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# LM317

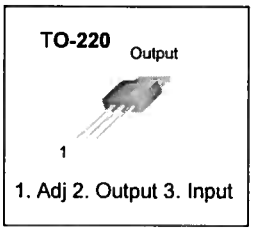
## 3-Terminal Positive Adjustable Regulator

### 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

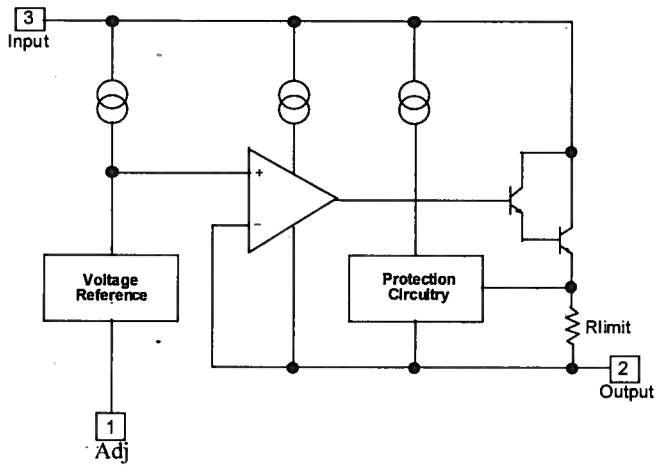
### Description

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.




1. Adj 2. Output 3. Input

### Internal Block Diagram




Rev. 1.0.4

## 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 | $\Delta Vo/\Delta T$ | ±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°C ≤ $T_J$ ≤ +125°C, $I_{MAX}$ = 1.5A, $P_{DMAX}$ = 20W, unless otherwise specified)

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

**Note 2:** Load and line regulation are specified at constant junction temperature. Change in $V_D$ due to heating effects must be taken into account separately. Pulse testing with low duty is used. ($P_{MAX}$ = 20W)
**Note 3:** $C_{ADJ}$, when used, is connected between the adjustment pin and ground.

## Typical Performance Characteristics

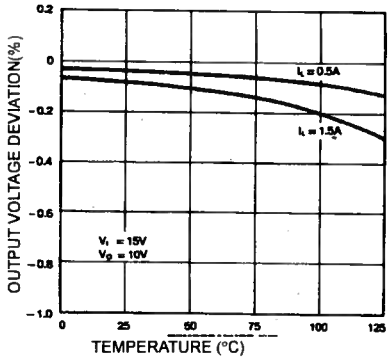



Figure 1. Load Regulation

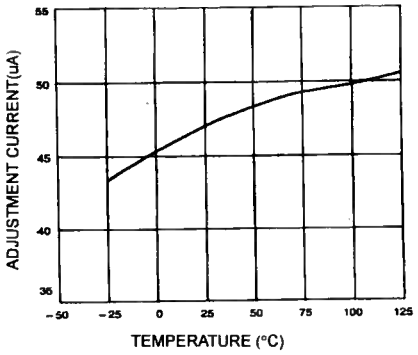



Figure 2. Adjustment Current

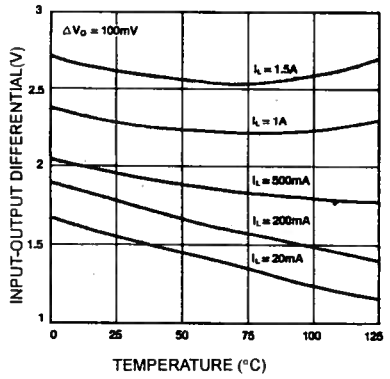



Figure 3. Dropout Voltage

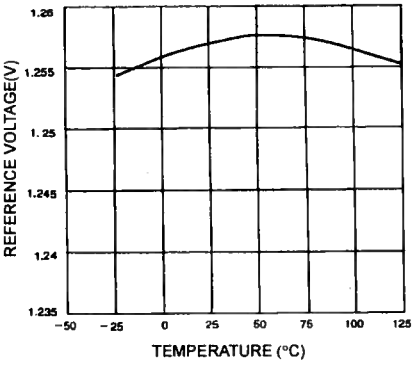
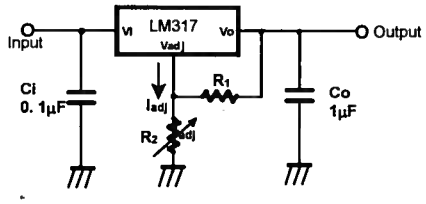



Figure 4. Reference Voltage

## Typical Application




$V_O = 1.25V\ (1 + R_2/R_1) + I_{adj} R_2$

**Figure 5. Programmable Regulator**

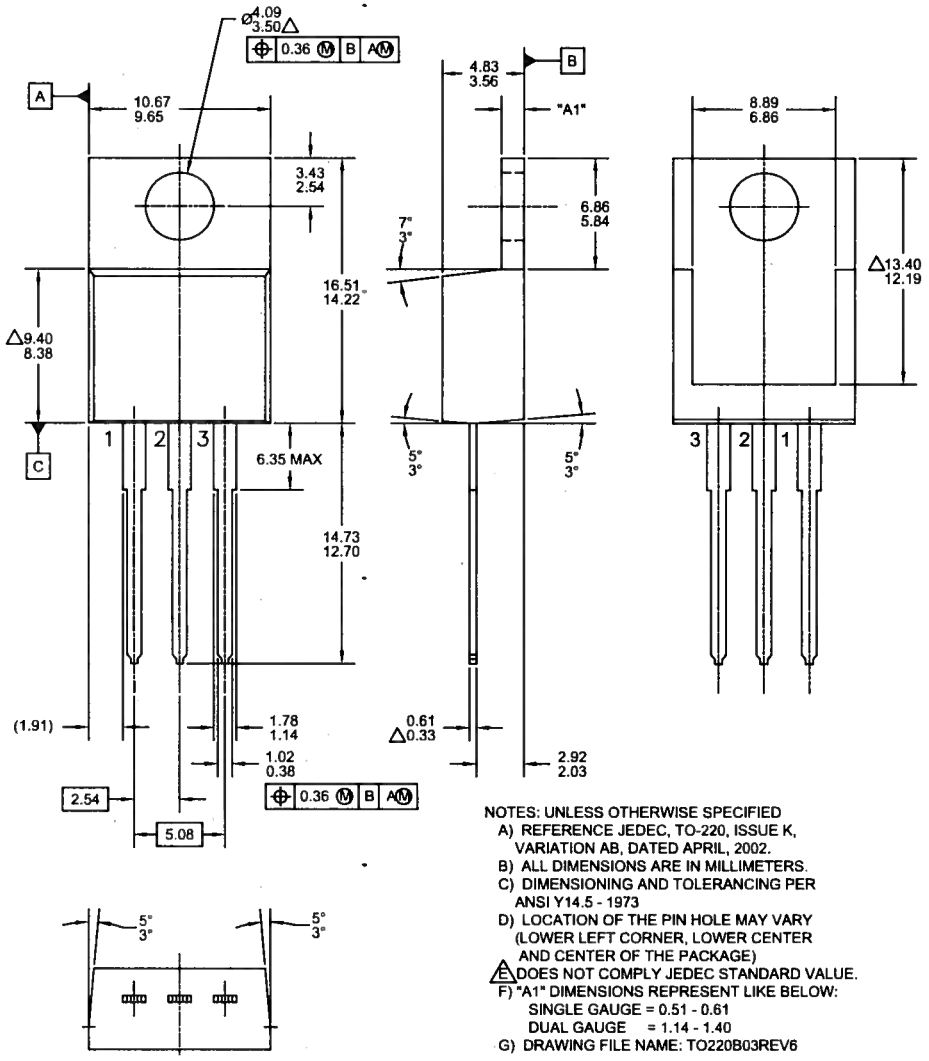
- $C_i$ is required when regulator is located an appreciable distance from power supply filter.
  $C_O$ is not needed for stability, however, it does improve transient response.
  Since $I_{ADJ}$ is controlled to less than 100µA, the error associated with this term is negligible in most applications.

## Mechanical Dimensions

### Package

**Dimensions in millimeters**

# TO-220 [ SINGLE GAUGE ]




NOTES: UNLESS OTHERWISE SPECIFIED

A) REFERENCE JEDEC, TO-220, ISSUE K, VARIATION AB, DATED APRIL, 2002.

B) ALL DIMENSIONS ARE IN MILLIMETERS.

C) DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1973

D) LOCATION OF THE PIN HOLE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)

△ DOES NOT COMPLY JEDEC STANDARD VALUE.

F) "A1" DIMENSIONS REPRESENT LIKE BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.14 - 1.40

G) DRAWING FILE NAME: TO220B03REV6

## Ordering Information

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





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