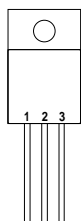


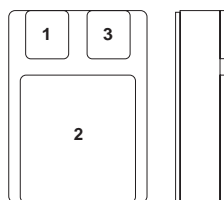
Pin 1 – ADJ.  
 Pin 2 –  $V_{IN}$   
 Pin 3 –  $V_{OUT}$   
 Case –  $V_{IN}$

**G Package – (TO-257AA)**



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

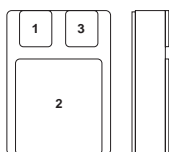
**IG Package – (TO-257AA)  
 (Isolated)**



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

**SMD1 (TO276AB)**

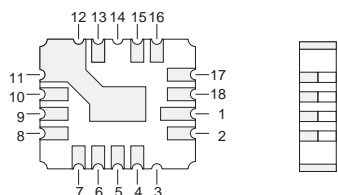
**CERAMIC SURFACE MOUNT**



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

**SMD05 (TO-276AA)**

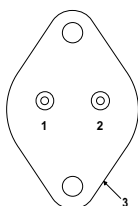
**CERAMIC SURFACE MOUNT**



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

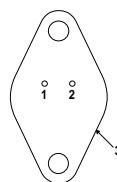
**LCC4**

**CERAMIC SURFACE MOUNT**



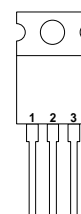
Pin 1 – ADJ.  
 Pin 2 –  $V_{OUT}$   
 Case –  $V_{IN}$

**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**

**1.5 AMP  
 NEGATIVE ADJUSTABLE  
 VOLTAGE REGULATOR**

**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**

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

$V_{I-O}$	Input - Output Differential Voltage	– Standard	40V
		– HV Series	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 LM137A , LM137AHV			IP137 , IP137HV LM137 , LM137HV			Units	
		Min.	Typ.	Max.	Min.	Typ.	Max.		
V <sub>REF</sub> Reference Voltage	I <sub>OUT</sub> = 10mA	-1.238	-1.25	-1.262	-1.225	-1.25	-1.275	V	
	I <sub>OUT</sub> = 10mA to I <sub>MAX</sub> T <sub>J</sub> = -55 to 150°C V <sub>IN</sub> - V <sub>OUT</sub> = 3V to V <sub>MAX</sub> P ≤ P <sub>MAX</sub>	-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> T <sub>J</sub> = -55 to 150°C	0.005	0.010		0.010	0.020	%V		
		0.010	0.030		0.020	0.050			
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Load Regulation 1	I <sub>OUT</sub> = 10mA to I <sub>MAX</sub> V <sub>OUT</sub> ≤ 5V	5	25		15	25	mV		
		0.1	0.5		0.3	0.5	%		
	I <sub>OUT</sub> = 10mA to I <sub>MAX</sub> V <sub>OUT</sub> ≤ 5V T <sub>J</sub> = -55 to 150°C	10	50		20	50	mV		
		0.2	1		0.3	1	%		
Thermal Regulation	t <sub>p</sub> = 10ms    T <sub>A</sub> = 25°C LCC4 Package	0.002	0.020		0.002	0.02	%W		
				0.040		0.040			
Ripple Rejection	V <sub>OUT</sub> = -10V f = 120Hz    C <sub>ADJ</sub> = 0 C <sub>ADJ</sub> = 10μF T <sub>J</sub> = -55 to 150°C	60	66		60		dB		
		70	80		66	77	dB		
I <sub>ADJ</sub> Adjust Pin Current	T <sub>J</sub> = -55 to 150°C		65	100		65	100	μA	
ΔI <sub>ADJ</sub> Adjust Pin Current Change	T <sub>J</sub> = -55 to 150°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 (HV SERIES)	2.0	6		3	6		
I <sub>MIN</sub> Minimum Load Current	T <sub>J</sub> = -55 to 150°C	V <sub>IN</sub> - V <sub>OUT</sub> ≤ 40V	2.5	5		2.5	5	mA	
		V <sub>IN</sub> - V <sub>OUT</sub> ≤ 10V	1.2	3		1.2	3		
I <sub>CL</sub> Current Limit	T <sub>J</sub> = -55 to 150°C	V <sub>IN</sub> - V <sub>OUT</sub> ≤ 15V	1.5	2.2	3.2	1.5	2.2	3.2	A
		V <sub>IN</sub> - V <sub>OUT</sub> = 40V	0.24	0.4	1	0.24	0.4		
		V <sub>IN</sub> - V <sub>OUT</sub> = 50V (HV SERIES)	0.2	0.4	0.8	0.2	0.4	0.8	
$\frac{\Delta V_{OUT}}{\Delta TEMP}$ Temperature Stability	T <sub>J</sub> = -55 to 150°C		0.6	1.5		0.6		%	
$\frac{\Delta V_{OUT}}{\Delta TIME}$ Long Term Stability	T <sub>A</sub> = +125°C t = 1000 Hrs		0.3	1		0.3	1	%	
e <sub>n</sub> RMS Output Noise (% of V <sub>OUT</sub> )	f = 10 Hz to 10 kHz T <sub>A</sub> = 25°C		0.003			0.003		%	
R <sub>θJC</sub> Thermal Resistance Junction to Case	K Package		2.3	3		2.3	3	°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 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<sub>IN</sub> - V<sub>OUT</sub> = 5V , I<sub>OUT</sub> = 0.5A , P<sub>MAX</sub> = 20W , I<sub>MAX</sub> = 1.5A , V<sub>MAX</sub> = 40V for standard series , 50V for HV series.

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Parameter	Test Conditions	IP337A IP337AHV			IP337, IP337HV 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> V <sub>IN</sub> - V <sub>OUT</sub> = 3V to V <sub>MAX</sub> 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> 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>	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> 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 f = 120Hz	C <sub>ADJ</sub> = 0	60	66		60		dB	
		C <sub>ADJ</sub> = 10μF 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 <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	1.5	2.2	3.5	A
		V <sub>IN</sub> - V <sub>OUT</sub> = 40V	0.24	0.4	1	0.15	0.4		
		V <sub>IN</sub> - V <sub>OUT</sub> = 50V <b>(HV SERIES)</b>	0.2	0.4	0.8	0.1	0.4	0.8	
$\frac{\Delta V_{OUT}}{\Delta TEMP}$ 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 (% of V <sub>OUT</sub> )	f = 10 Hz to 10 kHz T <sub>A</sub> = 25°C		0.003			0.003		%	
R <sub>θJC</sub> Thermal Resistance 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.

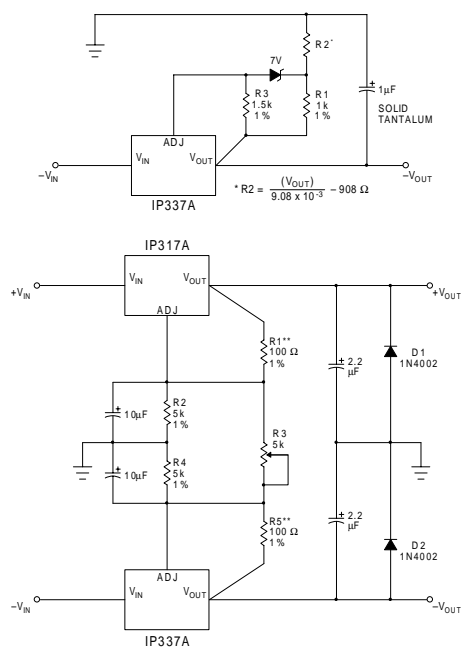
2) Test Conditions unless otherwise stated:                    V<sub>IN</sub> - V<sub>OUT</sub> = 5V, I<sub>OUT</sub> = 0.5A, P<sub>MAX</sub> = 20W, I<sub>MAX</sub> = 1.5A  
V<sub>MAX</sub> = 40V for standard series, 50V for HV series.

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## 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.



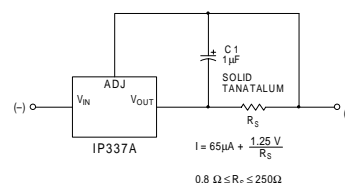
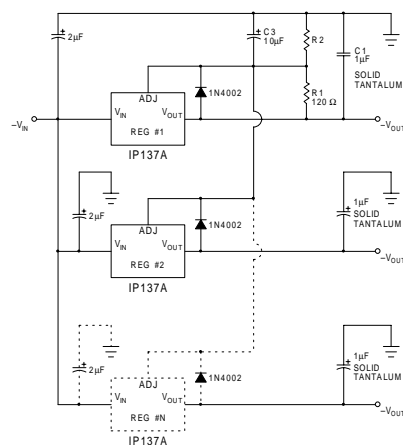
\* Solid Tantalum  
 \*\* R1 or R5 may be trimmed slightly to improve tracking.

### 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 G-Pack (TO257)	SMD1	SMD05	LCC4	K-Pack (TO3)	R-Pack (TO66)	T-Pack (TO220)	Temp. 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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Document Number 2831

Issue 3