

Description**3-Terminal Adjustable Voltage Regulators**

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.

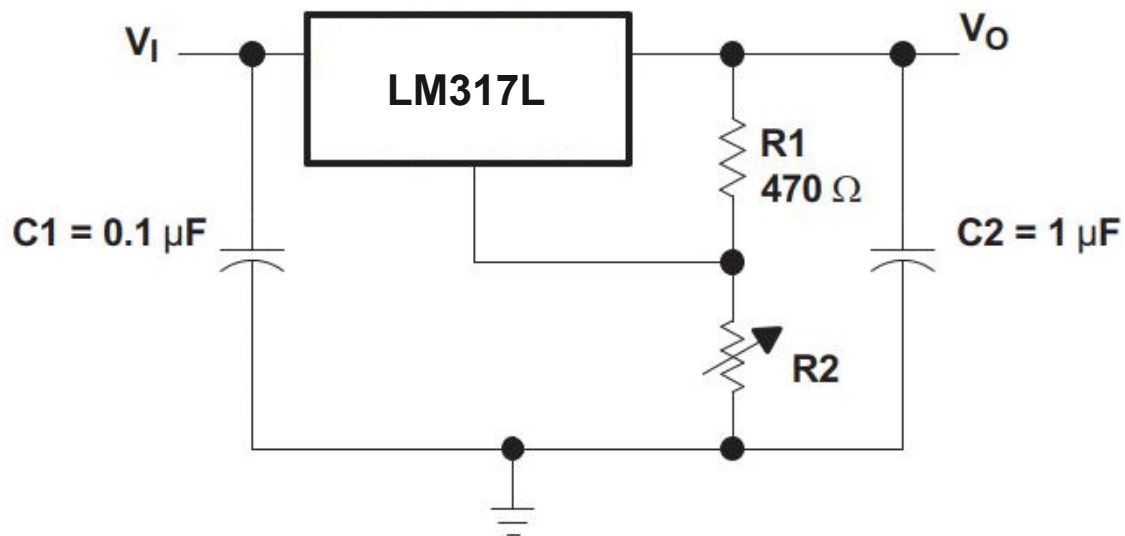
Features

- 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

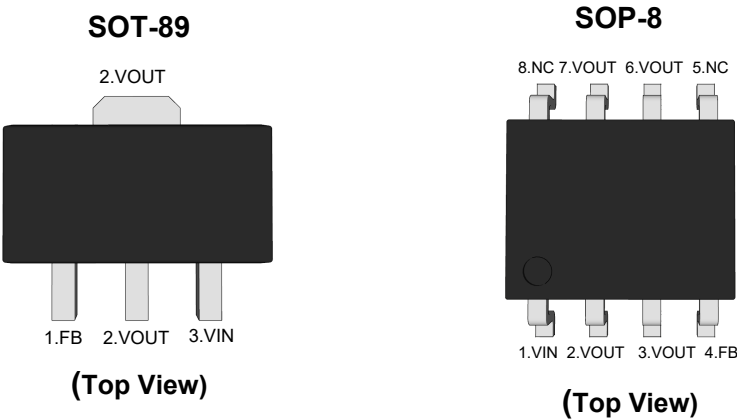
**Note:**

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 μA , the error associated with this term is negligible in most applications.

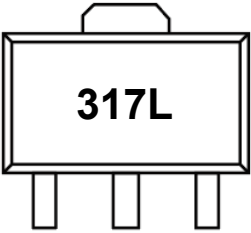
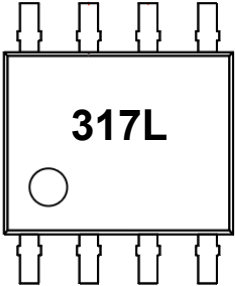
Pin Distribution



Functional Pin Description

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

Ordering Information Continue

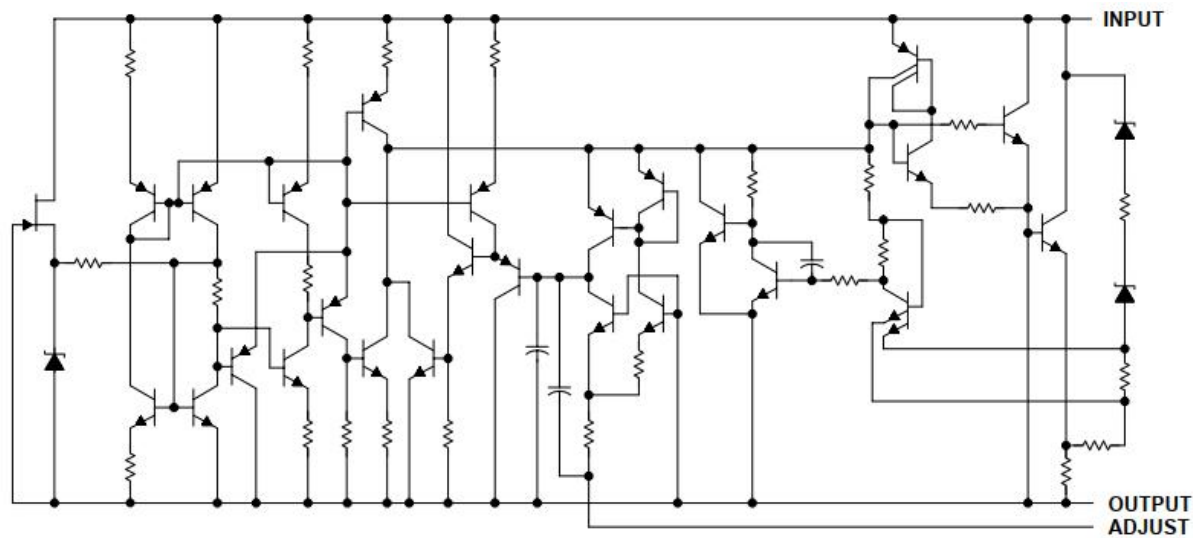
Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan ^{Note}	MSL Level	Marking Code
LM317LSQ	SOT-89	7/13	1000/3000	RoHS & Green	MSL1	
LM317LPA	SOP-8	13	4000	RoHS & Green	MSL3	

Note:

RoHS: TN 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: TN 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

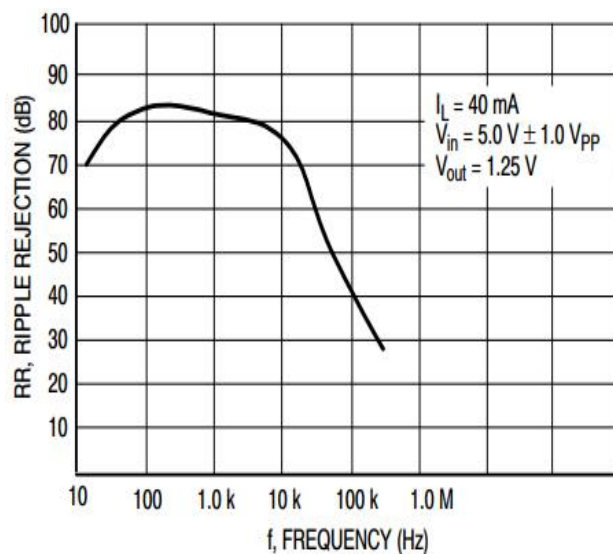
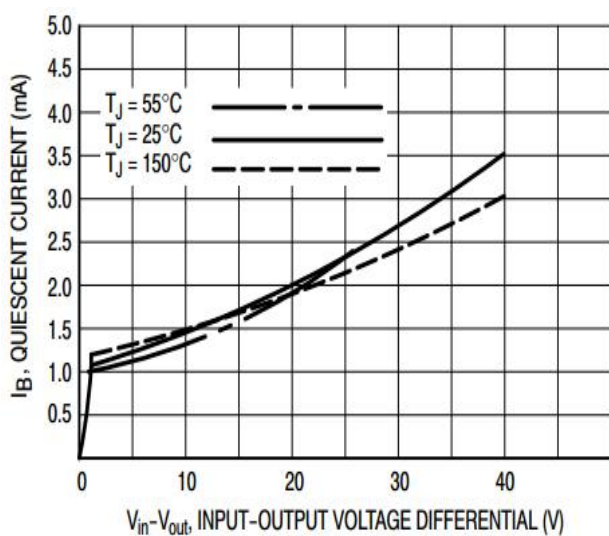
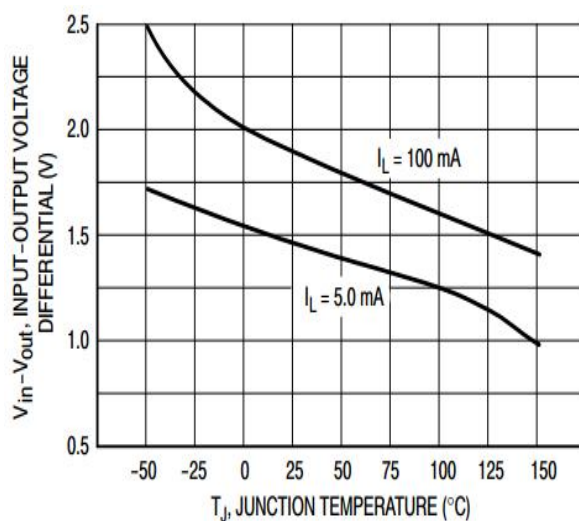
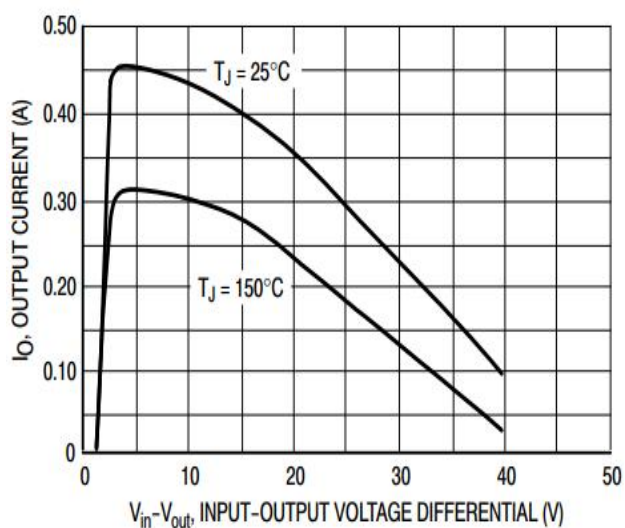
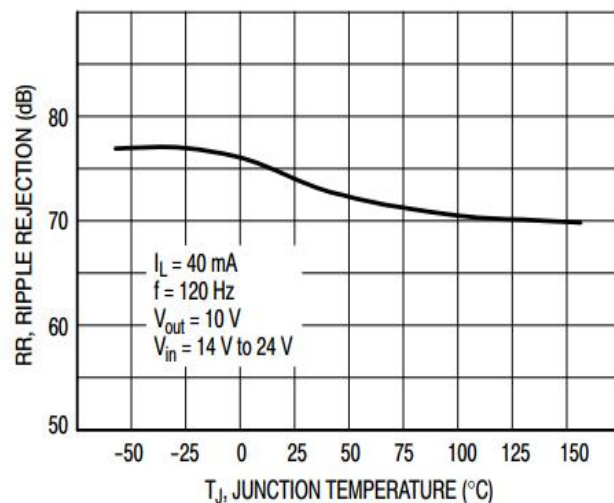
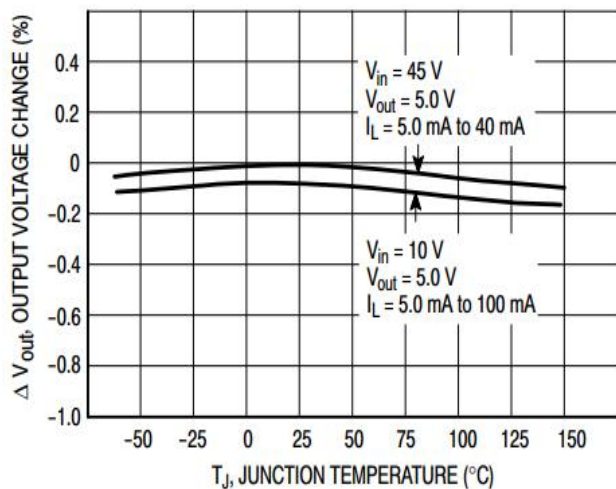
Parameter	Min.	Max.	Unit
Input-Output Voltage Differential	2.5	32	V
Output Current	2.5	100	mA
Operating Ambient Temperature	0	125	°C

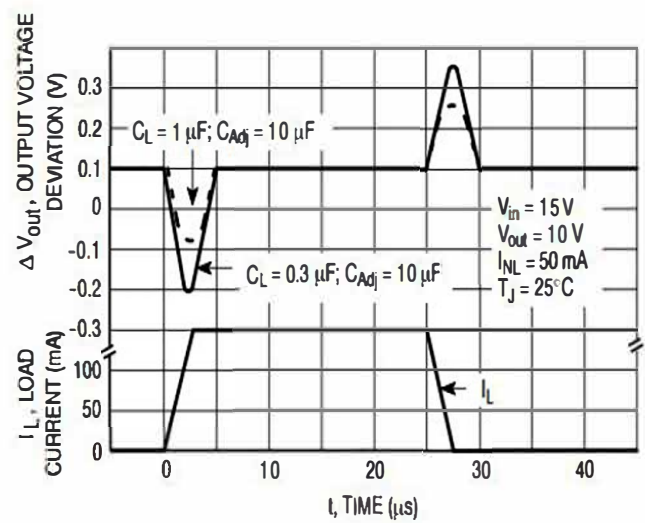
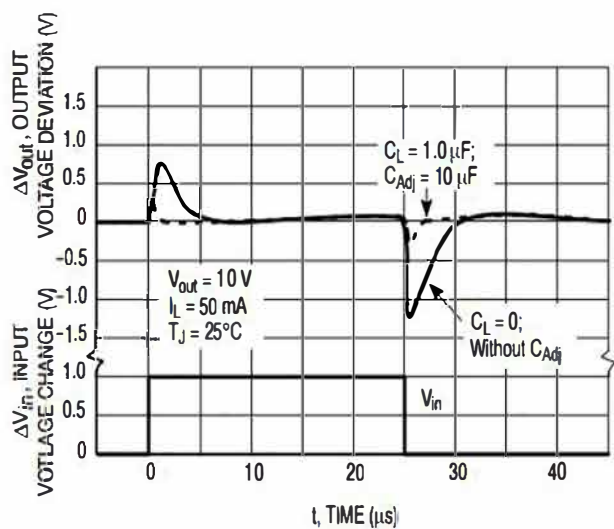
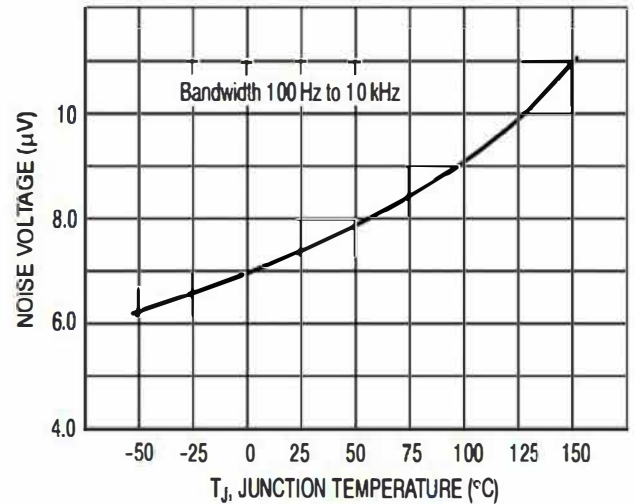
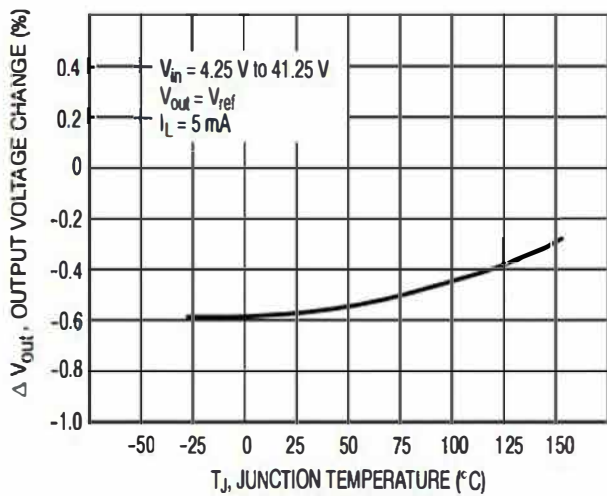
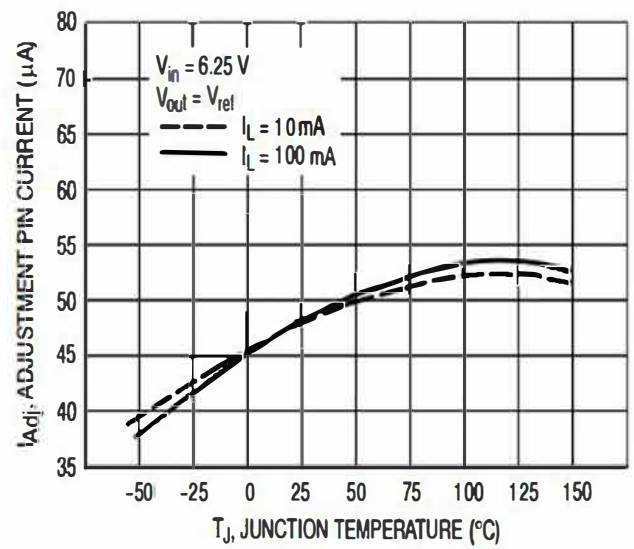
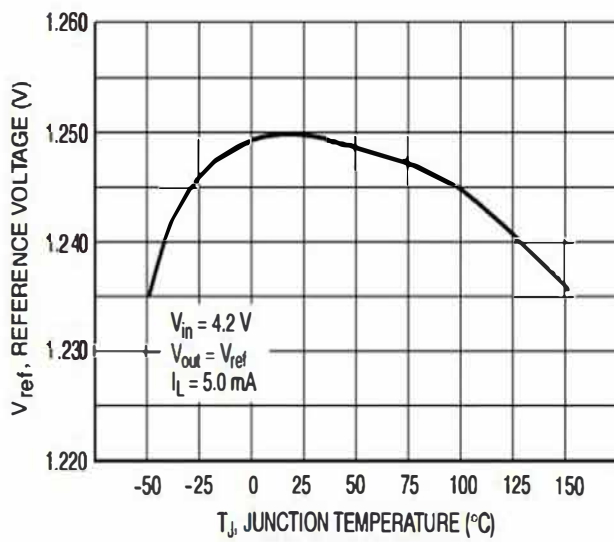
Electrical Characteristics

(V_I-V_O=3V, I_O=40mA, T_J=0~125°C, unless otherwise noted.)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Line Regulation	ΔV_{LINE}	V _I -V _O =3V~40V	--	0.01	0.04	%/V
Load Regulation	ΔV_{LOAD}	V _O ≤ 5V, I _O =10mA~100mA	--	5	25	mV
		V _O ≥ 5V, I _O =10mA~100mA	--	0.1	0.5	% V _O
Adjustment Pin Current	I _{adj}		--	--	100	μA
Adjustment Pin Current Change	ΔI_{adj}	V _I -V _O =2.5V~40V, I _O =10mA~100mA	--	0.2	5	μA
Reference Voltage	V _{ref}	V _I -V _O =3V~40V, I _O =10mA~100mA	1.2	--	1.3	V
Reference Line Regulation	ΔV_{LINE}	V _I -V _O =3V~40V	--	0.02	0.07	%V
Reference Load Regulation	ΔV_{LOAD}	V _O ≤ 5V, I _O =10mA~100mA	--	20	70	mV
		V _O ≥ 5V, I _O =10mA~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 ≤ 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°C, 10Hz<f<10KHz	--	0.003	--	% V _O
Rejection Ratio	RR	T _A =25°C, f=120Hz, C _{adj} =0	60	80	--	dB
		T _A =25°C, f=120Hz, C _{adj} =10μF	--	80	--	dB

Typical Characteristic Curves





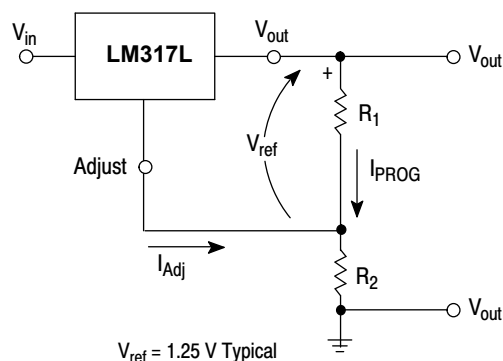
Applications Information

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 μA 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

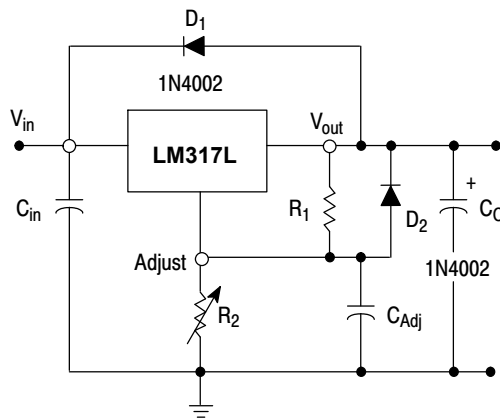
A 0.1 μF disc or 1.0 μF tantalum input bypass capacitor (C_{in}) is recommended to reduce the sensitivity to input line impedance. The adjustment terminal may be bypassed to ground to improve ripple rejection. This capacitor (C_{Adj}) prevents ripple from being amplified as the output voltage is increased. A 10 μF 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 μF tantalum or 25 μF 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 ($C_O > 25\mu\text{F}$, $C_{\text{Adj}} > 10\mu\text{F}$). 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.

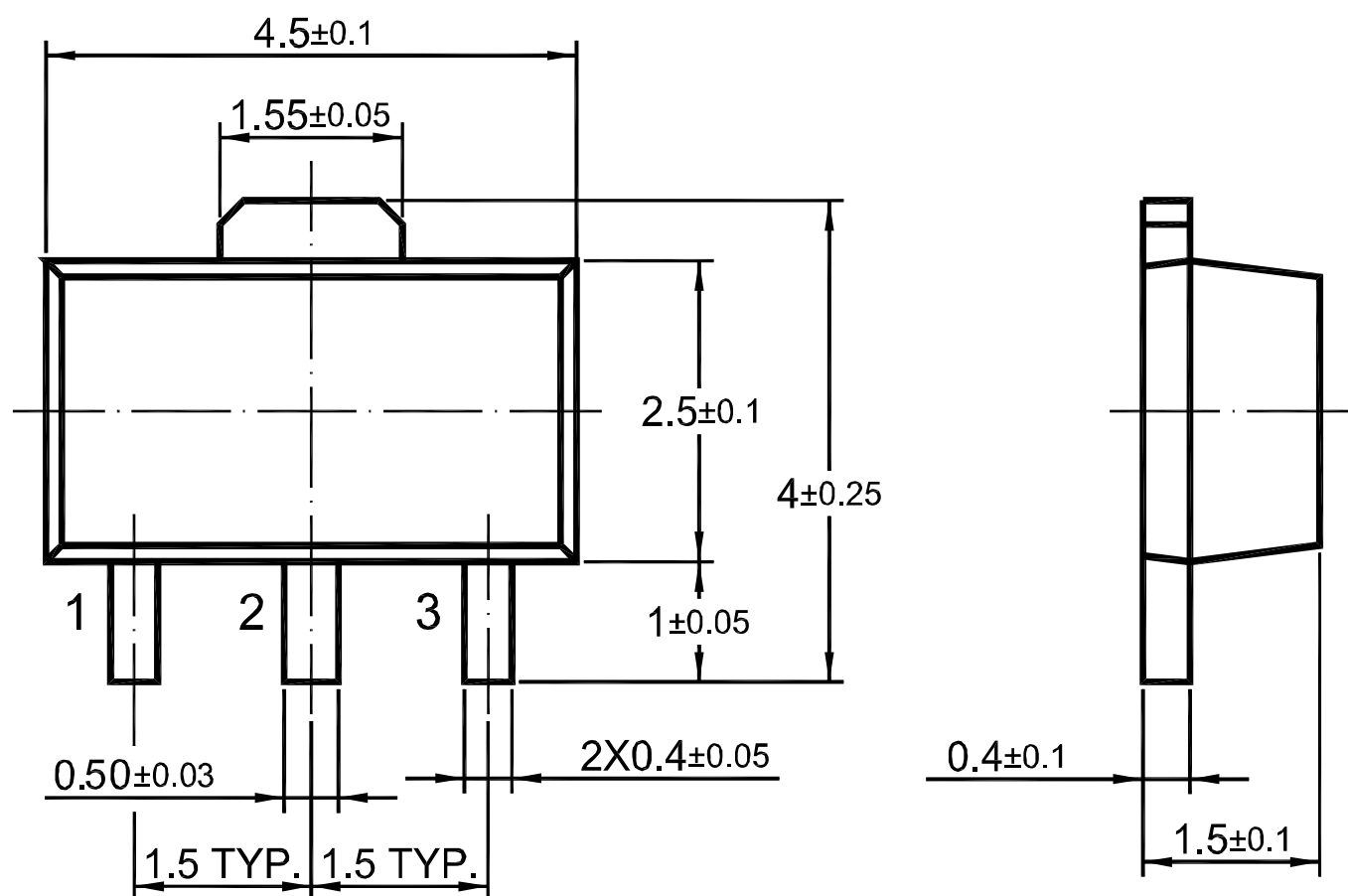


Voltage Regulator with Protection Diodes

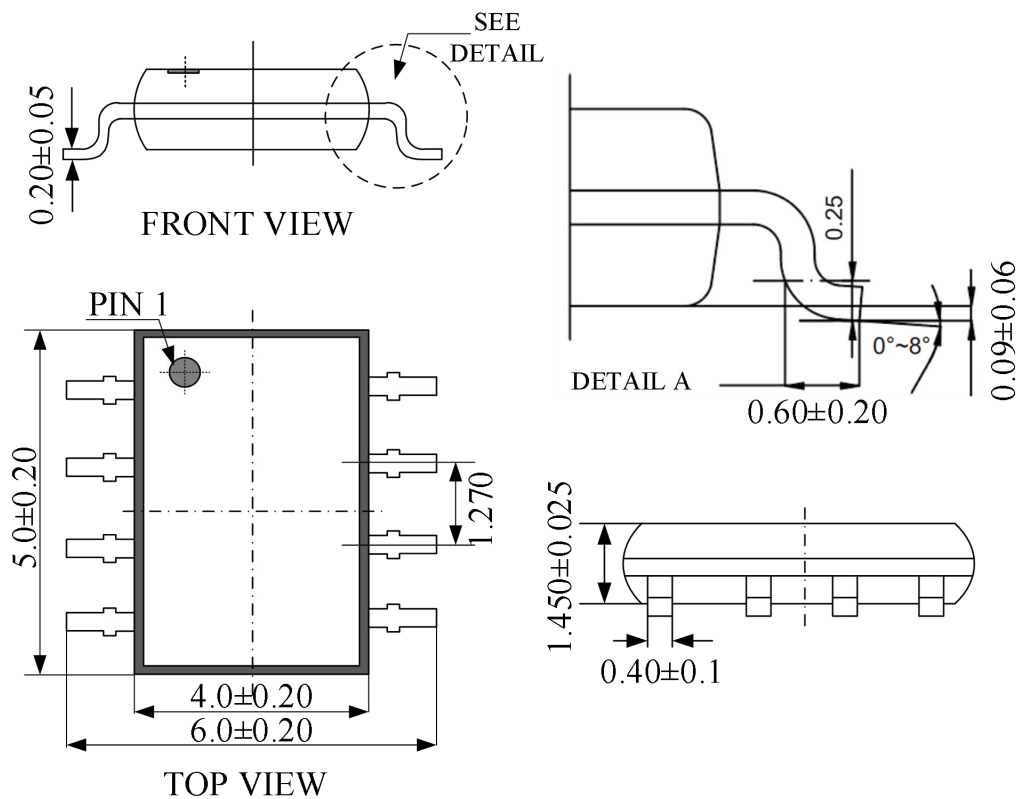
Package Outline

SOT-89

Dimensions in mm



Outline Drawing – SOP-8(Dimensions in mm)



Package Information

Package Type	Description	Quantity (pcs)	Standard
SOP-8	Reel -13" tape	4000	EIA-481

Contact Information

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For additional information, please contact your local Sales Representative.

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