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September 2014

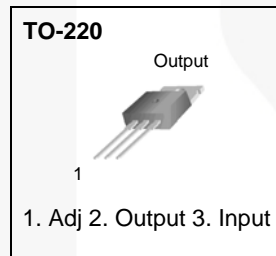
# KA317 / LM317 3-Terminal Positive Adjustable Regulator

## 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
- 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 1.5 A of load current with an output voltage adjustable over a 1.2 V to 37 V range. It employs internal current limiting, thermal shutdown, and safe area compensation.



## Ordering Information

| Product Number | Package               | Packing Method | Operating Temperature |
|----------------|-----------------------|----------------|-----------------------|
| LM317T         | TO-220 (Single Gauge) | Rail           | 0°C to +125°C         |
| KA317TU        | TO-220 (Dual Gauge)   | Rail           | 0°C to +125°C         |

## Block Diagram

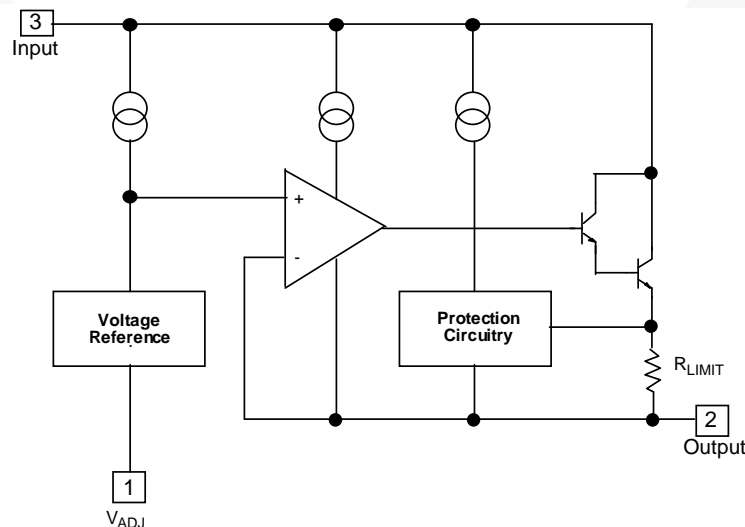


Figure 1. Block Diagram

KA317 / LM317 — 3-Terminal Positive Adjustable Regulator

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol                | Parameter                                 | Value       | Unit                |
|-----------------------|---|-------------|---------------------|
| $V_I - V_O$           | Input-Output Voltage Differential         | 40          | V                   |
| $T_{LEAD}$            | Lead Temperature                          | 230         | $^\circ\text{C}$    |
| $T_J$                 | Operating Junction Temperature Range      | 0 to +125   | $^\circ\text{C}$    |
| $T_{STG}$             | Storage Temperature Range                 | -65 to +125 | $^\circ\text{C}$    |
| $\Delta V_O/\Delta T$ | Temperature Coefficient of Output Voltage | $\pm 0.02$  | $\%/^\circ\text{C}$ |

## Thermal Characteristics

Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

| Symbol          | Parameter                               | Value              | Units                     |
|-----------------|---|--------------------|---------------------------|
| $P_D$           | Power Dissipation                       | Internally Limited | W                         |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient | 80                 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case    | 5                  | $^\circ\text{C}/\text{W}$ |

## Electrical Characteristics

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

| Symbol           | Parameter                                   | Conditions   | Min.   | Typ.  | Max.  | Unit          |           |
|------------------|---|--|--|-------|-------|---------------|-----------|
| $R_{LINE}$       | Line Regulation <sup>(1)</sup>              | $T_A = +25^\circ\text{C}$ , $3\text{ V} \leq V_I - V_O \leq 40\text{ V}$                                       |  | 0.01  | 0.04  | % / V         |           |
|                  |   | $3\text{ V} \leq V_I - V_O \leq 40\text{ V}$   |  | 0.02  | 0.07  |               |           |
| $R_{LOAD}$       | Load Regulation <sup>(1)</sup>              | $T_A = +25^\circ\text{C}$ ,<br>$10\text{ mA} \leq I_O \leq I_{MAX}$  | $V_O < 5\text{ V}$                                   |       | 18    | 25            | mV        |
|                  |   |  | $V_O \geq 5\text{ V}$                                |       | 0.4   | 0.5           | % / $V_O$ |
|                  |   | $10\text{ mA} \leq I_O \leq I_{MAX}$   | $V_O < 5\text{ V}$                                   |       | 40    | 70            | mV        |
|                  |   |  | $V_O \geq 5\text{ V}$                                |       | 0.8   | 1.5           | % / $V_O$ |
| $I_{ADJ}$        | Adjustable Pin Current                      |  |  | 46    | 100   | $\mu\text{A}$ |           |
| $\Delta I_{ADJ}$ | Adjustable Pin Current Change               | $3\text{ V} \leq V_I - V_O \leq 40\text{ V}$ ,<br>$10\text{ mA} \leq I_O \leq I_{MAX}$ , $P_D \leq P_{MAX}$    |  | 2.0   | 5.0   | $\mu\text{A}$ |           |
| $V_{REF}$        | Reference Voltage                           | $3\text{ V} \leq V_{IN} - V_O \leq 40\text{ V}$ ,<br>$10\text{ mA} \leq I_O \leq I_{MAX}$ , $P_D \leq P_{MAX}$ | 1.20   | 1.25  | 1.30  | V             |           |
| $ST_T$           | Temperature Stability                       |  |  | 0.7   |       | % / $V_O$     |           |
| $I_{L(MIN)}$     | Minimum Load Current to Maintain Regulation | $V_I - V_O = 40\text{ V}$  |  | 3.5   | 12.0  | mA            |           |
| $I_{O(MAX)}$     | Maximum Output Current                      | $T_A = 25^\circ\text{C}$   | $V_I - V_O \leq 15\text{ V}$ ,<br>$P_D \leq P_{MAX}$ | 1.5   | 2.2   | A             |           |
|                  |   |  | $V_I - V_O \leq 40\text{ V}$ ,<br>$P_D \leq P_{MAX}$ |       | 0.3   |               |           |
| $e_N$            | RMS Noise, % of $V_{OUT}$                   | $T_A = +25^\circ\text{C}$ , $10\text{ Hz} \leq f \leq 10\text{ kHz}$   |  | 0.003 | 0.010 | % / $V_O$     |           |
| RR               | Ripple Rejection <sup>(2)</sup>             | $V_O = 10\text{ V}$ ,<br>$f = 120\text{ Hz}$   | without $C_{ADJ}$                                    |       | 60    | dB            |           |
|                  |   |  | $C_{ADJ} = 10\text{ }\mu\text{F}$                    | 66    | 75    |               |           |
| ST               | Long-Term Stability,<br>$T_J = T_{HIGH}$    | $T_A = +25^\circ\text{C}$ for End Point Measurements, 1000 HR  |  | 0.3   | 1.0   | %             |           |

### Notes:

- 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 ( $P_{MAX} = 20\text{ W}$ ).
- $C_{ADJ}$ , when used, is connected between the adjustment pin and ground.

## Typical Performance Characteristics

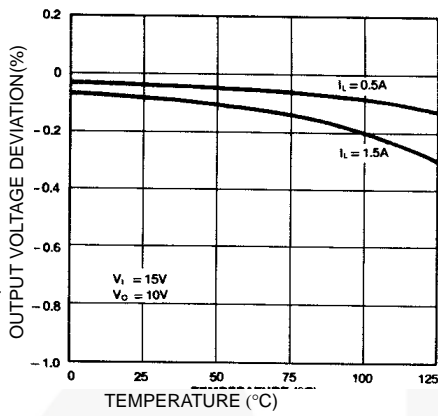


Figure 2. Load Regulation

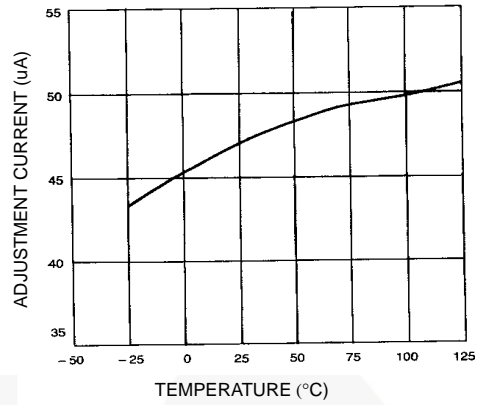


Figure 3. Adjustment Current

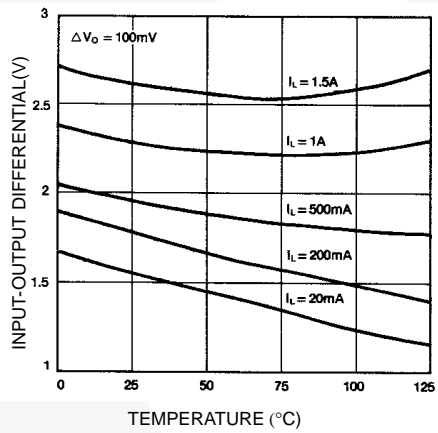


Figure 4. Drop Out Voltage

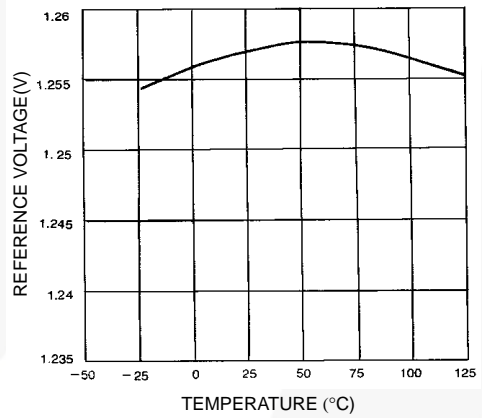


Figure 5. Reference Voltage

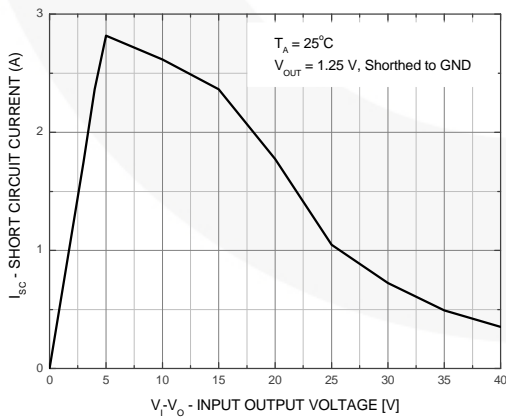
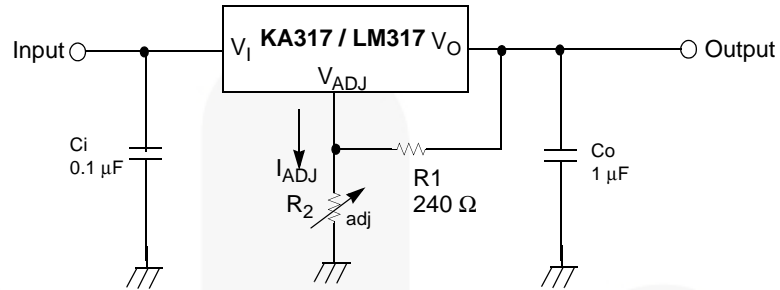


Figure 6. Short Circuit vs. Input-Output Voltage

### Typical Application<sup>(3)</sup>



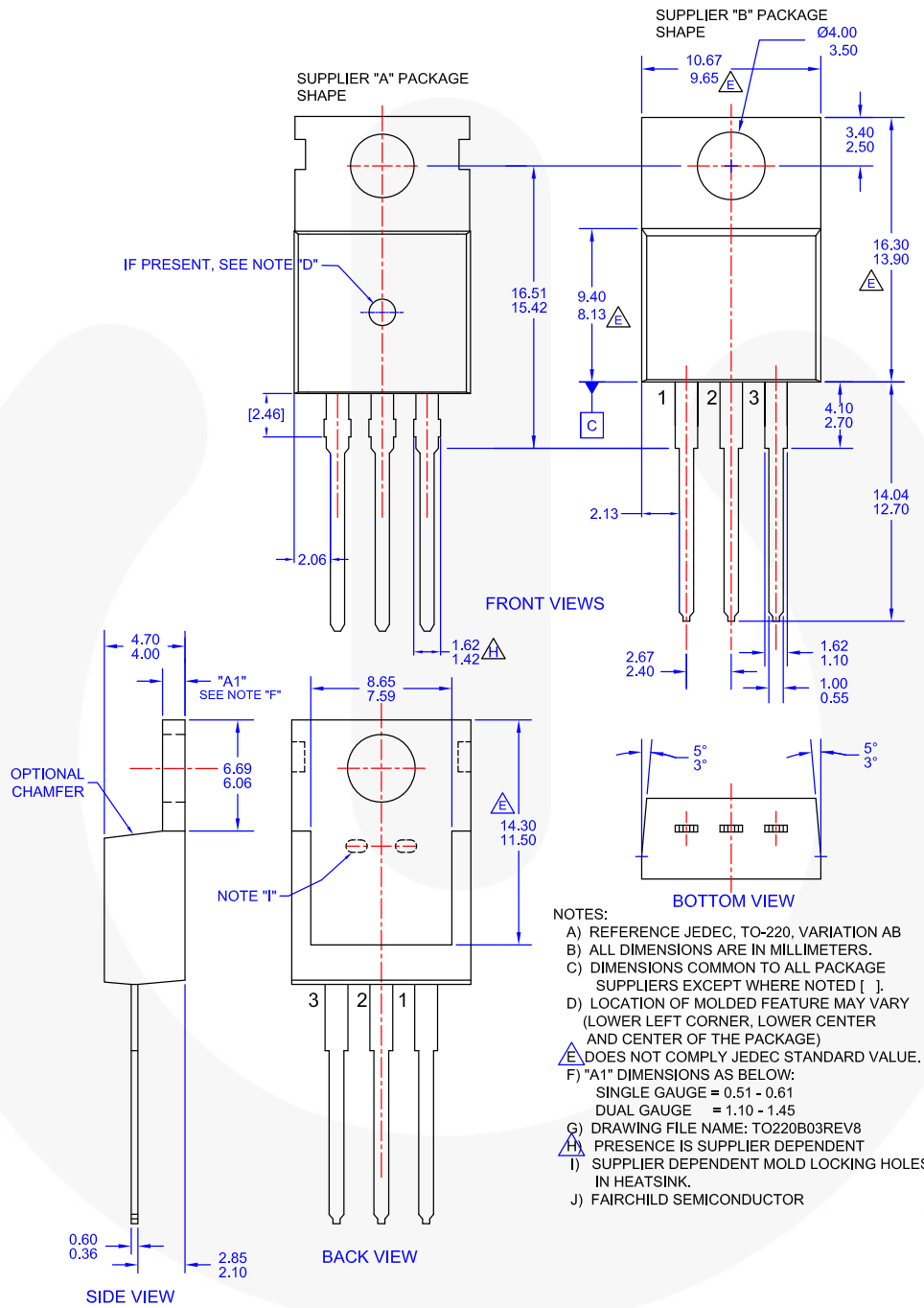
$$V_O = 1.25 \text{ V} \left( 1 + \frac{R_2}{R_1} \right) + I_{ADJ} R_2$$

**Figure 7. Typical Application**

**Note:**

3.  $C_i$  is required when the 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  $\mu\text{A}$ , the error associated with this term is negligible in most applications.

## Physical Dimensions



**Figure 8. TO-220, MOLDED, 3LEAD, JEDEC VARIATION AB**



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