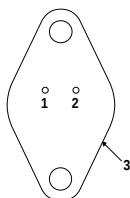


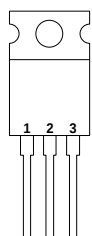
Pin 1 – ADJ.
 Pin 2 – V_{OUT}
 Case – V_{IN}

K Package – TO-3



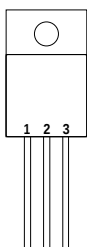
Pin 1 – ADJ.
 Pin 2 – V_{OUT}
 Case – V_{IN}

R Package – TO-66



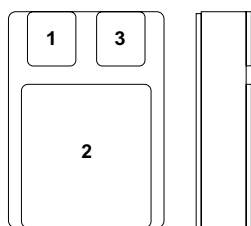
Pin 1 – ADJ.
 Pin 2 – V_{IN}
 Pin 3 – V_{OUT}
 Case – V_{IN}

T Package – TO-220



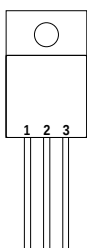
Pin 1 – ADJ.
 Pin 2 – V_{IN}
 Pin 3 – V_{OUT}
 Case – V_{IN}

G Package – TO-257



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

SG Package – SMD1
CERAMIC SURFACE
MOUNT



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

IG Package – TO-257
(Isolated)

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

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		%
$\frac{\Delta V_{OUT}}{\Delta T_{TIME}}$ 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	

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 SMD1 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: $V_{IN} - V_{OUT} = 5\text{V}$, $I_{OUT} = 0.5\text{A}$, $P_{MAX} = 20\text{W}$, $I_{MAX} = 1.5\text{A}$
 $V_{MAX} = 40\text{V}$ for standard series , 50V for HV series.

Parameter	Test Conditions	IP337AHV			IP337HV LM337HV			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V _{REF} Reference Voltage	I _{OUT} = 10mA	-1.238	-1.25	-1.262	-1.213	-1.25	-1.287	V
	I _{OUT} = 10mA to I _{MAX} V _{IN} – V _{OUT} = 3V to V _{MAX} P ≤ P _{MAX} T _J = 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 _{IN} – V _{OUT} = 3V to V _{MAX} T _J = 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 _{OUT} = 10mA to I _{MAX} T _J = 0 to 125°C	V _{OUT} ≤ 5V		5	25	15	50	mV
		V _{OUT} ≥ 5V		0.1	0.5	0.3	1	%
	I _{OUT} = 10mA to I _{MAX} T _J = 0 to 125°C	V _{OUT} ≤ 5V		10	50	20	70	mV
		V _{OUT} ≥ 5V		0.2	1	0.3	1.5	%
Thermal Regulation	t _p = 10ms T _A = 25°C	0.002	0.020		0.003	0.04		%/W
Ripple Rejection	V _{OUT} = 10V f = 120Hz	C _{ADJ} = 0		60	66	60		dB
		C _{ADJ} = 10μF T _J = 0 to 125°C		70	80	66	77	dB
I _{ADJ} Adjust Pin Current	T _J = 0 to 125°C	65	100		65	100		μA
ΔI_{ADJ} Adjust Pin Current Change	T _J = 0 to 125°C	I _{OUT} = 10mA to I _{MAX}		0.2	2	0.5	5	μA
		V _{IN} – V _{OUT} = 3V to 40V		1.0	5	2	5	
		V _{IN} – V _{OUT} = 3V to 50V (HV SERIES)		2.0	6	3	6	
I _{MIN} Minimum Load Current	T _J = 0 to 125°C	V _{IN} – V _{OUT} ≤ 40V		2.5	5	2.5	10	mA
		V _{IN} – V _{OUT} ≤ 10V		1.2	3	1	6	
I _{CL} Current Limit	T _J = 0 to 125°C	V _{IN} – V _{OUT} ≤ 15V		1.5	2.2	3.5		A
		V _{IN} – V _{OUT} = 40V		0.24	0.4	1	0.15	
		V _{IN} – V _{OUT} = 50V (HV SERIES)		0.2	0.4	0.8	0.1	
$\frac{\Delta V_{OUT}}{\Delta TEMP}$ Temperature Stability	T _J = 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 _n RMS Output Noise (% of V _{OUT})	f = 10 Hz to 10 kHz T _A = 25°C	0.003			0.003			%
R _{θJC} Thermal Resistance Junction to Case	K Package	2.3	3		2.3	3		°C/W
	T Package	4	5		4			

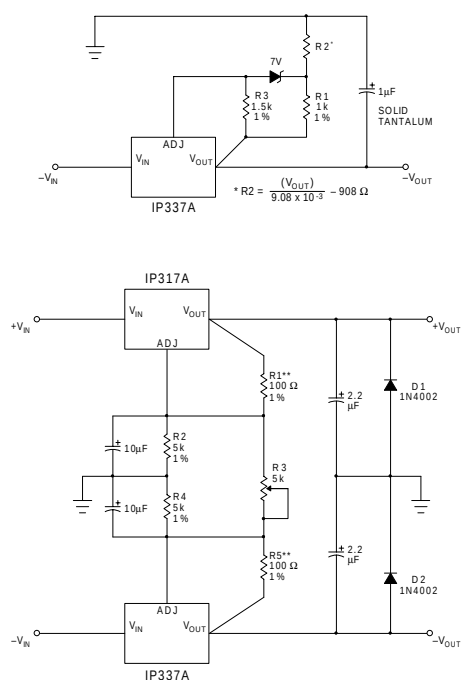
1) Regulation is measured at constant junction temperature, using pulse testing at a low duty cycle. Changes in output voltage due to heating effects are covered under thermal regulation specifications. Load regulation is measured at a point 1/8" from the bottom of the package for the TO-3 and TO-66 packages, at the junction of the wide and narrow portion of the output lead for the SMD1 package, 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 for standard series , 50V for HV series.

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.



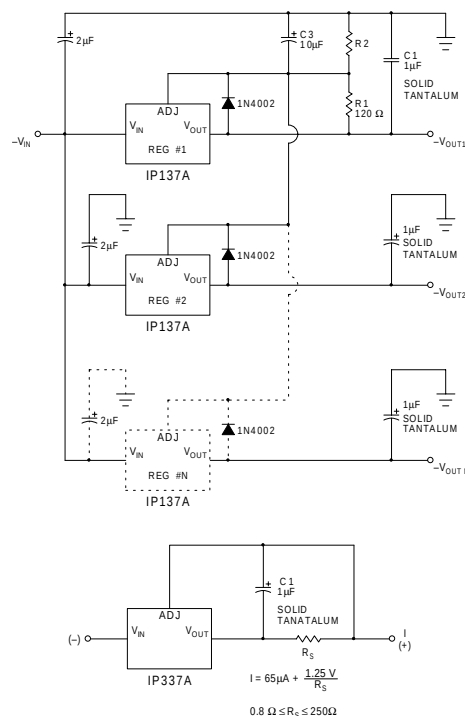
* Solid Tantalum
** R1 or R5 may be trimmed slightly to improve tracking.

Dual Tracking Supply

Multiple Tracking Regulators

In the application shown below, regulator #1 to "N" will track regulator #1 to within $\pm 24mV$ initially, and to $\pm 60mV$ 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	K-Pack (TO-3)	R-Pack (TO-66)	IG-Pack G-Pack (TO-257)	T-Pack (TO-220)	SG-Pack SMD1	Temp. Range
LM137	✓	✓	✓		✓	-55 to +150°C
LM137HV	✓	✓	✓		✓	"
LM137A	✓	✓	✓		✓	"
LM137AHV	✓	✓	✓		✓	"
IP137	✓	✓	✓		✓	-55 to +150°C
IP137HV	✓	✓	✓		✓	"
IP137A	✓	✓	✓		✓	"
IP137AHV	✓	✓	✓		✓	"
LM337	✓			✓		0 to 125°C
LM337HV	✓			✓		0 to 125°C
IP337	✓			✓		0 to 125°C
IP337HV	✓			✓		"
IP337A	✓			✓		0 to 125°C
IP337AHV	✓			✓		"