## Features

- Single-Supply Operation from +3V ~ +36V
- Dual-Supply Operation from ±1.5V ~ ±18V
- Gain-Bandwidth Product: 1MHz (Typ)
- Low Input Bias Current: 20nA (Typ)
- Low Offset Voltage: 5mV (Max)
- Quiescent Current: 250μA per Amplifier (Typ)
- Input Common Mode Voltage Range Includes Ground
- Large Output Voltage Swing:0V to Vcc-1.5V
- Operating Temperature: -25°C ~ +85°C
- Small Package:
  BL321H Available in SOT23-5 Package

## General Description

BL321H operates from a single 3V to 36V supply or dual ±1.5V to ±18V,The BL321H have a high gain-bandwidth product of 1MHz, a slew rate of 0.2V/μs, and a quiescent current of 500μA/amplifier at 5V. The BL321H is designed to provide optimal performance in low voltage and low noise systems. The maximum input offset voltage is 5mV for BL321H. The operating range is from 3V to 36V.

## Applications

- Motor Control
- Battery Management Solution
- Temperature Sensors or Controllers
- Digital Multimeter
- Blu-ray Players and Home Theaters

## Package/Ordering Information

| MODEL | CHANNEL | ORDER NUMBER | PACKAGE DESCRIPTION | PACKAGE OPTION |
|---|---|---|---|---|
| BL321H | Single | BL321HFR | SOT23-5 | Tape and Reel,3000 |

## Pin Configuration

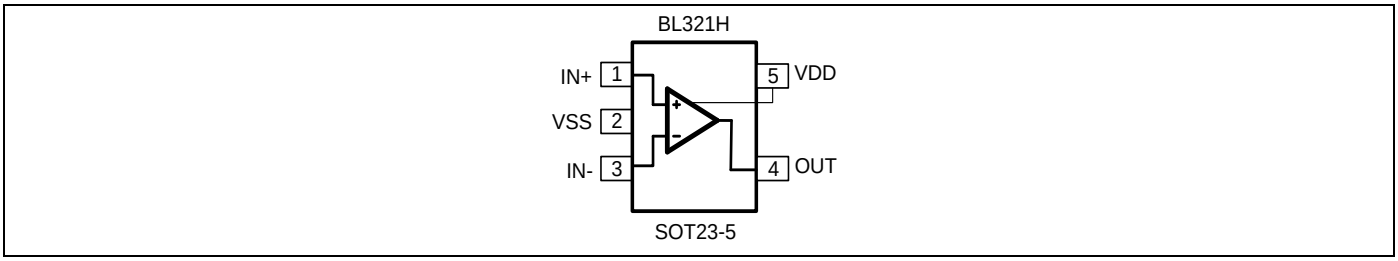



Figure 1. Pin Assignment Diagram

## Absolute Maximum Ratings

| Condition | Symbol | Max |
|---|---|---|
| Power Supply Voltage | Vcc | ±20V or 40V |
| Differential input voltage | $V_{I(DIFF)}$ | 40V |
| Input Voltage | $V_I$ | -0.3V~40V |
| Operating Temperature Range | Topr | -25°C ~+85°C |
| Storage Temperature Range | Tstg | -65°C ~+150°C |

**Note:** Stress greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions outside those indicated in the operational sections of this specification are not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

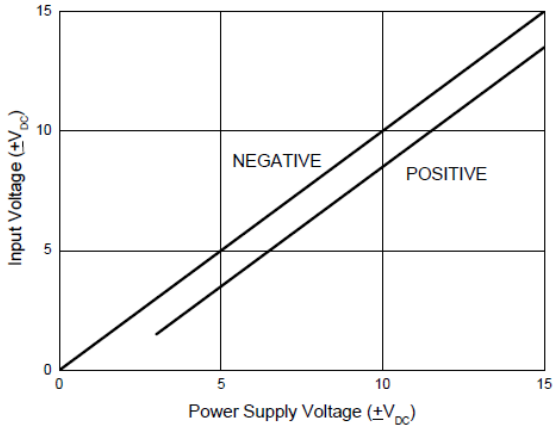
## Electrical Characteristics

(At $V_S$ = +15V, $T_A$=25ºC, unless otherwise noted.)

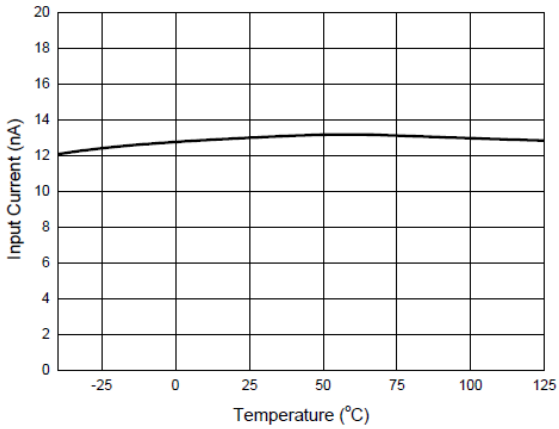
| PARAMETER | SYMBOL | CONDITIONS | BL321H | | | |
|---|---|---|---|---|---|---|
| | | | TYP | MIN/MAX OVER TEMPERATURE | | |
| | | | +25℃ | +25℃ | UNITS | MIN/MAX |
| **INPUT CHARACTERISTICS** | | | | | | |
| Input Offset Voltage | $V_{OS}$ | $V_{CM}$ = $V_S$/2 | 0.4 | 5 | mV | MAX |
| Input Bias Current | $I_B$ | | 20 | | nA | TYP |
| Input Offset Current | $I_{OS}$ | | 5 | | nA | TYP |
| Common-Mode Voltage Range | $V_{CM}$ | $V_S$ = 5.5V | -0.1 to +4 | | V | TYP |
| Common-Mode Rejection Ratio | CMRR | $V_{CM}$ = 0V to Vs-1.5V | 70 | 60 | dB | MIN |
| Open-Loop Voltage Gain | $A_{OL}$ | $R_L$ = 5kΩ, $V_O$ = 1V to 11V | 100 | 85 | dB | MIN |
| Input Offset Voltage Drift | $\Delta V_{OS}/\Delta_T$ | | 7 | | μV/℃ | TYP |
| **OUTPUT CHARACTERISTICS** | | | | | | |
| Output Voltage Swing from Rail | $V_{OH}$ | $R_L$ = 2kΩ | 11 | | V | MIN |
| | $V_{OL}$ | $R_L$ = 2kΩ | 5 | 20 | mV | MAX |
| | $V_{OH}$ | $R_L$ = 10kΩ | 12 | 13 | V | MIN |
| | $V_{OL}$ | $R_L$ = 10kΩ | 5 | 20 | mV | MAX |
| Output Current | $I_{SOURCE}$ | $R_L$ = 10Ω to $V_S$/2 | 40 | 60 | mA | MAX |
| | $I_{SINK}$ | | 40 | 60 | | |
| **POWER SUPPLY** | | | | | | |
| Operating Voltage Range | | | | 3 | V | MIN |
| | | | | 36 | V | MAX |
| Power Supply Rejection Ratio | PSRR | $V_S$ = +5V to +36V, $V_{CM}$ = +0.5V | 100 | 70 | dB | MIN |
| Quiescent Current / Amplifier | $I_Q$ | $V_S$ = 36V, RL=∞ | 0.25 | 2.0 | mA | MAX |
| **DYNAMIC PERFORMANCE** | | | | | | |
| Gain-Bandwidth Product | GBP | | 1 | | MHz | TYP |
| Slew Rate | SR | G = +1, 2V Output Step | 0.2 | | V/μs | TYP |

## Typical Performance characteristics

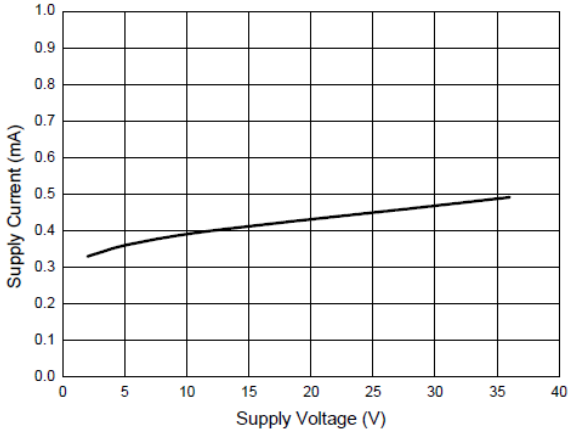
### Input Voltage Range



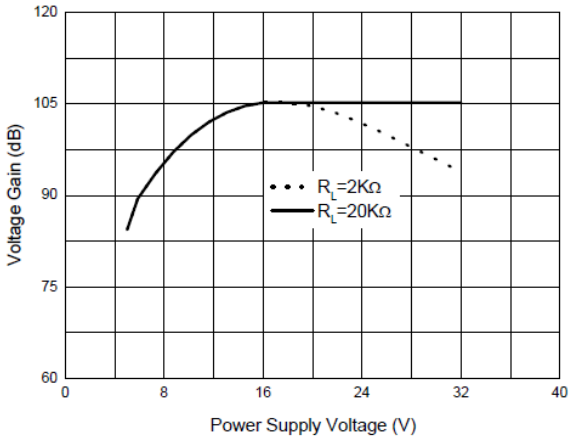

### Input Current



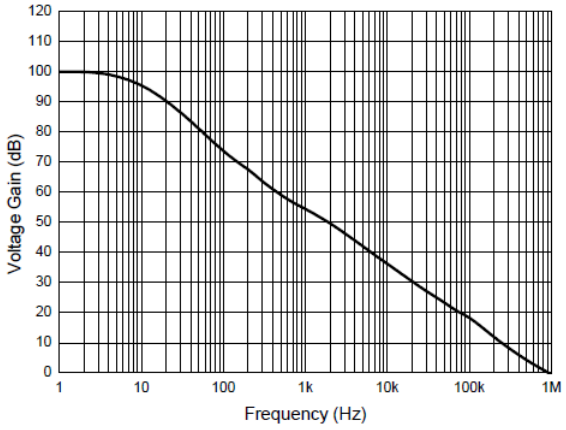

### Supply Current



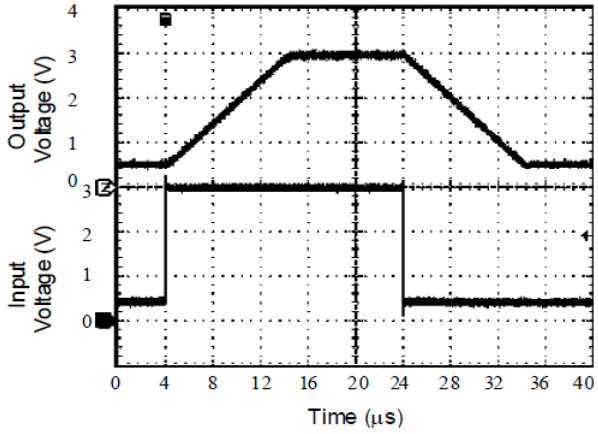

### Voltage Gain




### Open Loop Frequency Response

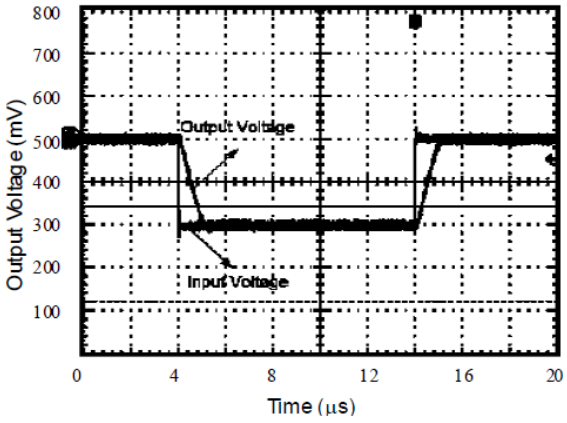



### Voltage Follower Pulse Response

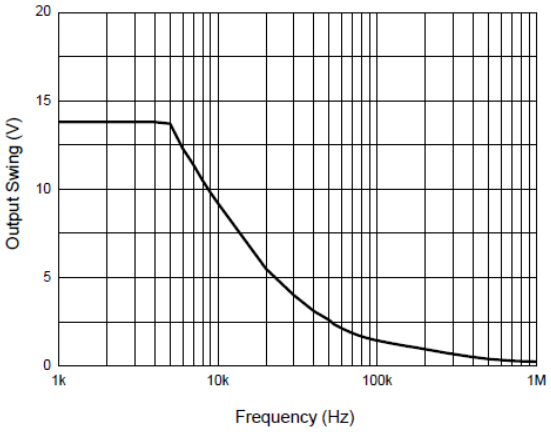


## Typical Performance characteristics

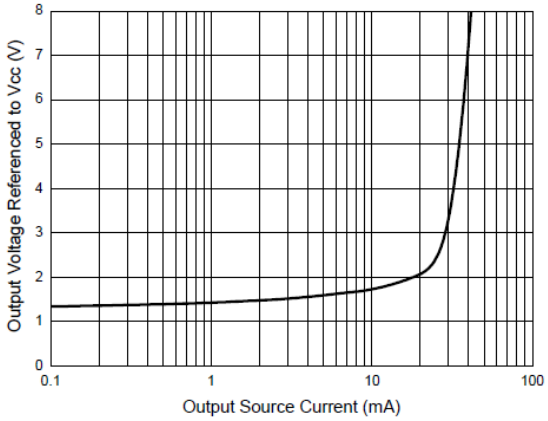
### Voltage Follower Pulse Response (Small Signal)



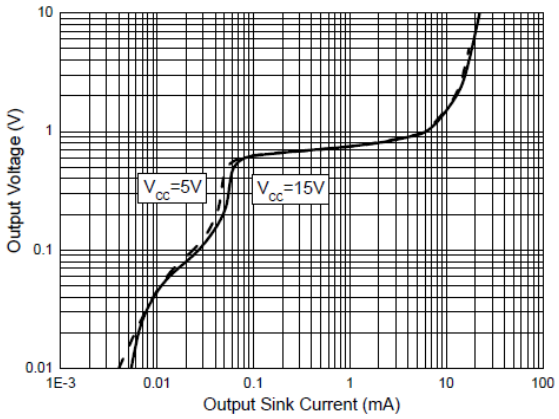

### Large Signal Frequency Response



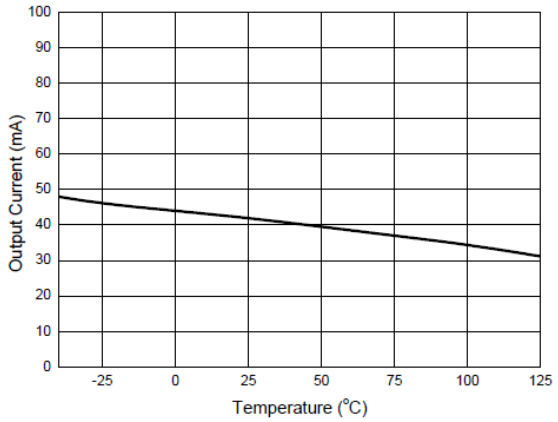

### Output Characteristics: Current Sourcing




### Output Characteristics: Current Sinking




### Current Limiting



## Typical Application Circuits

### Differential amplifier

The differential amplifier allows the subtraction of two input voltages or cancellation of a signal common the two inputs. It is useful as a computational amplifier in making a differential to single-end conversion or in rejecting a common mode signal. Figure 2. shown the differential amplifier using BL321H family.

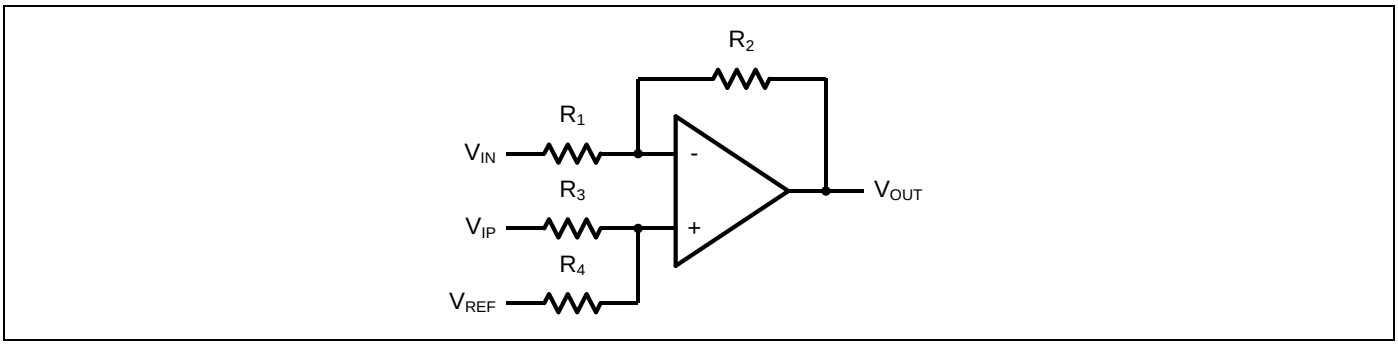



Figure 2. Differential Amplifier

$$V_{OUT}=(\frac{R_1+R_2}{R_3+R_4})\frac{R_4}{R_1}V_{IN}-\frac{R2}{R1}V_{IP}+(\frac{R_1+R_2}{R_3+R_4})\frac{R_3}{R_1}V_{REF}$$

If the resistor ratios are equal (i.e. $R_1=R_3$ and $R_2=R_4$), then

$$V_{OUT}=\frac{R_2}{R_1}(V_{IP}-V_{IN})+V_{REF}$$

### Instrumentation Amplifier

The triple BL321H family can be used to build a three-op-amp instrumentation amplifier as shown in Figure 3. The amplifier in Figure 3 is a high input impedance differential amplifier with gain of R2/R1. The two differential voltage followers assure the high input impedance of the amplifier.

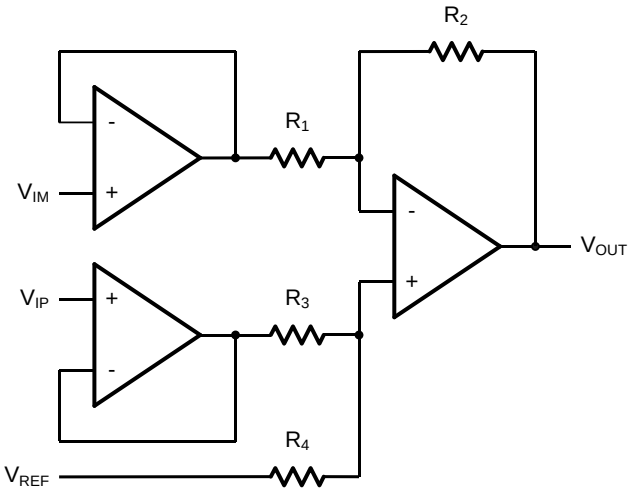
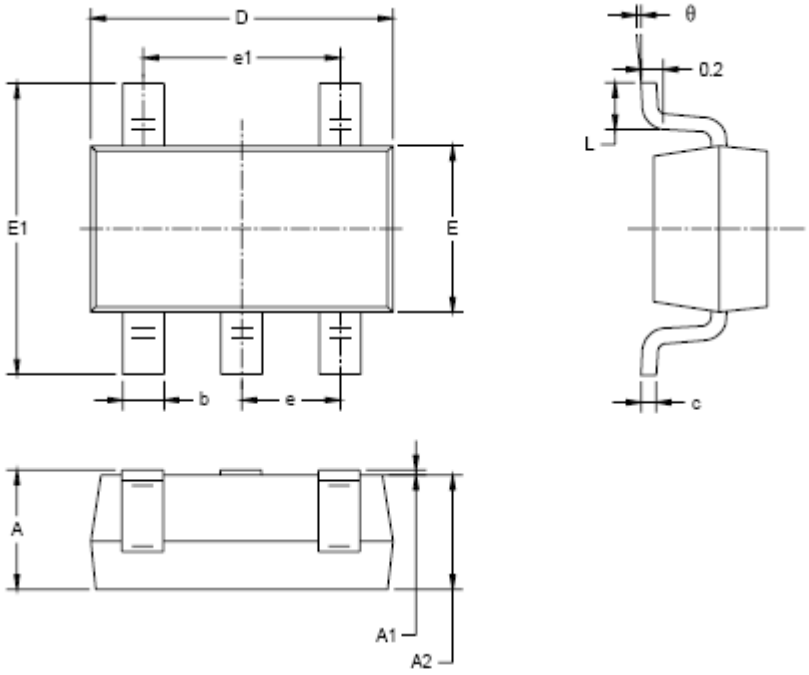



Figure 3. Instrument Amplifier

## Package Information

### SOT23-5




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.500 | 1.700 | 0.059 | 0.067 |
| E1 | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950 BSC | | 0.037 BSC | |
| e1 | 1.900 BSC | | 0.075 BSC | |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |