

# LM317

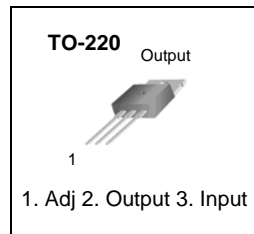
## 3-Terminal Positive Adjustable Regulator

### Features

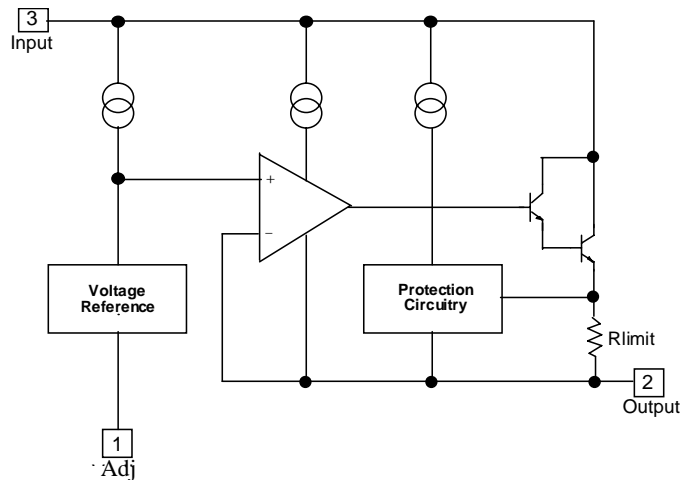
- Output Current In Excess of 1.5A
- Output Adjustable Between 1.2V and 37V
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe Operating Area Compensation
- TO-220 Package

### Description

This monolithic integrated circuit is an adjustable 3-terminal positive voltage regulator designed to supply more than 1.5A of load current with an output voltage adjustable over a 1.2V to 37V. It employs internal current limiting, thermal shut-down and safe area compensation.



### Internal Block Diagram



## Absolute Maximum Ratings

| Parameter                                 | Symbol                  | Value              | Unit |
|---|-------------------------|--------------------|------|
| Input-Output Voltage Differential         | $V_I - V_O$             | 40                 | V    |
| Lead Temperature                          | $T_{LEAD}$              | 230                | °C   |
| Power Dissipation                         | $P_D$                   | Internally limited | W    |
| Operating Junction Temperature Range      | $T_j$                   | 0 ~ +125           | °C   |
| Storage Temperature Range                 | $T_{STG}$               | -65 ~ +125         | °C   |
| Temperature Coefficient of Output Voltage | $\Delta V_O / \Delta T$ | ±0.02              | %/°C |

**Note 1:** Absolute Maximum Ratings: are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

## Electrical Characteristics

( $V_I - V_O = 5V$ ,  $I_O = 0.5A$ ,  $0^\circ C \leq T_J \leq +125^\circ C$ ,  $I_{MAX} = 1.5A$ ,  $P_{D_{MAX}} = 20W$ , unless otherwise specified)

| Parameter                                   | Symbol              | Conditions   | Min. | Typ.      | Max.      | Unit               |
|---|---------------------|--|------|-----------|-----------|--------------------|
| Line Regulation (Note2)                     | Rline               | $T_A = +25^\circ C$<br>$3V \leq V_I - V_O \leq 40V$                                      | -    | 0.01      | 0.04      | %/V                |
|   |                     | $3V \leq V_I - V_O \leq 40V$   | -    | 0.02      | 0.07      | %/V                |
| Load Regulation (Note2)                     | Rload               | $T_A = +25^\circ C$ , $10mA \leq I_O \leq I_{MAX}$<br>$V_O < 5V$<br>$V_O \geq 5V$        | -    | 18<br>0.4 | 25<br>0.5 | mV%/V <sub>O</sub> |
|   |                     | $10mA \leq I_O \leq I_{MAX}$<br>$V_O < 5V$<br>$V_O \geq 5V$                              | -    | 40<br>0.8 | 70<br>1.5 | mV%/V <sub>O</sub> |
| Adjustable Pin Current                      | I <sub>ADJ</sub>    | -  | -    | 46        | 100       | µA                 |
| Adjustable Pin Current Change               | ΔI <sub>ADJ</sub>   | $3V \leq V_I - V_O \leq 40V$<br>$10mA \leq I_O \leq I_{MAX}$ $P_D \leq P_{MAX}$          | -    | 2.0       | 5         | µA                 |
| Reference Voltage                           | V <sub>REF</sub>    | $3V \leq V_{IN} - V_O \leq 40V$<br>$10mA \leq I_O \leq I_{MAX}$<br>$P_D \leq P_{MAX}$    | 1.20 | 1.25      | 1.30      | V                  |
| Temperature Stability                       | ST <sub>T</sub>     | -  | -    | 0.7       | -         | %/V <sub>O</sub>   |
| Minimum Load Current to Maintain Regulation | I <sub>L(MIN)</sub> | $V_I - V_O = 40V$  | -    | 3.5       | 12        | mA                 |
| Maximum Output Current                      | I <sub>O(MAX)</sub> | $V_I - V_O \leq 15V$ , $P_D \leq P_{MAX}$  | 1.5  | 2.2       | -         | A                  |
|   |                     | $V_I - V_O \leq 40V$ , $P_D \leq P_{MAX}$<br>$T_A = 25^\circ C$                          | -    | 0.3       | -         |                    |
| RMS Noise, % of V <sub>OUT</sub>            | e <sub>N</sub>      | $T_A = +25^\circ C$ , $10Hz \leq f \leq 10kHz$   | -    | 0.003     | 0.01      | %/V <sub>O</sub>   |
| Ripple Rejection                            | RR                  | $V_O = 10V$ , $f = 120Hz$<br>without C <sub>ADJ</sub><br>C <sub>ADJ</sub> = 10µF (Note3) | 66   | 60<br>75  | -         | dB                 |
| Long-Term Stability, T <sub>J</sub> = THIGH | ST                  | $T_A = +25^\circ C$ for end point measurements, 1000HR                                   | -    | 0.3       | 1         | %                  |
| Thermal Resistance Junction to Case         | R <sub>θJC</sub>    | -  | -    | 5         | -         | °C/W               |

**Note 2:** Load and line regulation are specified at constant junction temperature. Change in V<sub>D</sub> due to heating effects must be taken into account separately. Pulse testing with low duty is used. ( $P_{MAX} = 20W$ )

**Note 3:** C<sub>ADJ</sub>, when used, is connected between the adjustment pin and ground.

## Typical Performance Characteristics

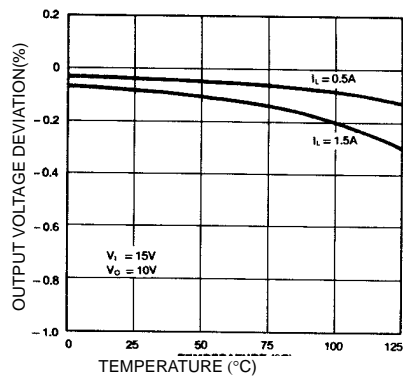


Figure 1. Load Regulation

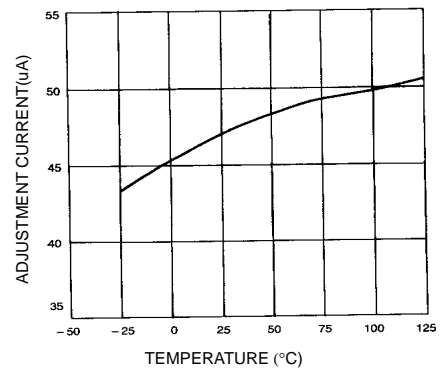


Figure 2. Adjustment Current

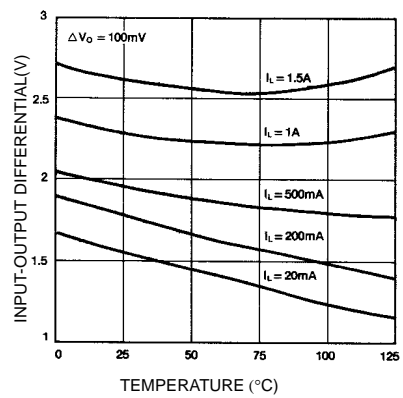


Figure 3. Dropout Voltage

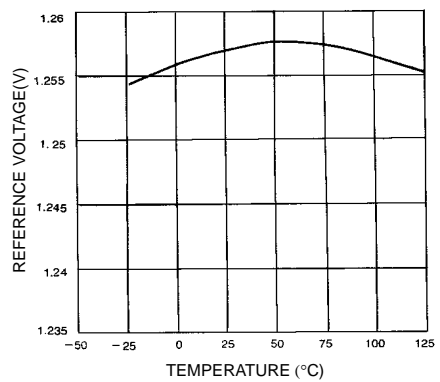
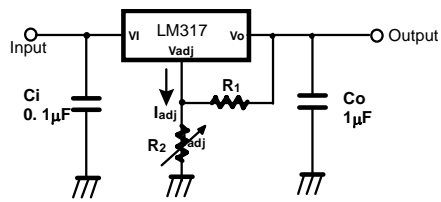


Figure 4. Reference Voltage

## Typical Application



$$V_o = 1.25V \left(1 + \frac{R_2}{R_1}\right) + I_{adj} R_2$$

**Figure 5. Programmable Regulator**

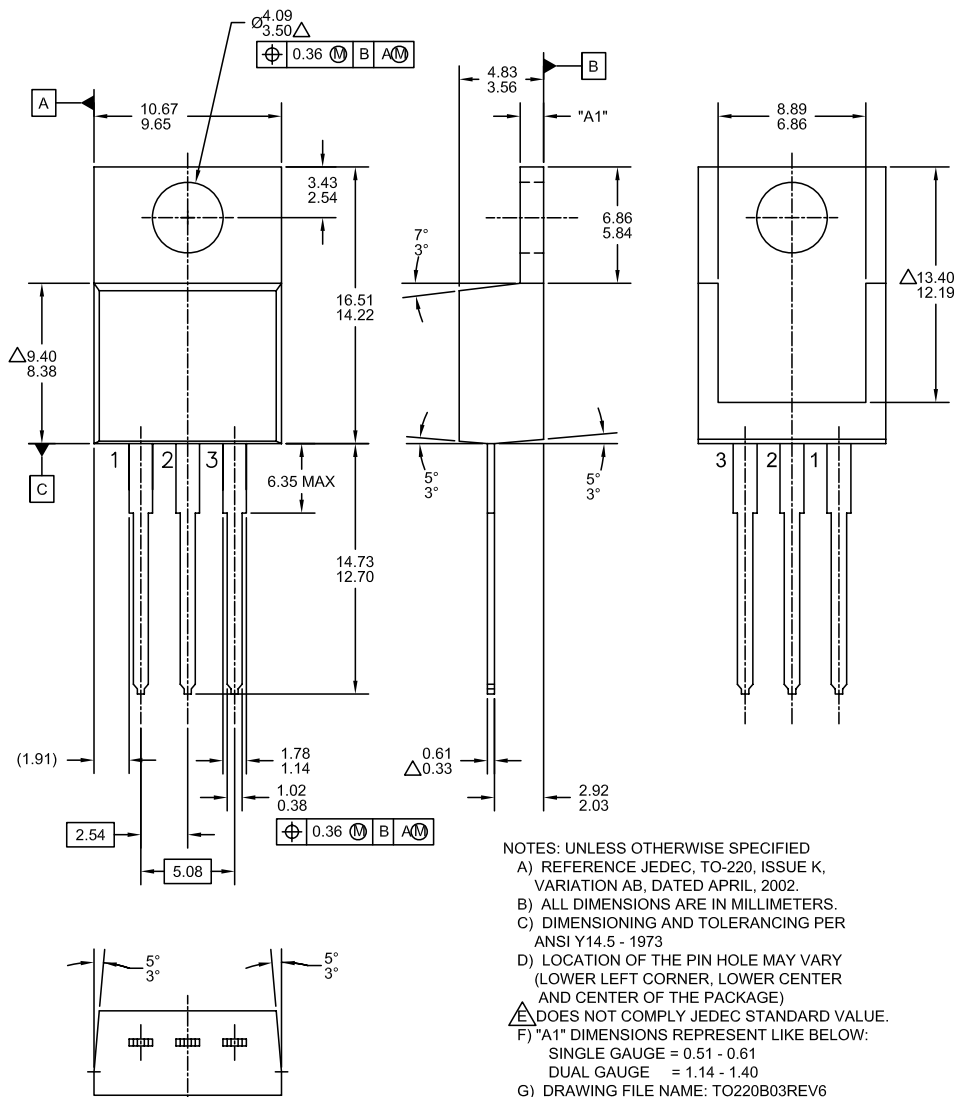
- $C_i$  is required when regulator is located an appreciable distance from power supply filter.  
 $C_o$  is not needed for stability, however, it does improve transient response.  
 Since  $I_{ADJ}$  is controlled to less than  $100\mu A$ , the error associated with this term is negligible in most applications.

# Mechanical Dimensions

## Package

Dimensions in millimeters

### TO-220 [ SINGLE GAUGE ]



## Ordering Information

| Product Number | Package | Operating Temperature |
|----------------|---------|-----------------------|
| LM317T         | TO-220  | 0°C to +125°C         |

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