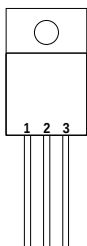


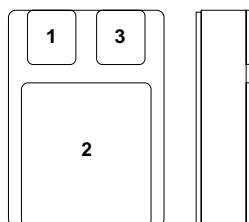
Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Pin 3 –  $V_{IN}$   
Case –  $V_{OUT}$

**G Package – TO257**



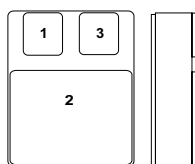
Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Pin 3 –  $V_{IN}$   
Case – Isolated

**IG Package – TO257**



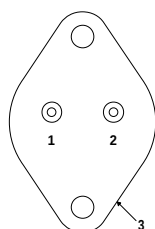
Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Pin 3 –  $V_{IN}$

**SMD1  
CERAMIC SURFACE  
MOUNT**



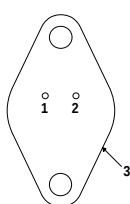
Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Pin 3 –  $V_{IN}$

**SMD05  
CERAMIC SURFACE  
MOUNT**



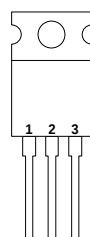
Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Case –  $V_{OUT}$

**K Package – TO3**



Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Case –  $V_{OUT}$

**R Package – TO66**



Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Pin 3 –  $V_{IN}$

**T Package – TO220 Plastic**

## 1.5 AMP POSITIVE ADJUSTABLE VOLTAGE REGULATOR FOR HI-REL APPLICATIONS

### FEATURES

- Output voltage range of:  
1.25 to 40V for standard version  
1.25 to 60V for HV version
- Output voltage tolerance 1%
- Load regulation 0.3%
- Line regulation 0.01%/V
- Complete series of protections:  
current limiting  
thermal shutdown  
soa control
- Also available in TO220 metal isolated package (1mm pins)

### ABSOLUTE MAXIMUM RATINGS ( $T_{case} = 25^{\circ}C$ unless otherwise stated)

|           |                                      |                           |                    |
|-----------|--------------------------------------|---------------------------|--------------------|
| $V_{I-O}$ | Input - Output Differential Voltage  | – Standard<br>– HV Series | 40V<br>60V         |
| $I_O$     | Output Current                       |                           | Internally limited |
| $P_D$     | Power Dissipation                    |                           | Internally limited |
| $T_J$     | Operating Junction Temperature Range |                           | See Table Above    |
| $T_{STG}$ | Storage Temperature                  |                           | –65 to 150°C       |

| Parameter                                                      | Test Conditions                                                                                                                                  | IP117A, IP117AHV<br>LM117A, LM117AHV |       |       | IP117, IP117HV<br>LM117, LM117HV |       |       | Units              |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------|-------|----------------------------------|-------|-------|--------------------|
|                                                                |                                                                                                                                                  | Min.                                 | Typ.  | Max.  | Min.                             | Typ.  | Max.  |                    |
| $V_{REF}$ Reference Voltage                                    | $I_{OUT} = 10\text{mA}$                                                                                                                          | 1.238                                | 1.25  | 1.262 |                                  |       |       | V                  |
|                                                                | $I_{OUT} = 10\text{mA to } I_{MAX}$<br>$V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$<br>$P \leq P_{MAX}$ $T_J = -55 \text{ to } +150^\circ\text{C}$ | 1.225                                | 1.250 | 1.270 | 1.200                            | 1.250 | 1.300 | V                  |
|                                                                |                                                                                                                                                  |                                      |       |       |                                  |       |       |                    |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$ Line Regulation 1       | $V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                                         |                                      | 0.005 | 0.010 |                                  | 0.010 | 0.020 | % / V              |
|                                                                |                                                                                                                                                  |                                      | 0.010 | 0.020 |                                  | 0.020 | 0.050 |                    |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Load Regulation 1      | $I_{OUT} = 10\text{mA to } I_{MAX}$ $V_{OUT} \leq 5\text{V}$                                                                                     |                                      | 5     | 15    |                                  | 5     | 15    | mV                 |
|                                                                | $I_{OUT} = 10\text{mA to } I_{MAX}$ $V_{OUT} \geq 5\text{V}$                                                                                     |                                      | 0.1   | 0.3   |                                  | 0.1   | 0.3   | %                  |
|                                                                | $I_{OUT} = 10\text{mA to } I_{MAX}$ $V_{OUT} \leq 5\text{V}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                       |                                      | 15    | 50    |                                  | 20    | 50    | mV                 |
|                                                                | $I_{OUT} = 10\text{mA to } I_{MAX}$ $V_{OUT} \geq 5\text{V}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                       |                                      | 0.3   | 1     |                                  | 0.3   | 1     | %                  |
| Thermal Regulation                                             | $t_p = 20\text{ms}$                                                                                                                              |                                      | 0.002 | 0.020 |                                  | 0.030 | 0.070 | %/W                |
| Ripple Rejection                                               | $V_{OUT} = 10\text{V}$ $C_{ADJ} = 0$<br>$f = 120\text{Hz}$                                                                                       |                                      | 65    |       |                                  | 65    |       | dB                 |
|                                                                | $C_{ADJ} = 10\mu\text{F}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                                                          | 66                                   | 80    |       | 66                               | 80    |       | dB                 |
| $I_{ADJ}$ Adjust Pin Current                                   | $T_J = -55 \text{ to } +150^\circ\text{C}$                                                                                                       |                                      | 50    | 100   |                                  | 50    | 100   | $\mu\text{A}$      |
| $\Delta I_{ADJ}$ Adjust Pin Current Change                     | $I_{OUT} = 10\text{mA to } I_{MAX}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$<br>$V_{IN} - V_{OUT} = 2.5\text{V to } V_{MAX}$                |                                      | 0.2   | 5     |                                  | 0.2   | 5     | $\mu\text{A}$      |
| $I_{MIN}$ Minimum Load Current                                 | $V_{IN} - V_{OUT} = 40\text{V}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                                                    |                                      | 3.5   | 5     |                                  | 3.5   | 5     | mA                 |
|                                                                | $V_{IN} - V_{OUT} = 60\text{V (HV SERIES)}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                                        |                                      | 3.5   | 7     |                                  | 3.5   | 7     |                    |
| $I_{CL}$ Current Limit                                         | $V_{IN} - V_{OUT} \leq 15\text{V}$<br>$T_J = -55 \text{ to } +150^\circ\text{C}$                                                                 | 1.5                                  | 2.2   |       | 1.5                              | 2.2   |       | A                  |
|                                                                | $V_{IN} - V_{OUT} = 40\text{V}$                                                                                                                  | 0.30                                 | 0.50  |       | 0.30                             | 0.50  |       | A                  |
|                                                                | $V_{IN} - V_{OUT} = 60\text{V (HV SERIES)}$                                                                                                      |                                      | 0.10  |       |                                  | 0.10  |       |                    |
| $\frac{\Delta V_{OUT}}{\Delta T_{TEMP}}$ Temperature Stability | $T_J = -55 \text{ to } +150^\circ\text{C}$                                                                                                       |                                      | 1     | 2     |                                  | 1     |       | %                  |
| $\frac{\Delta V_{OUT}}{\Delta T_{IME}}$ Long Term Stability    | $T_A = +125^\circ\text{C}$ $t = 1000 \text{ Hrs}$                                                                                                |                                      | 0.3   | 1     |                                  | 0.3   | 1     | %                  |
| $e_n$ RMS Output Noise (% of $V_{OUT}$ )                       | $f = 10 \text{ Hz to } 10 \text{ kHz}$                                                                                                           |                                      | 0.001 |       |                                  | 0.001 |       | %                  |
| $R_{\theta JC}$ Thermal Resistance Junction to Case            | K Package                                                                                                                                        |                                      | 2.3   | 3     |                                  | 2.3   | 3     | $^\circ\text{C/W}$ |
|                                                                | R Package                                                                                                                                        |                                      | 5     | 7     |                                  | 5     | 7     |                    |
|                                                                | G, IG Packages                                                                                                                                   |                                      | 3     | 5     |                                  | 3     | 5     |                    |

1) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured from the bottom of the package for the TO-3 and TO-66 packages, at the junction of the wide and narrow portion of the output lead for the TO-220 package, and  $\frac{1}{8}$ " below the base of the package on the output pin of the TO-257 package.

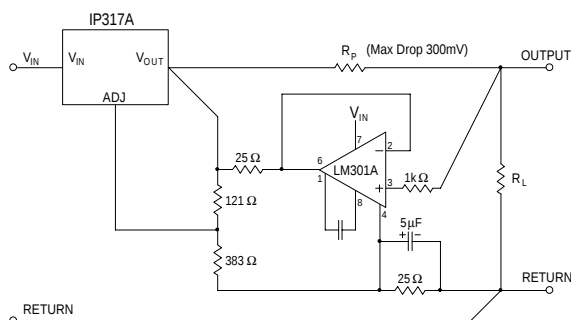
2) Test Conditions unless otherwise stated:  $V_{IN} - V_{OUT} = 5\text{V}$ ,  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 0.5\text{A}$ ,  $I_{MAX} = 1.5\text{A}$ .  
 $P_{MAX} = 10\text{W}$  for SMD1, 20W for all other package styles.  
 $V_{MAX} = 40\text{V}$  for standard series, 60V for HV series.

| Parameter                                                  | Test Conditions                                                                                                      | IP317A<br>IP317AHV |       |       | IP317<br>IP317HV |       |       | Units        |
|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------|-------|-------|------------------|-------|-------|--------------|
|                                                            |                                                                                                                      | Min.               | Typ.  | Max.  | Min.             | Typ.  | Max.  |              |
| $V_{REF}$ Reference Voltage                                | $I_{OUT} = 10mA$                                                                                                     | 1.238              | 1.25  | 1.262 |                  |       |       | V            |
|                                                            | $I_{OUT} = 10mA$ to $I_{MAX}$<br>$V_{IN} - V_{OUT} = 3V$ to $V_{MAX}$<br>$P \leq P_{MAX}$ $T_J = 0$ to $125^\circ C$ | 1.225              | 1.25  | 1.270 | 1.200            | 1.250 | 1.300 | V            |
| $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$ Line Regulation 1   | $V_{IN} - V_{OUT} = 3V$ to $V_{MAX}$<br>$T_J = 0$ to $125^\circ C$                                                   |                    | 0.005 | 0.010 |                  | 0.010 | 0.040 | % / V        |
|                                                            |                                                                                                                      |                    | 0.010 | 0.020 |                  | 0.020 | 0.070 |              |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Load Regulation 1  | $I_{OUT} = 10mA$ to $I_{MAX}$ $V_{OUT} \leq 5V$                                                                      |                    | 5     | 25    |                  | 5     | 25    | mV           |
|                                                            | $I_{OUT} = 10mA$ to $I_{MAX}$ $V_{OUT} \geq 5V$                                                                      |                    | 0.1   | 0.5   |                  | 0.1   | 0.5   | %            |
|                                                            | $I_{OUT} = 10mA$ to $I_{MAX}$ $V_{OUT} \leq 5V$                                                                      |                    | 15    | 50    |                  | 20    | 70    | mV           |
|                                                            | $T_J = -55$ to $+150^\circ C$ $V_{OUT} \geq 5V$                                                                      |                    | 0.3   | 1     |                  | 0.3   | 1.5   | %            |
| Thermal Regulation                                         | $t_p = 20ms$                                                                                                         |                    | 0.002 | 0.020 |                  | 0.030 | 0.070 | %/W          |
| Ripple Rejection                                           | $V_{OUT} = 10V$ $f = 120Hz$ $C_{ADJ} = 0$                                                                            |                    | 65    |       |                  | 65    |       | dB           |
|                                                            | $C_{ADJ} = 10\mu F$ $T_J = 0$ to $125^\circ C$                                                                       | 66                 | 80    |       | 66               | 80    |       | dB           |
| $I_{ADJ}$ Adjust Pin Current                               | $T_J = 0$ to $125^\circ C$                                                                                           |                    | 50    | 100   |                  | 50    | 100   | $\mu A$      |
| $\Delta I_{ADJ}$ Adjust Pin Current Change                 | $I_{OUT} = 10mA$ to $I_{MAX}$<br>$T_J = 0$ to $125^\circ C$<br>$V_{IN} - V_{OUT} = 2.5V$ to $V_{MAX}$                |                    | 0.2   | 5     |                  | 0.2   | 5     | $\mu A$      |
| $I_{MIN}$ Minimum Load Current                             | $V_{IN} - V_{OUT} = 40V$<br>$T_J = 0$ to $125^\circ C$                                                               |                    | 3.5   | 10    |                  | 3.5   | 10    | mA           |
|                                                            | $V_{IN} - V_{OUT} = 60V$ (HV SERIES)<br>$T_J = 0$ to $125^\circ C$                                                   |                    | 3.5   | 12    |                  | 3.5   | 12    |              |
| $I_{CL}$ Current Limit                                     | $V_{IN} - V_{OUT} \leq 15V$<br>$T_J = 0$ to $125^\circ C$                                                            | 1.5                | 2.2   |       | 1.5              | 2.2   |       | A            |
|                                                            | $V_{IN} - V_{OUT} = 40V$                                                                                             | 0.15               | 0.40  |       | 0.15             | 0.40  |       | A            |
|                                                            | $V_{IN} - V_{OUT} = 60V$ (HV SERIES)                                                                                 |                    | 0.10  |       |                  | 0.10  |       |              |
| $\frac{\Delta V_{OUT}}{\Delta TEMP}$ Temperature Stability | $T_J = 0$ to $125^\circ C$                                                                                           |                    | 1     | 2     |                  | 1     |       | %            |
| $\frac{\Delta V_{OUT}}{\Delta TIME}$ Long Term Stability   | $t = 1000$ Hrs                                                                                                       |                    | 0.3   | 1     |                  | 0.3   | 1     | %            |
| $e_n$ RMS Output Noise (% of $V_{OUT}$ )                   | $f = 10$ Hz to $10$ kHz                                                                                              |                    | 0.003 |       |                  | 0.003 |       | %            |
| $R_{\theta JC}$ Thermal Resistance Junction to Case        | K Package                                                                                                            |                    | 2.3   | 3     |                  | 2.3   | 3     | $^\circ C/W$ |
|                                                            | T Package                                                                                                            |                    | 4     | 5     |                  | 5     | 7     |              |

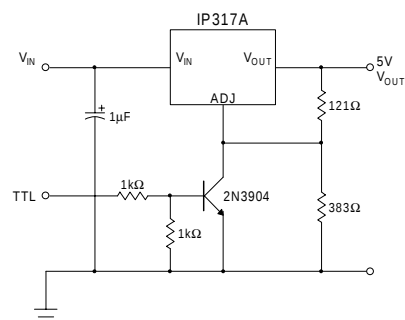
1) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured from the bottom of the package for the TO-3 and TO-66 packages, at the junction of the wide and narrow portion of the output lead for the TO-220 package, and  $\frac{1}{8}$ " below the base of the package on the output pin of the TO-257 package.

2) Test Conditions unless otherwise stated:  $V_{IN} - V_{OUT} = 5V$ ,  $T_J = 25^\circ C$ ,  $I_{OUT} = 0.5A$ ,  $P_{MAX} = 20W$ ,  $I_{MAX} = 1.5A$   
 $V_{MAX} = 40V$  for standard series,  $60V$  for HV series.

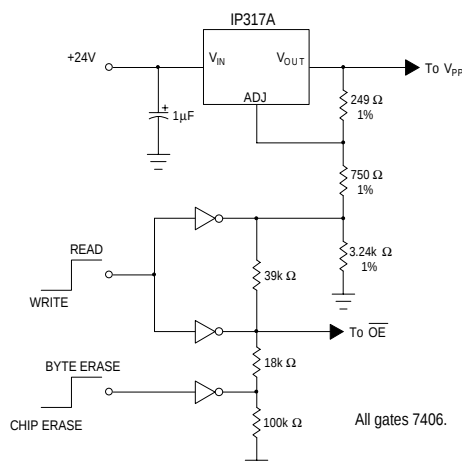
## APPLICATIONS INFORMATION



Remote Sensing

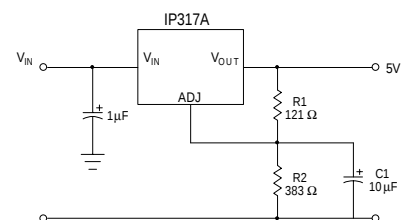


5V Regulator with Shut Down



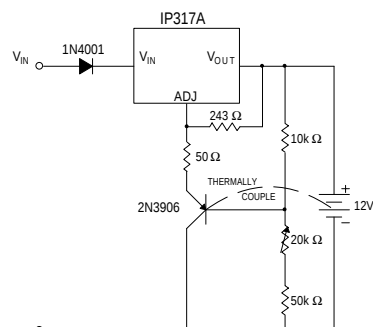
|            | $\overline{\text{OE}}$ | $V_{PP}$ |
|------------|------------------------|----------|
| READ       | 0V                     | 5V       |
| WRITE      |                        |          |
| BYTE       | 5V                     | 21V      |
| CHIP ERASE | 12V                    | 21V      |

2816 EEPROM Supply Programmer for  
Read/Write Control



C1 improves ripple rejection.  
 $X_C$  should be small compared to R2.

Improving Ripple Rejection



Temperature Compensated  
Lead-Acid Battery Charger

## Order Information

| Part Number | IG-Pack<br>G-Pack<br>(TO257) | SMD1 | SMD05 | K-Pack<br>(TO3) | R-Pack<br>(TO66) | T-Pack<br>(TO220) | Temp.<br>Range | <b>Note:</b><br>To order, add the package identifier to the part number.<br>eg. IP117AHVK<br>IP1175SMD05<br>IP317T |
|-------------|------------------------------|------|-------|-----------------|------------------|-------------------|----------------|--------------------------------------------------------------------------------------------------------------------|
| LM117       | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | -55 to +150°C  |                                                                                                                    |
| LM117HV     | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | "              |                                                                                                                    |
| LM117A      | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | "              |                                                                                                                    |
| LM117AHV    | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | "              |                                                                                                                    |
| IP117       | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | -55 to +150°C  |                                                                                                                    |
| IP117HV     | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | "              |                                                                                                                    |
| IP117A      | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | "              |                                                                                                                    |
| IP117AHV    | ✓                            | ✓    | ✓     | ✓               | ✓                |                   | "              |                                                                                                                    |
| LM317       |                              |      |       | ✓               |                  | ✓                 | 0 to 125°C     |                                                                                                                    |
| LM317HV     |                              |      |       | ✓               |                  | ✓                 | "              |                                                                                                                    |
| IP317       |                              |      |       | ✓               |                  | ✓                 | "              |                                                                                                                    |
| IP317HV     |                              |      |       | ✓               |                  | ✓                 | "              |                                                                                                                    |
| IP317A      |                              |      |       | ✓               |                  | ✓                 | "              |                                                                                                                    |
| IP317AHV    |                              |      |       | ✓               |                  | ✓                 | "              |                                                                                                                    |