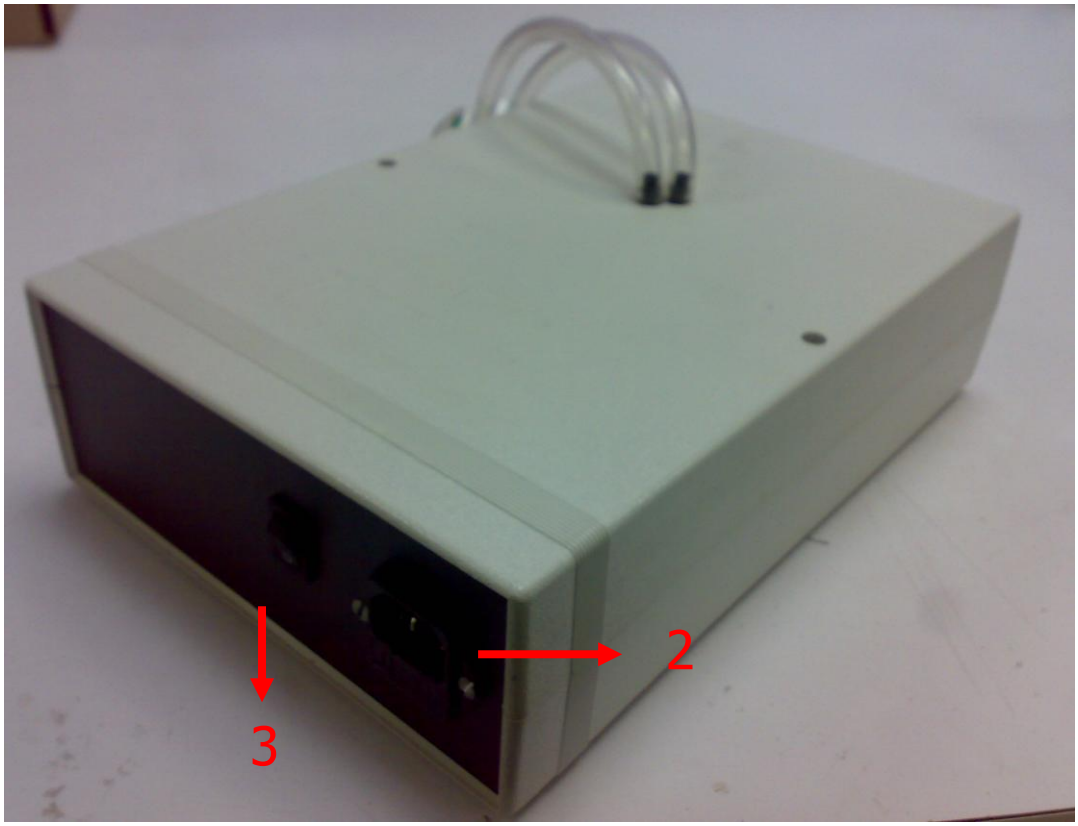
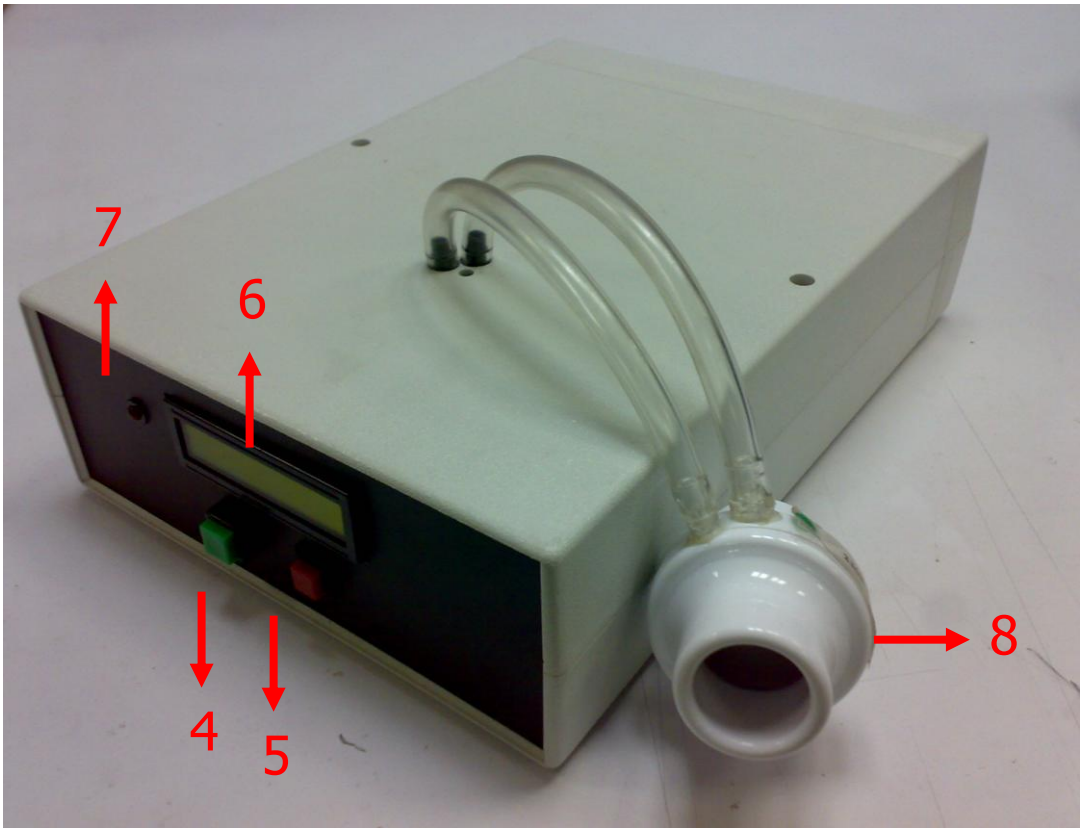
APÉNDICE A

MANUAL DE USUARIO

A. 1 COMPONENTES DEL ESPIRÓMETRO DE FLUJO





1. Cable de alimentación.
2. Alimentación.
3. Interruptor de encendido.
4. Botón de inicio/fin de la prueba.
5. Botón de reset.
6. Display.
7. Led indicador del estado de la prueba.
8. Transductor de flujo -*Neumotacógrafo*-

A. 2 PROCEDIMIENTO DE FUNCIONAMIENTO

1. Para alimentar el espirómetro, primero es necesario conectarlo mediante un cable de alimentación (1), de la línea eléctrica de 120 [V_{AC}] hacia el conector del espirómetro (2). Paso seguido, para iniciar el funcionamiento del mismo, se activa el interruptor de encendido (3).

2. En este momento, la pantalla del display (6) mostrará la leyenda "sin señal", y el led indicador del estado de la prueba (7) permanecerá intermitente.

3. Antes de comenzar la prueba espirométrica, se coloca una boquilla desechable en el neumotacógrafo (8), en el lado que está marcado con la leyenda *"patien side"*. Para comenzar la prueba, se presiona por unos instantes el botón de reset *–botón rojo-* (5) para volver a condiciones iniciales al integrador del espirómetro, después se presiona el botón de inicio/fin de la prueba *–botón verde-* (4). En este momento el display mostrará dos leyendas: en la primera línea se leerá el Volumen de aire espirado por el paciente, medido en litros [L], y en la segunda línea se leerá la velocidad de salida del Flujo aéreo, medido en litros/segundo [L/S]. Ambas variables deberán marcar 0.00. Así mismo, el led indicador del estado de la prueba (7) permanecerá encendido. Esto indica que el espirómetro esta listo para su realizar su función.

4. Se indica al paciente que haga una inhalación profunda, mientras toma el neumotacógrafo en sus manos. Antes de espirar, introduce la boquilla desechable a su boca y sopla hasta que parezca que no sale más aire de los pulmones. En el display se leerá la cantidad de volumen de aire que desalojó el paciente en la prueba. Después, para realizar una segunda prueba, se presiona nuevamente por unos instantes el botón de reset -*botón rojo-,* para que las medidas vuelven a su estado inicial, es decir, el display marcará 0.00 en ambas variables. Para seguir con la recolección de datos, se repite el paso 4 las veces que sea necesario según las medidas que se deseen tomar.

5. Para finalizar la prueba, se presiona nuevamente el botón de inicio/fin de la prueba -*botón verde-*. El display volverá a mostrar la leyenda "sin señal" y el led volverá a un estado intermitente.

APÉNDICE B

PROGRAMA PARA LA CONVERSIÓN ANALÓGICO-DIGITAL Y DESPLIEGUE DE DATOS EMPLEANDO UN MICROCONTROLADOR PIC16F877

```
#include <16F877.h>
#device ADC=10
#fuses HS,NOWDT,NOPROTECT,NOLVP,NOPUT,NOBROWNOUT,NOCPD,WRT
#use delay(clock=20000000)
#include <lcd.c>
int k;
long v;
long f;
float vol;
float flu;
float const resoluc=5.0/1024.0;
float const c=0.14;

void lectura_ad0(void)
{
        setup_adc_ports(RA0_ANALOG);
        setup_adc(ADC_CLOCK_INTERNAL);
        output_high(PIN_B1);
        set_adc_channel(0);
        delay_us(10);
        v=read_adc();
        vol=v*resoluc*2;
        lcd_gotoxy(1,1);
        printf(lcd_putc,"Volumen=%1.2f[L]", vol);
        delay_ms(50);
}

void lectura_ad1(void)
{
        setup_adc_ports(RA0_ANALOG);
        setup_adc(ADC_CLOCK_INTERNAL);
        output_high(PIN_B1);
        set_adc_channel(1);
        delay_us(10);
        f=read_adc();
        flu=(f*resoluc*2)-c;
        lcd_gotoxy(1,2);
        printf(lcd_putc,"Flujo=%1.2f[L/S]", flu);
        delay_ms(50);
}
```

```
void determina ()
{
        if (input(PIN_A2))
        k=1;
        else
        k=2;
}

void main()
{
        set_tris_b(0xff);
        set_tris_a(0xff);
        lcd_init();

        while(1)
        {
                determina();
                switch (k)
                {
                        case 1:
                        lectura_ad0();
                        lectura_ad1();
                        break;

                        case 2:
                        lcd_putc("\fSIN SEÑAL\n");
                        output_high(PIN_B1);
                        delay_ms(500);
                        output_low(PIN_B1);
                        delay_ms(500);
                        break;
                }
        }
}
```

APÉNDICE C

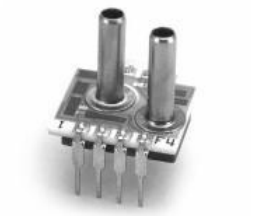
HOJAS DE DATOS COMPONENTES ELECTRÓNICOS

Product Data Sheet

GE NovaSensor

NPC-1210 Series

Low Pressure



Description

The NPC-1210 low pressure series of solid state pressure sensors are designed to provide the same cost effective solution as NovaSensor®'s other NPC-1210 pressure ranges. Packaged in a dual-in-line configuration, this NPC-1210 series is intended for printed circuit board mounting. Optional pressure port and lead configurations give superior flexibility in low profile applications where pressure connection orientation is critical.

The NPC-1210 series is based on NovaSensor®'s advanced SenStable® piezoresistive sensing technology. Silicon micromachining techniques are used to ion implant piezoresistive strain gages into a Wheatstone bridge configuration. The NPC-1210 offers the added advantage of superior temperature performance over the temperature compensated range of 0°C to +60°C. A gain set resistor is included to provide field interchangeability. The low pressure NPC-1210 series is available in pressure ranges from 0 to 10 inches of water to 0 to 1 psi.

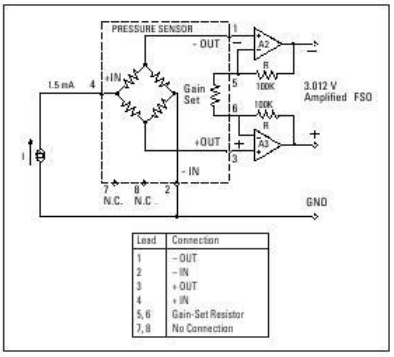
Features

- ±0.5% static accuracy
- Interchangeable
- Temperature compensated 0°C to 60°C
- PCB mountable package
- DIP package
- Solid state reliability
- Individual device traceability

Applications

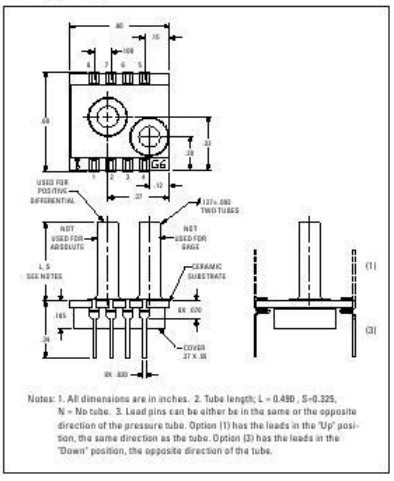
- Ventilation
- Air flow monitors
- Process control
- Respirators
- Medical equipment

Schematic Diagram



Lead	Connection
1	– OUT
2	– IN
3	+ OUT
4	+ IN
5, 6	Gain-Set Resistor
7, 8	No Connection

Package Diagram



Notes: 1. All dimensions are in inches. 2. Tube length; L = 0.490 , S=0.325, N = No tube. 3. Lead pins can be either be in the same or the opposite direction of the pressure tube. Option (1) has the leads in the 'Up' position, the same direction as the tube. Option (3) has the leads in the 'Down' position, the opposite direction of the tube.

Pressure Ranges

- Gauge and differential
  10 inch H20, 1 psi

NPC-1210 Series
Low Pressure

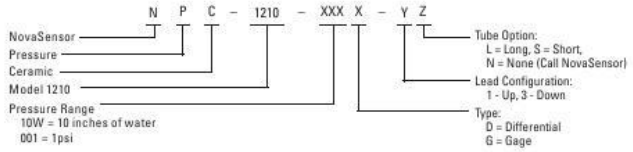
Specifications

Parameter	Value	Units	Notes
Environmental			
Temperature Range			
Operating	–40 to +125	°C	–40 to +257°F
Compensated	0 to +60	°C	+32 to +140°F
Storage	–55 to +150	°C	-67 to +302°F
Mechanical			
Weight	2.5	grams	
Media Compatibility			
Positive differential and gage ports	Compatible with exposed materials		6
Negative differential ports	Dry gases only		

Parameter (Note 1)	Units	Min.	Typ.	Max.	Notes
Performance Parameters					
Full Scale Output (FSO) 10 inch	mV	25	50	70	2, 3
Full Scale Output (FSO) 1psi	mV	50	75	110	2, 3
Zero Pressure Output	mV	-2	—	2	3
Linearity	%FSO	-0.5	—	0.5	4
Pressure Hysteresis	%FSO	-0.1	—	0.1	
Input Impedance	Ω	2500	4000	6000	
Output Impedance	Ω	4000	5000	6000	
Thermal Accuracy–Span	%FSO	-1.0	—	1.0	3, 5
Thermal Accuracy–Zero	%FSO	-1.25	—	1.25	3, 5
Temperature Coefficient–Resistance	%/°C	—	0.22	—	5
Thermal Hysteresis–Zero	±%FSO	—	0.1	—	5
Pressure Overload	psi	5	—	—	
Stability	μV/V	—	5	—	6

Notes: 1. Supply current = 1.5mA and ambient temperature = 25°C, unless otherwise noted. 2. Output span of unamplified sensor. 3. Compensation resistors are an integral part of the sensor package; no additional external resistors are required. Pins 7 and 8 must be kept open. The NPC-1210 is interchangeable only when used with the gain set resistor shown in the Schematic Diagram. Maximum gain-set resistor mismatch is 2%. 4. Best fit straight line 5. Temperature range 0-60°C, reference to 25°C. 6. Exposed materials are ceramic, silicon, epoxy, RTV and stainless steel.

Ordering Information



GE NovaSensor

GE Novasensor, Inc.
1055 Mission Court,
Fremont, California 94539
www.novasensor.com
Toll Free: 800-962-7364
Tel: 510-661-6000
Fax: 510-770-0645

Sales Terms:
NovaSensor standard sales terms apply.
Prices and specifications are subject to change without notice.

Warranty:
NovaSensor warrants its products against defects in material and workmanship for 12 months from the date of shipment. Products not subjected to misuse will be repaired or replaced. NovaSensor reserves the right to make changes without further notice to any products herein. NovaSensor makes no warranty, representation or guarantee regarding the suitability of its products for any particular application, nor does NovaSensor assume any liability arising out of the application or use of any product or circuit and specifically disclaims and all liability without limitation consequential or incidental damages. The foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED STATUTORY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE SHALL APPLY.

SM0049 Rev B 04/03

ANALOG DEVICES

Low Cost, Low Power Instrumentation Amplifier

AD620

FEATURES

EASY TO USE
Gain Set with One External Resistor
(Gain Range 1 to 1000)
Wide Power Supply Range (±2.3 V to ±18 V)
Higher Performance than Three Op Amp IA Designs
Available in 8-Lead DIP and SOIC Packaging
Low Power, 1.3 mA max Supply Current

EXCELLENT DC PERFORMANCE ("B GRADE")
50 μV max, Input Offset Voltage
0.6 μV/°C max, Input Offset Drift
1.0 nA max, Input Bias Current
100 dB min Common-Mode Rejection Ratio (G = 10)

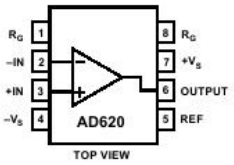
LOW NOISE
9 nV/√Hz, @ 1 kHz, Input Voltage Noise
0.28 μV p-p Noise (0.1 Hz to 10 Hz)

EXCELLENT AC SPECIFICATIONS
120 kHz Bandwidth (G = 100)
15 μs Settling Time to 0.01%

APPLICATIONS
Weigh Scales
ECG and Medical Instrumentation
Transducer Interface
Data Acquisition Systems
Industrial Process Controls
Battery Powered and Portable Equipment

CONNECTION DIAGRAM

8-Lead Plastic Mini-DIP (N), Cerdip (Q) and SOIC (R) Packages



PRODUCT DESCRIPTION

The AD620 is a low cost, high accuracy instrumentation amplifier that requires only one external resistor to set gains of 1 to 1000. Furthermore, the AD620 features 8-lead SOIC and DIP packaging that is smaller than discrete designs, and offers lower power (only 1.3 mA max supply current), making it a good fit for battery powered, portable (or remote) applications.

The AD620, with its high accuracy of 40 ppm maximum nonlinearity, low offset voltage of 50 μV max and offset drift of 0.6 μV/°C max, is ideal for use in precision data acquisition systems, such as weigh scales and transducer interfaces. Furthermore, the low noise, low input bias current, and low power of the AD620 make it well suited for medical applications such as ECG and noninvasive blood pressure monitors.

The low input bias current of 1.0 nA max is made possible with the use of Superβeta processing in the input stage. The AD620 works well as a preamplifier due to its low input voltage noise of 9 nV/√Hz at 1 kHz, 0.28 μV p-p in the 0.1 Hz to 10 Hz band, 0.1 pA/√Hz input current noise. Also, the AD620 is well suited for multiplexed applications with its settling time of 15 μs to 0.01% and its cost is low enough to enable designs with one in-amp per channel.

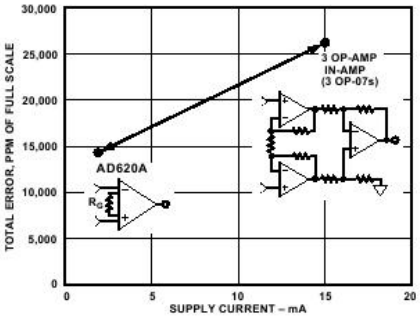


Figure 1. Three Op Amp IA Designs vs. AD620

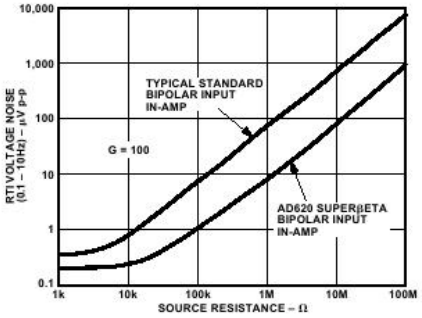


Figure 2. Total Voltage Noise vs. Source Resistance

REV. E

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 World Wide Web Site: http://www.analog.com
Fax: 781/326-8703

National Semiconductor

January 2003

LM2940/LM2940C
1A Low Dropout Regulator

General Description

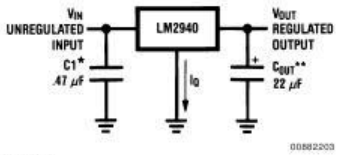
The LM2940/LM2940C positive voltage regulator features the ability to source 1A of output current with a dropout voltage of typically 0.5V and a maximum of 1V over the entire temperature range. Furthermore, a quiescent current reduction circuit has been included which reduces the ground current when the differential between the input voltage and the output voltage exceeds approximately 3V. The quiescent current with 1A of output current and an input-output differential of 5V is therefore only 30 mA. Higher quiescent currents only exist when the regulator is in the dropout mode ($V_{IN} - V_{OUT} \leq 3V$).

Designed also for vehicular applications, the LM2940/LM2940C and all regulated circuitry are protected from reverse battery installations or 2-battery jumps. During line transients, such as load dump when the input voltage can momentarily exceed the specified maximum operating voltage, the regulator will automatically shut down to protect both the internal circuits and the load. The LM2940/LM2940C cannot be harmed by temporary mirror-image insertion. Familiar regulator features such as short circuit and thermal overload protection are also provided.

Features

- Dropout voltage typically 0.5V @I_O = 1A
- Output current in excess of 1A
- Output voltage trimmed before assembly
- Reverse battery protection
- Internal short.circuit current limit
- Mirror image insertion protection
- P+ Product Enhancement tested

Typical Application



*Required if regulator is located far from power supply filter.

**C_{OUT} must be at least 22 µF to maintain stability. May be increased without bound to maintain regulation during transients. Locate as close as possible to the regulator. This capacitor must be rated over the same operating temperature range as the regulator and the ESR is critical; see curve.

Ordering Information

Temperature Range	Output Voltage						Package
	5.0	8.0	9.0	10	12	15	
0°C ≤ T_J ≤ 125°C	LM2940CT-5.0		LM2940CT-9.0		LM2940CT-12	LM2940CT-15	TO-220
	LM2940CS-5.0		LM2940CS-9.0		LM2940CS-12	LM2940CS-15	TO-263
−40°C ≤ T_J ≤ 125°C	LM2940LD-5.0	LM2940LD-8.0	LM2940LD-9.0	LM2940LD-10	LM2940LD-12	LM2940LD-15	LLP 1k Units Tape and Reel
	LM2940LDX-5.0	LM2940LDX-8.0	LM2940LDX-9.0	LM2940LDX-10	LM2940LDX-12	LM2940LDX-15	LLP 4.5k Units Tape and Reel
−40°C ≤ T_J ≤ 125°C	LM2940T-5.0	LM2940T-8.0	LM2940T-9.0	LM2940T-10	LM2940T-12		TO-220
	LM2940S-5.0	LM2940S-8.0	LM2940S-9.0	LM2940S-10	LM2940S-12		TO-263
−40°C ≤ T_J ≤ 85°C	LM2940IMP-5.0	LM2940IMP-8.0	LM2940IMP-9.0	LM2940IMP-10	LM2940IMP-12	LM2940IMP-15	SOT-223
	LM2940IMPX-5.0	LM2940IMPX-8.0	LM2940IMPX-9.0	LM2940IMPX-10	LM2940IMPX-12	LM2940IMPX-15	SOT-223 in Tape and Reel
SOT-223 Package Marking	L53B	L54B	L0EB	L55B	L56B	L70B	

The physical size of the SOT-223 is too small to contain the full device part number. The package markings indicated are what will appear on the actual device.

 DS008822

National Semiconductor

June 1999

LM2990
Negative Low Dropout Regulator

General Description

The LM2990 is a three-terminal, low dropout, 1 ampere negative voltage regulator available with fixed output voltages of −5, −5.2, −12, and −15V.

The LM2990 uses new circuit design techniques to provide low dropout and low quiescent current. The dropout voltage at 1A load current is typically 0.6V and a guaranteed worst-case maximum of 1V over the entire operating temperature range. The quiescent current is typically 1 mA with 1A load current and an input-output voltage differential greater than 3V. A unique circuit design of the internal bias supply limits the quiescent current to only 9 mA (typical) when the regulator is in the dropout mode ($V_{OUT} - V_{IN} \leq 3V$). Output voltage accuracy is guaranteed to ±5% over load, and temperature extremes.

The LM2990 is short-circuit proof, and thermal shutdown includes hysteresis to enhance the reliability of the device when overloaded for an extended period of time. The LM2990 is available in a 3-lead TO-220 package and is rated for operation over the automotive temperature range of −40˚C to +125˚C.

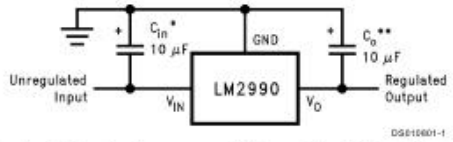
Features

- 5% output accuracy over entire operating range
- Output current in excess of 1A
- Dropout voltage typically 0.6V at 1A load
- Low quiescent current
- Internal short circuit current limit
- Internal thermal shutdown with hysteresis
- Functional complement to the LM2940 series

Applications

- Post switcher regulator
- Local, on-card, regulation
- Battery operated equipment

Typical Application



*Required if the regulator is located further than 6 inches from the power supply filter capacitors. A 1 µF solid tantalum or a 10 µF aluminum electrolytic capacitor is recommended.

**Required for stability. Must be at least a 10 µF aluminum electrolytic or a 1 µF solid tantalum to maintain stability. May be increased without bound to maintain regulation during transients. Locate the capacitor as close as possible to the regulator. The equivalent series resistance (ESR) is critical, and should be less than 10Ω over the same operating temperature range as the regulator.

Ordering Information and Connection Diagrams

Temperature Range	Output Voltage				Package
	-5.0	-5.2	-12	-15	
−40˚C to +125˚C	LM2990T-5.0	LM2990T-5.2	LM2990T-12	LM2990T-15	TO-220
	LM2990S-5.0		LM2990S-12	LM2990S-15	TO-263
−55˚C to +125˚C	LM2990J-5.0-QML 5962-9571101QEA		LM2990J-12-QML 5962-9571001QEA	LM2990J-15-QML 5962-9570901QEA	J16A
	LM2990WG5.0-QML 5962-9571101QXA				WG16A

 DS010801

FAIRCHILD
SEMICONDUCTOR®

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MC78XX/LM78XX/MC78XXA

3-Terminal 1A Positive Voltage Regulator

Features

- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 10, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

Description

The MC78XX/LM78XX/MC78XXA series of three terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

TO-220

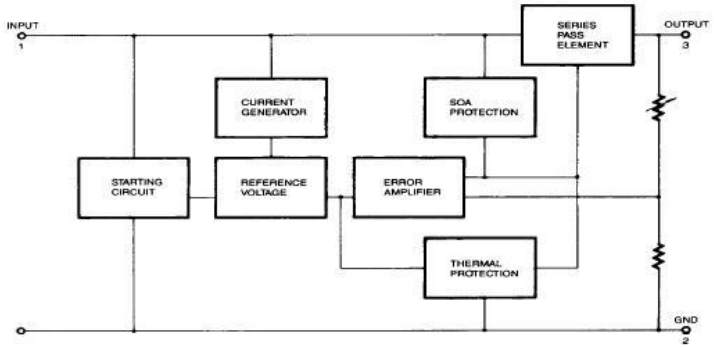
1

D-PAK

1

1. Input 2. GND 3. Output

Internal Block Digram



Rev. 1.0.1

National Semiconductor

November 1994

TL082 Wide Bandwidth Dual JFET Input Operational Amplifier

General Description

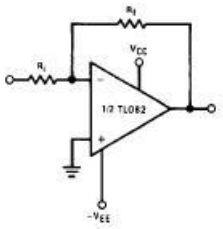
These devices are low cost, high speed, dual JFET input operational amplifiers with an internally trimmed input offset voltage (BI-FET II™ technology). They require low supply current yet maintain a large gain bandwidth product and fast slew rate. In addition, well matched high voltage JFET input devices provide very low input bias and offset currents. The TL082 is pin compatible with the standard LM1558 allowing designers to immediately upgrade the overall performance of existing LM1558 and most LM358 designs.

These amplifiers may be used in applications such as high speed integrators, fast D/A converters, sample and hold circuits and many other circuits requiring low input offset voltage, low input bias current, high input impedance, high slew rate and wide bandwidth. The devices also exhibit low noise and offset voltage drift.

Features

■ Internally trimmed offset voltage	15 mV
■ Low input bias current	50 pA
■ Low input noise voltage	16nV/√ Hz
■ Low input noise current	0.01 pA/√ Hz
■ Wide gain bandwidth	4 MHz
■ High slew rate	13 V/μs
■ Low supply current	3.6 mA
■ High input impedance	$10^{12}\Omega$
■ Low total harmonic distortion A_V = 10, R_L = 10k, V_O = 20 Vp − p, BW = 20 Hz−20 kHz	<0.02%
■ Low 1/f noise corner	50 Hz
■ Fast settling time to 0.01%	2 μs

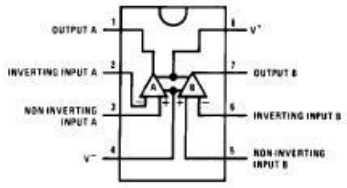
Typical Connection



TL/H/8357–1

Connection Diagram

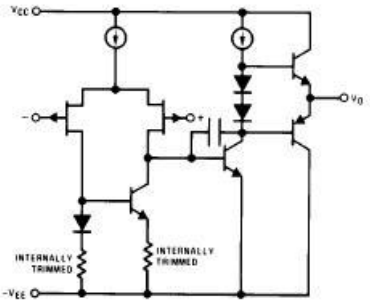
DIP/SO Package (Top View)



TL/H/8357–3

Order Number TL082CM or TL082CP
See NS Package Number M08A or N08E

Simplified Schematic



TL/H/8357–2

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 TL/H/8357 RRD-B30M115/Printed in U. S. A.

TL082 Wide Bandwidth Dual JFET Input Operational Amplifier