National Semiconductor

LH0037/LH0037C Low Cost Instrumentation Amplifier

General Description

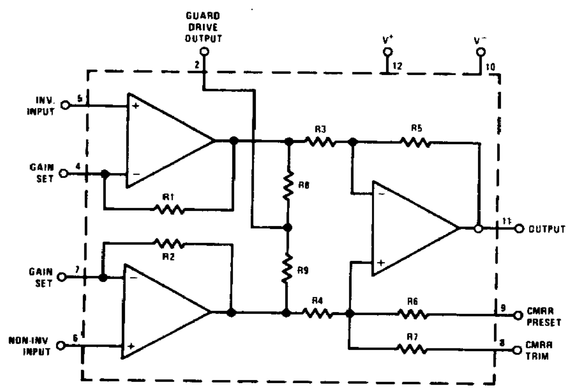
The LH0037/LH0037C is a true instrumentation amplifier designed for precision differential signal processing. Extremely high accuracy can be obtained due to the 300 MΩ input impedance and excellent 100 dB common-mode rejection ratio. It is packaged in a hermetic TO-8 package Gain is programmable with 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.

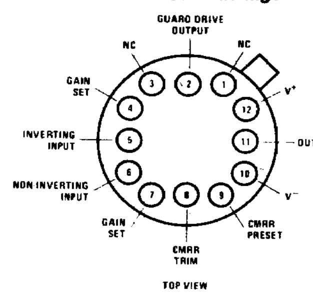
Features

- High input impedance 300 MΩ
- High CMRR 10 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



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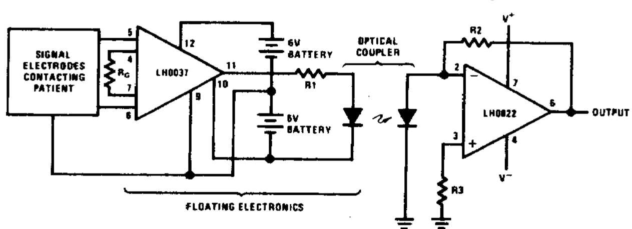
Order Number LH0037G or LH0037CG
See Package H12B

Typical Applications

Isolation Amplifier for Medical Telemetry



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Absolute Maximum Ratings

Supply Voltage	±22V	Short Circuit Duration	Continuous
Differential Input Voltage	±30V	Operating Temperature Range	
Input Voltage Range	±Vs	LH0037	−55°C to +125°C
Shield Drive Voltage	±Vs	LH0037C	−25°C to +85°C
CMRR Preset Voltage	±Vs	Storage Temperature Range	−65°C to +150°C
CMRR Trim Voltage	±Vs	Lead Temp. (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})	$R_S = 1.0\ k\Omega$, $T_A = 25°C$ $R_S = 1.0\ k\Omega$		0.5	1.0 2.0		1.0	20 30	mV mV
Output Offset Voltage (V_{OOS})	$R_S = 1.0\ k\Omega$, $T_A = 25°C$ $R_S = 1.0\ k\Omega$		20	5.0 6.0		5.0	10 12	mV mV
Input Offset Voltage Tempco ($\Delta V_{IOS}/\Delta T$)	$R_S \le 1.0\ k\Omega$		10			10		μV/°C
Output Offset Voltage Tempco ($\Delta V_{OOS}/\Delta T$)			15			15		μV/°C
Overall Offset Referred to	$A_V = 1.0$		2.5			6.0		mV
Input (V_{OS})	$A_V = 10$ $A_V = 100$ $A_V = 1000$		0.7 0.52 0.502			1.5 1.05 1.005		mV mV mV
Input Bias Current (I_B)	$T_A = 25°C$		200	500 1.5		200	200 0.8	nA μA
Input Offset Current (I_{OS})	$T_A = 25°C$			100 200			250 250	nA
Small Signal Bandwidth	$A_V = 1.0$, $R_L = 2\ k\Omega$ $A_V = 10$, $R_L = 2\ k\Omega$ $A_V = 100$, $R_L = 2\ k\Omega$ $A_V = 1000$, $R_L = 2\ k\Omega$		350 35 3.5 350			350 35 3.5 350		kHz kHz kHz Hz
Full Power Bandwidth	$V_{IN} = \pm 10V$, $R_L = 2\ k\Omega$ $A_V = 1$		5.0			5.0		kHz
Input Voltage Range	Differential Common Mode	±12 ±12			±12 ±12			V V
Gain Nonlinearity			0.03			0.03		%
Deviation From Gain Equation Formula	$A_V = 1$ to 1000		±0.3	±1		±1.0	±3	%
PSRR	$\pm 5.0V \le V_S \le \pm 15V$, $A_V = 1.0$ $\pm 5.0V \le V_S \le \pm 15V$, $A_V = 100$		1.0 0.05	2.5 0.25		1.0 0.10	5 0.25	mV/V mV/V
CMRR	$A_V = 1.0$ DC to $A_V = 10$ 100 Hz $A_V = 100$ $\Delta R_S = 1.0k$		1.0 0.1 25	2.5 0.25 100		2.5 0.25 25	5.0 1.0 100	mV/V mV/V μV/V
Output Voltage	$R_L = 2\ k\Omega$	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	$\Delta V_{IN} = \pm 10V$, $R_L = 2\ k\Omega$, $A_V = 1.0$		0.5			0.5		V/μS
Settling Time	To ±10 mV, $R_L = 2\ k\Omega$ $\Delta V_{OUT} = 1.0V$ $A_V = 1.0$ $A_V = 100$		3.8 180			3.8 180		μS μS

Note 1: Unless otherwise specified, all specifications apply for $V_S = \pm 15V$, 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.

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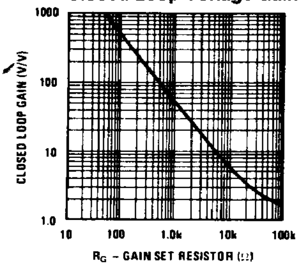
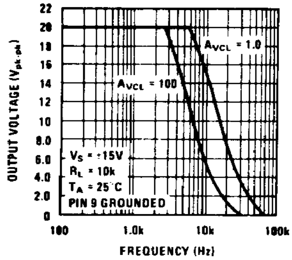
Typical Performance Characteristics

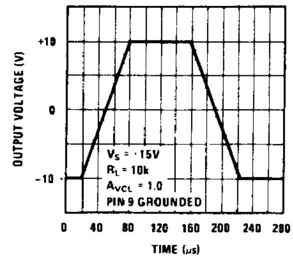
Closed Loop Voltage Gain



Output Voltage Swing vs Frequency



Large Signal Pulse Response



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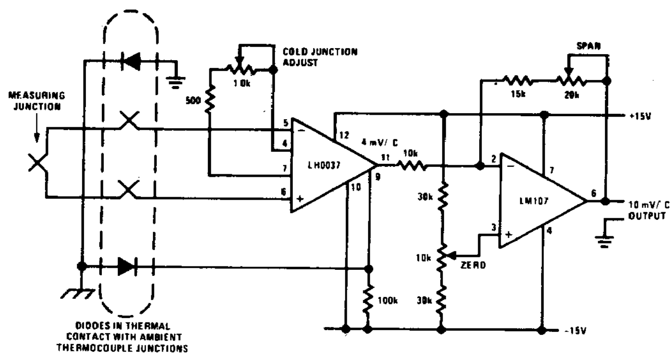
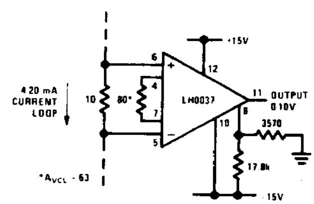
Typical Applications (Continued)

Thermocouple Amplifier with Cold Junction Compensation



Process Control Interface



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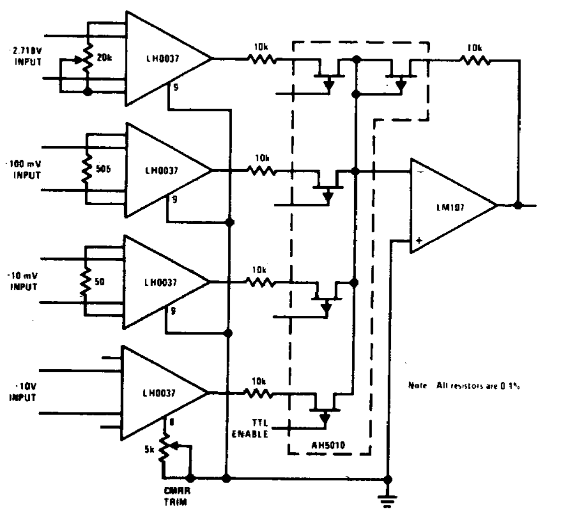
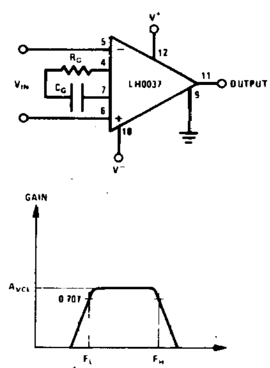
Pre MUX Signal Conditioning



High Pass Filter



$$F_L = \frac{1}{2\pi R_G C_G}$$

F_H = a function of selected A_{VCL}

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