LM237, LM337
3-TERMINAL ADJUSTABLE REGULATORS

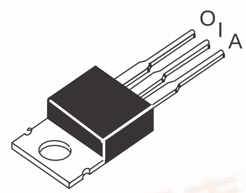
SLVS047C – NOVEMBER 1981 – REVISED JULY 1999

- **Output Voltage Range Adjustable From –1.2 V to –37 V**
- **Output Current Capability of 1.5 A Max**
- **Input Regulation Typically 0.01% Per Input-Voltage Change**
- **Output Regulation Typically 0.3%**
- **Peak Output Current Constant Over Temperature Range of Regulator**
- **Ripple Rejection Typically 77 dB**
- **Direct Replacement for National Semiconductor LM237 and LM337**

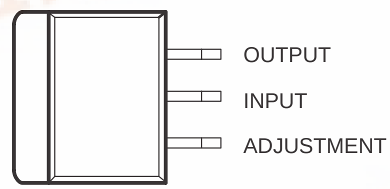
KC PACKAGE
(TOP VIEW)

The INPUT terminal is in electrical contact with the mounting base.

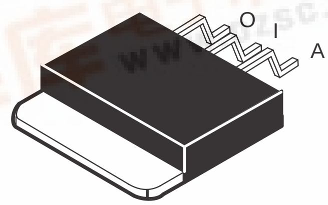
TO-220AB



KTE PACKAGE
(TOP VIEW)



The INPUT terminal is in electrical contact with the mounting base.



description

The LM237 and LM337 are adjustable 3-terminal negative-voltage regulators capable of supplying in excess of –1.5 A over an output voltage range of –1.2 V to –37 V. They are exceptionally easy to use, requiring only two external resistors to set the output voltage and one output capacitor for frequency compensation. The current design has been optimized for excellent regulation and low thermal transients. In addition, the LM237 and LM337 feature internal current limiting, thermal shutdown, and safe-area compensation, making them virtually immune to failure by overloads.

The LM237 and LM337 serve a wide variety of applications, including local on-card regulation, programmable output-voltage regulation, and precision current regulation.

The LM237 is characterized for operation over the virtual junction temperature range of –25°C to 150°C. The LM337 is characterized for operation over the virtual junction temperature range of 0°C to 125°C.

AVAILABLE OPTIONS

T_J	PACKAGED DEVICES		CHIP FORM (Y)
	HEAT-SINK MOUNTED (KC)	PLASTIC FLANGE MOUNTED (KTE)	
–25°C to 150°C	LM237KC	LM237KTE	—
0°C to 125°C	LM337KC	LM337KTE	LM337Y

The KTE package is only available taped and reeled. Add the R suffix to the device type (e.g., LM237KTER). Chip forms are tested at 25°C.

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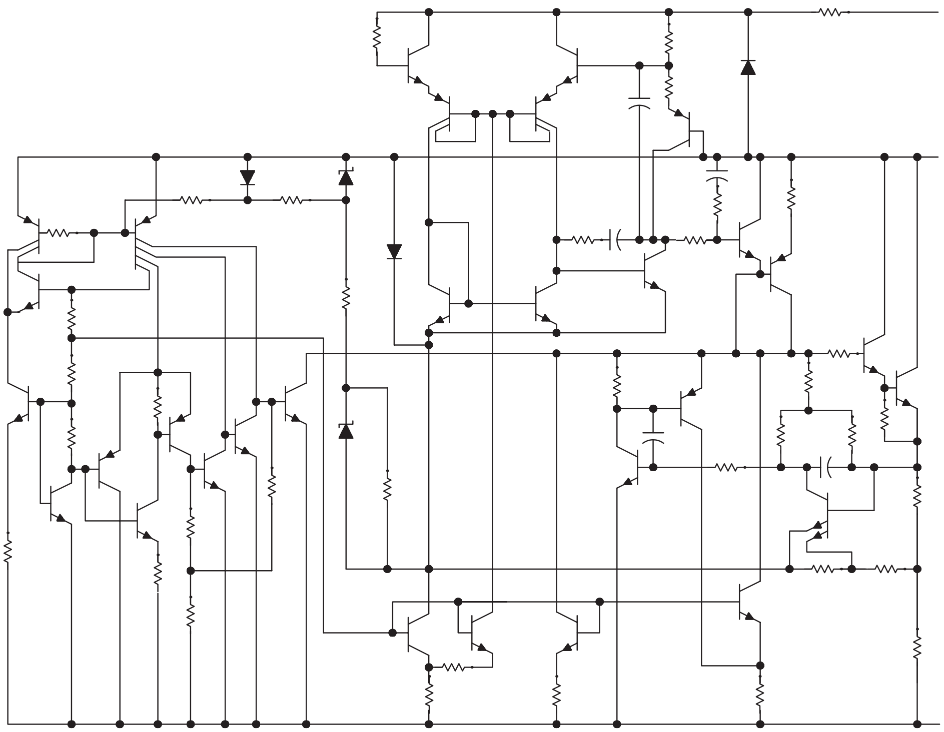
schematic diagram



absolute maximum ratings over operating temperature ranges (unless otherwise noted)†

Input-to-output differential voltage, $V_I - V_O$ . . . . –40 V
Package thermal impedance, θ_{JA} (see Notes 1 and 2): KC package . . . . 22°C/W
KTE package . . . . 23°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°C
Storage temperature range, T_{stg} . . . . –65°C to 150°C

† Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can impact reliability. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.

2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions

			MIN	MAX	UNIT
Output current, I_O	$\lvert V_I - V_O\rvert \le 40$ V,	$P \le 15$ W	10	1500	mA
	$\lvert V_I - V_O\rvert \le 10$ V,	$P \le 15$ W	6	1500	
Operating virtual junction temperature, T_J		LM237	–25	150	°C
		LM337	0	125	

electrical characteristics over recommended ranges of operating virtual junction temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		LM237 MIN	LM237 TYP	LM237 MAX	LM337 MIN	LM337 TYP	LM337 MAX	UNIT
Input regulation‡	$V_I - V_O$ = –3 V to –40 V	T_J = 25°C		0.01	0.02		0.01	0.04	%/V
		T_J = MIN to MAX		0.02	0.05		0.02	0.07	
Ripple rejection	V_O = –10 V,	f = 120 Hz		60			60		dB
	V_O = –10 V, f = 120 Hz,	C_{ADJ} = 10 µF	66	77		66	77		
Output regulation	I_O = 10 mA to 1.5 A, T_J = 25°C	$\|V_O\| \le 5$ V			25			50	mV
		$\|V_O\| \ge 5$ V		0.3%	0.5%		0.3%	1%	
	I_O = 10 mA to 1.5 A	$\|V_O\| \le 5$ V			50			70	mV
		$\|V_O\| \ge 5$ V			1%			1.5%	
Output-voltage change with temperature	T_J = MIN to MAX			0.6%			0.6%		
Output-voltage long-term drift	After 1000 h at T_J = MAX and $V_I - V_O$ = –40 V			0.3%	1%		0.3%	1%	
Output noise voltage	f = 10 Hz to 10 kHz,	T_J = 25°C		0.003%			0.003%		
Minimum output current to maintain regulation	$\|V_I - V_O\| \le 40$ V			2.5	5		2.5	10	mA
	$\|V_I - V_O\| \le 10$ V			1.2	3		1.5	6	
Peak output current	$\|V_I - V_O\| \le 15$ V		1.5	2.2		1.5	2.2		A
	$\|V_I - V_O\| \le 40$ V,	T_J = 25°C	0.24	0.4		0.15	0.4		
Adjustment-terminal current				65	100		65	100	µA
Change in adjustment-terminal current	$V_I - V_O$ = – 2.5 V to –40 V, I_O = 10 mA to MAX	T_J = 25°C,		2	5		2	5	µA
Reference voltage (output to ADJ)	$V_I - V_O$ = – 3 V to –40 V, I_O = 10 mA to 1.5 A, P ≤ rated dissipation	T_J = 25°C	–1.225	–1.25	–1.275	–1.213	–1.25	–1.287	V
		T_J = MIN to MAX	–1.2	–1.25	–1.3	–1.2	–1.25	–1.3	
Thermal regulation	Initial T_J = 25°C,	10-ms pulse		0.002	0.02		0.003	0.04	%/W

† Unless otherwise noted, these specifications apply for the following test conditions $|V_I - V_O|$ = 5 V and I_O = 0.5 A. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions. All characteristics are measured with a 0.1-µF capacitor across the input and a 1-µF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

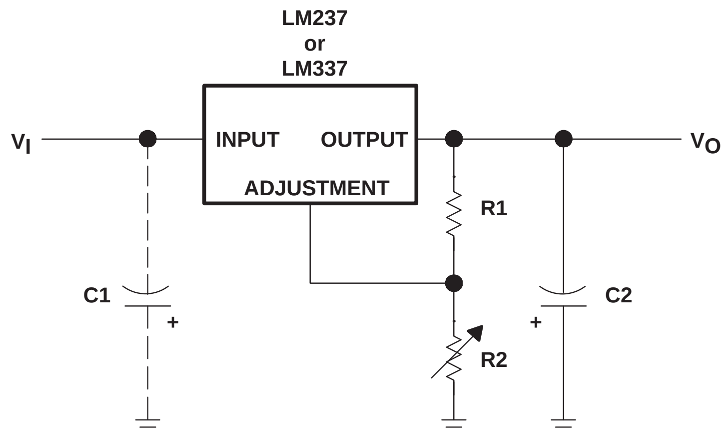
electrical characteristics, $T_J = 25°C$

PARAMETER	TEST CONDITIONS†		LM237, LM337 MIN	TYP	MAX	UNIT
Input regulation‡	$V_I - V_O = -3$ V to –40 V			0.01	0.04	%/V
Ripple rejection	$V_O = -10$ V,	f = 120 Hz		60		dB
	$V_O = -10$ V, $C_{ADJ} = 10$ µF,	f = 120 Hz	66	77		
Output regulation	$I_O = 10$ mA to 1.5 A	$\|V_O\| \le 5$ V			50	mV
		$\|V_O\| \ge 5$ V		0.3%	1%	
Output noise voltage	f = 10 Hz to 10 kHz			0.003%		
Minimum output current to maintain regulation	$\|V_I - V_O\| \le 40$ V			2.5	10	mA
	$\|V_I - V_O\| \le 10$ V			1.5	6	
Peak output current	$\|V_I - V_O\| \le 15$ V		1.5	2.2		A
	$\|V_I - V_O\| \le 40$ V		0.15	0.4		
Adjustment-terminal current				65	100	µA
Change in adjustment-terminal current	$V_I - V_O = -2.5$ V to –40 V, $I_O = 10$ mA to MAX			2	5	µA
Reference voltage (output to ADJ)	$V_I - V_O = -3$ V to –40 V, $I_O = 10$ mA to 1.5 A, P ≤ rated dissipation		–1.213	–1.25	–1.287	V

† Unless otherwise noted, these specifications apply for the following test conditions $|V_I - V_O| = 5$ V and $I_O = 0.5$ A. All characteristics are measured with a 0.1-µF capacitor across the input and a 1-µF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ Input regulation is expressed here as the percentage change in output voltage per 1-V change at the input.

APPLICATION INFORMATION

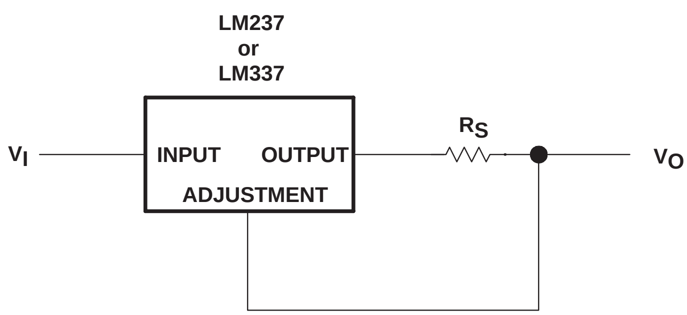


R1 is typically 120 Ω.

$$R2 = R1\left(\frac{-V_O}{-1.25} - 1\right)$$ where V_O is the output in volts.

C1 is a 1-µF solid tantalum capacitor required only if the regulator is more than 10 cm (4 in) from the power-supply filter capacitor.
C2 is a 1-µF solid tantalum or 10-µF aluminum electrolytic capacitor required for stability.

Figure 1. Adjustable Negative-Voltage Regulator



$$R_S = \frac{1.25\ V}{I_{LIMIT}}$$

Figure 2. Current-Limiting Circuit

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