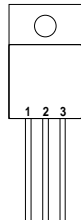
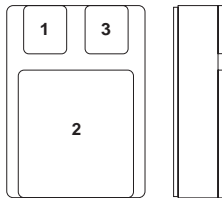


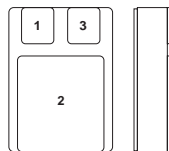
Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Pin 3 –  $V_{OUT}$   
Case –  $V_{IN}$   
**G Package – (TO–257AA)**



Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Pin 3 –  $V_{OUT}$   
**IG Package – (TO–257AA)**  
(Isolated)



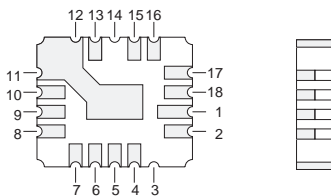
Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Pin 3 –  $V_{OUT}$   
**SMD1 (TO276AB)**  
**CERAMIC SURFACE MOUNT**



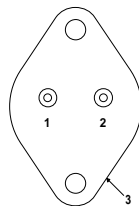
Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Pin 3 –  $V_{OUT}$   
**SMD05 (TO-276AA)**  
**CERAMIC SURFACE MOUNT**

## FEATURES

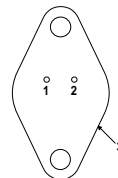
- **OUTPUT VOLTAGE RANGE OF:**  
1.25 TO 40V FOR STANDARD VERSION  
1.25 TO 50V FOR –HV VERSION
- **1% OUTPUT VOLTAGE TOLERANCE**
- **0.3% LOAD REGULATION**
- **0.01%/V LINE REGULATION**
- **COMPLETE SERIES OF PROTECTIONS:**
  - **CURRENT LIMITING**
  - **THERMAL SHUTDOWN**
  - **SOA CONTROL**



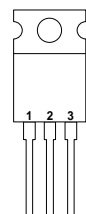
Pins 4,5 – ADJ.  
Pins 6,7,8,9,10,11,12,13 –  $V_{OUT}$   
Pins 15,16,17,18,1,2 –  $V_{IN}$   
**LCC4**  
**CERAMIC SURFACE MOUNT**



Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Case –  $V_{IN}$   
**K Package – TO–3 (TO-204AA)**



Pin 1 – ADJ.  
Pin 2 –  $V_{OUT}$   
Case –  $V_{IN}$   
**R Package – TO–66**  
(TO-213AA)



Pin 1 – ADJ.  
Pin 2 –  $V_{IN}$   
Pin 3 –  $V_{OUT}$   
Case –  $V_{IN}$   
**T Package – TO–220**

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

|           |                                      |                           |                             |
|-----------|--------------------------------------|---------------------------|-----------------------------|
| $V_{I-O}$ | Input - Output Differential Voltage  | – Standard<br>– HV Series | 40V<br>50V                  |
| $I_O$     | Output Current                       |                           | Internally limited          |
| $P_D$     | Power Dissipation                    |                           | Internally limited          |
| $T_j$     | Operating Junction Temperature Range |                           | See Order Information Table |
| $T_{stg}$ | Storage Temperature                  |                           | -65 to 150°C                |

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| Parameter  | Test Conditions  | IP137A , IP137AHV<br>LM137A , LM137AHV                                 |       |        | IP137 , IP137HV<br>LM137 , LM137HV |        |        | Units              |
|--|--|--|-------|--------|------------------------------------|--------|--------|--------------------|
|  |  | Min.   | Typ.  | Max.   | Min.                               | Typ.   | Max.   |                    |
| $V_{REF}$ Reference Voltage                                    | $I_{OUT} = 10\text{mA}$  | -1.238   | -1.25 | -1.262 | -1.225                             | -1.25  | -1.275 | V                  |
|  | $I_{OUT} = 10\text{mA to } I_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$<br>$V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$ $P \leq P_{MAX}$ | -1.220   | -1.25 | -1.280 | -1.200                             | -1.250 | -1.300 | V                  |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Line Regulation 1      | $V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$   |  | 0.005 | 0.010  |                                    | 0.010  | 0.020  | %V                 |
|  | $T_J = -55 \text{ to } 150^\circ\text{C}$  |  | 0.010 | 0.030  |                                    | 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      | 25                                 | 15     | 25     | mV                 |
|  |  | $V_{OUT} \geq 5\text{V}$   |       | 0.1    | 0.5                                | 0.3    | 0.5    | %                  |
|  | $I_{OUT} = 10\text{mA to } I_{MAX}$<br>$T_J = -55 \text{ to } 150^\circ\text{C}$   | $V_{OUT} \leq 5\text{V}$   |       | 10     | 50                                 | 20     | 50     | mV                 |
|  |  | $V_{OUT} \geq 5\text{V}$   |       | 0.2    | 1                                  | 0.3    | 1      | %                  |
| Thermal Regulation   | $t_p = 10\text{ms}$ $T_A = 25^\circ\text{C}$   |  |       | 0.002  | 0.020                              | 0.002  | 0.02   | %W                 |
|  |  | LCC4 Package   |       |        | 0.040                              |        | 0.040  |                    |
| Ripple Rejection   | $V_{OUT} = -10\text{V}$<br>$f = 120\text{Hz}$  | $C_{ADJ} = 0$  |       | 60     | 66                                 | 60     |        | dB                 |
|  |  | $C_{ADJ} = 10\mu\text{F}$<br>$T_J = -55 \text{ to } 150^\circ\text{C}$ |       | 70     | 80                                 | 66     | 77     | dB                 |
| $I_{ADJ}$ Adjust Pin Current                                   | $T_J = -55 \text{ to } 150^\circ\text{C}$  |  | 65    | 100    |                                    | 65     | 100    | $\mu\text{A}$      |
| $\Delta I_{ADJ}$ Adjust Pin Current Change                     | $T_J = -55 \text{ to } 150^\circ\text{C}$  | $I_{OUT} = 10\text{mA to } I_{MAX}$                                    |       | 0.2    | 2                                  | 0.5    | 5      | $\mu\text{A}$      |
|  |  | $V_{IN} - V_{OUT} = 3\text{V to } 40\text{V}$                          |       | 1.0    | 5                                  | 2      | 5      |                    |
|  |  | $V_{IN} - V_{OUT} = 3\text{V to } 50\text{V}$<br><b>(HV SERIES)</b>    |       | 2.0    | 6                                  | 3      | 6      |                    |
| $I_{MIN}$ Minimum Load Current                                 | $T_J = -55 \text{ to } 150^\circ\text{C}$  | $V_{IN} - V_{OUT} \leq 40\text{V}$                                     |       | 2.5    | 5                                  | 2.5    | 5      | mA                 |
|  |  | $V_{IN} - V_{OUT} \leq 10\text{V}$                                     |       | 1.2    | 3                                  | 1.2    | 3      |                    |
| $I_{CL}$ Current Limit   | $T_J = -55 \text{ to } 150^\circ\text{C}$  | $V_{IN} - V_{OUT} \leq 15\text{V}$                                     |       | 1.5    | 2.2                                | 3.2    |        | A                  |
|  |  | $V_{IN} - V_{OUT} = 40\text{V}$  |       | 0.24   | 0.4                                | 1      | 0.24   |                    |
|  |  | $V_{IN} - V_{OUT} = 50\text{V}$<br><b>(HV SERIES)</b>                  |       | 0.2    | 0.4                                | 0.8    | 0.2    |                    |
| $\frac{\Delta V_{OUT}}{\Delta T_{TEMP}}$ Temperature Stability | $T_J = -55 \text{ to } 150^\circ\text{C}$  |  | 0.6   | 1.5    |                                    | 0.6    |        | %                  |
| $\frac{\Delta V_{OUT}}{\Delta T_{IME}}$ Long Term Stability    | $T_A = +125^\circ\text{C}$<br>$t = 1000 \text{ Hrs}$   |  | 0.3   | 1      |                                    | 0.3    | 1      | %                  |
| $e_n$ RMS Output Noise<br>(% of $V_{OUT}$ )                    | $f = 10 \text{ Hz to } 10 \text{ kHz}$<br>$T_A = 25^\circ\text{C}$   |  | 0.003 |        |                                    | 0.003  |        | %                  |
| $R_{\theta JC}$ Thermal Resistance<br>Junction to Case         | K Package  |  | 2.3   | 3      |                                    | 2.3    | 3      | $^\circ\text{C/W}$ |
|  | R Package  |  | 5     | 7      |                                    | 5      | 7      |                    |
|  | G Package  |  | 3     | 5      |                                    | 3      | 5      |                    |
|  | LCC4 Package   |  |       | 13     |                                    |        | 13     |                    |

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 at a point  $\frac{1}{8}$ " 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 SMD packages, 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:  $V_{IN} - V_{OUT} = 5\text{V}$  ,  $I_{OUT} = 0.5\text{A}$  ,  $P_{MAX} = 20\text{W}$  ,  $I_{MAX} = 1.5\text{A}$  ,  $V_{MAX} = 40\text{V}$  for standard series , 50V for HV series.

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Document Number 2831

Issue 3

| Parameter   | Test Conditions  | IP337A<br>IP337AHV   |       |        | IP337, IP337HV<br>LM337, LM337HV |        |        | Units |
|---|--|--|-------|--------|----------------------------------|--------|--------|-------|
|   |  | Min.   | Typ.  | Max.   | Min.                             | Typ.   | Max.   |       |
| V <sub>REF</sub> Reference Voltage                          | I <sub>OUT</sub> = 10mA  | -1.238   | -1.25 | -1.262 | -1.213                           | -1.25  | -1.287 | V     |
|   | I <sub>OUT</sub> = 10mA to I <sub>MAX</sub><br>V <sub>IN</sub> – V <sub>OUT</sub> = 3V to V <sub>MAX</sub><br>P ≤ P <sub>MAX</sub> T <sub>J</sub> = 0 to 125°C | -1.220   | -1.25 | -1.280 | -1.200                           | -1.250 | -1.300 | V     |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Line Regulation 1   | V <sub>IN</sub> – V <sub>OUT</sub> = 3V to V <sub>MAX</sub><br>T <sub>J</sub> = 0 to 125°C   |  | 0.005 | 0.010  |                                  | 0.010  | 0.040  | %V    |
|   |  |  | 0.010 | 0.030  |                                  | 0.020  | 0.070  |       |
| $\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Load Regulation 1   | I <sub>OUT</sub> = 10mA to I <sub>MAX</sub><br>T <sub>J</sub> = 0 to 125°C   | V <sub>OUT</sub> ≤ 5V  |       | 5      | 25                               | 15     | 50     | mV    |
|   |  | V <sub>OUT</sub> ≥ 5V  |       | 0.1    | 0.5                              | 0.3    | 1      | %     |
|   | I <sub>OUT</sub> = 10mA to I <sub>MAX</sub><br>T <sub>J</sub> = 0 to 125°C   | V <sub>OUT</sub> ≤ 5V  |       | 10     | 50                               | 20     | 70     | mV    |
|   |  | V <sub>OUT</sub> ≥ 5V  |       | 0.2    | 1                                | 0.3    | 1.5    | %     |
| Thermal Regulation  | t <sub>p</sub> = 10ms                      T <sub>A</sub> = 25°C   |  | 0.002 | 0.020  |                                  | 0.003  | 0.04   | %/W   |
| Ripple Rejection  | V <sub>OUT</sub> = 10V<br>f = 120Hz  | C <sub>ADJ</sub> = 0   |       | 60     | 66                               | 60     |        | dB    |
|   |  | C <sub>ADJ</sub> = 10μF<br>T <sub>J</sub> = 0 to 125°C               |       | 70     | 80                               | 66     | 77     | dB    |
| I <sub>ADJ</sub> Adjust Pin Current                         | T <sub>J</sub> = 0 to 125°C  |  | 65    | 100    |                                  | 65     | 100    | μA    |
| ΔI <sub>ADJ</sub> Adjust Pin Current Change                 | T <sub>J</sub> = 0 to 125°C  | I <sub>OUT</sub> = 10mA to I <sub>MAX</sub>                          |       | 0.2    | 2                                | 0.5    | 5      | μA    |
|   |  | V <sub>IN</sub> – V <sub>OUT</sub> = 3V to 40V                       |       | 1.0    | 5                                | 2      | 5      |       |
|   |  | V <sub>IN</sub> – V <sub>OUT</sub> = 3V to 50V<br><b>(HV SERIES)</b> |       | 2.0    | 6                                | 3      | 6      |       |
| I <sub>MIN</sub> Minimum Load Current                       | T <sub>J</sub> = 0 to 125°C  | V <sub>IN</sub> – V <sub>OUT</sub> ≤ 40V                             |       | 2.5    | 5                                | 2.5    | 10     | mA    |
|   |  | V <sub>IN</sub> – V <sub>OUT</sub> ≤ 10V                             |       | 1.2    | 3                                | 1      | 6      |       |
| I <sub>CL</sub> Current Limit                               | T <sub>J</sub> = 0 to 125°C  | V <sub>IN</sub> – V <sub>OUT</sub> ≤ 15V                             |       | 1.5    | 2.2                              | 3.5    | 3.5    | A     |
|   |  | V <sub>IN</sub> – V <sub>OUT</sub> = 40V                             |       | 0.24   | 0.4                              | 1      | 0.15   |       |
|   |  | V <sub>IN</sub> – V <sub>OUT</sub> = 50V<br><b>(HV SERIES)</b>       |       | 0.2    | 0.4                              | 0.8    | 0.1    |       |
| $\frac{\Delta V_{OUT}}{\Delta TEMP}$ Temperature Stability  | T <sub>J</sub> = 0 to 125°C  |  | 0.6   | 1.5    |                                  | 0.6    |        | %     |
| $\frac{\Delta V_{OUT}}{\Delta TIME}$ Long Term Stability    | t = 1000 Hrs   |  | 0.3   | 1      |                                  | 0.3    | 1      | %     |
| e <sub>n</sub> RMS Output Noise<br>(% of V <sub>OUT</sub> ) | f = 10 Hz to 10 kHz<br>T <sub>A</sub> = 25°C   |  | 0.003 |        |                                  | 0.003  |        | %     |
| R <sub>θJC</sub> Thermal Resistance<br>Junction to Case     | K Package  |  | 2.3   | 3      |                                  | 2.3    | 3      | °C/W  |
|   | T Package  |  | 4     | 5      |                                  | 4      |        |       |
|   | LCC4 Package   |  |       | 13     |                                  |        | 13     |       |

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 at a point 1/8" 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 SMD packages, and 1/8" below the base of the package on the output pin of the TO-257 package.

2) Test Conditions unless otherwise stated:

$$V_{IN} - V_{OUT} = 5V, I_{OUT} = 0.5A, P_{MAX} = 20W, I_{MAX} = 1.5A$$

$$V_{MAX} = 40V \text{ for standard series, } 50V \text{ for HV series.}$$

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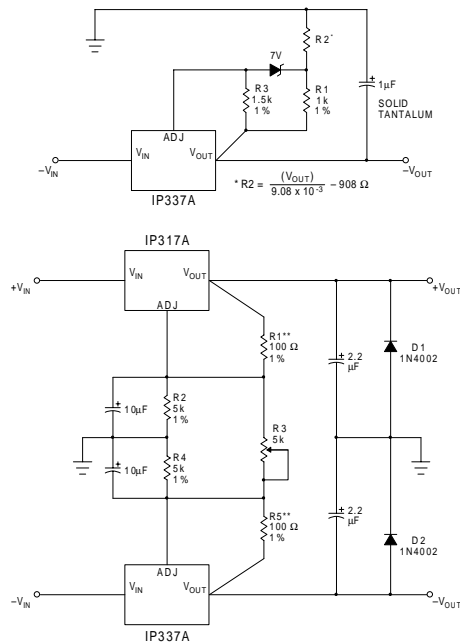
Document Number 2831

Issue 3

## APPLICATIONS INFORMATION

### High Stability Regulator

The output stability, load regulation, line regulation, thermal regulation, temperature drift, long term drift, and noise, can be improved by a factor of 6.6 over the standard regulator configuration. This assumes a zener has 20PPM/°C maximum drift and about 10 times lower noise than the regulator.



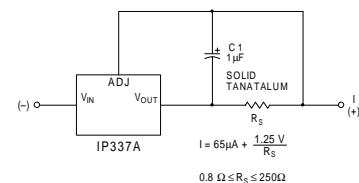
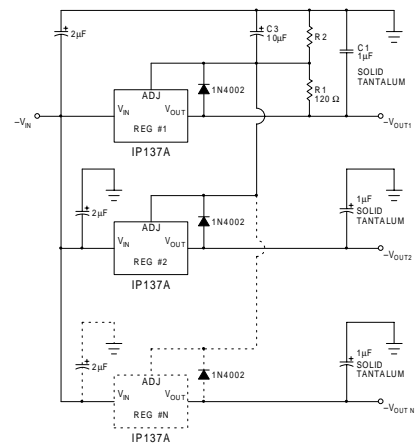
\* Solid Tantalum  
\*\* R1 or R5 may be trimmed slightly to improve tracking.

### Dual Tracking Supply

### Multiple Tracking Regulators

In the application shown below, regulator #2 to "N" will track regulator #1 to within ±24mV initially, and to ±60mV over all load, line, and temperature conditions.

If any regulator output is shorted to ground, all other outputs will drop to -2V. Load regulation of regulators 2 to "N" will be improved by  $V_{OUT} / 1.25V$  compared to a standard regulator, so regulator #1 should be the one which has the lowest load current.



### Current Regulator

## Order Information

| Part Number | IG-Pack<br>G-Pack<br>(TO257) | SMD1 | SMD05 | LCC4 | K-Pack<br>(TO3) | R-Pack<br>(TO66) | T-Pack<br>(TO220) | Temp.<br>Range |
|-------------|------------------------------|------|-------|------|-----------------|------------------|-------------------|----------------|
| LM137       | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | -55 to +150°C  |
| LM137HV     | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| LM137A      | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| LM137AHV    | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| IP137       | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| IP137HV     | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| IP137A      | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| IP137AHV    | ✓                            | ✓    | ✓     | ✓    | ✓               | ✓                |                   | "              |
| LM337       |                              |      |       |      | ✓               |                  | ✓                 | 0 to 125°C     |
| LM337HV     |                              |      |       |      | ✓               |                  | ✓                 | "              |
| IP337       |                              |      |       |      | ✓               |                  | ✓                 | "              |
| IP337HV     |                              |      |       |      | ✓               |                  | ✓                 | "              |
| IP337A      |                              |      |       |      | ✓               |                  | ✓                 | "              |
| IP337AHV    |                              |      |       |      | ✓               |                  | ✓                 | "              |

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