National Semiconductor

LH0037/LH0037C Low Cost Instrumentation Amplifier

General Description

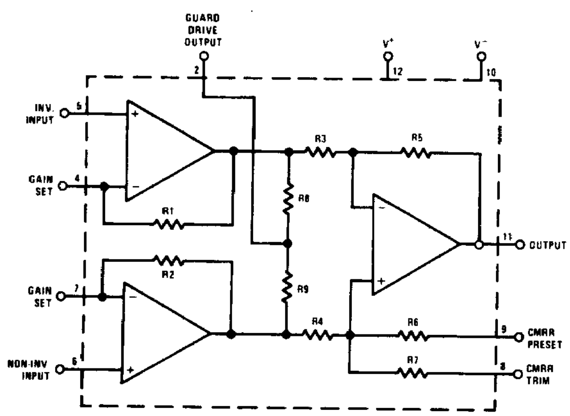
The LH0037/LH0037C is a true instrumentation amplifier designed for precision differential signal processing. Extremely high accuracy can be obtained due to the 300 MΩ input impedance and excellent 100 dB common-mode rejection ratio. It is packaged in a hermetic TO-8 package Gain is programmable with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

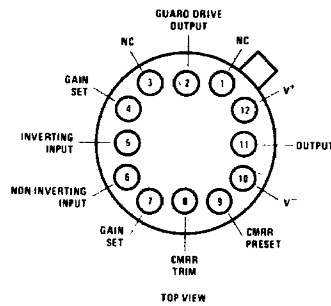
Features

- 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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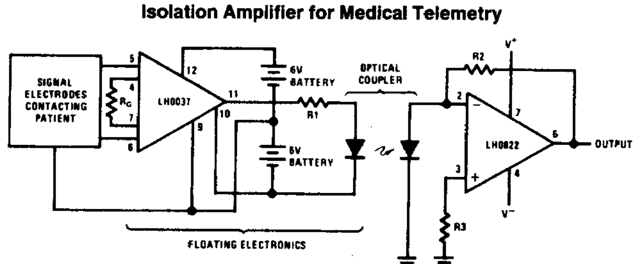
Order Number LH0037G or LH0037CG
See Package H12B

Typical Applications

Isolation Amplifier for Medical Telemetry



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Absolute Maximum Ratings

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

Electrical Characteristics (Notes 1 and 2)

Parameter	Conditions	Limits						Units
		LH0037			LH0037C			
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage (V_{IOS})	$R_S=1.0\ k\Omega$, $T_A=25°C$		0.5	1.0		1.0	20	mV
	$R_S=1.0\ k\Omega$			2.0			30	mV
Output Offset Voltage (V_{OOS})	$R_S=1.0\ k\Omega$, $T_A=25°C$		20	5.0		5.0	10	mV
	$R_S=1.0\ k\Omega$			6.0			12	mV
Input Offset Voltage Tempco ($\Delta V_{IOS}/\Delta T$)	$R_S \leq 1.0\ k\Omega$		10			10		µV/°C
Output Offset Voltage Tempco ($\Delta V_{OOS}/\Delta T$)			15			15		µV/°C
Overall Offset Referred to 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	200	nA
				1.5			0.8	µA
Input Offset Current (I_{OS})	$T_A=25°C$			100			250	nA
				200			250	
Small Signal Bandwidth	$A_V=1.0$, $R_L=2\ k\Omega$		350			350		kHz
	$A_V=10$, $R_L=2\ k\Omega$		35			35		kHz
	$A_V=100$, $R_L=2\ k\Omega$		3.5			3.5		kHz
	$A_V=1000$, $R_L=2\ k\Omega$		350			350		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	±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	$\pm 5.0V \leq V_S \leq \pm 15V$, $A_V=1.0$		1.0	2.5		1.0	5	mV/V
	$\pm 5.0V \leq V_S \leq \pm 15V$, $A_V=100$		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
	$A_V=100$ $\Delta R_S=1.0k$		25	100		25	100	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, $R_L=2\ k\Omega$, $\Delta V_{OUT}=1.0V$, $A_V=1.0$		3.8			3.8		µS
	$A_V=100$		180			180		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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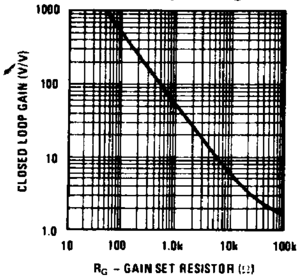
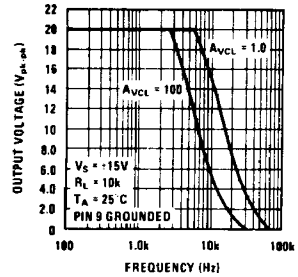
Typical Performance Characteristics

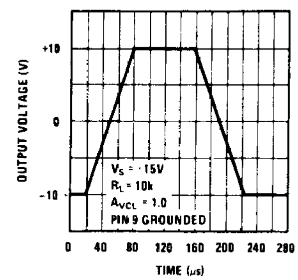
Closed Loop Voltage Gain



Output Voltage Swing vs Frequency



Large Signal Pulse Response



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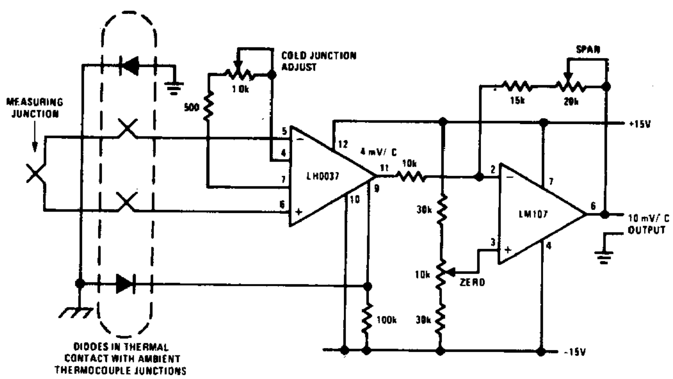
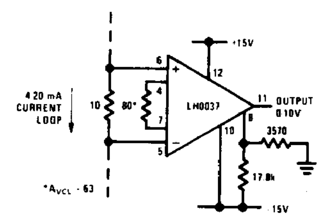
Typical Applications (Continued)

Thermocouple Amplifier with Cold Junction Compensation



Process Control Interface



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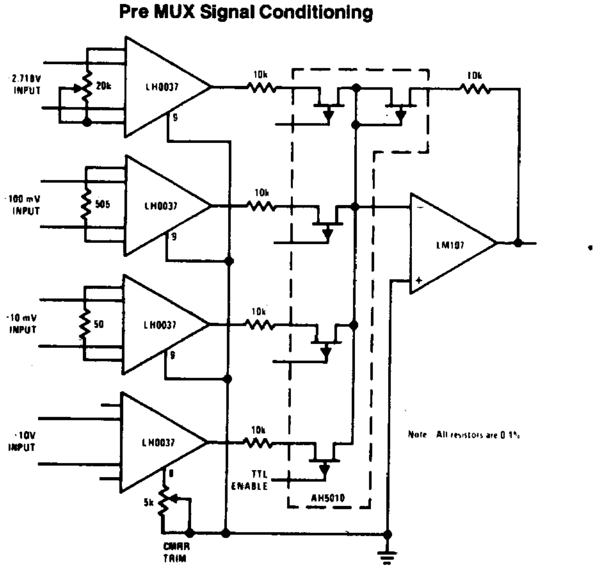
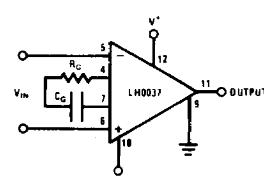
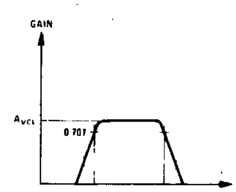
Pre MUX Signal Conditioning



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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