Description

The LM317 is an adjustable 3-terminal positive-voltage regulator capable of supplying 1.5 A 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 LM317 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 LM317 can be used as a precision current regulator.

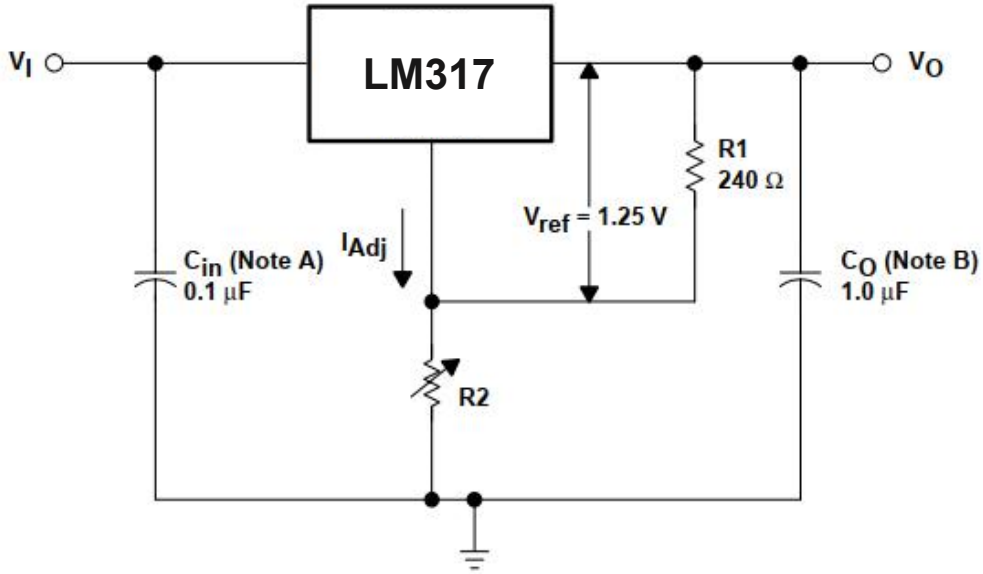
Features

- Output Current in Excess of 1.5 A
- 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-223 and TO-220

Applications

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

Typical Applications



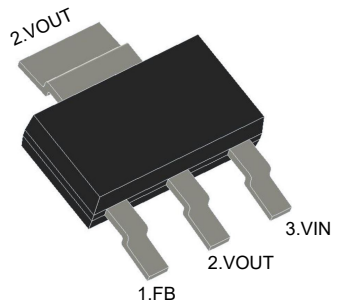
Note:
C_{in} is required if regulator is located an appreciable distance from power supply filter.
C_O is not needed for stability, however, it does improve transient response.

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

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

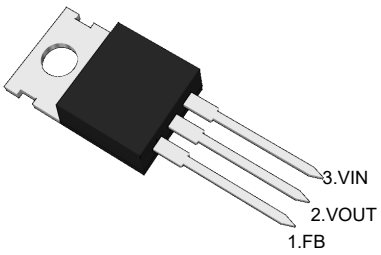
Pin Distribution

SOT-223



(Top View)

TO-220

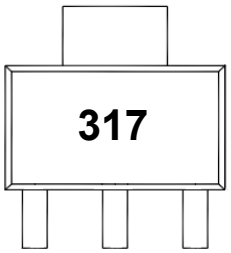
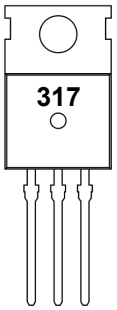


(Top View)

Functional Pin Description

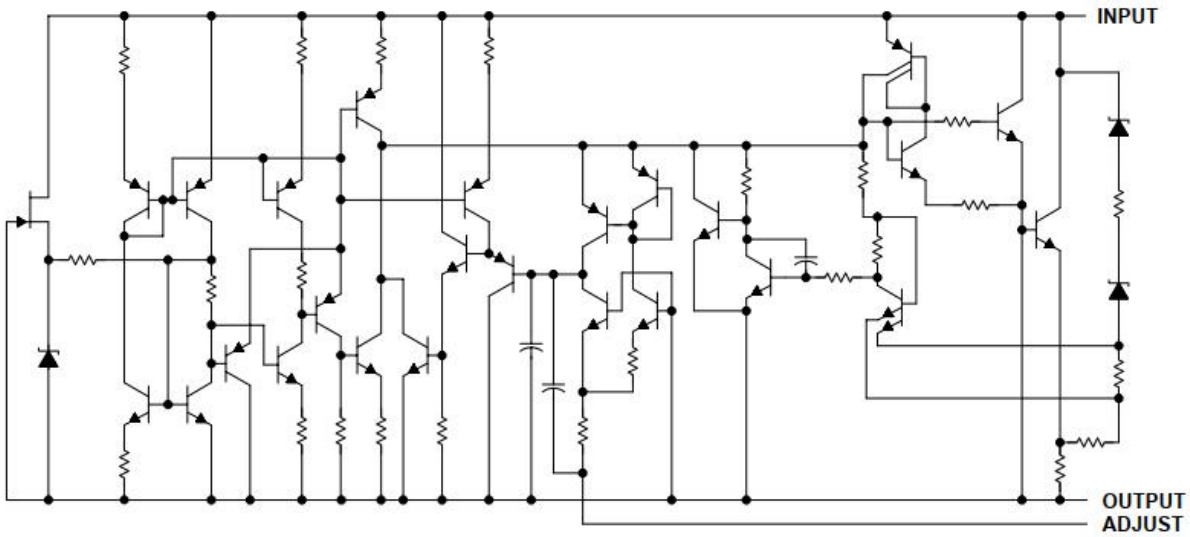
Pin Name	Pin Function
FB	Output Feedback Voltage
VOUT	Output Voltage
VIN	Power Input Voltage

Ordering Information Continue

Orderable Device	Package	Package Qty (PCS)	Eco Plan [Note]	MSL Level	Marking Code
LM317ST	SOT-223	4000/Reel	RoHS & Green	MSL3	
LM317TO	TO-220	50/Rail	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℃ ambient temperature unless otherwise specified.

Parameter		Value	Unit
Input−Output Voltage Differential		-0.3 ~ +40	V
Output Current		Internally limited	--
Power Dissipation	SOT-223	1.5	W
	TO-220	2.5	W
Thermal Resistance,Junction-to-Ambient	SOT-223	67	°C/W
	TO-220	40	°C/W
Junction temperature		150	°C
Storage temperature range		-40 ~ +150	°C

Recommended Operating Conditions

Parameter	Min.	Max.	Unit
Input−Output Voltage Differential	3	37	V
Output Current	--	1.5	A
Operating Ambient Temperature	0	125	°C

Electrical Characteristics

(V_I-V_O=5V, I_O=500mA, 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~1500mA	--	5	25	mV
		V_O ≥ 5V, I_O=10mA~1500mA	--	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~1500mA	--	0.2	5	μA
Reference Voltage	V_{ref}	V_I-V_O =3V~40V, I_O=10mA~1500mA	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~1500mA	--	20	70	mV
		V_O ≥ 5V, I_O=10mA~1500mA	--	0.3	1.5	% V_O
Temperature Stability	T_S		--	1	--	%
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 ≤ 15V, P_D<20W	1.5	--	--	A
		V_I-V_O=40V, P_D<20W	0.15	--	--	A
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	--	65	--	dB
		T_A=25°C, f=120Hz, C_{adj}=10μF	66	80	--	dB

Typical Characteristic Curves

图 5. 负载调整率

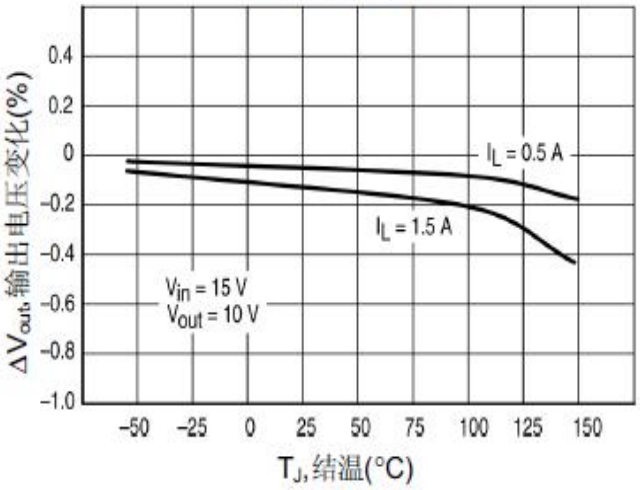


图 6. 电流限度

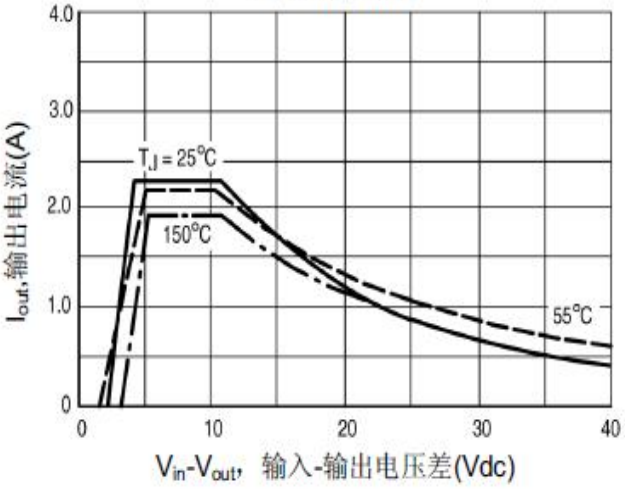


图 7. 调节管脚电流

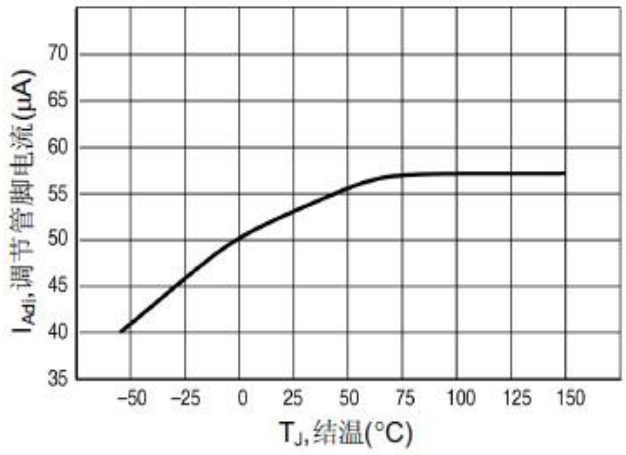


图 8. 压降电压

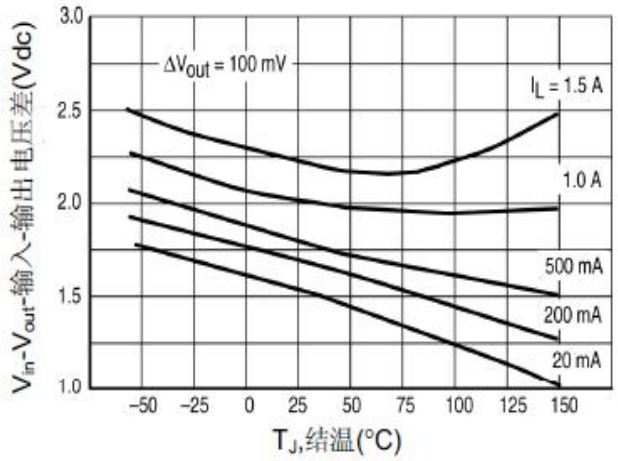


图 9. 温度稳定性

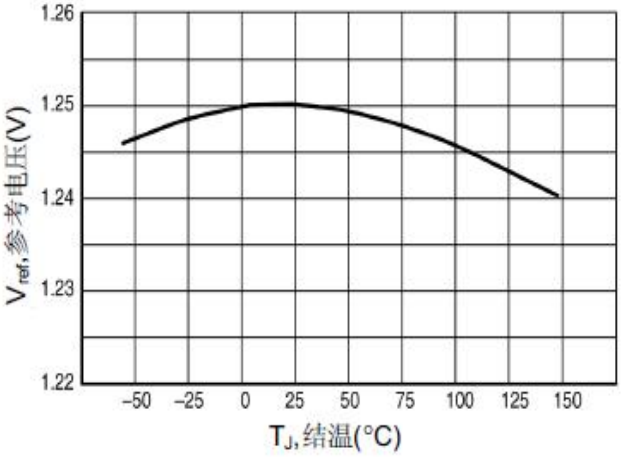


图 10. 最小工作电流

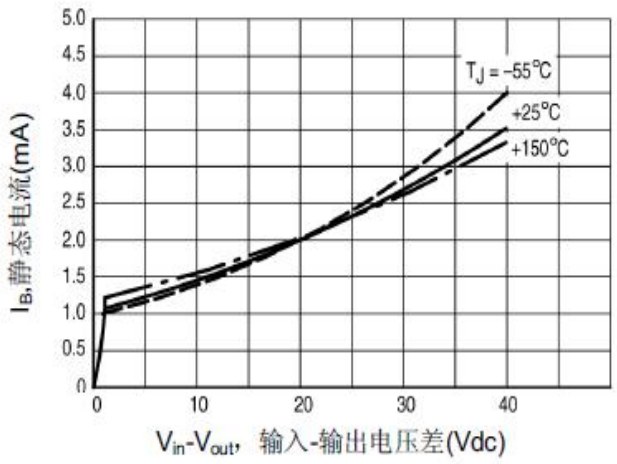


图 11. 纹波抑制与输出电压关系曲线

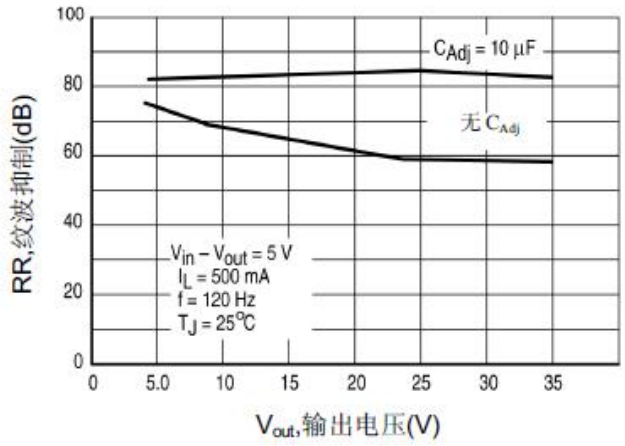


图 12. 纹波抑制与输出电流关系曲线

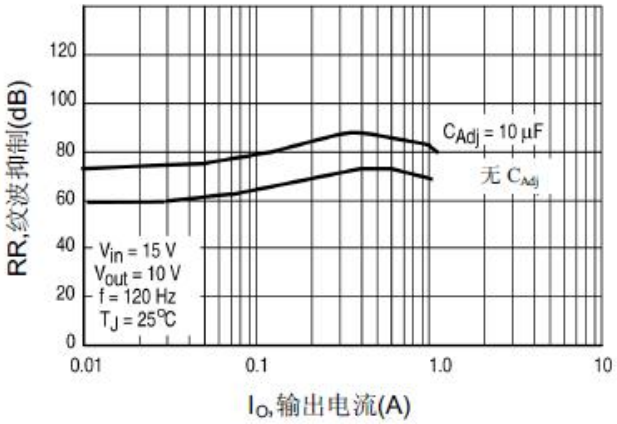


图 13. 纹波抑制与频率关系曲线

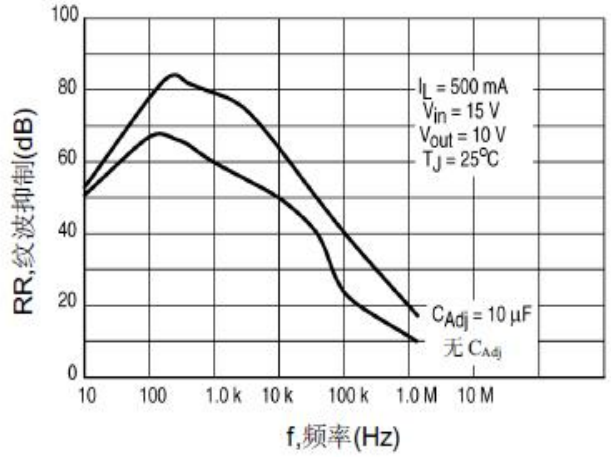


图 14. 输出阻抗

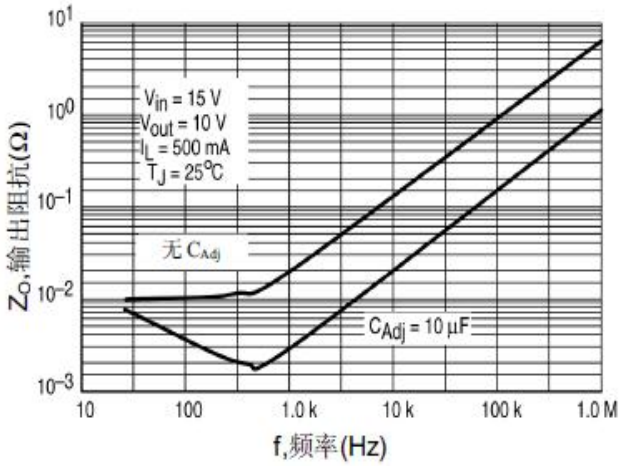


图 15.电源瞬态响应

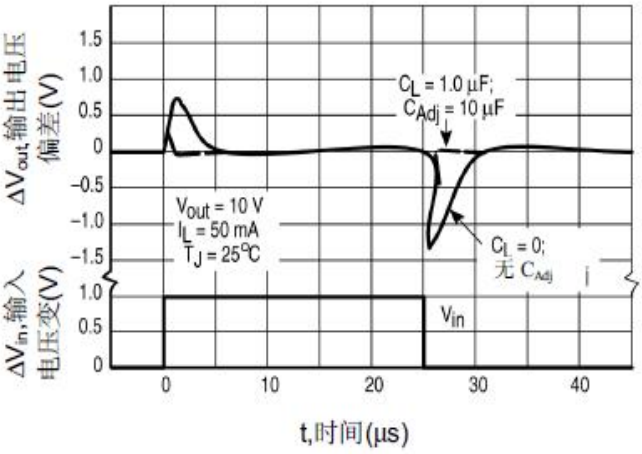
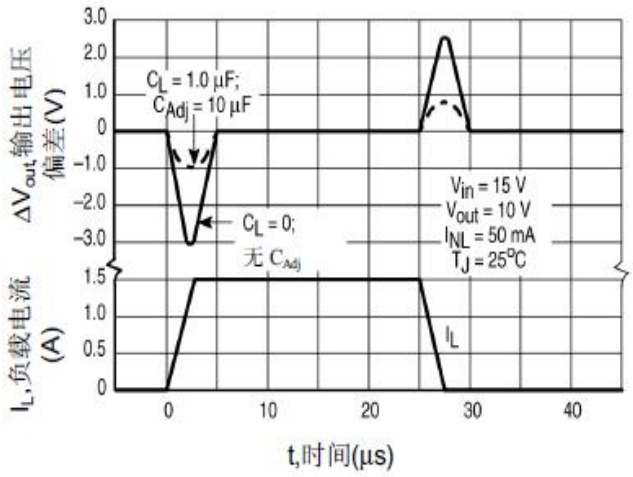


图 16.负载瞬态响应

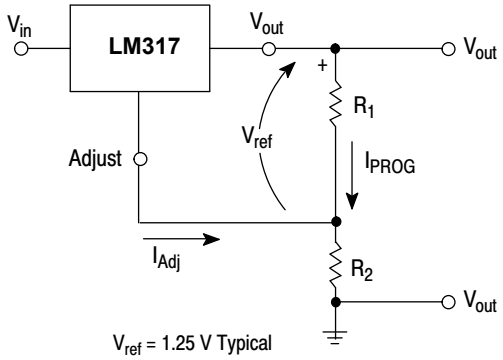


Applications Information

Basic Circuit Operation

The LM317 is a 3−terminal floating regulator. In operation, the LM317 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 (IPROG) by R1 (see the following figure), and this constant current flows through R2 to ground.
The regulated output voltage is given by:

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



Basic Circuit Configuration

Since the current from the adjustment terminal (I_{Adj}) represents an error term in the equation, the LM317 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 LM317 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 LM317 is capable of providing extremely good load regulation, but a few precautions are needed to obtain maximum performance. For best performance, the programming resistor (R1) should be connected as close to the regulator as possible to minimize line drops which effectively appear in series with the reference, there by degrading regulation. The ground end of R2 can be returned near the load ground to provide remote ground sensing and improve load regulation.

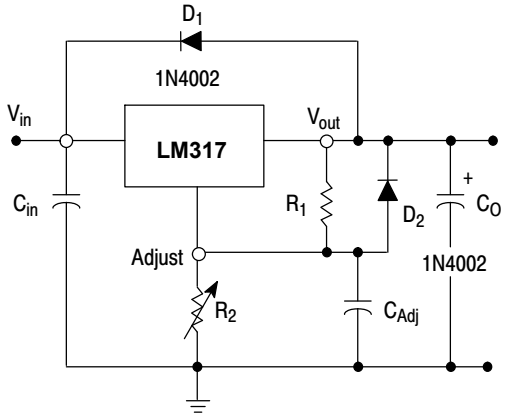
External Capacitors

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 10μF capacitor should improve ripple rejection about 15 dB at 120 Hz in a 10V application.
Although the LM317 is stable with no output capacitance, like any feedback circuit, certain values of external capacitance can cause excessive ringing. An output capacitance (C2) in the form of a 1.0μF tantalum or 25μF 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 LM317 with the recommended protection diodes for output voltages in excess of 25 V or high capacitance values (C_O > 25μF, C_{Adj} > 10μF). Diode D1 prevents CO 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.

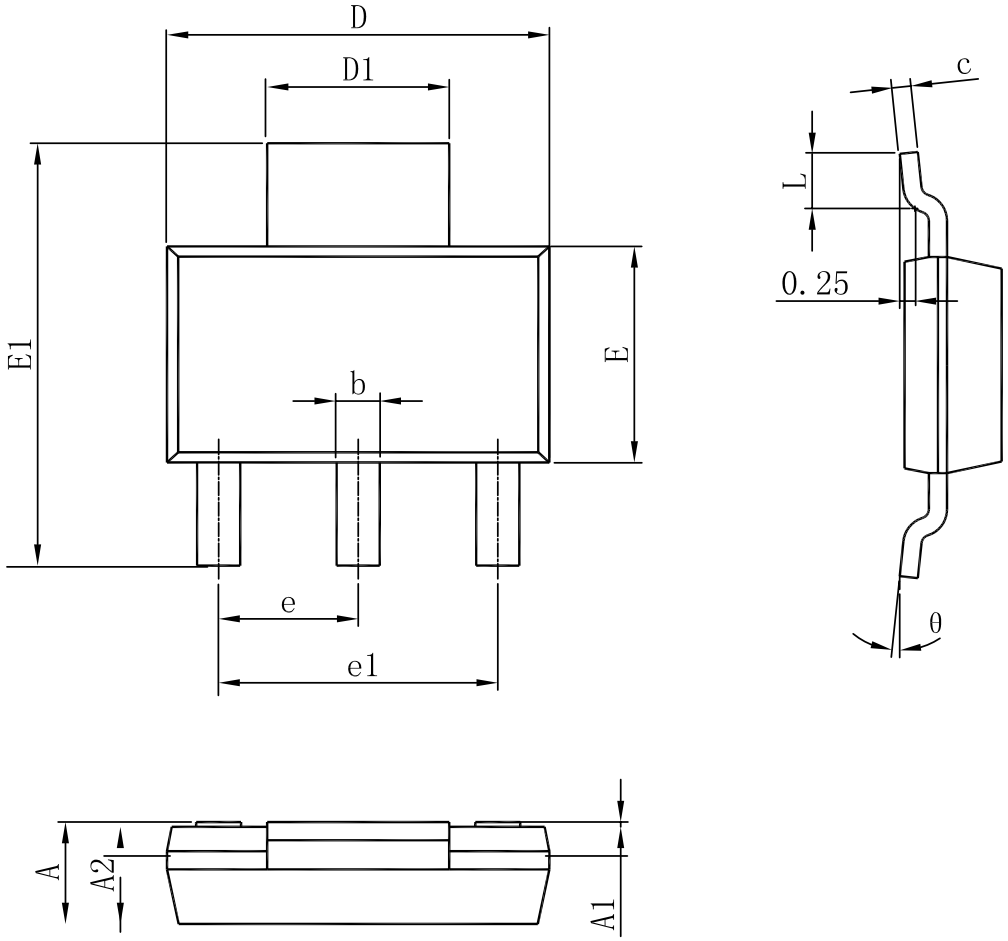


Voltage Regulator with Protection Diodes

Package Outline

SOT-223

Dimensions in mm

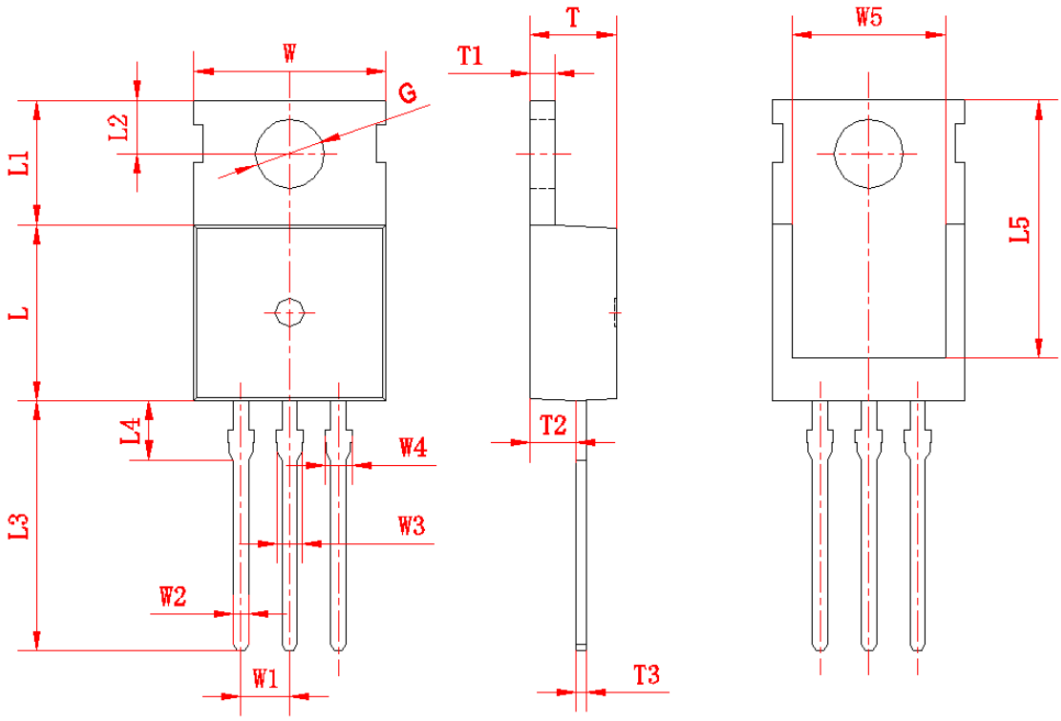


1.塑脂体无缺损、缩孔、气泡、裂纹等缺陷；
2.树脂体上下部XY方向偏差、树脂体中心与引线框中心错位±0.035；
3.粗糙度Ra为0.4--0.6。

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	/	/	1.80
A1	0.02	/	0.10
A2	1.50	1.60	1.70
b	0.66	0.71	0.84
c	0.23	0.30	0.35
D	6.30	6.50	6.70
D1	2.90	3.00	3.10
E	3.30	3.50	3.70
E1	6.70	7.00	7.30
e	2.30 BASIC		
e1	4.60 BASIC		
L	0.75	/	/
θ	0°	/	10°

Package Outline

TO-220
Dimensions in mm



2.1.2 尺寸标准

（单位：mm）

符号	尺寸		符号	尺寸		符号	尺寸	
	Min	Max		Min	Max		Min	Max
W	9.80	10.20	L	9.00	9.40	T	4.30	4.70
W1	(2.54)		L1	6.30	6.70	T1	1.20	1.40
W2	0.70	0.90	L2	2.70	2.90	T2	2.20	2.60
W3	1.17	1.37	L3	12.88	13.28	T3	0.45	0.60
W4	1.17	1.62	L4	(3.10)		G	3.50	3.70
W5	(8.00)		L5	(13.5)				

注：（）内数值为参考值；尺寸不包含毛刺及模具溢料。

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