National Semiconductor

February 1995

# LM3080
# Operational Transconductance Amplifier

## General Description

The LM3080 is a programmable transconductance block intended to fulfill a wide variety of variable gain applications. The LM3080 has differential inputs and high impedance push-pull outputs. The device has high input impedance and its transconductance ($g_m$) is directly proportional to the amplifier bias current ($I_{ABC}$).

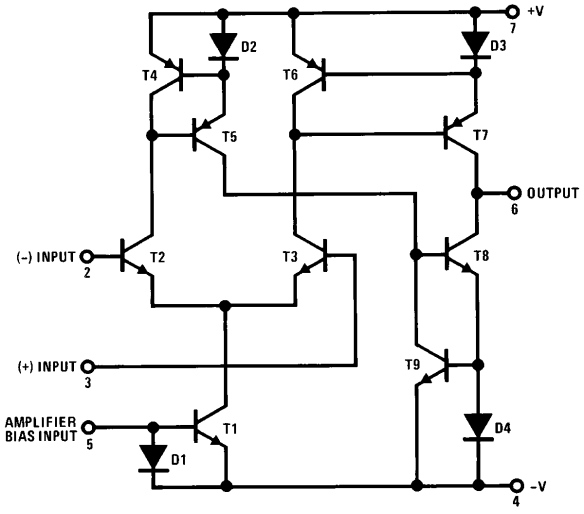
High slew rate together with programmable gain make the LM3080 an ideal choice for variable gain applications such as sample and hold, multiplexing, filtering, and multiplying.

The LM3080N and LM3080AN are guaranteed from 0°C to +70°C.

## Features

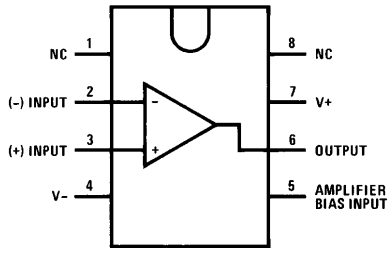
- Slew rate (unity gain compensated): 50 V/$\mu$s
- Fully adjustable gain: 0 to $g_m \bullet R_L$ limit
- Extended $g_m$ linearity: 3 decades
- Flexible supply voltage range: ±2V to ±18V
- Adjustable power consumption

## Schematic and Connection Diagrams




TL/H/7148–1

**Dual-In-Line Package**




TL/H/7148–2

**Top View**

**Order Number LM3080AN, LM3080M or LM3080N**
**See NS Package Number M08A or N08E**

RRD-B30M115/Printed in U. S. A.

## Absolute Maximum Ratings

**If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.**

| | |
|---|---|
| Supply Voltage (Note 2) | |
| LM3080 | ±18V |
| LM3080A | ±22V |
| Power Dissipation | 250 mW |
| Differential Input Voltage | ±5V |
| Amplifier Bias Current ($I_{ABC}$) | 2 mA |
| DC Input Voltage | $+V_S$ to $-V_S$ |
| Output Short Circuit Duration | Indefinite |
| Operating Temperature Range | |
| LM3080N or LM3080AN | 0°C to +70°C |
| Storage Temperature Range | −65°C to +150°C |
| Lead Temperature (Soldering, 10 sec.) | 260°C |

## Electrical Characteristics (Note 1)

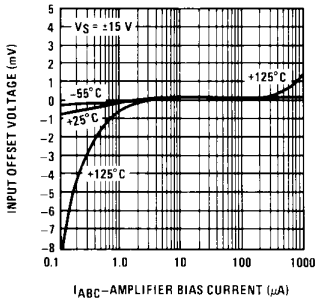
| Parameter | Conditions | LM3080 | | | LM3080A | | | Units |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | | | 0.4 | 5 | | 0.4 | 2 | mV |
| | Over Specified Temperature Range | | | 6 | | | 5 | mV |
| | $I_{ABC}$ = 5 μA | | 0.3 | | | 0.3 | 2 | mV |
| Input Offset Voltage Change | 5 μA ≤ $I_{ABC}$ ≤ 500 μA | | 0.1 | | | 0.1 | 3 | mV |
| Input Offset Current | | | 0.1 | 0.6 | | 0.1 | 0.6 | μA |
| Input Bias Current | | | 0.4 | 5 | | 0.4 | 5 | μA |
| | Over Specified Temperature Range | | 1 | 7 | | 1 | 8 | μA |
| Forward Transconductance ($g_m$) | | 6700 | 9600 | 13000 | 7700 | 9600 | 12000 | μmho |
| | Over Specified Temperature Range | 5400 | | | 4000 | | | μmho |
| Peak Output Current | $R_L$ = 0, $I_{ABC}$ = 5 μA | | 5 | | 3 | 5 | 7 | μA |
| | $R_L$ = 0 | 350 | 500 | 650 | 350 | 500 | 650 | μA |
| | $R_L$ = 0 Over Specified Temperature Range | 300 | | | 300 | | | μA |
| Peak Output Voltage | | | | | | | | |
| Positive | $R_L$ = ∞, 5 μA ≤ $I_{ABC}$ ≤ 500 μA | +12 | +14.2 | | +12 | +14.2 | | V |
| Negative | $R_L$ = ∞, 5 μA ≤ $I_{ABC}$ ≤ 500 μA | −12 | −14.4 | | −12 | −14.4 | | V |
| Amplifier Supply Current | | | 1.1 | | | 1.1 | | mA |
| Input Offset Voltage Sensitivity | | | | | | | | |
| Positive | $\Delta V_{OFFSET}/\Delta V+$ | | 20 | 150 | | 20 | 150 | μV/V |
| Negative | $\Delta V_{OFFSET}/\Delta V-$ | | 20 | 150 | | 20 | 150 | μV/V |
| Common Mode Rejection Ratio | | 80 | 110 | | 80 | 110 | | dB |
| Common Mode Range | | ±12 | ±14 | | ±12 | ±14 | | V |
| Input Resistance | | 10 | 26 | | 10 | 26 | | kΩ |
| Magnitude of Leakage Current | $I_{ABC}$ = 0 | | 0.2 | 100 | | 0.2 | 5 | nA |
| Differential Input Current | $I_{ABC}$ = 0, Input = ±4V | | 0.02 | 100 | | 0.02 | 5 | nA |
| Open Loop Bandwidth | | | 2 | | | 2 | | MHz |
| Slew Rate | Unity Gain Compensated | | 50 | | | 50 | | V/μs |

**Note 1:** These specifications apply for $V_S$ = ±15V and $T_A$ = 25°C, amplifier bias current ($I_{ABC}$) = 500 μA, unless otherwise specified.

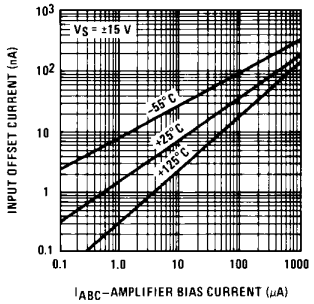
**Note 2:** Selection to supply voltage above ±22V, contact the factory.

## Typical Performance Characteristics

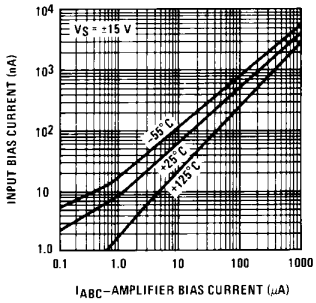
**Input Offset Voltage**



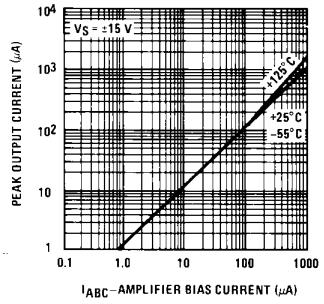

**Input Offset Current**



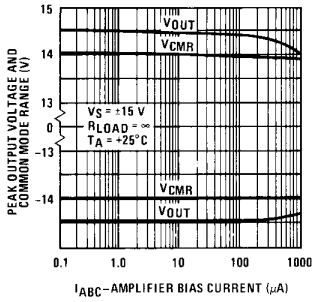

**Input Bias Current**



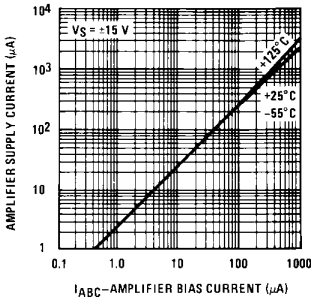

**Peak Output Current**



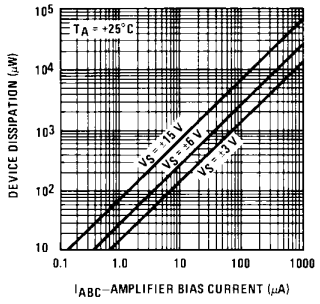

**Peak Output Voltage and Common Mode Range**



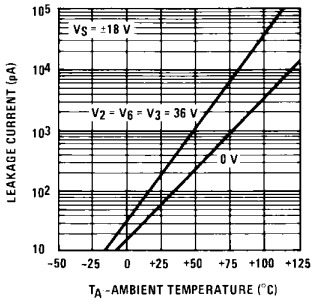

**Amplifier Supply Current**



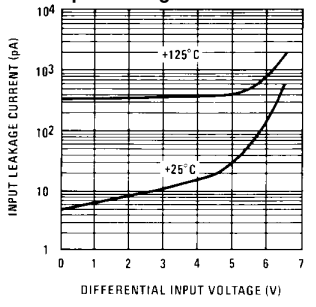

**Total Power Dissipation**



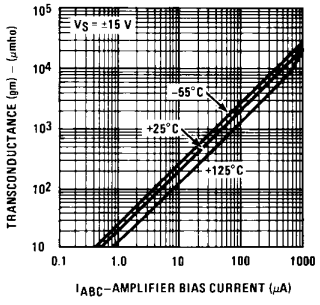

**Leakage Current**



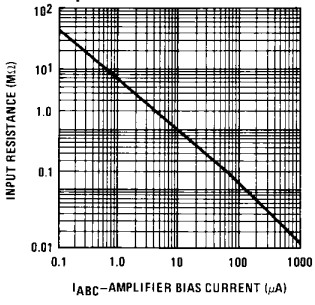

**Input Leakage**



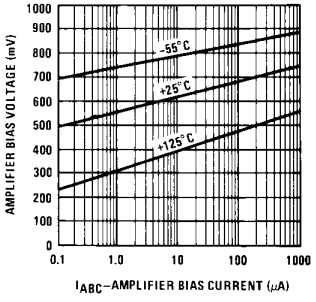

**Transconductance**




**Input Resistance**



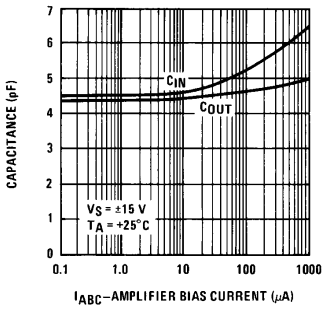

**Amplifier Bias Voltage vs Amplifier Bias Current**




TL/H/7148–3

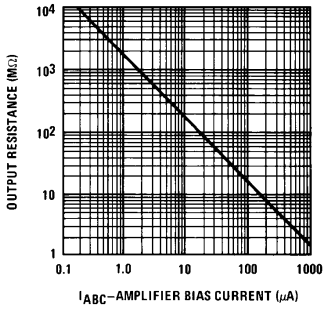
## Typical Performance Characteristics (Continued)

**Input and Output Capacitance**



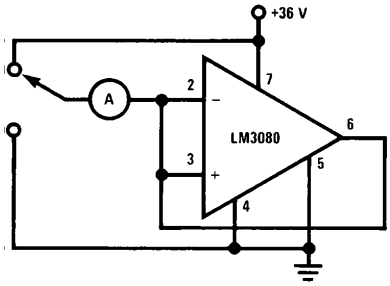

TL/H/7148–4

**Output Resistance**



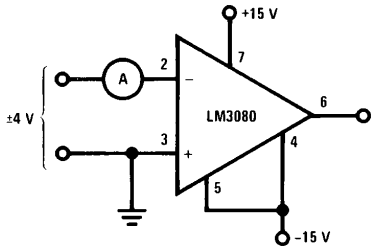

TL/H/7148–5

**Leakage Current Test Circuit**



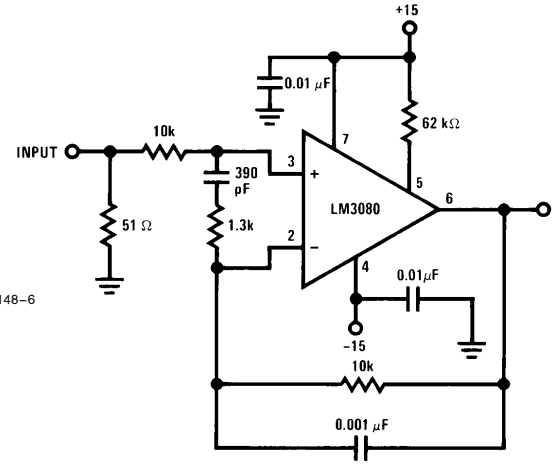

TL/H/7148–6

**Differential Input Current Test Circuit**



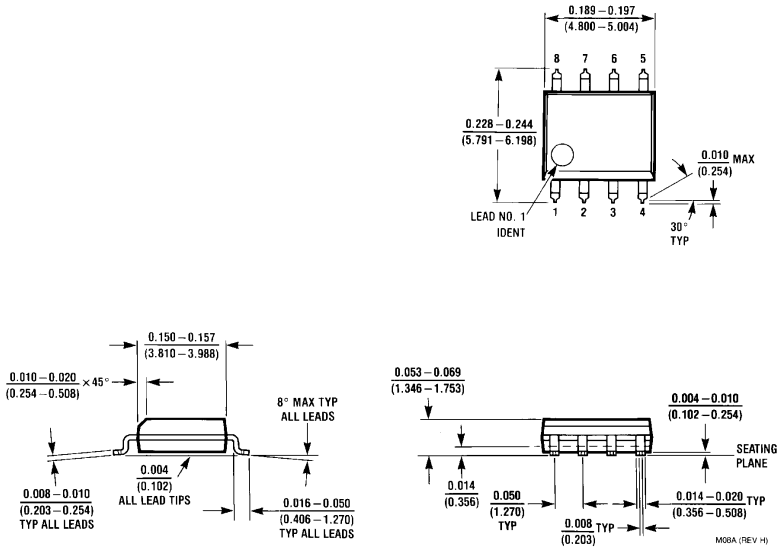

TL/H/7148–7

**Unity Gain Follower**



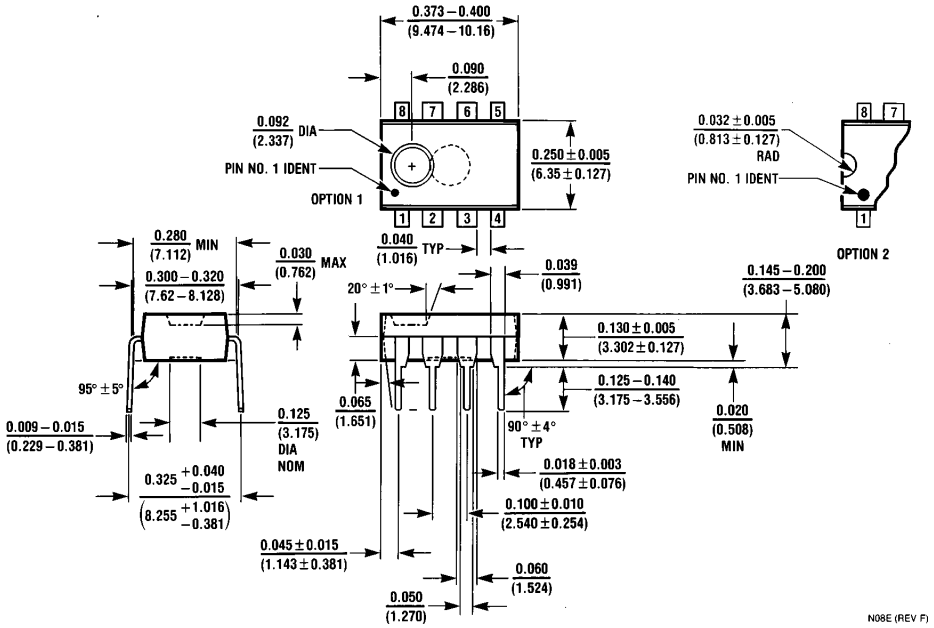

TL/H/7148–8

## Physical Dimensions inches (millimeters)




**Molded Package SO (M)**
**Order Number LM3080M**
**NS Package Number M08A**

## Physical Dimensions inches (millimeters) (Continued)




**Molded Dual-In-Line Package (N)**
**Order Number LM3080AN or LM3080N**
**NS Package Number N08E**

**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**National Semiconductor Corporation**
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

**National Semiconductor Europe**
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor Hong Kong Ltd.**
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

**National Semiconductor Japan Ltd.**
Tel: 81-043-299-2309
Fax: 81-043-299-2408