



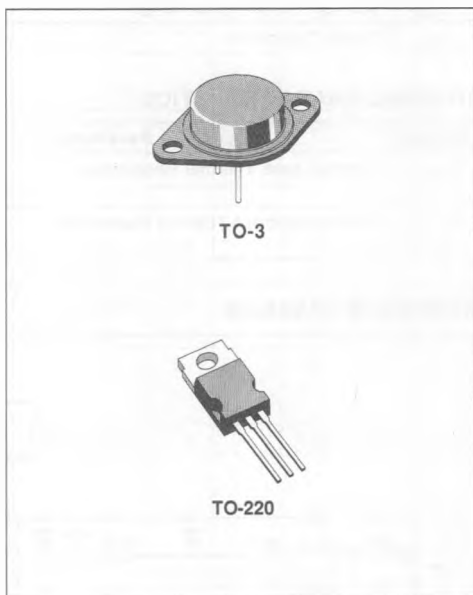
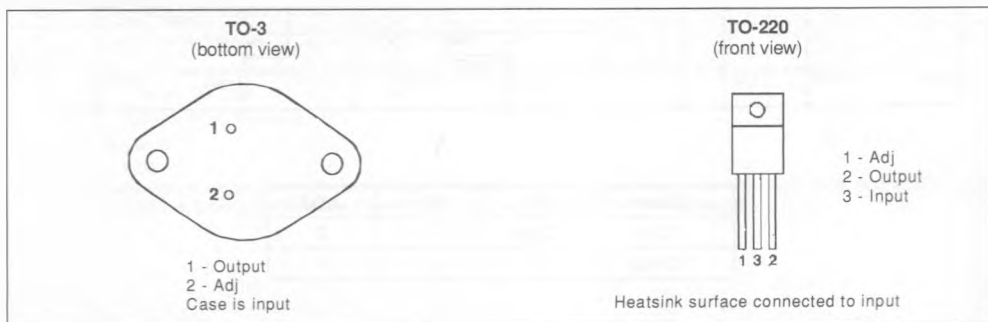
THREE-TERMINAL ADJUSTABLE NEGATIVE VOLTAGE REGULATORS

- OUTPUT VOLTAGE ADJUSTABLE DOWN TO V_{ref}
- 1.5A GUARANTEED OUTPUT CURRENT
- 0.3%/V TYPICAL LOAD REGULATION
- 0.01%/V TYPICAL LINE REGULATION
- CURRENT LIMIT CONSTANT WITH TEMPERATURE
- RIPPLE REJECTION : 77dB
- STANDARD 3-LEAD TRANSISTOR PACKAGES
- EXCELLENT THERMAL REGULATION : 0.002%/V
- 50ppm/°C TEMPERATURE COEFFICIENT

DESCRIPTION

The LM237 series are adjustable 3-terminal negative voltage regulators capable of supplying in excess - 1.5A over a - 1.2 to - 37V output voltage range. They are exceptionally easy to use and require only two external resistors to set the output voltage. Further, both line and load regulation are better than standard fixed regulators. Also, LM237 regulators are supplied in standard transistor packages which are easily mounted and handled. In addition to higher performance than fixed regulators, the LM237 series offer full overload protection available only in integrated circuits. Included on the chip are current limit, thermal overload protection and safe area protection. All overload protection circuitry remains fully functional even if the adjustment terminal is disconnected.

PIN CONNECTIONS



ORDER CODES

Part Number	Temperature Range	Package	
		K	SP
LM237	- 25°C to + 150°C	•	•
LM337	0°C to + 125°C	•	•

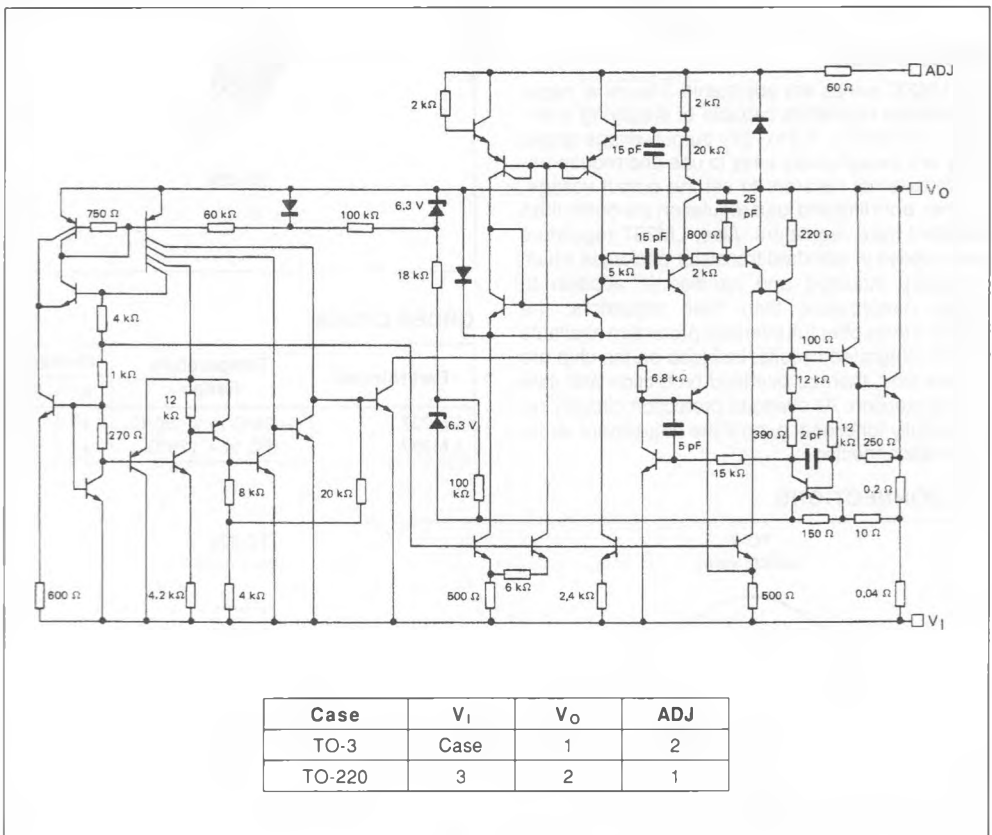
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_I - V_O$	Input-output Voltage Differential	40	V
I_O	Output Current	1.5	A
T_{oper}	Operating Junction Temperature Range LM237 LM337	- 25 to + 150 0 to + 125	°C
T_{stg}	Storage Temperature Range	- 65 to + 150	°C
P_{tot}	Power Dissipation	Internally Limited	

THERMAL CHARACTERISTICS

Symbol	Parameter	Typ.	Max.	Unit
$R_{th(j-c)}$	Junction-case Thermal Resistance TO-3 TO-220		4 3	°C/W
$R_{th(j-a)}$	Junction-ambient Thermal Resistance TO-3 TO-220	35	70	°C/W

SCHEMATIC DIAGRAM



ELECTRICAL CHARACTERISTICS

LM237 : $-25^{\circ}\text{C} < T_j < +150^{\circ}\text{C}$ LM337 : $0^{\circ}\text{C} < T_j < +125^{\circ}\text{C}$ $|V_I - V_O| = 5\text{V}$, $I_O = 0.5\text{A}$

(unless otherwise specified)

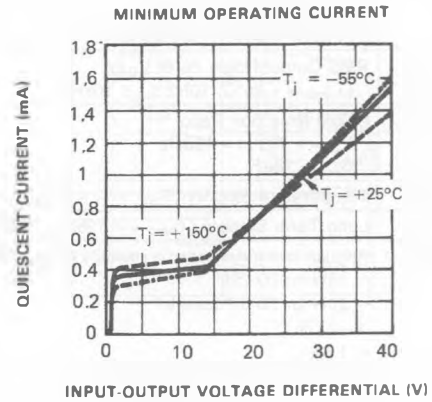
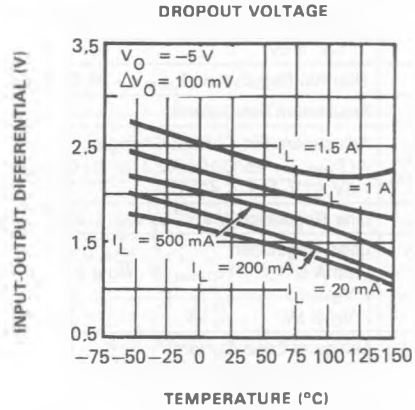
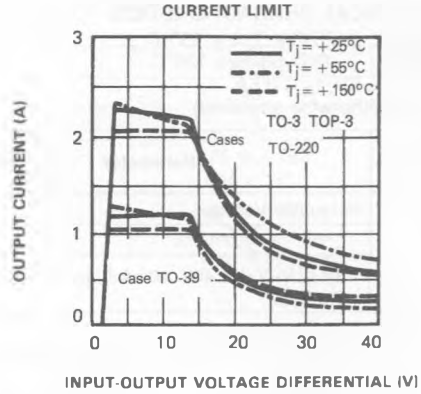
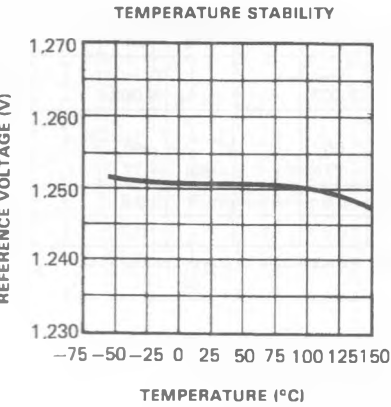
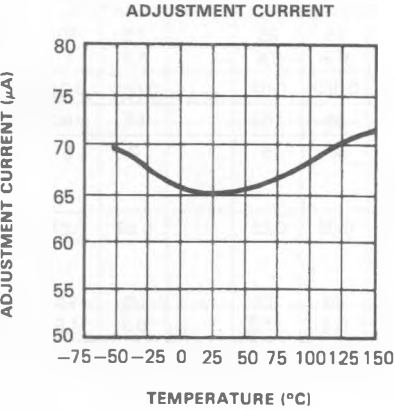
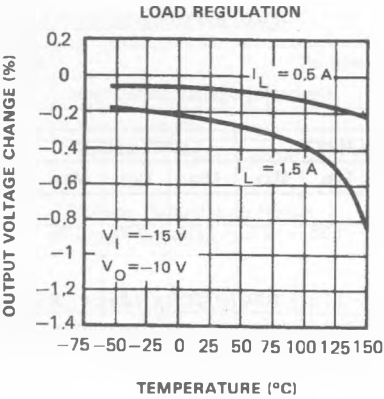
Symbol	Parameter	LM237			LM337-LM337I			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{ref}	Reference Voltage $T_{amb} = +25^{\circ}\text{C}$ $T_{min} \leq T_j \leq T_{max}$ $3\text{V} \leq V_I - V_O \leq 40\text{V}$, $10\text{mA} \leq I_O \leq I_{O(max)} $, $P \leq P_{max}$	-1.225	-1.25	-1.275	-1.213	-1.25	-1.287	V
K_{VI}	Line Regulation ($T_{amb} = +25^{\circ}\text{C}$, $3\text{V} \leq V_I - V_O \leq 40\text{V}$) - Note 2 $I_O = 0.1\text{A}$		0.01	0.02		0.01	0.04	%/V
K_{VO}	Load Regulation ($T_{amb} = +25^{\circ}\text{C}$, $10\text{mA} \leq I_O \leq I_{O(max)} $) - Note 2 $ V_O \leq 5\text{V}$ $ V_O \geq 5\text{V}$		15 0.3	25 0.5		15 0.3	50 1	mV %
	Thermal Regulation ($T_{amb} = +25^{\circ}\text{C}$, pulse 10ms)		0.002	0.02		0.003	0.04	%/W
I_{adj}	Adjustment Pin Current		65	100		65	100	μA
ΔI_{adj}	Adjustment Pin Current Change ($T_{amb} = +25^{\circ}\text{C}$, $10\text{mA} \leq I_O \leq I_{O(max)} $, $3\text{V} \leq V_I - V_O \leq 40\text{V}$)		2	5		2	5	μA
K_{VI}	Line Regulation ($3\text{V} \leq V_I - V_O \leq 40\text{V}$) - Note 2		0.02	0.05		0.02	0.07	%/V
K_{VO}	Load Regulation ($10\text{mA} \leq I_O \leq I_{O(max)} $) - Note 2 $V_O \leq 5\text{V}$ $V_O \geq 5\text{V}$		20 0.3	50 1		20 0.3	70 1.5	mV %
$ I_{O(min)} $	Minimum Load Current $ V_I - V_O \leq 40\text{V}$ $ V_I - V_O \leq 40\text{V}$		2.5 1.2	5 3		2.5 1.5	10 6	mA
I_{OS}	Short-circuit Output Current $ V_I - V_O \leq 15\text{V}$ $ V_I - V_O = 40\text{V}$, $T_j = +25^{\circ}\text{C}$	1.5 0.24	2.2 0.4		1.5 0.15	2.2 0.4		A
V_{NO}	RMS Output Noise (% of V_O) ($T_{amb} = +25^{\circ}\text{C}$, $10\text{Hz} \leq f \leq 10\text{kHz}$)		0.003			0.003		%
R_{VI}	Ripple Rejection Ratio $V_O = -10\text{V}$, $f = 120\text{Hz}$ $C_{adj} = 10\mu\text{F}$	66	60 77		66	60 77		dB
K_{VT}	Temperature Stability ($T_{min} \leq T_j \leq T_{max}$)		0.6			0.6		%
K_{VH}	Long Term Stability ($T_{amb} = +125^{\circ}\text{C}$, 1000H)		0.3	1		0.3	1	%

Notes : 1. Although power dissipation is internally limited, these specifications are applicable for power dissipation of :

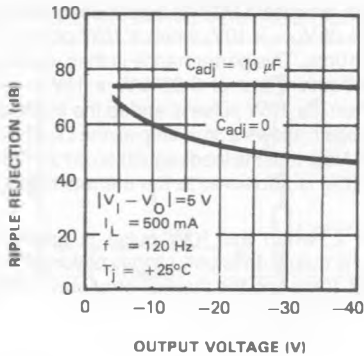
- 15W for TO-220
- 20W for TO-3 Package

 $I_{O(max)}$ is :

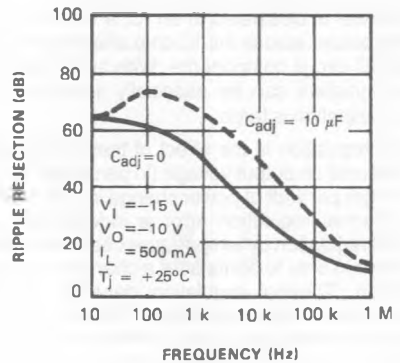
- 1.5A
2. Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle. Changes in output voltage due to heating effects are covered under the specification for thermal regulation.



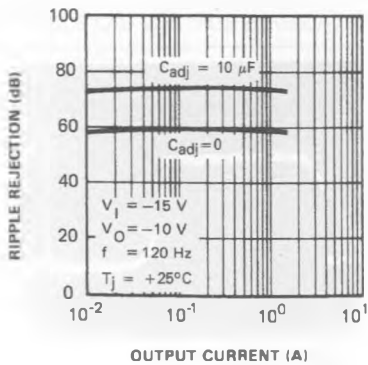
RIPPLE REJECTION VERSUS OUTPUT VOLTAGE



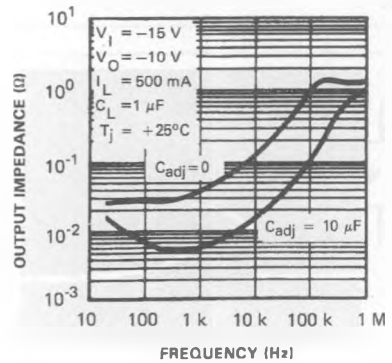
RIPPLE REJECTION VERSUS FREQUENCY



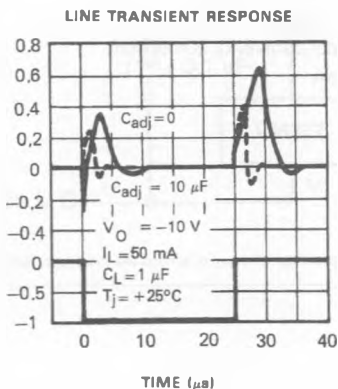
RIPPLE REJECTION VERSUS OUTPUT CURRENT



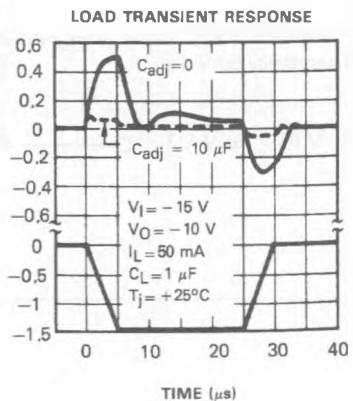
OUTPUT IMPEDANCE



INPUT VOLTAGE CHANGE (V) OUTPUT VOLTAGE DEVIATION (V)



LOAD CURRENT (A) OUTPUT VOLTAGE DEVIATION (V)



THERMAL REGULATION

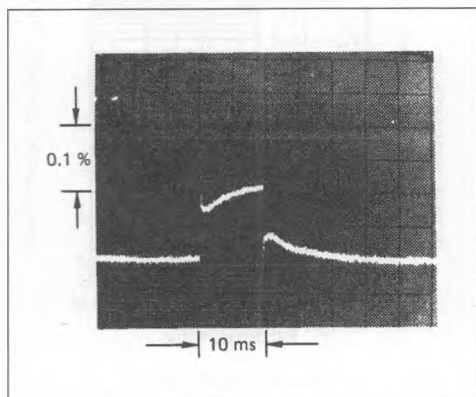
When power is dissipated in an IC, a temperature gradient occurs across the IC chip affecting the individual IC circuit components. With an IC regulator, this gradient can be especially severe since power dissipation is large.

Thermal regulation is the effect of these temperature gradients on output voltage (in percentage output change) per watt of power change in a specified time. Thermal regulation error is independent of electrical regulation or temperature coefficient, and occurs within 5ms to 50ms after a change in power dissipation. Thermal regulation depends on IC layout as well as electrical design. The thermal regulation of a voltage regulator is defined as the percentage change of V_O , per watt, within the first 10ms after a step of power, is applied.

In figure 1, a typical LM337's output drifts only 3mV for 0.03% of $V_O = -10V$ when a 10W pulse is applied for 10ms. This performance is thus well inside the specification limit of $0.02\%/W \times 10W = 0.2\%$ max. When the 10W pulse is ended the thermal regulation again shows a 3mV step as the LM337 chip cools off. Note that the load regulation error of about 8mV(0.08%) is additional to the thermal regulation error.

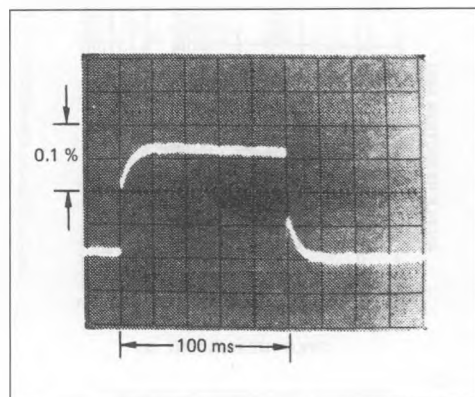
In figure 2, when the 10W pulse is applied for 100ms, the output drifts only slightly beyond the drift in the first 10ms and the thermal error stays well within 0.1% (10mV).

Figure 1.

LM 337, $V_O = -10V$ $V_I - V_O = -40V$ $I_L = 0A \rightarrow 0.25A \rightarrow 0A$

Vertical sensitivity 5mV/div.

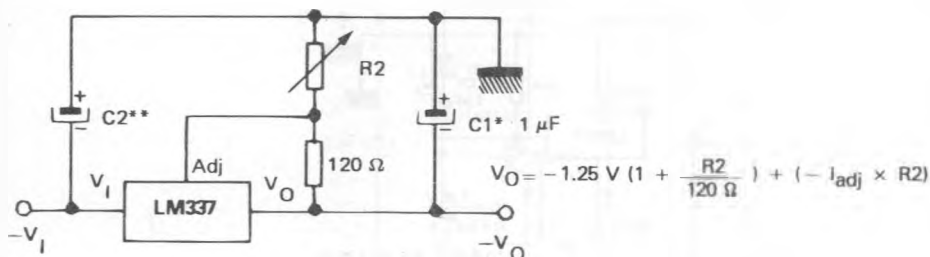
Figure 2.

LM 337, $V_O = -10V$ $V_I - V_O = -40V$ $I_L = 0A \rightarrow 0.25A \rightarrow 0A$

Horizontal sensitivity 20msN/div.

TYPICAL APPLICATIONS

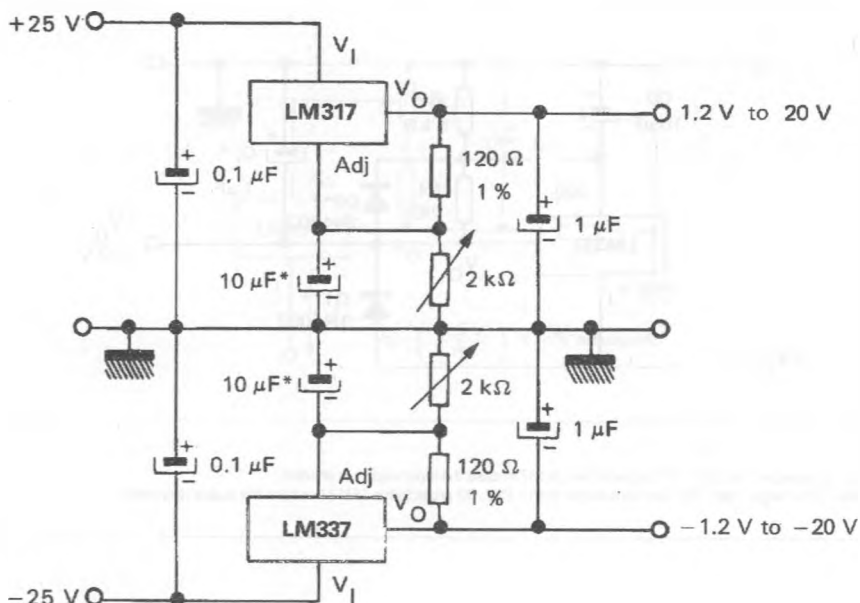
ADJUSTABLE NEGATIVE VOLTAGE REGULATOR



* C1 = 1 μF solid tantalum or 10 μF aluminium electrolytic required for stability.

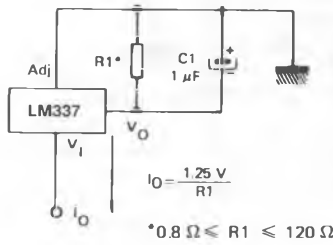
** C2 = 1 μF solid tantalum is required only if regulator is more than 10cm from power supply filter capacitor.

ADJUSTABLE LAB VOLTAGE REGULATOR

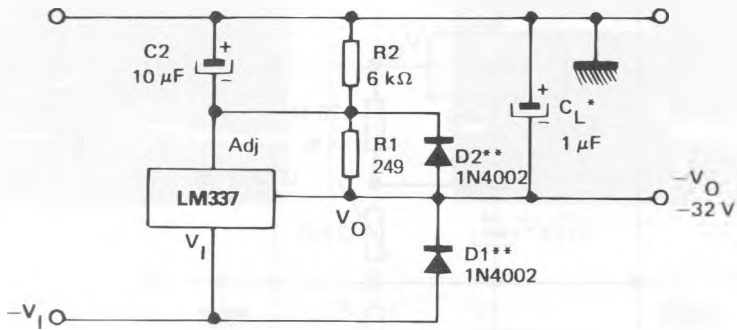


* The 10 μF capacitors are optimal to improve ripple rejection.

CURRENT REGULATOR

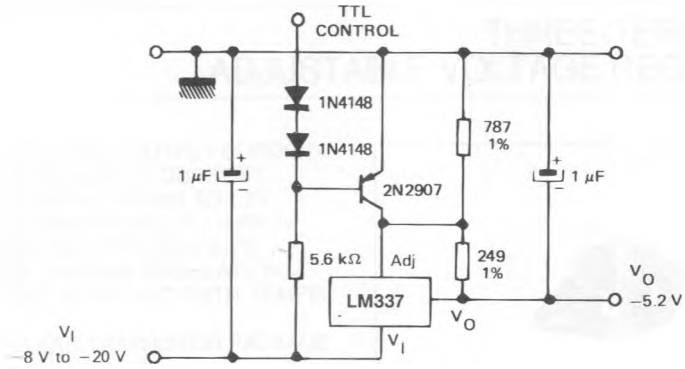


NEGATIVE REGULATOR WITH PROTECTION DIODES



- * When C_L is larger than $20 \mu\text{F}$, D1 protects the LM137 in case the input supply is shorted.
- * When $C2$ is larger than $10 \mu\text{F}$ and V_O is larger than -25V , D2 protects the LM137 in case the output is shorted.

* - 5.2V REGULATOR WITH ELECTRONIC SHUTDOWN



* Minimum output = -1.3V when control input is low.

ADJUSTABLE CURRENT REGULATOR

