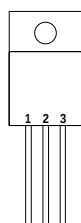


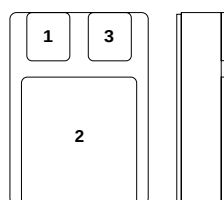
Pin 1 – ADJ.
Pin 2 – V_{IN}
Pin 3 – V_{OUT}
Case – V_{IN}

G Package – (TO-257AA)



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

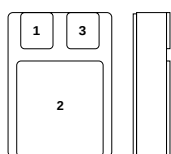
**IG Package – (TO-257AA)
(Isolated)**



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

SMD1 (TO276AB)

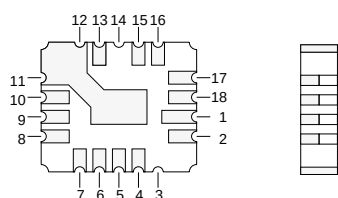
CERAMIC SURFACE MOUNT



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

SMD05 (TO-276AA)

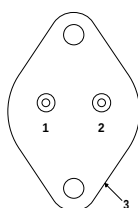
CERAMIC SURFACE MOUNT



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

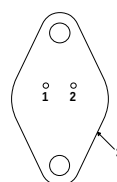
LCC4

CERAMIC SURFACE MOUNT



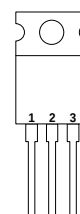
Pin 1 – ADJ.
Pin 2 – V_{OUT}
Case – V_{IN}

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 – HV Series	40V 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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Website: <http://www.semelab.co.uk>

Document Number 2831

Issue 2

Parameter	Test Conditions	IP137A , IP137AHV LM137A , LM137AHV			IP137 , IP137HV 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
	$I_{OUT} = 10\text{mA to } I_{MAX}$ $V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$ $P \leq P_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$	-1.220	-1.25	-1.280	-1.200	-1.250	-1.300	V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Line Regulation 1	$V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$		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	$I_{OUT} = 10\text{mA to } I_{MAX}$	$V_{OUT} \leq 5\text{V}$		5	25	15	25	mV
		$V_{OUT} \geq 5\text{V}$		0.1	0.5	0.3	0.5	%
	$I_{OUT} = 10\text{mA to } I_{MAX}$ $T_J = -55 \text{ to } 150^\circ\text{C}$	$V_{OUT} \leq 5\text{V}$		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
Ripple Rejection	$V_{OUT} = -10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$		60	66	60		dB
		$C_{ADJ} = 10\mu\text{F}$ $T_J = -55 \text{ to } 150^\circ\text{C}$		70	80	66	77	dB
I_{ADJ} Adjust Pin Current	$T_J = -55 \text{ to } 150^\circ\text{C}$		65	100		65	100	μA
ΔI_{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	μA
		$V_{IN} - V_{OUT} = 3\text{V to } 40\text{V}$		1.0	5	2	5	
		$V_{IN} - V_{OUT} = 3\text{V to } 50\text{V}$ (HV SERIES)		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	3.2	A
		$V_{IN} - V_{OUT} = 40\text{V}$		0.24	0.4	1	0.24	
		$V_{IN} - V_{OUT} = 50\text{V}$ (HV SERIES)		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	$T_A = +125^\circ\text{C}$ $t = 1000 \text{ Hrs}$		0.3	1		0.3	1	%
e_n RMS Output Noise (% of V_{OUT})	$f = 10 \text{ Hz to } 10 \text{ kHz}$ $T_A = 25^\circ\text{C}$		0.003			0.003		%
$R_{\theta JC}$ Thermal Resistance Junction to Case	K Package		2.3	3		2.3	3	$^\circ\text{C/W}$
	R Package		5	7		5	7	
	G 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: $V_{IN} - V_{OUT} = 5\text{V}$, $I_{OUT} = 0.5\text{A}$, $P_{MAX} = 20\text{W}$, $I_{MAX} = 1.5\text{A}$, $V_{MAX} = 40\text{V}$ for standard series, 50V for HV series.

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Parameter	Test Conditions	IP337A IP337AHV			IP337, IP337HV LM337, LM337HV			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{REF} Reference Voltage	$I_{OUT} = 10\text{mA}$	-1.238	-1.25	-1.262	-1.213	-1.25	-1.287	V
	$I_{OUT} = 10\text{mA to } I_{MAX}$ $V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$ $P \leq P_{MAX}$ $T_J = 0 \text{ to } 125^\circ\text{C}$	-1.220	-1.25	-1.280	-1.200	-1.250	-1.300	V
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$ Line Regulation 1	$V_{IN} - V_{OUT} = 3\text{V to } V_{MAX}$ $T_J = 0 \text{ to } 125^\circ\text{C}$		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	$I_{OUT} = 10\text{mA to } I_{MAX}$ $T_J = 0 \text{ to } 125^\circ\text{C}$	$V_{OUT} \leq 5\text{V}$		5	25	15	50	mV
		$V_{OUT} \geq 5\text{V}$		0.1	0.5	0.3	1	%
	$I_{OUT} = 10\text{mA to } I_{MAX}$ $T_J = 0 \text{ to } 125^\circ\text{C}$	$V_{OUT} \leq 5\text{V}$		10	50	20	70	mV
		$V_{OUT} \geq 5\text{V}$		0.2	1	0.3	1.5	%
Thermal Regulation	$t_p = 10\text{ms}$ $T_A = 25^\circ\text{C}$		0.002	0.020		0.003	0.04	%/W
Ripple Rejection	$V_{OUT} = 10\text{V}$ $f = 120\text{Hz}$	$C_{ADJ} = 0$		60	66	60		dB
		$C_{ADJ} = 10\mu\text{F}$ $T_J = 0 \text{ to } 125^\circ\text{C}$		70	80	66	77	dB
I_{ADJ} Adjust Pin Current	$T_J = 0 \text{ to } 125^\circ\text{C}$		65	100		65	100	μA
ΔI_{ADJ} Adjust Pin Current Change	$T_J = 0 \text{ to } 125^\circ\text{C}$	$I_{OUT} = 10\text{mA to } I_{MAX}$		0.2	2	0.5	5	μA
		$V_{IN} - V_{OUT} = 3\text{V to } 40\text{V}$		1.0	5	2	5	
		$V_{IN} - V_{OUT} = 3\text{V to } 50\text{V}$ (HV SERIES)		2.0	6	3	6	
I_{MIN} Minimum Load Current	$T_J = 0 \text{ to } 125^\circ\text{C}$	$V_{IN} - V_{OUT} \leq 40\text{V}$		2.5	5	2.5	10	mA
		$V_{IN} - V_{OUT} \leq 10\text{V}$		1.2	3	1	6	
I_{CL} Current Limit	$T_J = 0 \text{ to } 125^\circ\text{C}$	$V_{IN} - V_{OUT} \leq 15\text{V}$		1.5	2.2	3.5	3.5	A
		$V_{IN} - V_{OUT} = 40\text{V}$		0.24	0.4	1	0.15	
		$V_{IN} - V_{OUT} = 50\text{V}$ (HV SERIES)		0.2	0.4	0.8	0.1	
$\frac{\Delta V_{OUT}}{\Delta \text{TEMP}}$ Temperature Stability	$T_J = 0 \text{ to } 125^\circ\text{C}$		0.6	1.5		0.6		%
$\frac{\Delta V_{OUT}}{\Delta \text{TIME}}$ Long Term Stability	$t = 1000 \text{ Hrs}$		0.3	1		0.3	1	%
e_n RMS Output Noise (% of V_{OUT})	$f = 10 \text{ Hz to } 10 \text{ kHz}$ $T_A = 25^\circ\text{C}$		0.003			0.003		%
$R_{\theta JC}$ Thermal Resistance Junction to Case	K Package		2.3	3		2.3	3	$^\circ\text{C/W}$
	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 $\frac{1}{8}$ " 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:

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

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

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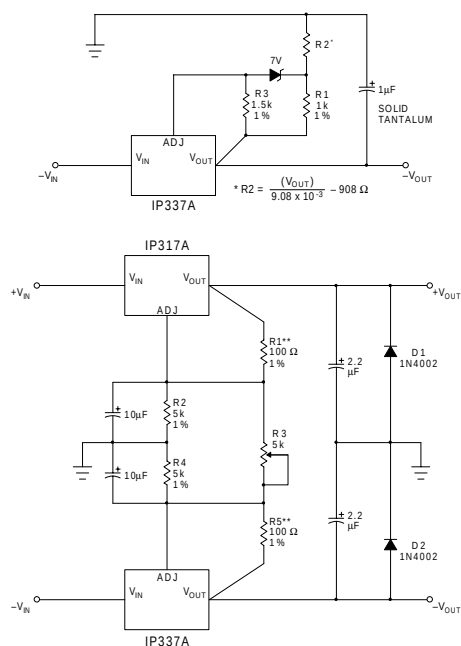
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Issue 2

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.



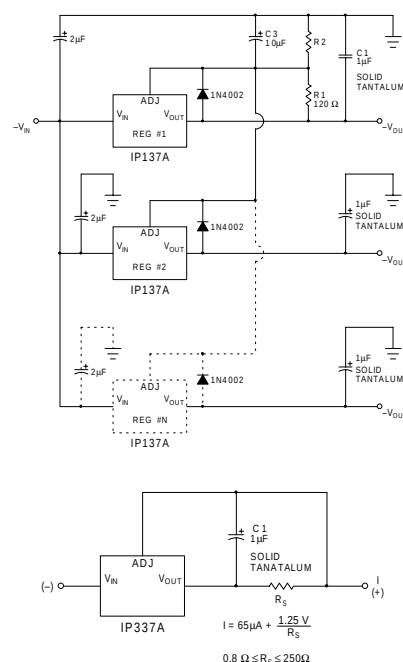
* Solid Tantalum
** R1 or R5 may be trimmed slightly to improve tracking.

Dual Tracking Supply

Multiple Tracking Regulators

In the application shown below, regulator #2 to "N" will track regulator #1 to within $\pm 24\text{mV}$ initially, and to $\pm 60\text{mV}$ 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 $V_{\text{OUT}} / 1.25\text{V}$ 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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