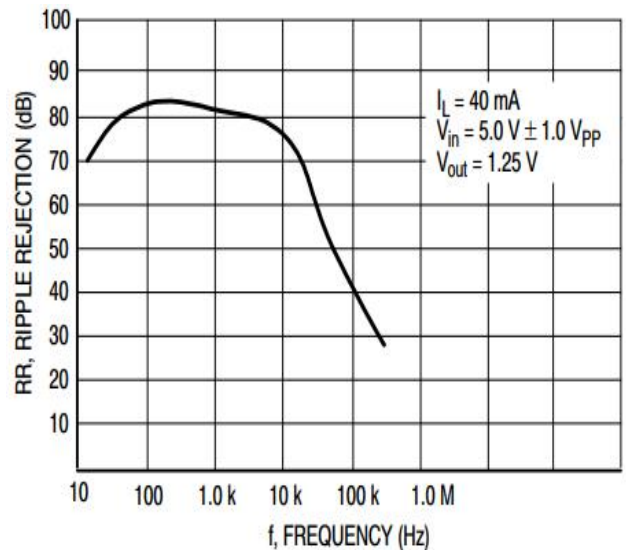
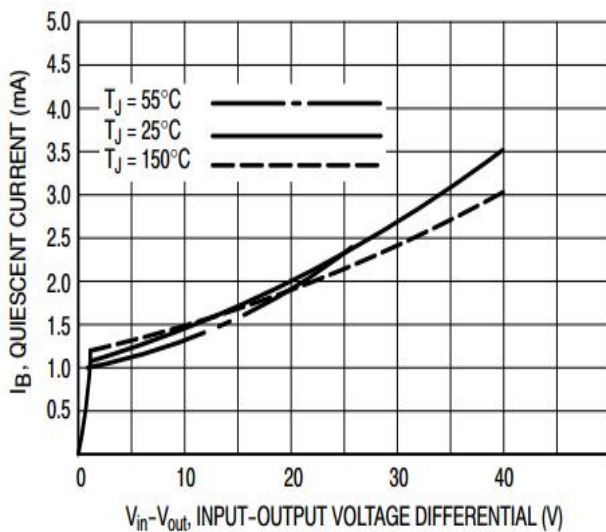
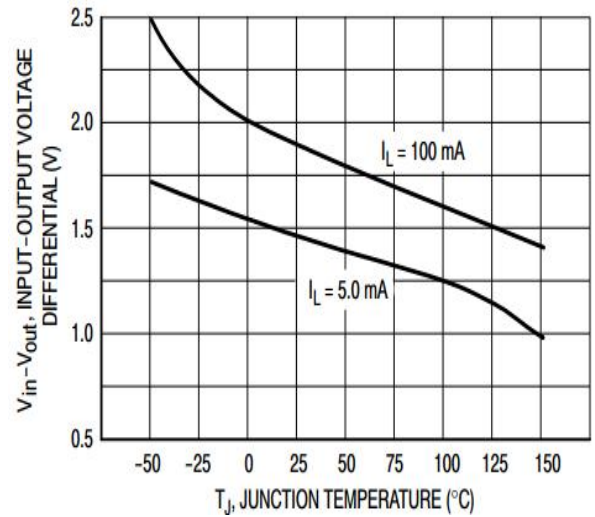
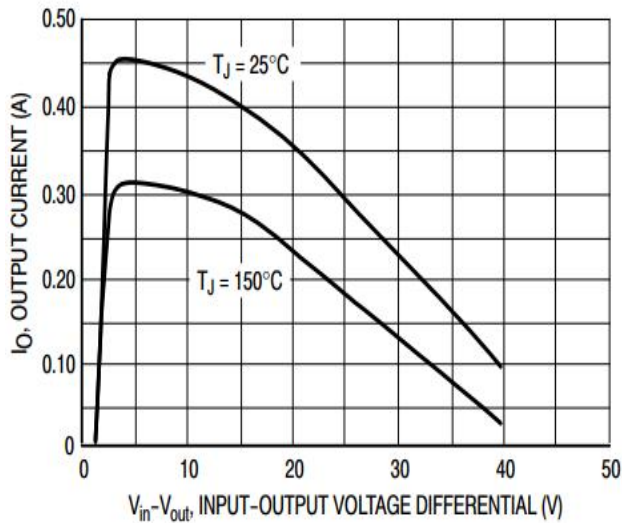
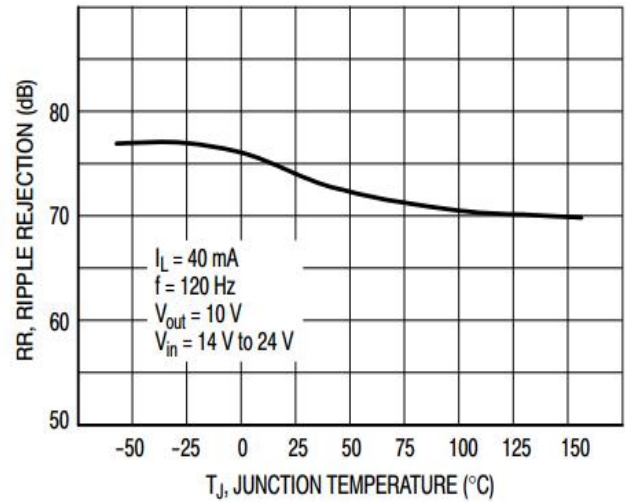
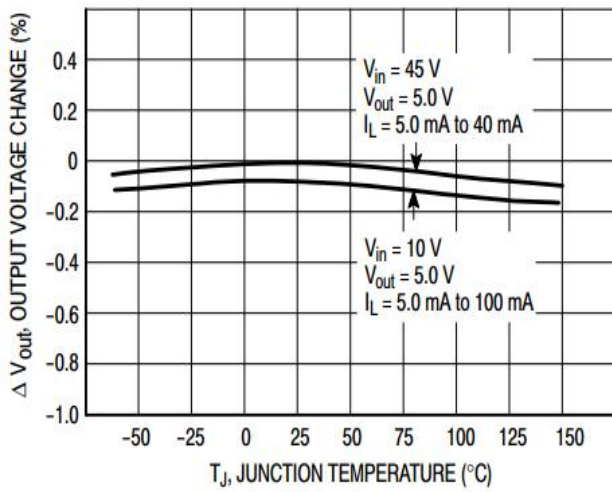
## 3-Terminal Adjustable Voltage Regulators

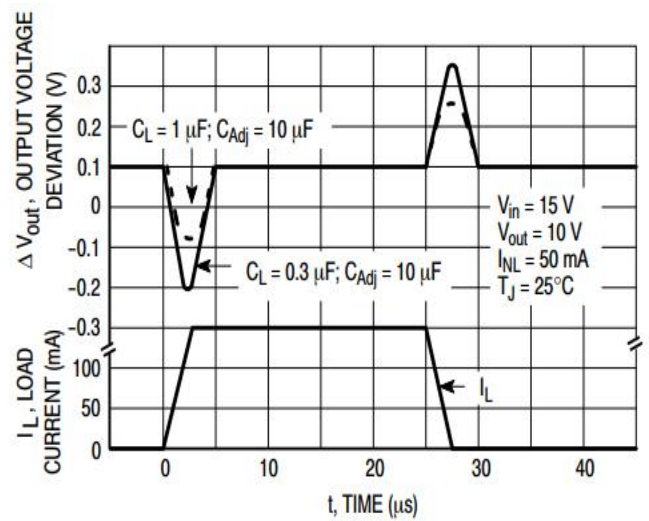
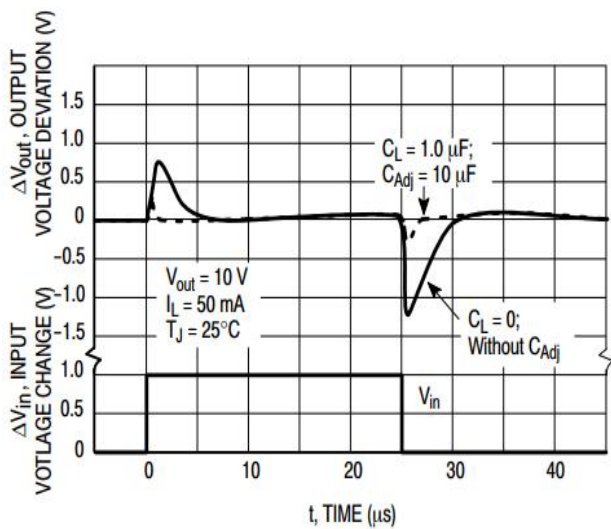
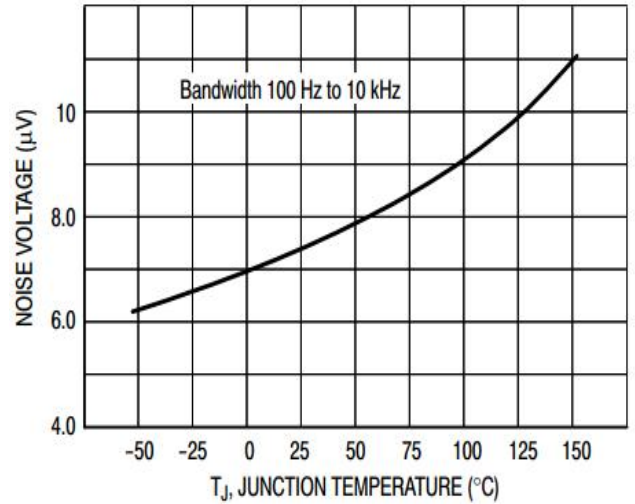
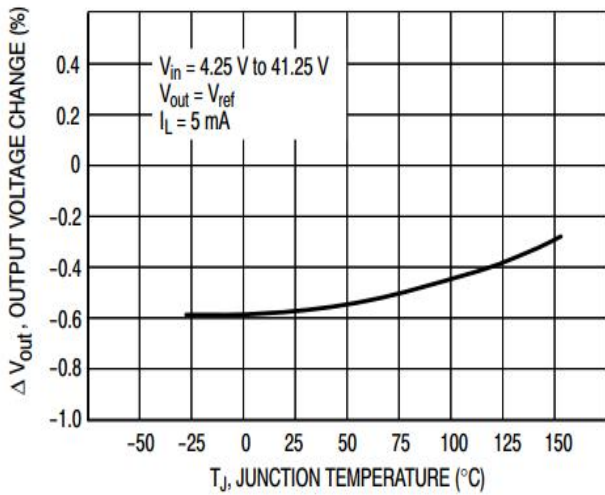
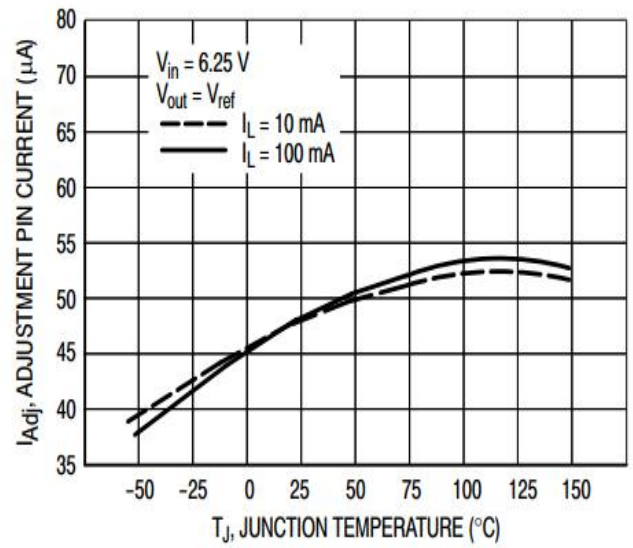
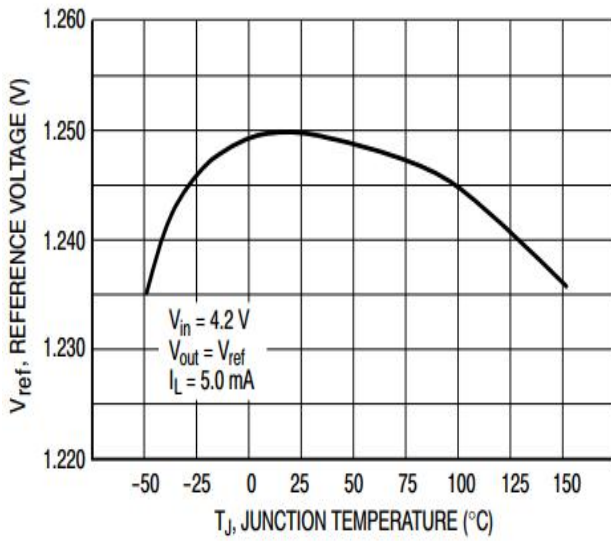
### Electrical Characteristics

( $V_I - V_O = 3V$ ,  $I_O = 40mA$ ,  $T_J = 0 \sim 125^\circ C$ , unless otherwise noted.)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Line Regulation	$\Delta V_{LINE}$	$V_I - V_O = 3V \sim 40V$	--	0.01	0.04	%/V
Load Regulation	$\Delta V_{LOAD}$	$V_O \leq 5V$ , $I_O = 10mA \sim 100mA$	--	5	25	mV
		$V_O \geq 5V$ , $I_O = 10mA \sim 100mA$	--	0.1	0.5	% $V_O$
Adjustment Pin Current	$I_{adj}$		--	--	100	$\mu A$
Adjustment Pin Current Change	$\Delta I_{adj}$	$V_I - V_O = 2.5V \sim 40V$ , $I_O = 10mA \sim 100mA$	--	0.2	5	$\mu A$
Reference Voltage	$V_{ref}$	$V_I - V_O = 3V \sim 40V$ , $I_O = 10mA \sim 100mA$	1.2	--	1.3	V
Reference Line Regulation	$\Delta V_{LINE}$	$V_I - V_O = 3V \sim 40V$	--	0.02	0.07	%V
Reference Load Regulation	$\Delta V_{LOAD}$	$V_O \leq 5V$ , $I_O = 10mA \sim 100mA$	--	20	70	mV
		$V_O \geq 5V$ , $I_O = 10mA \sim 100mA$	--	0.3	1.5	% $V_O$
Temperature Stability	$T_S$		--	0.7	--	%
Minimum Load Current to Maintain Regulation	$I_{O\_min}$	$V_I - V_O = 40V$	--	--	10	mA
Maximum Load Current to Maintain Regulation	$I_{O\_max}$	$V_I - V_O \leq 6.25V$ , $P_D < 625mW$	100	200	--	mA
		$V_I - V_O = 40V$ , $P_D < 625mW$	--	20	--	mA
RMS Noise, % of $V_O$	N	$T_A = 25^\circ C$ , $10Hz < f < 10KHz$	--	0.003	--	% $V_O$
Rejection Ratio	RR	$T_A = 25^\circ C$ , $f = 120Hz$ , $C_{adj} = 0$	60	80	--	dB
		$T_A = 25^\circ C$ , $f = 120Hz$ , $C_{adj} = 10\mu F$	--	80	--	dB

### Typical Characteristic Curves





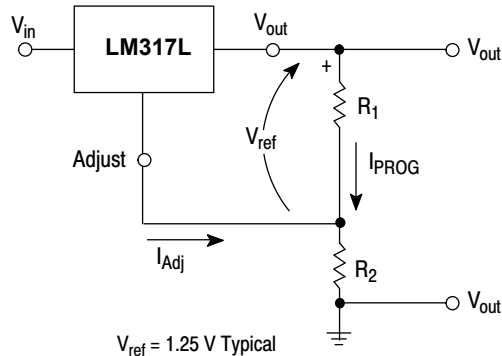
### Applications Information

#### Basic Circuit Operation

The LM317L is a 3-terminal floating regulator. In operation, the LM317L develops and maintains a nominal 1.25V reference ( $V_{ref}$ ) between its output and adjustment terminals. This reference voltage is converted to a programming current ( $I_{PROG}$ ) by  $R_1$  (see the following figure), and this constant current flows through  $R_2$  to ground.

The regulated output voltage is given by:

$$V_{OUT} = 1.25V \cdot (1 + R_2/R_1) + I_{Adj} \cdot R_2$$



**Basic Circuit Configuration**

Since the current from the adjustment terminal ( $I_{Adj}$ ) represents an error term in the equation, the LM317L was designed to control  $I_{Adj}$  to less than 100  $\mu A$  and keep it constant. To do this, all quiescent operating current is returned to the output terminal. This imposes the requirement for a minimum load current. If the load current is less than this minimum, the output voltage will rise.

Since the LM317L is a floating regulator, it is only the voltage differential across the circuit which is important to performance, and operation at high voltages with respect to ground is possible.

#### Load Regulation

The LM317L is capable of providing extremely good load regulation, but a few precautions are needed to obtain maximum performance. For best performance, the programming resistor ( $R_1$ ) should be connected as close to the regulator as possible to minimize line drops which effectively appear in series with the reference, thereby degrading regulation. The ground end of  $R_2$  can be returned near the load ground to provide remote ground sensing and improve load regulation.

#### External Capacitors

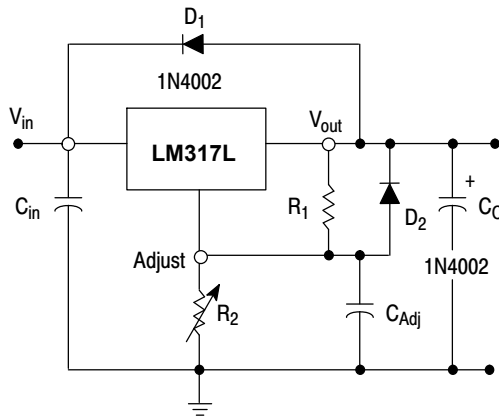
A 0.1  $\mu F$  disc or 1.0  $\mu F$  tantalum input bypass capacitor ( $C_{in}$ ) is recommended to reduce the sensitivity to input line impedance. The adjustment terminal may be bypassed to ground to improve ripple rejection. This capacitor ( $C_{Adj}$ ) prevents ripple from being amplified as the output voltage is increased. A 10  $\mu F$  capacitor should improve ripple rejection about 15 dB at 120 Hz in a 10V application.

Although the LM317L is stable with no output capacitance, like any feedback circuit, certain values of external capacitance can cause excessive ringing. An output capacitance ( $C_2$ ) in the form of a 1.0  $\mu F$  tantalum or 25  $\mu F$  aluminum electrolytic capacitor on the output swamps this effect and insures stability.

### Protection Diodes

When external capacitors are used with any IC regulator it is sometimes necessary to add protection diodes to prevent the capacitors from discharging through low current points into the regulator. The following figure shows the LM317L with the recommended protection diodes for output voltages in excess of 25 V or high capacitance values ( $C_O > 25\mu\text{F}$ ,  $C_{Adj} > 10\mu\text{F}$ ). Diode D1 prevents  $C_O$  from discharging thru the IC during an input short circuit. Diode D2 protects against capacitor  $C_{Adj}$  discharging through the IC during an output short circuit.

The combination of diodes D1 and D2 prevents  $C_{Adj}$  from discharging through the IC during an input short circuit.



**Voltage Regulator with Protection Diodes**



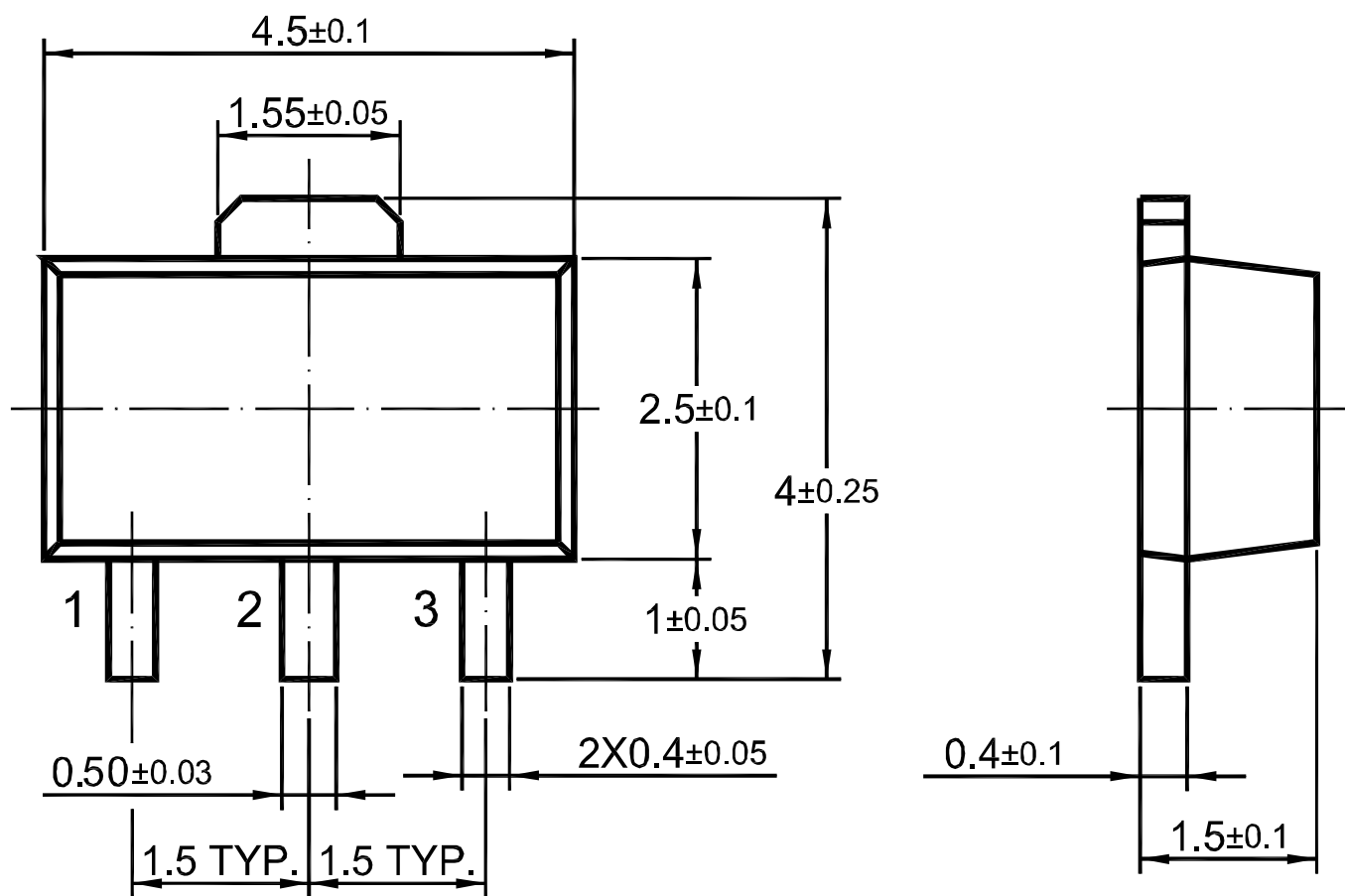
# LM317L

## 3-Terminal Adjustable Voltage Regulators

### Package Outline

SOT-89

Dimensions in mm



### Package Outline

SOP-8

Dimensions in mm

