

1.5A, 3-TERMINAL NEGATIVE ADJUSTABLE REGULATORS

IP137A, IP137, LM137, IP137AHV, IP137HV, LM137HV, IP337AHV, IP337HV, LM337HV

DESCRIPTION

The IP137A family of negative adjustable regulators will deliver up to 1.5 amps output current over an output voltage range of -1.2V to -47V . Seagate Microelectronics has made significant improvements in these regulators compared to previous devices, such as better line and load regulation, and a maximum output voltage error of 1%.

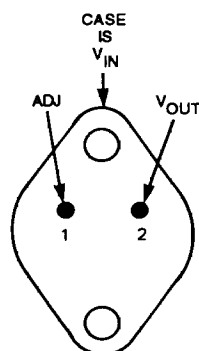
Internal current and power limiting coupled with true thermal limiting prevents device damage due to overloads or shorts, even if the regulator is not fastened to a heat sink.

FEATURES

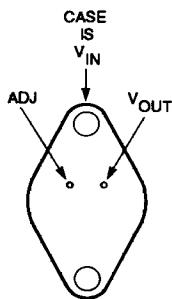
- 1% Initial voltage tolerance
- 0.01%/V line regulation
- 0.5%/A load regulation
- 0.02%/W thermal regulation

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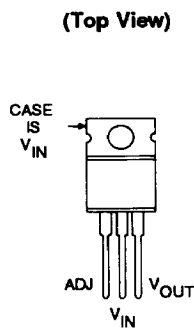
CONNECTIONS



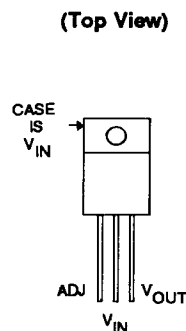
TO-3



TO-66



TO-220



TO-257



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ABSOLUTE MAXIMUM RATINGS

Power Dissipation Internally Limited
 Input to output voltage differential 40V
 Input to output voltage differential (HV) 50V

Storage Temperature Range -65°C to +150°C

Lead Temperature (Soldering, 10 sec.) +300°C

Operating Junction Temperature Range

IP137AHV, IP137A, IP137 -55°C to +150°C
 LM137HV, LM137 -55°C to +150°C
 IP337AHV, IP337HV 0°C to +125°C
 LM337HV 0°C to +125°C

Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

ELECTRICAL CHARACTERISTICS (NOTES 1 AND 3)

Parameter	Test Conditions	IP137A IP137AHV			LM137 IP137 LM137HV IP137HV			Units
		Min	Typ	Max	Min	Typ	Max	
Reference Voltage, V_{REF}	$I_{OUT} = 10 \text{ mA}$	-1.238	-1.250	-1.262	-1.225	-1.250	-1.275	V
	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ $10 \text{ mA} \leq I_{OUT} \leq I_{MAX}$, $P \leq P_{MAX}$	• -1.220	-1.250	-1.280	-1.200	-1.250	-1.300	V
Line Regulation, $\Delta V_{OUT}/\Delta V_{IN}$	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ (See Note 2)		0.005	0.010		0.010	0.020	%/V
		•	0.010	0.030		0.020	0.050	%/V
Load Regulation, $\Delta V_{OUT}/\Delta I_{OUT}$	$10 \text{ mA} \leq I_{OUT} \leq I_{MAX}$ ($V_O \leq 5\text{V}$) (See Note 2 and 3)		5	25		15	25	mV
			0.1	0.5		0.3	0.5	%
		•	10	50		20	50	mV
		•	0.2	1.0		0.3	1.0	%
Thermal Regulation	$T_A = 25^\circ\text{C}$, 10 msec Pulse		0.002	0.02		0.002	0.02	%/W
Ripple Rejection	$V_{OUT} = -10\text{V}$, $C_{ADJ} = 0$		60	66		60		dB
	$f = 120\text{Hz}$, $C_{ADJ} = 10 \mu\text{F}$	•	70	80		66	77	dB
Adjust Pin Current, I_{ADJ}		•	65	100		65	100	μA
Adjust Pin Current Change, ΔI_{ADJ}	$10 \text{ mA} \leq I_{OUT} \leq I_{MAX}$	•	0.2	2		0.5	5	μA
	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$	•	1.0	5		2	5	μA
	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 50\text{V}$, HV series	•	2.0	6		3	6	μA
Minimum Load Current, I_{MIN}	$(V_{IN} - V_{OUT}) \leq 40\text{V}$	•	2.5	5.0		2.5	5.0	mA
	$(V_{IN} - V_{OUT}) \leq 10\text{V}$	•	1.2	3.0		1.2	3.0	mA
Current Limit, I_{CL}	$(V_{IN} - V_{OUT}) \leq 15\text{V}$	•	1.5	2.2	3.2	1.5	2.2	A
	$(V_{IN} - V_{OUT}) = 40\text{V}$	•	0.24	0.4	1.0	0.24	0.4	A
	$(V_{IN} - V_{OUT}) = 50\text{V}$ HV Series	•	0.2	0.4	0.8	0.2	0.4	A
Temperature Stability, $\Delta V_{OUT}/\Delta\text{TEMP}$		•	0.6	1.5		0.6		%
Long Term Stability, $\Delta V_{OUT}/\Delta\text{TIME}$	$T_A = 125^\circ\text{C}$, 1000 Hrs.		0.3	1		0.3	1	%
RMS Output Noise (% of V_{OUT}), e_n	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 10\text{kHz}$		0.003			0.003		%
Thermal Resistance	K Package		2.3	3		2.3	3	$^\circ\text{C/W}$
	R Package		5	7		5	7	$^\circ\text{C/W}$
	G Package		3	5		3	5	$^\circ\text{C/W}$



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ELECTRICAL CHARACTERISTICS (CONTINUED)

Parameter	Test Conditions		IP337AHV			IP337HV LM337HV			Units
			Min	Typ	Max	Min	Typ	Max	
Reference Voltage, V_{REF}	$I_{OUT} = 10 \text{ mA}$		-1.238	-1.250	-1.262	-1.213	-1.250	-1.287	V
	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$ $10 \text{ mA} \leq I_{OUT} \leq I_{MAX}$, $P \leq P_{MAX}$	•	-1.220	-1.250	-1.280	-1.200	-1.250	-1.300	V
Line Regulation, $\Delta V_{OUT}/\Delta V_{IN}$	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq V_{MAX}$			0.005	0.010		0.010	0.040	%/V
	(See Note 2)	•		0.010	0.03		0.020	0.070	%/V
Load Regulation, $\Delta V_{OUT}/\Delta I_{OUT}$	$10 \text{ mA} \leq I_{OUT} \leq I_{MAX}$								
	(See Note 2 and 3)								
	$(V_O) \leq 5\text{V}$			5	25		15	50	mV
	$(V_O) \leq 5\text{V}$			0.1	0.5		0.3	1.0	%
	$(V_O) \leq 5\text{V}$	•		10	50		20	70	mV
	$(V_O) \leq 5\text{V}$	•		0.2	1.0		0.3	1.5	%
Thermal Regulation	$T_A = 25^\circ\text{C}$, 10 msec Pulse			0.002	0.020		0.003	0.04	%/W
Ripple Rejection	$V_{OUT} = -10\text{V}$, $C_{ADJ} = 0$		60	66		60			dB
	$f = 120\text{Hz}$, $C_{ADJ} = 10 \mu\text{F}$	•	70	80		66	77		dB
Adjust Pin Current, I_{ADJ}		•		65	100		65	100	μA
Adjust Pin Current Change, ΔI_{ADJ}	$10 \text{ mA} \leq I_{OUT} \leq I_{MAX}$	•		0.2	2		0.5	5	μA
	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 40\text{V}$	•		1.0	5		2	5	μA
	$3\text{V} \leq (V_{IN} - V_{OUT}) \leq 50\text{V}$, HV series	•		2.0	6		3	6	μA
Minimum Load Current, I_{MIN}	$(V_{IN} - V_{OUT}) \leq 40\text{V}$	•		2.5	5		2.5	10	mA
	$(V_{IN} - V_{OUT}) \leq 10\text{V}$	•		1.2	3.0		1	6	mA
Current Limit, I_{CL}	$(V_{IN} - V_{OUT}) \leq 15\text{V}$	•	1.5	2.2	3.5	1.5	2.2	3.5	A
	$(V_{IN} - V_{OUT}) = 40\text{V}$	•	0.24	0.4	1.0	0.15	0.4		A
	$(V_{IN} - V_{OUT}) = 50\text{V}$ HV Series	•	0.2	0.4	0.8	0.1	0.4	0.8	A
Temperature Stability, $\Delta V_{OUT}/\Delta T_{EMP}$		•		0.6	1.5		0.6		%
Long Term Stability, $\Delta V_{OUT}/\Delta T_{IME}$	$T_A = 125^\circ\text{C}$, 1000 Hrs.			0.3	1		0.3	1	%
RMS Output Noise (% of V_{OUT}), e_n	$T_A = 25^\circ\text{C}$, $10\text{Hz} \leq f \leq 10\text{kHz}$			0.003			0.003		%
Thermal Resistance	K Package			2.3	3		2.3	3	$^\circ\text{C}/\text{W}$
Junction to Case, θ_{JC}	R Package			5	7		5	7	$^\circ\text{C}/\text{W}$
	T Package			4	5		4		
	G Package			3	5		3	5	$^\circ\text{C}/\text{W}$

The • denotes the specifications which apply over the full operating temperature range, all others apply at $T_j = 25^\circ\text{C}$ unless otherwise specified.

Note 1: Unless otherwise specified, $(V_{IN} - V_{OUT}) = 5\text{V}$, and $I_{OUT} = 0.5\text{A}$ for the TO-3 (K), TO-257 (G), TO-66 (R), and TO-220 (T) Packages. Although power dissipation is internally limited, these specifications apply for dissipations up to 20W for the TO-3, TO-66, TO-220 and TO-257. $I_{MAX} = 1.5\text{A}$ for the TO-3, TO-66 TO-220 and TO-257.

Note 2: 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, at the junction of the wide and narrow portion of the output lead for the TO-220, and $1/8"$ below the base of the package on the output pin of the TO-257.

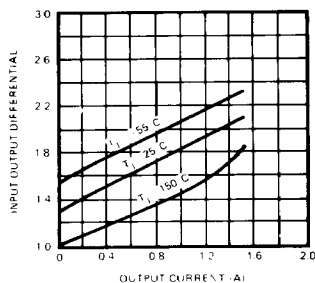
Note 3: $V_{MAX} = 40\text{V}$, IP137A, IP337A, LM137, LM337, IP137, IP337.
 $V_{MAX} = 50\text{V}$ for IP137AHV, IP337AHV, LM137HV, LM337HV, IP137HV, IP337HV.



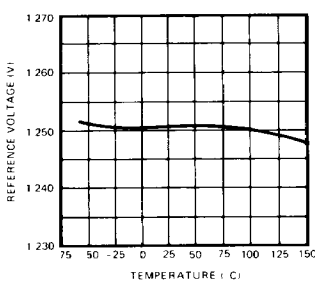
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TYPICAL PERFORMANCE CHARACTERISTICS

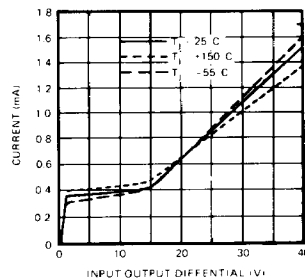
Dropout Voltage



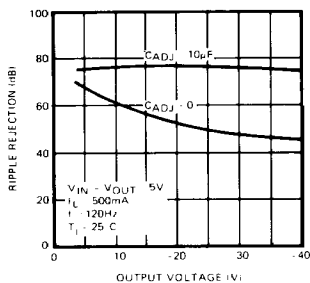
Temperature Stability



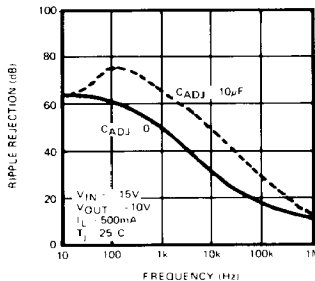
Minimum Load Current



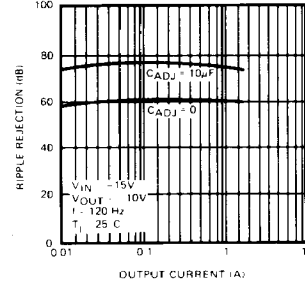
Ripple Rejection



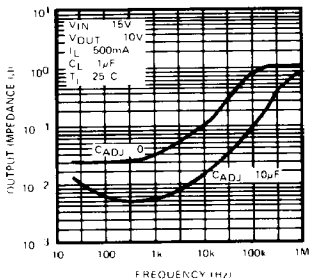
Ripple Rejection



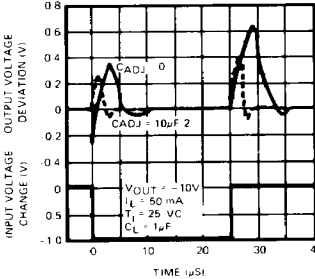
Ripple Rejection



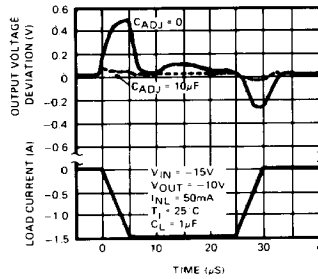
Output Impedance



Line Transient Response



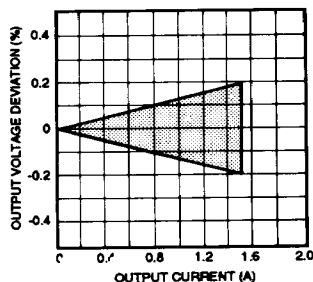
Load Transient Response



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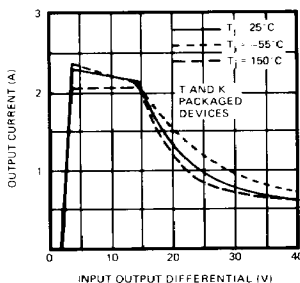
TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

Load Regulation*

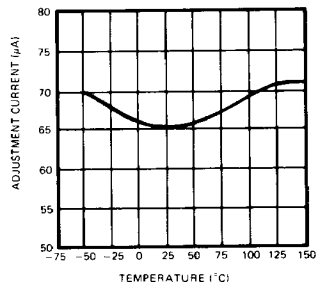


*The IP137A/AHV, IP337A/AHV series has load compensation which makes the typical unit read close to zero. This band represents the typical production spread.

Current Limit



Adjustment Current

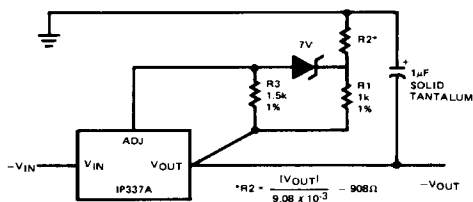


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APPLICATIONS INFORMATION

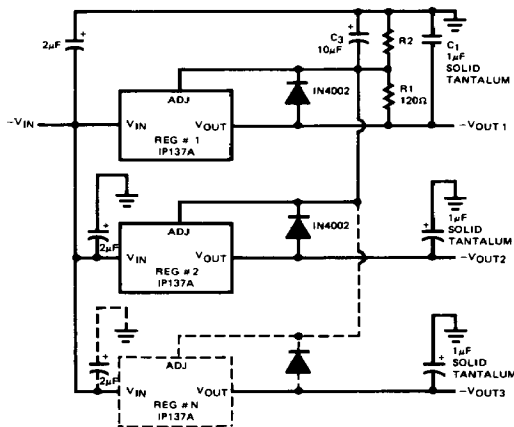
High Stability Regulator:

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/ $^\circ\text{C}$ maximum drift and about 10 times lower noise than the regulator.



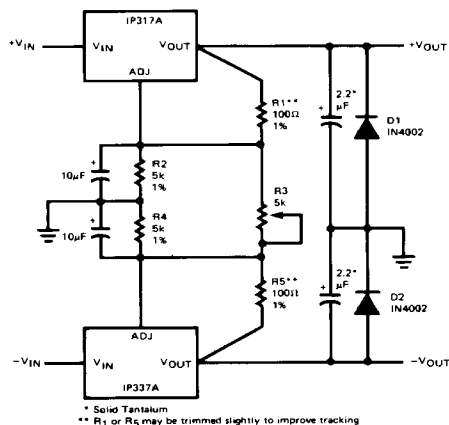
Multiple Tracking Regulators:

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.

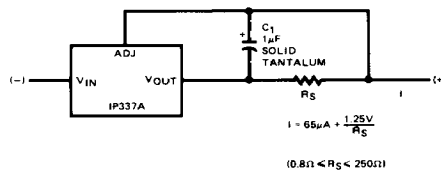


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APPLICATION INFORMATION (CONTINUED)



Dual Tracking Supply ±1.25V to ±20V



Current Regulator

ORDER INFORMATION

Part Number

IP137AK/IP137AHVK/LM137K/LM137HVK/
IP137K/IP137HVK
IP137AR/IP137AHVR/IP137R/IP137HVR
IP137AG/IP137AHVG/IP137G/IP137HVG
IP337AHVK/LM337HVK
IP337AHVT/LM337HVT

Temperature Range

- 55°C to + 150°C
- 55°C to + 150°C
- 55°C to + 150°C
0°C to + 125°C
0°C to + 125°C

Package

TO-3
TO-66
TO-257 (Hermetic TO-220 style)
TO-3
TO-220

