National Semiconductor

LH0037/LH0037C Low Cost Instrumentation Amplifier

General Description

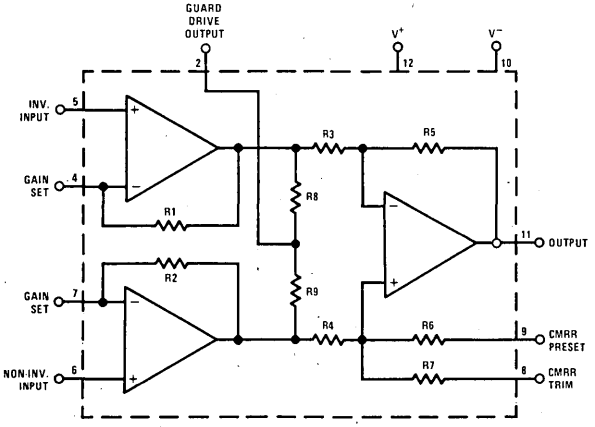
The LH0037/LH0037C is a true instrumentation amplifier designed for precision differential signal processing. Extremely high accuracy can be obtained due to the 300 MΩ input impedance and excellent 100 dB common-mode rejection ratio. It is packaged in a hermetic TO-8 package. Gain is programmable with one external resistor from 1 to 1000. Power supply operating range is between ±5V and ±22V.

The LH0037 is specified for operation over the −55°C to +125°C temperature range and the LH0037C is specified for operation over the −25°C to +85°C temperature range.

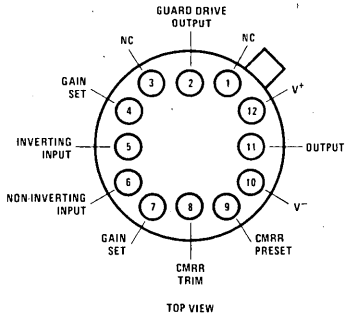
Features

- High input impedance 300 MΩ
- High CMRR 100 dB
- Single resistor gain adjust 1 to 1000
- Low power 250 mW
- Wide supply range ±5V to ±22V
- Guard drive output

Equivalent Circuit and Connection Diagrams

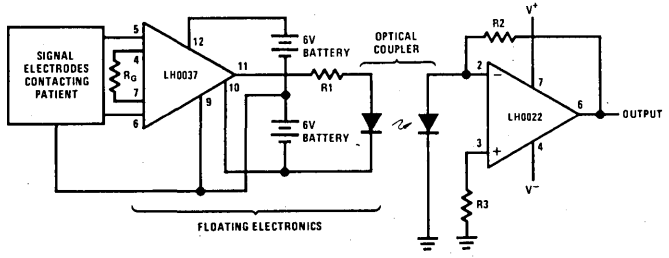


Metal Can Package



Order Number LH0037G or LH0037CG
See Package H12B

Typical Applications



Isolation Amplifier for Medical Telemetry

Absolute Maximum Ratings

Supply Voltage	±22V	Short Circuit Duration	Continuous
Differential Input Voltage	±30V	Operating Temperature Range	
Input Voltage Range	$\pm V_S$	LH0037	−55°C to +125°C
Shield Drive Voltage	$\pm V_S$	LH0037C	−25°C to +85°C
CMRR Preset Voltage	$\pm V_S$	Storage Temperature Range	−65°C to +150°C
CMRR Trim Voltage	$\pm V_S$	Lead Temperature (Soldering, 10 seconds)	300°C
Power Dissipation (Note 3)	1.5W		

Electrical Characteristics (Notes 1 and 2)

PARAMETER	CONDITIONS	LIMITS						UNITS
		LH0037			LH0037C			
		MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage (V_{IOS})	R_S = 1.0 kΩ, T_A = 25°C		0.5	1.0		1.0	2.0	mV
	R_S = 1.0 kΩ			2.0			3.0	mV
Output Offset Voltage (V_{OOS})	R_S = 1.0 kΩ, T_A = 25°C		2.0	5.0		5.0	10	mV
	R_S = 1.0 kΩ			6.0			12	mV
Input Offset Voltage Tempco ($\Delta V_{IOS}/\Delta T$)	$R_S \leq$ 1.0 kΩ		10			10		µV/°C
Output Offset Voltage Tempco ($\Delta V_{OOS}/\Delta T$)			15			15		µV/°C
Overall Offset Referred to Input (V_{OS})	A_V = 1.0		2.5			6.0		mV
	A_V = 10		0.7			1.5		mV
	A_V = 100		0.52			1.05		mV
	A_V = 1000		0.502			1.005		mV
Input Bias Current (I_B)	T_A = 25°C		200	500		200	500	nA
				1.5			0.8	µA
Input Offset Current (I_{OS})	T_A = 25°C			100			250	nA
				200			250	
Small Signal Bandwidth	A_V = 1.0, R_L = 2 kΩ		350			350		kHz
	A_V = 10, R_L = 2 kΩ		35			35		kHz
	A_V = 100, R_L = 2 kΩ		3.5			3.5		kHz
	A_V = 1000, R_L = 2 kΩ		350			350		Hz
Full Power Bandwidth	V_{IN} = ±10V, R_L = 2 kΩ A_V = 1		5.0			5.0		kHz
Input Voltage Range	Differential	±12			±12			V
	Common Mode	±12			±12			V
Gain Nonlinearity			0.03			0.03		%
Deviation From Gain Equation Formula	A_V = 1 to 1000		±0.3	±1		±1.0	±3	%
PSRR	±5.0V ≤ V_S ≤ ±15V, A_V = 1.0		1.0	2.5		1.0	5	mV/V
	±5.0V ≤ V_S ≤ ±15V, A_V = 100		0.05	0.25		0.10	0.25	mV/V
CMRR	A_V = 1.0 DC to		1.0	2.5		2.5	5.0	mV/V
	A_V = 10 100 Hz		0.1	0.25		0.25	1.0	mV/V
	A_V = 100 ΔR_S = 1.0k		25	100		25	100	µV/V
Output Voltage	R_L = 2 kΩ	10	13		10	13		V
Output Resistance			0.5			0.5		Ω
Supply Current			4.5	8.4		4.5	8.4	mA
Slew Rate	ΔV_{IN} = ±10V, R_L = 2 kΩ, A_V = 1.0		0.5			0.5		V/µs
Settling Time	To ±10 mV, R_L = 2 kΩ ΔV_{OUT} = 1.0V							
	A_V = 1.0		3.8			3.8		µs
	A_V = 100		180			180		µs

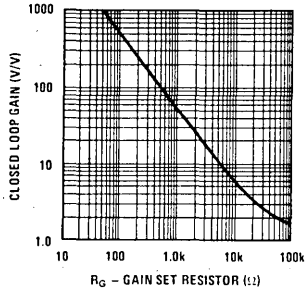
Note 1: Unless otherwise specified, all specifications apply for V_S = ±15V, pin 9 grounded, −25°C to +85°C for the LH0037C and −55°C to +125°C for the LH0037.

Note 2: All typical values are for T_A = 25°C.

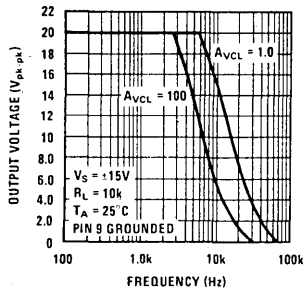
Note 3: The maximum junction temperature is 150°C. For operation at elevated temperature derate the G package on a thermal resistance of 90°C/W, above 25°C.

Typical Performance Characteristics

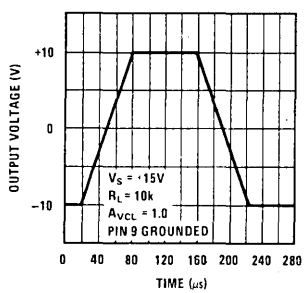
Closed Loop Voltage Gain



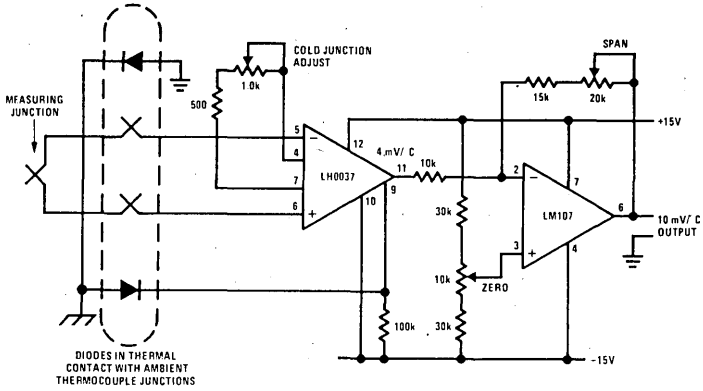
Output Voltage Swing vs Frequency



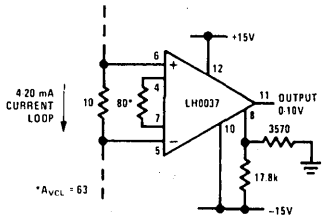
Large Signal Pulse Response



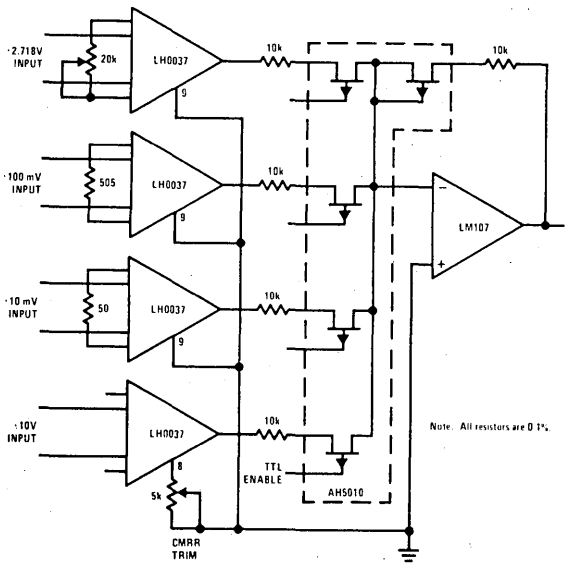
Typical Applications (Cont'd)



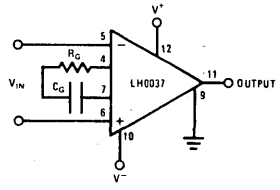
Thermocouple Amplifier with Cold Junction Compensation

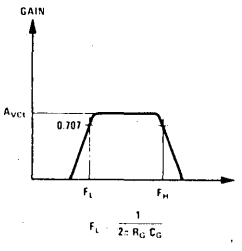


Process Control Interface



Pre MUX Signal Conditioning





High Pass Filter